BEHAVIORAL FINANCE

Investors, Corporations, and Markets

H.Kent Baker and John R. Nofsinger, Editors

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BEHAVIORAL FINANCE

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Editors

H. Kent Baker

John R. Nofsinger

The Robert W. Kolb Series in Finance

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PART I

Foundation and Key Concepts

CHAPTER 1

Behavioral Finance: An Overview

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INTRODUCTION

Behavioral finance is a relatively new but quickly expanding field that seeks to provide explanations for people's economic decisions by combining behavioral and cognitive psychological theory with conventional economics and finance. Fueling the growth of behavioral finance research has been the inability of the traditional expected utility maximization of rational investors within the efficient markets framework to explain many empirical patterns. Behavioral finance attempts to resolve these inconsistencies through explanations based on human behavior, both individually and in groups. For example, behavioral finance helps explain why and how markets might be inefficient. After initial resistance from traditionalists, behavioral finance is increasingly becoming part of mainstream finance.

An underlying assumption of behavioral finance is that the information structure and the characteristics of market participants systematically influence individuals' investment decisions as well as market outcomes. The thinking process does not work like a computer. Instead, the human brain often processes information using shortcuts and emotional filters. These processes influence financial decision makers such that people often act in a seemingly irrational manner, routinely violate traditional concepts of risk aversion, and make predictable errors in their forecasts. These problems are pervasive in investor decisions, financial markets, and corporate managerial behavior. The impact of these suboptimal financial decisions has ramifications for the efficiency of capital markets, personal wealth, and the performance of corporations.

The purpose of this book is to provide a comprehensive view of the psychological foundations and their applications to finance as determined by the current state of behavioral financial research. The book is unique in that it surveys all facets of the literature and thus offers unprecedented breadth and depth. The targeted audience includes academics, practitioners, regulators, students, and others

interested in behavioral finance. For example, researchers and practitioners who are interested in behavioral finance should find this book to be useful given the scope of the work. This book is appropriate as a stand-alone or supplementary book for undergraduate or graduate-level courses in behavioral finance.

This chapter begins in the next section with a brief discussion of behavioral finance from the context of its evolution from standard finance. Four key themes of behavioral finance (heuristics, framing, emotions, and market impact) are delineated next. These themes are then applied to the behavior of investors, corporations, markets, regulation and policy, and education. Lastly, the structure of this book is outlined, followed by an abstract for each of the remaining 35 chapters.

BEHAVIORAL FINANCE

Before the evolution of behavioral finance, there was standard or traditional finance. This section discusses some of the key concepts underlying standard finance and the need for behavioral finance.

Standard (Traditional) Finance

At its foundation, standard finance assumes that finance participants, institutions, and even markets are rational. On average, these people make unbiased decisions and maximize their self-interests. Any individual who makes suboptimal decisions would be punished through poor outcomes. Over time, people would either learn to make better decisions or leave the marketplace. Also, any errors that market participants make are not correlated with each other; thus the errors do not have the strength to affect market prices.

This rationality of market participants feeds into one of the classic theories of standard finance, the efficient market hypothesis (EMH). The rational market participants have impounded all known information and probabilities concerning uncertainty about the future into current prices. Therefore, market prices are generally right. Changes in prices are therefore due to the short-term realization of information. In the long term, these price changes, or returns, reflect compensation for taking risk. Another fundamental and traditional concept is the relationship between expected risk and return. Risk-averse rational market participants demand higher expected returns for higher risk investments. For decades, finance scholars have tried to characterize this risk-return relationship with asset pricing models, beginning with the capital asset pricing model (CAPM). The paradigms of traditional finance are explained in more detail in Chapter 2. Chapter 8 summarizes the behavioral finance view of risk aversion.

Evolution of Behavioral Finance

Although the traditional finance paradigm is appealing from a market-level perspective, it entails an unrealistic burden on human behavior. After all, psychologists had been studying decision heuristics for decades and found many biases and limits to cognitive resources. In the 1960s and 1970s, several psychologists began examining economic decisions. Slovic (1969, 1972) studied stock brokers and

investors. Tversky and Kahneman (1974) detailed the heuristics and biases that occur when making decisions under uncertainty. Their later work (see Kahneman and Tversky, 1979) on prospect theory eventually earned Daniel Kahneman the Nobel Prize in Economics in 2002. (See Chapters 11 and 12 for discussion about prospect theory and cumulative prospect theory, respectively.)

In his book, Shefrin (2000) describes how these early psychology papers influenced the field of finance. The American Finance Association held its first behavioral finance session at its 1984 annual meeting. The next year, DeBondt and Thaler (1985) published a behaviorally based paper on investors' overreaction to news and Shefrin and Statman (1985) published their famous disposition effect paper. Chapter 10 provides a detailed discussion of the disposition effect.

The beginning of this psychologically based financial analysis coincided with the start of many empirical findings (starting with the small firm effect) that raised doubts about some of the key foundations in standard finance: EMH and CAPM. Chapter 18 provides a discussion about these anomalies and market inefficiency. The early anomaly studies examined security prices and found that either markets were not as efficient as once purported or that the asset pricing models were inadequate (the joint test problem). However, later studies cut to the potential root of the problem and examined the behavior and decisions of market participants. For example, Odean (1998, 1999) and Barber and Odean (2000) find that individual investors are loss averse, exhibit the disposition effect, and trade too much. Researchers also discovered that employees making their pension fund decisions about participation (Madrian and Shea, 2001), asset allocation (Benartzi, 2001; Benartzi and Thaler, 2001), and trading (Choi, Laibson, and Metrick, 2002) are largely influenced by psychological biases and cognitive errors. Evidence also shows that even professionals such as analysts behave in ways consistent with psychologists' view of human behavior (DeBondt and Thaler, 1990; Easterwood and Nutt, 1999; Hilary and Menzly, 2006).

Today, the amount of research and publishing being done in behavioral finance seems staggering. Though psychology scholars have been examining economic and financial decision making for decades, psychology research is conducted in a fundamentally different manner than finance research. Psychology research involves setting up elaborate surveys or experiments in order to vary the behavior in which researchers are interested in observing and controlling. The advantage of this approach is that researchers can isolate the heuristic they are testing. Several disadvantages include doubt that people might make the same choice in a real life setting and using college students as the most common subjects. Finance scholars, on the other hand, use data of actual decisions made in real economic settings. While using this method is more convincing that people would actually behave in the manner identified, isolating that behavior in tests is difficult. Chapter 7 provides a discussion on experimental finance.

KEY THEMES IN BEHAVIORAL FINANCE

To help organize the vast and growing field of behavioral finance, it can be characterized by four key themes: heuristics, framing, emotions, and market impact.

Heuristics

Heuristics, often referred to as rules of thumb, are means of reducing the cognitive resources necessary to find a solution to a problem. They are mental shortcuts that simplify the complex methods ordinarily required to make judgments. Decision makers frequently confront a set of choices with vast uncertainty and limited ability to quantify the likelihood of the results. Scholars are continuing to identify, reconcile, and understand all the heuristics that might affect financial decision making. However, some familiar heuristic terms are affect, representativeness, availability, anchoring and adjustment, familiarity, overconfidence, status quo, loss and regret aversion, ambiguity aversion, conservatism, and mental accounting. Heuristics are well suited to help the brain make a decision in this environment. Chapter 4 discusses heuristics in general, while many other chapters focus on a specific heuristic. These heuristics may actually be hardwired into the brain. Chapter 5 explores the growing field of neuroeconomics and neurofinance, where scholars examine the physical characteristics of the brain in relation to financial and economic decision making.

Framing

People's perceptions of the choices they have are strongly influenced by how these choices are framed. In other words, people often make different choices when the question is framed in a different way, even though the objective facts remain constant. Psychologists refer to this behavior as frame dependence. For example, Glaser, Langer, Reynders, and Weber (2007) show that investor forecasts of the stock market vary depending on whether they are given and asked to forecast future prices or future returns. Choi, Laibson, Madrian, and Metrick (2004) show that pension fund choices are heavily dependent on how the choices and processes are framed. Lastly, Thaler and Sunstein's (2008) book, *Nudge*, is largely about framing important decisions in such a way to as "nudge" people toward better choices. Chapter 31 describes in detail how poor framing has adversely affected many people's pension plan choices.

Emotions

People's emotions and associated universal human unconscious needs, fantasies, and fears drive many of their decisions. How much do these needs, fantasies, and fears influence financial decisions? This aspect of behavioral finance recognizes the role Keynes's "animal spirits" play in explaining investor choices, and thus shaping financial markets (Akerlof and Shiller, 2009). The underlying premise is that the subtle and complex way our feelings determine psychic reality affect investment judgments and may explain how markets periodically break down. Chapter 6 describes the role of emotional attachment in investing activities and the consequences of engaging in a necessarily ambivalent relationship with something that can disappoint an investor. Chapter 36 examines the relationship between investor mood and investment decisions through sunshine, weather, and sporting events.

Market Impact

Do the cognitive errors and biases of individuals and groups of people affect markets and market prices? Indeed, part of the original attraction for a fledgling behavioral finance field was that market prices did not appear to be fair. In other words, market anomalies fed an interest in the possibility that they could be explained by psychology. Standard finance argues that investor mistakes would not affect market prices because when prices deviate from fundamental value, rational traders would exploit the mispricing for their own profit. But who are these arbitrageurs who would keep the markets efficient? Chapter 32 discusses the institutional class of investors. They are the best candidates for keeping markets efficient because they have the knowledge and wealth needed. However, they often have incentives to trade with the trend that causes mispricing. Thus, institutional investors often exacerbate the inefficiency. Other limits to arbitrage (Shleifer and Vishny, 1997; Barberis and Thaler, 2003) are that most arbitrage involves: (1) fundamental risk because the long and short positions are not perfectly matched; (2) noise trader risk because mispricing can get larger and bankrupt an arbitrageur before the mispricing closes; and (3) implementation costs. Hence, the limits of arbitrage may prevent rational investors from correcting price deviations from fundamental value. This leaves open the possibility that correlated cognitive errors of investors could affect market prices. Chapter 35 examines the degree of correlated trading across investors, and Chapter 19 describes models that attempt to accommodate these influences in asset pricing.

APPLICATIONS

The early behavioral finance research focused on finding, understanding, and documenting the behaviors of investors and managers, and their effect on markets. Can these cognitive errors be overcome? Can people learn to make better decisions? Some of the more recent scholarship in behavioral finance is addressing these questions. Knowing these biases goes a long way to understanding how to avoid them.

Investors

A considerable amount of research has documented the biases and associated problems with individual investor trading and portfolio allocations (see Chapters 28 and 29). How can individual investors improve their financial decisions? Some of the problems are a result of investor cognitive abilities, experience, and learning. Chapter 30 discusses learning and the role of cognitive aging in financial decisions. This chapter provides recommendations for dealing with the limitations of aging investors. Other problems arise from the decision frames faced by employees making investment decisions. The reframing of pension choices helps employees make better choices. This topic is addressed in Chapter 31.

Corporations

Traditional finance argues that arbitrageurs will trade away investor mistakes and thus those errors will not affect market prices. Limits to arbitrage put in doubt any real ability of arbitrageurs to correct mispricing. However, the arbitrage argument may be even less convincing in a corporate setting. In companies, one or a few people make decisions involving millions (even billions) of dollars. Thus, their biases can have a direct impact on corporate behavior that may not be susceptible to arbitrage corrections. Therefore, behavioral finance is likely to be even more important to corporate finance than it is to investments and markets. Shefrin (2007, p. 3) states that "Like agency costs, behavioral phenomena also cause managers to take actions that are detrimental to the interests of shareholders." Knowledgeable managers can avoid these mistakes in financing (Chapter 21), capital budgeting (Chapter 22), dividend policy (Chapter 23), corporate governance (Chapter 24), initial public offerings (Chapter 25), and mergers and acquisitions (Chapter 26) decisions to add value to the firm.

Markets

The manner in which cognitive errors of market participants affects markets is a key theme of behavioral finance scholarship. Markets are the critical mechanism for distributing financing in a capitalistic society. Therefore, their functioning directly affects the health of the economy. Chapter 33 provides an example of the biases of the people who work in these markets, specifically the derivative markets. As Chapter 27 shows, behavioral finance also has implications for the trust between participants and markets. Trust is another important component for a well-functioning market.

Regulations

Behavioral finance has the potential to impact the regulatory and policy environment in several ways. First, the heuristics that impact investors and managers also influence the politicians who make law and policy. New regulation and policy tends to overreact to financial events. Second, well-designed policy can help people overcome their biases to make better choices. Chapter 9 provides a discussion on the psychological influences in regulation and policy. Chapter 34 describes how cultural factors, including religion, affect financial laws and development.

Education

The psychological biases of employees, investors, institutions, managers, politicians, and others can clearly have negative consequences on the financial well being of individuals and society. As a new field, behavioral finance is not systematically taught in business schools. Yet, knowledge and understanding of behavioral finance offer the potential to add substantial value to any undergraduate and graduate business program. This book will be useful in educating future business students and training current managers. Chapter 3 provides ideas about implementing a course or training program in behavioral finance.

STRUCTURE OF THE BOOK

This book is organized into six sections. A brief synopsis of each chapter follows.

Foundation and Key Concepts

The remaining eight chapters (Chapters 2 to 9) of the first section provide an overview of behavioral finance. These chapters lay the foundation and provide the concepts needed for understanding the chapters in the other five sections.

Chapter 2 Traditional versus Behavioral Finance (Robert Bloomfield)
This chapter examines the tension between traditional and behavioral finance, which differ only in that the latter incorporates behavioral forces into the otherwise-traditional assumption that people behave as expected utility maximizers. Behavioralists typically argue their approach can account for market inefficiencies and other results that are inconsistent with traditional finance, while traditionalists reject this new paradigm on the grounds that it is too complex and incapable of refutation. A history of behavioral research in financial reporting shows the importance of sociological factors in building acceptance for behavioral finance. Behavioral researchers should redouble their efforts to demonstrate that the influence of behavioral factors is mediated by the ability of institutions (such as competitive markets) to scrub aggregate results of human idiosyncrasies. Such research will establish common ground between traditionalists and behavioralists, while also identifying settings in which behavioral research is likely to have the most predictive power.

Chapter 3 Behavioral Finance: Applications and Pedagogy in Business Education and Training (Rassoul Yazdipour and James A. Howard)
While behavioral finance had its beginnings in the early 1970s, it has not yet been fully and systematically accepted into the finance curricula of higher education. Acceptance of the findings from psychological research and recent advances in neuroscience are now being fully integrated into a research framework that explains how managers and investors make decisions. The framework also explains why some, if not all, decisions persistently deviate from those predicted by the economic theories of the law of one price and expected utility theory. More importantly, such a framework also prescribes strategies to avoid costly mistakes caused by behavioral phenomena. This chapter contends that the time is right for higher education programs to develop and offer courses in behavioral finance. Such courses should be based upon a new and developing paradigm that has its roots mainly in the field of cognitive psychology with added enrichments from the field of neuroscience.

Chapter 4 Heuristics or Rules of Thumb (Hugh Schwartz)
Heuristics or rules of thumb provide shortcuts to full-fledged calculation and usually indicate the correct direction, but with biases. There is considerable evidence on general heuristics—notably representativeness, availability, anchoring and adjustment, and affect (dealing with emotions) but much less on the specific heuristics used in most decision-making processes. The direction of heuristic biases is almost

invariably predictable. There are reasons for using heuristics, beginning with the presence of uncertainty, but there is not yet an adequate theory of the matter. This leads to problems, particularly conflicts in the results obtained using different heuristics. The affect heuristic often influences judgments, sometimes triggering but at other times countering cognitive reasoning. Major biases of the general heuristics stem from a lack of attention to base-rate data, generalizing from too small a sample, failing to allow for regression toward the mean, overconfidence, imperfect memory, reliance on incorrect applications of statistics, and framing.

Chapter 5 Neuroeconomics and Neurofinance (Richard L. Peterson)
By observing predictive correlations between financial behavior and neural activations, researchers are gaining novel perspectives on the roles of emotions, thoughts, beliefs, and biology in driving economic decision making and behavior. Experimental techniques from the neuroscience community including functional magnetic resonance imaging, serum studies, genetic assays, and electroencephalogram, used in experimental economic research, are bridging the fields of neuroscience and economics. The use of such techniques in the investigation of economic decision making has created the monikers "neuroeconomics" and "neurofinance" (specifically in relation to the financial markets). Research in behavioral finance typically identifies and describes nonoptimal financial behavior by individuals and in market prices (often extrapolated from collective behavior). Neuroeconomics research is identifying the origins of nonoptimal economic behavior, from a biological perspective, which opens up the dual possibilities of modifying problematic behaviors and promoting optimal ones through individual education and training, biological intervention, and public policy.

Chapter 6 Emotional Finance (Richard J. Taffler and David A. Tuckett)
This chapter explores the role of emotions in financial activity. Emotional finance is a new area of behavioral finance that seeks to examine how unconscious needs, fantasies, and fears may influence individual investor and market behaviors. Theory is first outlined together with some of its implications for market participants. These concepts are then applied in practice. Particular theoretical contributions include the different states of mind in which investment decisions can be made, how markets become carried away under the sway of group psychology, the way uncertainty leads to anxiety, and the unconscious meaning financial assets can represent as "phantastic objects." Applications described include: the "real" meaning of risk, market anomalies, the reluctance to save, market pricing bubbles including dot-com mania, hedge funds and the Bernie Madoff conundrum, and aspects of the current credit crisis. The chapter concludes that cognition and emotion need to be considered together as they are intertwined in all investment activity.

Chapter 7 Experimental Finance (Robert Bloomfield and Alyssa Anderson)
This chapter provides a guide for those interested in experimental research in finance. The chapter emphasizes the role experiments play in a field governed largely by modeling and archival data analysis; discusses the basic methods and challenges of experimental finance; explores the close connection between experiments and behavioral finance; and comments on how to think about experimental design. First, the chapter begins by discussing the relationship between

experiments and archival data analysis. Experiments are useful because they allow researchers to circumvent common econometric issues such as omitted variables, unobserved variables, and self-selection. Next, the chapter examines the contributions that experiments can make beyond theoretical models, either by relaxing certain assumptions or by addressing settings that are too complex to be modeled analytically. Lastly, the chapter discusses the difference between experiments and demonstrations, and emphasizes the critical role of controlled manipulation.

Chapter 8 The Psychology of Risk and Uncertainty (Victor Ricciardi)
The topic of risk incorporates a variety of definitions within different fields such as psychology, sociology, finance, and engineering. In academic finance, the analysis of risk has two major perspectives known as standard (traditional) finance and behavioral finance. The central focus of standard finance proponents is based on the objective aspects of risk. The standard finance school uses statistical tools such as beta, standard deviation, and variance to measure risk. The risk-related topics of standard finance are classical decision theory, rationality, risk-averse behavior, modern portfolio theory, and the capital asset pricing model. The behavioral finance viewpoint examines both the quantitative (objective) and qualitative (subjective) aspects of risk. The subjective component of behavioral finance incorporates the cognitive and emotional issues of decision making. The risk-oriented subjects of behavioral finance are behavioral decision theory, bounded rationality, prospect theory, and loss aversion. The assessment of risk is a multidimensional process and is contingent on the particular attributes of the financial product or service.

Chapter 9 Psychological Influences on Financial Regulation and Policy (David Hirshleifer and Siew Hong Teoh)
This chapter reviews how financial regulation and accounting rules result in part from psychological bias on the part of political participants (such as voters, politicians, regulators, and media commentators) and of the designers of the accounting system (managers, auditors, and users, as well as the above-mentioned parties). Some key elements of the psychological attraction approach to regulation are limited attention, omission bias, in-group bias, fairness and reciprocity norms, overconfidence, and mood effects. Regulatory outcomes are influenced by the way that individuals with psychological biases interact, resulting in attention cascades and in regulatory ideologies that exploit psychological susceptibilities. Several stylized facts about financial regulation and accounting flow from this approach. To help explain accounting, the chapter also discusses conservatism, aggregation, the use of historical costs, and a downside focus in risk disclosures. It also explains informal shifts in reporting and disclosure regulation and policy that parallel fluctuations in the economy and the stock market.

Psychological Concepts and Behavioral Biases

The eight chapters (Chapters 10 to 17) in the second section describe the fundamental heuristics, cognitive errors, and psychological biases that affect financial decisions.

Chapter 10 Disposition Effect (Markku Kaustia)
Many investors tend to sell their winning investments rather quickly while holding on to losing investments. The *disposition effect* is a term used by financial economists to describe this tendency. Empirical studies conducted with stocks as well as other assets show strong evidence for the disposition effect. The effect varies by investor type. Household investors are more affected by the disposition effect than professional investors. Investors can also learn to avoid the disposition effect. The disposition effect underlies patterns in market trading volume and plays a part in stock market underreactions, leading to price momentum. In addition to the original purchase price of the stock, investors can frame their gains against other salient price levels such as historical highs. This chapter also discusses the potential underlying causes of the disposition effect, which appear to be psychological.

Chapter 11 Prospect Theory and Behavioral Finance (Morris Altman)
Prospect theory provides better descriptions of choice behavior than conventional models. This is especially true in a world of uncertainty, which characterizes decision making in financial markets. Of particular importance is the introduction and development of the concepts of the differential treatment of losses and gains, emotive considerations, loss aversion, and reference points as key decision-making variables. Prospect theory questions the rationality in decision making. This chapter argues, however, that prospect theory–like behavior can be rational, albeit non-neoclassical, with important potential public policy implications.

Chapter 12 Cumulative Prospect Theory: Tests Using the Stochastic Dominance Approach (Haim Levy)
Prospect theory and its modified version cumulative prospect theory (CPT) are cornerstones in the behavioral economics paradigm. Experimental evidence employing the certainty equivalent or the elicitation of utility midpoints strongly supports CPT. In these two methods, all prospects must have at most two outcomes. Recently developed Prospect Stochastic Dominance rules allow testing CPT with realistic prospects with no constraints either on the number of outcomes or on their sign. The results in the econometrically important uniform probability case do not support the S-shape value function and the decision weights of CPT. Yet, loss aversion, mental accounting, and the employment of decision weights in the non-uniform probability case, which are important features of CPT, still constitute a challenge to the expected utility paradigm.

Chapter 13 Overconfidence (Markus Glaser and Martin Weber)
Overconfidence is the most prevalent judgment bias. Several studies find that overconfidence can lead to suboptimal decisions on the part of investors, managers, or politicians. This chapter explains which effects are usually summarized as overconfidence, shows how to measure these effects, and discusses several factors affecting the degree of overconfidence of people. Furthermore, the chapter explains how overconfidence is modeled in finance and that the main assumptions—investors are miscalibrated by underestimating stock variances or by overestimating the precision of their knowledge—are reasonable in modeling.

Applications of overconfidence in the theoretical and empirical finance literature are also described.

Chapter 14 The Representativeness Heuristic (Richard J. Taffler)
This chapter explores the role the representativeness heuristic plays in investor judgments and its potential implications for market pricing. The theory underlying the representativeness heuristic is first outlined and different aspects of the representativeness heuristic described. The chapter highlights how tests of the heuristic's validity are typically based on simple and context-free laboratory-type experiments with often naïve participants, followed by a discussion of the problems of directly testing this heuristic in real-world financial environments. The chapter also describes a range of financial market–based "natural experiments." The chapter concludes by pointing out the tendency in behavioral finance to apply the label of representativeness *ex post* to describe anomalous market behaviors that cannot readily be explained otherwise. Nonetheless, despite questions relating to the heuristic's contested scientific underpinning, if investors are aware of their potential to make representativeness-type decisions, they may be able to reduce any resulting judgmental errors.

Chapter 15 Familiarity Bias (Hisham Foad)
Familiarity bias occurs when investors hold portfolios biased toward local assets despite gains from greater diversification. Why does this bias occur? This chapter examines different explanations involving measurement issues, institutional frictions, and behavioral matters. On the measurement side, the chapter discusses estimates of familiarity bias from both a model-based and data-based approach, while discussing the merits of each method. Institutional explanations for home bias cover such costs of diversification as currency risk, transaction costs, asymmetric information, and implicit risk. Behavioral explanations include overconfidence, patriotism, regret, and social identification. The chapter provides an assessment of the existing literature involving these explanations and concludes by examining the costs of familiarity bias.

Chapter 16 Limited Attention (Sonya S. Lim and Siew Hong Teoh)
This chapter provides a review of the theoretical and empirical studies on limited attention. It offers a model to capture limited attention effects in capital markets and reviews evidence on the model's prediction of underreaction to public information. The chapter also discusses how limited attention affects investor trading, market prices, and corporate decision making and reviews studies on the allocation of attention by individuals with limited attention. The final topic discussed is how limited attention is related to other well-known psychological biases such as narrow framing and the use of heuristics.

Chapter 17 Other Behavioral Biases (Michael Dowling and Brian Lucey)
This chapter discusses a range of behavioral biases that are hypothesized to be important influences on investor decision making. While these biases are important influences on behavior, they are individually limited in scope and thus a number of biases are discussed together in this chapter. A key purpose of the chapter is to emphasize the interaction among the various biases and to show how a richer

picture of investor psychology can be built from an awareness of these interactions. The biases are categorized into three groups: inertia, self-deception, and affect.

Behavioral Aspects of Asset Pricing

The third section consists of two chapters (Chapters 18 and 19), which discuss market inefficiency and behavioral-based pricing models.

Chapter 18 Market Inefficiency (Raghavendra Rau)
Many stock patterns seem to deviate from the efficient market paradigm, given the possibility of constructing profitable trading strategies that take advantage of the predictability of these patterns. These anomalies include calendar effects, short-term and long-term momentum, firm characteristics (such as the book-to-market ratio) effects, the market reaction to news, and even investor moods. Though investor biases are systematic and predictable, markets are inefficient because limits to arbitrage mean that arbitrageurs cannot take advantage of these biases and restore market efficiency. Noise trader risk and limits to arbitrage explain several anomalies in efficient markets.

Chapter 19 Belief- and Preference-Based Models (Adam Szyszka)
This chapter presents behavioral attempts of modeling the capital market. Described first are the early models that seem to fit some market peculiarities well but are unable to provide explanations of other important anomalies. Thus, these models have often been accused of being incomplete, fragmentary, and designed *a priori* in such a way as to fit only selected empirical observations. Next, the new Generalized Behavioral Model is presented. It develops a generalized asset pricing model that could be applied to a possibly broad catalogue of phenomena observed in the market. The GBM incorporates key categories of psychologically driven factors and describes how these factors might impact the return-generating process. The model is capable of explaining a vast array of market anomalies including market underreaction and overreaction, continuations and reversals of stock returns, the high volatility puzzle, small size and book-to-market effects, calendar anomalies, and others.

Behavioral Corporate Finance

The fourth section consists of seven chapters (Chapters 20 to 26) and relates heuristics to corporate and executive behavior. These chapters focus on the behavioral influences involving investment and financing decisions as well as corporate governance.

Chapter 20 Enterprise Decision Making as Explained in Interview-Based Studies (Hugh Schwartz)
Most analyses of enterprise decision making are based on data that reflect the result of what occurs. Interview-based studies attempt to uncover the reasoning that underlies decisions, something traditional analyses and laboratory experiments have been unable to do. Interview-based studies allow for open-ended responses and, despite problems, constitute a legitimate empirical technique. Such studies

can provide more plausible explanations for many aspects of business and employee behavior including seemingly anomalous results such as downward wage rigidity. Key factors such as the importance of morale and imperfect perception of information emerge more clearly with this approach. Interview-based analyses have only begun to deal with financial matters.

Chapter 21 Financing Decisions (Jasmin Gider and Dirk Hackbarth)
This chapter surveys the effect of well-documented managerial traits on corporate financial policy within an efficient capital market setting. Optimistic and/or overconfident managers choose higher debt levels and issue new debt more often but need not follow a pecking order. Surprisingly, these managerial traits can play a positive role for shareholder value. Biased managers' higher debt levels restrain them from diverting funds, which increases firm value by reducing this manager-shareholder conflict. Though higher debt levels delay investment, mildly biased managers' investment decisions can increase firm value by reducing bondholder-shareholder conflicts. In addition to existing theoretical research, this chapter reviews several recent empirical studies and proposes several open research issues.

Chapter 22 Capital Budgeting and Other Investment Decisions (Simon Gervais)
This chapter surveys the literature on the effects of behavioral biases on capital budgeting. A large body of the psychology literature finds that people tend to be overconfident and overly optimistic. Because of self-selection, these biases tend to affect firm managers more than the general population. Indeed, the literature finds that biased managers overinvest their firm's free cash flows, initiate too many mergers, start more firms and more novel projects, and stick with unprofitable investment policies longer. Corrective measures to reduce the effects of the managers' biases include learning, inflated discount rates, and contractual incentives, but their effectiveness in curbing overinvestment appears to be limited.

Chapter 23 Dividend Policy Decisions (Itzhak Ben-David)
Firms have been paying dividends for four centuries, yet the motivation for doing so is still debated in the academic literature. This chapter reviews the literature that attempts to explain dividend payout policies based on theories that relate to behavioral finance, that is, recognizing that markets are not necessarily efficient or that investors and managers are not necessarily rational. The balance of the evidence suggests that behavioral theories can meaningfully contribute to understanding why firms distribute dividends.

Chapter 24 Loyalty, Agency Conflicts, and Corporate Governance (Randall Morck)
Agency problems in economics concern self-interested agents' "insufficient" loyalty to their principal. Social psychology also embraces problems of agency, but concerning excessive loyalty—an "agentic shift" where people forsake rationality for loyalty to a legitimate principal, as when "loyal" soldiers obey orders to commit atrocities. This literature posits that human nature features a deep inner satisfaction from acts of loyalty—essentially a "utility of loyalty"—and that this both buttresses institutions organized as hierarchies and explains much human

misery. Agency problems of excessive loyalty, as when boards kowtow to errant chief executive officers or controlling shareholders, may be as economically important as the more familiar problems of insufficient loyalty of corporate insiders to shareholders.

Chapter 25 Initial Public Offerings (François Derrien)
The literature on initial public offerings (IPOs) has identified and analyzed three puzzles: high first-day returns, hot-issue markets characterized by the clustering of IPOs in some periods, and poor long-run performance following IPOs. Can behavioral explanations help to understand these phenomena? This chapter presents the main behavioral theories that have been proposed to explain these puzzles and discusses their empirical validity. In particular, the chapter focuses on stylized facts that are not easily explained by standard theories, such as the extremely high IPO first-day returns observed in the late 1990s. This chapter also critically assesses the validity of the behavioral explanations and their relative explanatory power compared with that of the traditional theories.

Chapter 26 Mergers and Acquisitions (Ming Dong)
Recent studies suggest that market misvaluation and managerial behavioral biases have important effects on mergers and acquisitions. Both the irrational investor and the irrational manager approaches provide useful complements to neoclassical theories of acquisitions. In particular, the irrational investors approach in combination with agency factors in some cases helps to unify a wide range of findings about the relative bidder and target valuations, offer characteristics, managerial horizons, long-run bidder performance, and merger waves. The behavioral approaches also provide insights into acquisitions involving unlisted firms.

Investor Behavior

Much of the scholarship in behavioral finance has been conducted on individual and intuitional investors' holdings and trading. These topics are detailed in the fifth section, which consists of seven chapters (Chapters 27 to 33).

Chapter 27 Trust Behavior: The Essential Foundation of Securities Markets (Lynn A. Stout)
Evidence is accumulating that in making investment decisions, many investors do not employ a "rational expectations" approach that predicts others' future behavior by analyzing their incentives and constraints. Rather, many investors rely on trust. Indeed, trust may be essential to a well-developed securities market. A growing empirical literature investigates why and when people trust, and offers several useful lessons. In particular, most people seem surprisingly willing to trust other people and even to trust institutions such as "the market." Trust behavior, however, is subject to "history effects." When trust is not met by trustworthiness but is instead abused, trust tends to disappear. These lessons carry important implications for our understanding of modern securities markets.

Chapter 28 Individual Investor Trading (Ning Zhu)
Individual investors trade stocks in a way that differs from what mainstream financial economic theory would predict: The investors generate too much trading volume and yet obtain below-benchmark performance. This chapter provides an overview of major "puzzles" of individual investor trading. The extant literature suggests that behavioral biases and psychological explanations are largely responsible for many of the observed patterns in individual trading. The chapter discusses three aspects of individual investor trading: the disposition effect, the local bias, and the ability to learn overtrading, followed by a discussion of the costs associated with individual investor trading.

Chapter 29 Individual Investor Portfolios (Valery Polkovnichenko)
This chapter focuses on two aspects of individual portfolio choice: diversification and stock market participation. Evidence from the Survey of Consumer Finances shows that many investors combine diversified investments in funds with a substantial share of their portfolio allocated in just a few different stocks. Furthermore, some investors, even those with considerable wealth, choose not to hold any stocks either directly or through mutual funds.This chapter presents an argument that the neoclassical portfolio model based on expected utility has difficulty explaining the data on individual portfolio allocations and evaluates potential portfolio inefficiencies and biases implied by the model. Next, the chapter shows that rank-dependent utility functions can explain the observed portfolios. According to these utility models, two opposing forces drive investor decisions: standard risk aversion, and the desire to get ahead by chasing high but unlikely gains from undiversified investments. In addition, the first-order risk aversion explains limited stock market participation.

Chapter 30 Cognitive Abilities and Financial Decisions (George M. Korniotis and Alok Kumar)
This chapter demonstrates that a person's level of cognitive abilities is a key determinant of financial decisions. Households with high cognitive abilities tend to participate more in the stock market and accumulate more financial wealth than households with low cognitive abilities. Upon participation, portfolio performance improves with experience, but it is negatively correlated with age due to the adverse effects of cognitive aging. A portfolio choice model that accounts for cognitive abilities can also provide a parsimonious explanation of why retail investors hold under diversified portfolios, engage in active trading, and overweight local stocks. Specifically, portfolio distortions by smart investors reflect an informational advantage and generate higher risk-adjusted returns. In contrast, the distortions by investors with lower abilities arise from psychological biases and result in low risk-adjusted performance.

Chapter 31 Pension Participant Behavior (Julie Richardson Agnew)
Over the past 25 years, the United States has witnessed a dramatic shift in pension plan coverage. Today, many individuals have more responsibility for their own financial security at retirement than they would have had in previous years. This shift has provided academic researchers a rich context to test behavioral finance theories. This chapter summarizes the most significant findings in this area and

the resulting changes to retirement plan design. In addition, the chapter includes a discussion of how financial illiteracy and lack of interest can contribute to the influence of biases and heuristics in these decisions.

Chapter 32 Institutional Investors (Tarun Ramadorai)
This chapter discusses the literature on institutional investors. First, it selectively surveys the vast literature on whether institutional investment managers (specifically hedge funds and mutual funds) deliver superior risk-adjusted returns to their outside investors. Early work was skeptical about the ability of investment managers to deliver alpha, but the use of new econometric techniques and the advent of hedge funds have resulted in new evidence that some investment managers can deliver consistently positive risk-adjusted performance. Next, the chapter discusses the literature that analyzes the holdings and trades of institutional investors at both low and high frequencies. Evidence suggests that institutions are well informed about cash flow–relevant news and trade consistently in the right direction before and after earnings announcements. Also discussed are the restrictions on institutional investors imposed by the behavior of capital flows from outside investors and the incentives that institutions have to exacerbate, rather than correct, mispricings in asset markets.

Chapter 33 Derivative Markets (Peter Locke)
Derivative markets, especially futures markets, are an ideal setting for investigating behavior-driven market anomalies. Derivatives traders, especially locals, trade frequently, and a near perfect symmetry exists between the costs of holding long and short positions. For locals, the typical pattern is to begin and end a day with a flat position so that each trading day is a new experience with no direct dependence on past positions. Many studies use data generated by traders in these markets to perform behavioral experiments. Not surprisingly, the results on the behavior of these professional traders are mixed. Other research examines the effect of regret aversion and overconfidence on equilibrium hedging, along with the impact of speculative strategies on the futures price backwardation or contango.

Social Influences

The sixth and final section contains three chapters (Chapters 34 to 36) and shows how cultural factors and society attitudes affect markets.

Chapter 34 The Role of Culture in Finance (Rohan Williamson)
The influence of culture in finance cannot be ignored. There are significant differences across countries in the importance of capital markets, the access of firms to external finance, and the ownership of publicly traded firms. Additionally, economic development as well as firm and investor decisions vary greatly across societies. Some of these differences cannot be easily explained by conventional approaches in finance and economics. The evidence in this chapter shows that culture plays a very important role in financial decisions and outcomes from economic development to cross-border trade and foreign direct investment. The chapter also argues that cultural values and beliefs impact the development of institutions, values, and the allocation of resources. Religion, language, ethnicity, and wars can affect the culture in a society, which is transmitted through generations.

Culture also influences firm investment decisions, corporate governance, and investor portfolio decisions.

Chapter 35 Social Interactions and Investing (Mark S. Seasholes)
How do social interactions affect investment behavior? Answering such a question touches on vast and diverse research in the field of financial economics. This chapter provides an overview of published work. The emphasis is on recent empirical papers covering correlated trading (herding), the effects of neighbors/colleagues, information diffusion, and the link between social capital and financial development. The final section discusses the difficulty of identifying a causal link between social interactions and investment behavior. Papers employing identification strategies are rare. The chapter provides examples of four strategies currently being used: (1) laboratory experiments; (2) field experiments; (3) instrumental variable approaches; and (4) exploitation of market structures.

Chapter 36 Mood (Tyler Shumway)
Several variables that psychologists associate with mood are also associated with stock market returns. Sunny weather, long days, and winning sports teams are all associated with relatively high stock market returns. Mood variables are unlikely to be affected by either the market or any other variable that simultaneously causes market returns to fluctuate. This makes correlations between mood variables and market returns particularly strong evidence that something beyond discounted expected cash flows affects prices. While mood effects are generally too small to allow traders to make large arbitrage profits, their existence implies that at least some traders are suboptimally trading on their short-term moods.

SUMMARY AND CONCLUSIONS

Although a relatively young field, behavioral finance seems to be growing exponentially. This growth is not surprising given that behavioral finance has the potential to explain not only how people make financial decisions and how markets function but also how to improve them. Four key themes—heuristics, framing, emotions, and market impact—characterize the field. These themes are integrated into the scholarly review and application of investments, corporations, markets, regulations, and education. Leading scholars provide a synthesis of the current state of each behavioral finance topic and give suggestions or predictions about its future direction. Now, let's continue our journey into exploring the fascinating world of behavioral finance.

REFERENCES

Akerlof, George E., and Robert J. Shiller. 2009. *Animal spirits: How human psychology drives the economy, and why it matters for global capitalism*. Princeton, NJ: Princeton University Press.

Barber, Brad, and Terrance Odean. 2000. Trading is hazardous to your wealth: The common stock investment performance of individual investors. *Journal of Finance* 55:2, 773–806.

Barberis, Nicholas, and Richard Thaler. 2003. A survey of behavioral finance. In *Financial markets and asset pricing: Handbook of the economics and finance*, ed. George Constantinides, Milton Harris, and René Stulz, 1053–1128. Amsterdam: Elsevier.

Benartzi, Shlomo. 2001. Excessive extrapolation and the allocation of 401(k) accounts to company stock. *Journal of Finance* 56:5, 1747–1764.

——, and Richard Thaler. 2001. Naïve diversification strategies in retirement savings plans. *American Economic Review* 91:1, 79–98.

Choi, James J., David Laibson, Brigitte C. Madrian, and Andrew Metrick. 2004. For better or for worse: Default effects and 401(k) savings behavior. In *Perspectives on the economics of aging*, ed. David A. Wise, 81–121. Chicago: University of Chicago Press.

Choi, James J., David Laibson, and Andrew Metrick. 2002. How does the Internet affect trading? Evidence from investor behavior in 401(k) plans. *Journal of Financial Economics* 64:3, 397–421.

DeBondt, Werner, and Richard Thaler. 1985. Does the stock market overreact? *Journal of Finance* 40:3, 793–805.

DeBondt, Werner, and Richard Thaler. 1990. Do security analysts overreact? *American Economic Review* 80:2, 52–77.

Easterwood, John, and Stacey R. Nutt. 1999. Inefficiency in analysts' earnings forecasts: Systematic misreaction or systematic optimism." *Journal of Finance* 54:5, 1777–1797.

Glaser, Markus, Thomas Langer, Jens Reynders, and Martin Weber. 2007. Framing effects in stock market forecasts: The difference between asking for prices and asking for returns. *Review of Finance* 11:2, 325–357.

Hilary, Gilles, and Lior Menzly. 2006. Does past success lead analysts to become overconfident? *Management Science* 52:4, 489–500.

Kahneman, Daniel, and Amos Tversky. 1979. Prospect theory: An analysis of decision making under risk. *Econometrica* 47:2, 263–291.

Madrian, Brigitte C., and Dennis F. Shea. 2001. The power of suggestion: Inertia in 401(k) participation and savings behavior. *Quarterly Journal of Economics* 116:4, 1149–1187.

Odean, Terrance. 1998. Are investors reluctant to realize their losses? *Journal of Finance* 53:5, 1775–1798.

Odean, Terrance. 1999. Do investors trade too much? *American Economic Review* 89:5, 1279–98.

Shefrin, Hersh. 2000. *Beyond greed and fear: Understanding behavioral finance and the psychology of investing*. Boston, MA: Harvard Business School Press.

Shefrin, Hersh. 2007. *Behavioral corporate finance: Decisions that create value.* New York: McGraw-Hill/Irwin.

Shefrin, Hersh, and Meir Statman. 1985. The disposition to sell winners too early and ride losers too long: Theory and evidence. *Journal of Finance* 40:3, 777–790.

Shleifer, Andrei, and Robert Vishny. 1997. The limits of arbitrage. *Journal of Finance* 52:1, 35–55.

Slovic, Paul. 1969. Analyzing the expert judge: A study of a stockbroker's decision process. *Journal of Applied Psychology* 53:1, 255–263.

Slovic, Paul. 1972. Psychological study of human judgment: Implications for investment decision making. *Journal of Finance* 21:3, 61–74.

Thaler, Richard H., and Cass R. Sunstein. 2008. *Nudge: Improving decisions about health, wealth, and happiness.* New Haven, CT: Yale University Press.

Tversky, Amos, and Daniel Kahneman. 1974. Judgment under uncertainty: Heuristics and biases. *Science* 185:4157, 1124–1131.

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CHAPTER 2

Traditional Versus Behavioral Finance

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INTRODUCTION

The traditional finance researcher sees financial settings populated not by the error-prone and emotional *Homo sapiens*, but by the awesome *Homo economicus.* The latter makes perfectly rational decisions, applies unlimited processing power to any available information, and holds preferences well-described by standard expected utility theory.

Anyone with a spouse, child, boss, or modicum of self-insight knows that the assumption of *Homo economicus* is false. Behavioralists in finance seek to replace *Homo economicus* with a more-realistic model of the financial actor. Richard Thaler, a founding father of behavioral finance, captured the conflict in a memorable National Bureau of Economic Research (NBER) conference remark to traditionalist Robert Barro: "The difference between us is that you assume people are as smart as you are, while I assume people are as dumb as I am." Thaler's tongue-in-cheek comparison aptly illustrates how the modest substantive differences in traditionalist and behavioralist viewpoints can be exaggerated by larger differences in framing and emphasis, bringing to mind the old quip about Britain and America being "two nations divided by a common tongue." (For what it is worth, when confirming this account of the exchange, Thaler reports that Barro agreed with his statement.)

The purpose of this chapter is to guide readers through this debate over fundamental assumptions about human behavior and indicate some directions behavioralists might pursue. The next section provides a general map of research in finance and describes in greater detail the similarities and differences between behavioral and traditional finance. The ensuing section places the disagreements between the two camps in the context of the philosophy of science: Behavioralists argue, à la Thomas Kuhn, that behavioral theories are necessary to explain anomalies that cannot be accommodated by traditional theory. In return, traditionalists use a philosophy of instrumental positivism to argue that the competitive institutions in finance make deviations from *Homo economicus* unimportant, as long as

simplifying assumption is sufficient to predict how observable variables are related to one another.

A brief history of behavioral research in financial reporting then shows that while these two philosophical perspectives are powerful, they are incomplete. The success of behavioral financial reporting also depends heavily on sociological factors, particularly the comingling of behavioral and traditional researchers within similar departments. Because most finance departments lack this form of informal interaction, behavioralists must redouble their efforts to pursue a research agenda that will persuade traditionalists. The last section proposes a research agenda that behavioralists can use to address both their substantive and sociological challenges: developing and testing models explaining how the influence of behavioral factors is mediated by the ability of institutions (like competitive markets) to scrub aggregate results of human idiosyncrasies. Such research should establish common ground between traditionalists and behavioralists, while also identifying settings in which behavioral research is likely to have the most predictive power.

A THREE-DIMENSIONAL MODEL OF RESEARCH IN FINANCE

A helpful way to illuminate the similarities and differences between traditional and behavioral finance is to map finance research in a matrix with three dimensions: institution, method, and theory, as shown in Exhibit 2.1.

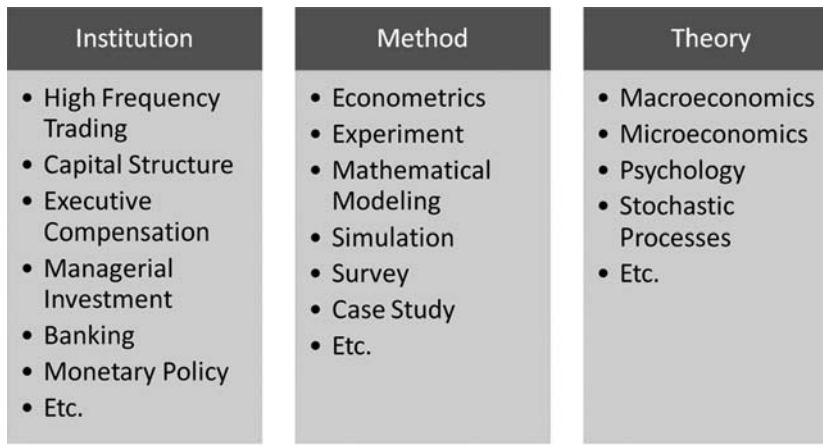

Exhibit 2.1 Three-Dimensional Matrix of Finance Research.

Note: Every research study in finance can be placed in a three-dimensional matrix describing the institution being studied, the theory from which hypotheses are described, and the methods used to demonstrate results.

The institution can be thought of as the topic of study of a finance researcher. As described in Bloomfield and Rennekamp (2009, p. 143),

> *North (1990) emphasizes "the varying meanings and usage of the concept of* institution*. One of the oldest and most often-employed ideas in social thought, it has continued to take on new and diverse meanings over time, much like barnacles on a ship's hull, without shedding the old." We use the term* institution *to refer to laws, common practices and types of organizations that persist over long periods of time. Thus, institutions in accounting research would include the existence of capital markets and financial reporting, managerial reporting techniques, tax laws, and auditing. Note that specific organizations are not institutions, but the types of organizations are. For example, Bear Sterns and Lehman Brothers were never institutions, but "banks" are. Sociologists emphasize that institutions include norms and beliefs that impact social behavior (Scott, 2007). Thus, we also include as institutions practices like management forecasting behavior or the nature of conference calls, and common forms of commercial arrangements and "best practices," such as long-term contracts, relative performance evaluation, and debt covenants.*

The most common research methods are economic modeling and econometric analysis of data archives, with experimentation a distant third, along with a smattering of field studies, surveys, and simulations. Almost every research study published in peer-reviewed finance journals is motivated or guided by a theory, even if not explicitly stated. By far the most predominant theories are drawn from economics. These include theories of efficient markets and no arbitrage (crucial for studies of asset pricing and market behavior), agency theory (central to corporate governance), monetary theory (in banking), and stochastic processes (for financial engineering). A growing number of studies draw their theory at least partly from psychology. Psychological research has made considerable progress over the last three decades developing robust theories of how people behave, which have been summarized into the categories of drive (fundamental motivations as described by Maslow's hierarchies of needs), cognition (how humans analyze data and draw conclusions), and affect (emotional responses to environmental stimuli, and how those responses affect behavior).

The three-dimensional model of finance research clarifies the rather slight differences between traditional and behavioral finance. Both address largely the same institutions and use similar methods. The distinction between the approaches lies entirely in their theoretical underpinnings. Many studies use econometric techniques to test psychological theories and are therefore appropriately called behavioral. Others use experimental methods to test economic theory as discussed in Chapter 7 and are therefore appropriately called traditional.

Even the distinctions in theory should not be overstated. While traditional finance incorporates no element of human psychology, behavioral finance usually incorporates almost no element, relying primarily on economic theory. The reason is straightforward: Finance institutions place people in complex settings that are best described in terms of information, incentives, and actions that can be taken—exactly the building blocks of economic theory. Thus, behavioral studies typically include only a small element of psychology, integrated into the economic theory needed to understand the institution itself. In this way, behavioral finance adds only a slight wrinkle to traditional finance, which is to alter some of one or

more facets of an assumption at the very foundation of economic theory: How do individuals behave?

ARGUING ABOUT ASSUMPTIONS: A PRIMER IN PHILOSOPHY OF SCIENCE

Disagreements about fundamental assumptions lead to various philosophical debates. The following discussion provides a brief primer on the philosophies of science that behavioral and traditional researchers in finance rely on most heavily.

Behavioralists often defend their iconoclastic approach by referring to Kuhn's (1962) popular and influential book *The Structure of Scientific Revolutions*. Kuhn argues that science progresses through *paradigm-shifting* and "normal" science. A paradigm provides a theoretical framework for researchers to test and bolster (or modify) through what Kuhn calls "normal science." Normal science establishes the validity of the paradigm but may also uncover anomalies—observations inconsistent with the paradigm. New paradigms become successful only if they can explain anomalies of sufficient quantity and importance in a sufficiently simple way.

Copernicus and Einstein represent archetypal examples of scientists who introduced new successful paradigms. In Copernicus's time, Tycho Brahe, who is considered in some circles as the father of modern astronomy, had provided exceptionally detailed observations showing that planetary motion was inconsistent with a simple geocentric model of the solar system. According to the geocentric theory, planets orbited Earth, but the data indicated that they must move backwards at certain points in their path. Copernicus demonstrated that a different paradigm, in which all planets (including Earth) orbited the sun, could allow a much more elegant explanation of Brahe's observations: All planets move in ellipses around the sun, resulting in apparent retrograde motion when seen from Earth.

Einstein also provided an entirely new paradigm that replaced Newtonian mechanics. To simplify a far more complex story, Einstein's special theory of relativity (Einstein, 1920) was inspired in part by experimental observations that the speed of light in a vacuum is the same in every direction, a result difficult to reconcile with Newtonian mechanics.

The appeal of Kuhn to behavioralists is obvious. Kuhn allows behavioralists to paint the traditionalist as a modern-day Ptolemy, papering over increasingly obvious anomalies, while painting themselves as Copernicus, or even better, Einstein.

Traditionalists often show a fondness for *instrumental positivism*, a variant of a closely related set of philosophies. All variants of positivism emphasize the importance of predictive power: Science is a process of deriving refutable hypotheses from a theory, and then testing those hypotheses and discarding theories that are not supported. A particularly extreme variant is Popper's *strict logical positivism* (Newton-Smith, 1981), which claims that theories can never be supported by evidence; they can only be refuted. Strict logical positivism is not very popular among practicing scientists for two reasons. First, most find empirical support for the theory to be persuasive evidence in the theory's favor. Second, positivism provides no guidance on the origin of theories or how scientists should choose between two theories that are supported by some evidence, but also have some predictions that

are empirically rejected. However, weaker forms of positivism are shared by most traditionalists in finance.

Positivism is closely tied to *instrumentalism*, which views science as a method of identifying associations among observable variables, but does not argue that the variables themselves, or the theories that describe the relationships between these variables, necessarily describe reality. (A philosophy that does so would be called "realism.") Rather, variables and theories are merely tools or instruments that allow for theories to be tested. Instrumentalist positivism has a natural appeal to traditionalists because the assumption of *Homo economicus* is patently unrealistic. Still, as Friedman (1953) argues in his classic book *Essays in Positive Economics*, economic theory has great predictive power, and the realism of its assumptions is irrelevant. All that matters is whether economic variables behave *as if* all decisions are being made by *Homo economicus*. Even in physical sciences, researchers often make assumptions they know are false, such as assuming that atoms have no volume or that velocities are linearly additive. Neither is true, but data indicate that the world behaves *as if* they are, except at very small sizes or high velocities. Positivism also offers traditionalists another argument against behavioralists: Until positivism offers a single explicit alternative to *Homo economicus*, behavioral finance is irrefutable. Any apparent anomaly can be explained by offering up another post hoc psychological tendency. While few traditionalists are strict positivists (who would never place value on results that support a theory), support clearly has less value if refutation is impossible.

Kuhn's (1962) perspective is not in direct opposition to instrumental positivism. Yet, behavioralists tend to argue Kuhn against traditionalists, who reply with instrumental positivism. While both arguments have substance, they also contain a rather contentious personal element. By adopting a Kuhnian perspective, behavioralists implicitly brand their opponents as old, fading Luddites. (Kuhn famously claimed that individual scientists never change their minds; instead, fields change because the old scientists die or retire, and are replaced by a new generation of scientists who hold to the new paradigm.) By emphasizing instrumental positivism, the traditionalists imply that behavioralists are arguing their case on the basis of realism rather than predictive power, and suggest that behavioralists are not even real scientists because they proffer an irrefutable theory that can be adapted ex post to accommodate almost any observation.

Here are some key paragraphs from one of the most pointed criticisms of behavioral finance, written by Eugene Fama, a founder of modern (traditional) finance. The paper was a response to two modeling papers by Barberis, Shleifer, and Vishny (1998) and Hong and Stein (1999) that used different behavioral assumptions to generate both price underreactions and overreactions, as observed in econometric studies. Fama poses himself the question of whether the empirical evidence, along with these ex post models, should convince him to "discard market efficiency." Fama (1998, p. 284) answers no, reasoning as follows:

> *First, an efficient market generates categories of events that individually suggest that prices over-react to information. But in an efficient market, apparent underreaction will be about as frequent as overreaction. If anomalies split randomly between underreaction and overreaction, they are consistent with market efficiency. We shall see that a roughly even split between apparent overreaction and underreaction is a good description of the menu of existing anomalies.*

> *Second, and more important, if the long-term return anomalies are so large they cannot be attributed to chance, then an even split between over- and underreaction is a pyrrhic victory for market efficiency. We shall find, however, that the long-term return anomalies are sensitive to methodology. They tend to become marginal or disappear when exposed to different models for expected (normal) returns or when different statistical approaches are used to measure them. Thus, even viewed one-by-one, most long-term return anomalies can reasonably be attributed to chance.*
>
> *A problem in developing an overall perspective on long-term return studies is that they rarely test a specific alternative to market efficiency. Instead, the alternative hypothesis is vague, market inefficiency. This is unacceptable. Like all models, market efficiency (the hypothesis that prices fully reflect available information) is a faulty description of price formation. Following the standard scientific rule, however, market efficiency can only be replaced by a better specific model of price formation, itself potentially rejectable by empirical tests.*
>
> *Any alternative model has a daunting task. It must specify biases in information processing that cause the same investors to under-react to some types of events and over-react to others. The alternative must also explain the range of observed results better than the simple market efficiency story; that is, the expected value of abnormal returns is zero, but chance generates deviations from zero (anomalies) in both directions.*

Fama's (1998) first two points question the robustness and reliability of the supposed anomalies. His last two points are that one must discard a reasonably successful theory such as market efficiency only if provided with one that not only explains what existing theory explains, but also goes further without being too complex, and while still being refutable.

While these arguments are largely what one would expect from an instrumental positivist, Fama's style of argument suggests an antipathy to behavioral work that goes beyond the data. No serious researcher in finance, behavioral or otherwise, is likely to "discard market efficiency." Instead, they will relax particular assumptions about individual behavior that might create modest but important deviations from market efficiency. Moreover, Fama (1998) misstates what it means for a market to be efficient. If researchers can reliably predict overreactions to 10 types of events and reliably predict underreactions to another 10 types of events, the fact that the market may react appropriately on average (without conditioning on which type of event occurs) hardly counts as market efficiency. Arbitrageurs can simply bet on overreaction to the first 10 and bet on underreaction to the second 10 and earn abnormal returns. This is like saying that post–earnings-announcement drift does not exist, because even though returns predictably rise after good news and fall after bad news, there is no abnormal return if we do not distinguish whether the news was good or bad.

A third school of philosophy would suggest that Fama's (1998) position is colored more than a little by sociological forces within the scientific community itself. Sociological philosophers such as Feyerabend and Lakatos (and Thomas Kuhn, at times) often cast their arguments in radical terms: that objective successes and the ability to predict the real world are *entirely* irrelevant to their success in being adopted by other scientists, scientific "progress" is an illusion, and the path of science is *entirely* political and social. While few practicing scientists would accept such extreme claims, even fewer would doubt the influence of social and political factors in guiding research in finance, ranging from the explicit impact

of financial support (from the Federal Reserve Bank, for example) to the prestige conferred by affiliation with premier institutions.

The sociological perspective suggests that behavioralists will face significant challenges in getting the much larger traditionalist community to adopt their perspective. Few faculty members at the highest ranked institutions are behavioralists. Also, finance departments are nearly devoid of faculty trained in the fundamental disciplines of the behavioral sciences, such as psychology and experimental methods. These facts explain why behavioral perspectives on finance appeared only recently within finance departments. For those who might think the tradition is longer, two key facts need emphasis. First, Richard Thaler, often called the father of behavioral finance, was an economist during his years at Cornell and is Professor of Behavioral Science and Economics at Chicago, not in finance. Second, much of Thaler's work *in finance* (rather than in economics or decision theory) is almost entirely devoid of behavioral content. Papers such as DeBondt and Thaler (1985, 1987) provided hotly contested evidence of market inefficiency. However, while the authors might have asserted that the causes for inefficiencies are behavioral, psychological explanations took a backseat to demonstrations of mispricing.

How pessimistic should behavioralists be about their future in finance? The next section provides some answers by looking at a subfield of applied finance that has debated traditionalist and behavioralist views for many decades, and one that faces different sociological forces: financial reporting.

THE RISE AND FALL AND RISE OF BEHAVIORAL RESEARCH IN FINANCIAL REPORTING

One look at the possible future of behavioral finance is provided by the history of behavioral research in financial reporting. Financial reporting can be viewed as a subfield of finance focusing on the role of accounting data and other financial disclosures in market behavior, management decisions, executive compensation, related institutions, and the effects of those institutions on reporting decisions. This section recounts how and why behavioral research in financial reporting was viewed as a legitimate approach in the 1960s, fell from favor in the 1970s, and resurfaced in the 1990s.

The Rise of Behavioral Research in Accounting

Empirical research in financial accounting is typically dated to a paper by Ray Ball and Phil Brown, then of the University of Chicago's Accounting Department. Ball and Brown (1968) show that stock prices rose (fell) when firms reported earnings that were higher (lower) than expected by a simple time-series model. Their results surprised finance professors because accounting earnings are considerably delayed reports of financial performances and include accruals, which can be viewed as a noisy measure of the cash flows that provide the foundation of most valuation models in finance.

Ball and Brown's (1968) paper contained another surprise. Not only did the market respond sharply to the earnings announcement, but also the response

continued for many months. This post–earnings-announcement drift was in direct contradiction to Fama's Efficient Markets Hypothesis, formalized in Fama (1970), and ultimately reflected what Fama (1998, p. 304) referred to as the only market anomaly that was "above suspicion." However, researchers in accounting using stock price data archives were steeped in traditional views of *Homo economicus* until well into the 1980s, and paid little attention to a price drift that they deemed most likely to be an artifact of a flawed model of expected returns or flawed statistical technique.

While archival researchers were solid traditionalists, they worked side-by-side with people steeped in behavioral methods even at the University of Chicago. In particular, researchers like Robert Libby drew from a rich literature examining the decision making of doctors and jurors and others in professional situations, and applied those techniques to auditors (for an excellent review and introduction, see Libby, 1981). This has led to decades of research examining how auditors weigh evidence as they attest to the accuracy of account balances, and how their judgments might be affected by the order in which information is presented or whether the information includes irrelevant details.

Research on auditor behavior led to a wealth of "decision aids," which are simple techniques that can be used to improve audit outcomes by limiting deviations from optimal decision making. Behavioral research also led to an early form of behavioral finance for sociological reasons: behavioral auditing researchers and traditionalist archival researchers worked together on teaching, hiring, workshops, and other departmental matters. These behavioralists began conducting experiments in financial reporting as it became clear to them that (1) decisions by individual investors drove market reactions to accounting information, and (2) decisions of individual investors were likely to be driven by the same behavioral forces that drive those of jurors, doctors, and auditors.

Many of these studies provided subjects with financial reports that contain similar information that is presented under different accounting methods. In a typical experiment (e.g., Dyckman, 1964), some subjects might see financial statements reporting high income, but reporting in a footnote that inventory was accounted for under the first-in-first-out (FIFO) method, while the remaining subjects see financial statements reporting low income, but reporting in a footnote that inventory was accounted for under the last-in-first-out (LIFO) method. Analysis of the footnote would indicate that performance was identical in the two versions, but that in a period of rising prices, LIFO accounting results in lower income and smaller ending inventory than FIFO. However, limitations to information processing and a "functional fixation" on reported earnings might lead individual investors to assess performance more favorably for the FIFO firm.

The Fall of Behavioral Research in Accounting

Traditionalists in finance soon put a stop to this research program. In a highly influential paper, Gonedes and Dopuch (1974) proffer two arguments against applying behavioral perspectives to investor and market behavior. The first argument is that investors might well devote additional resources to understanding information they felt was more important, and that the experiments did not allow such a choice of resource allocation. The second argument spoke directly to the institutions in

finance that make investors' individual limitations uninteresting. As Gonedes and Dopuch (1974, p. 106) comment:

> *Even if these studies were based upon an explicit theory of resource allocation by individuals, it still is not apparent that their results would be pertinent to issues of reporting to capital market agents. To see this, consider the implications of capital market efficiency and competition in the market for information.*
>
> *Recall that the kind of efficient market considered here is simply a competitive market, a market within which each individual is a price-taker. Given this type of market, any generalizations made about the aggregate behavior of capital market agents on the basis of results from lab/field studies are extremely tenuous. Specifically, given an efficient capital market, studies of the behavior of particular types of investors (e.g., "average" investors or "financial analysts") are not likely to lead to reliable generalizations about the relationship between the production of accounting information and capital market equilibrium. To see this, recall that, within a competitive market, market behavior is a function of the interactions among rivalrous price-takers. The attainment of equilibrium in such a market is induced by the workings of the system as a whole, or* aggregate *market behavior, and not by the actions of particular individuals. Since the lab/field studies concentrated on individual behavior rather than competitive market phenomena, their relevance to the issues at hand seems nonexistent.*
>
> *Note also that available lab/field studies fail to simulate competition among sources of information. Indeed, the information available to subjects is usually deliberately limited to accounting information. This limitation makes the settings of these studies even further removed from the setting within which the equilibrium prices of firms' ownership shares appear to be established. . . . To be sure, the indicated deficiencies of lab/field studies can, in principle, be overcome. But to our knowledge, few (if any) attempts to do so have been completed or are even underway.*

Gonedes and Dopuch (1974) hardly spelled the end of behavioral research in accounting. As they indicated in a footnote to the above quotation, "This statement does not imply that lab/field approaches are irrelevant to all accounting issues. Indeed, these approaches may be particularly helpful in resolving some issues of managerial accounting" (p. 106). Because Gonedes and Dopuch's argument resonated well within the traditionalist research community, researchers trained in behavioral methods turned their attention away from financial reporting topics, reasonably assessing little chance such work would be published in top journals. (Dopuch was the editor of *Journal of Accounting Research* at the time the paper was published.) Instead, they focused their efforts on the behaviors of individual managers and particularly of individual auditors because research on the latter began to receive funding from public accounting firms.

The Rise (Again) of Behavioral Research in Accounting

Top journals in accounting shied away from publishing behavioral papers in financial reporting until the mid-1990s. Libby, Bloomfield, and Nelson (2002) argue that two key forces led to a resurgence of such research. The first was mounting evidence that financial markets were not, in fact, informationally efficient. Bernard and Thomas (1990) and Abarbanell and Bernard (1992) provide particularly persuasive evidence in accounting that strongly supported views that the

post-earnings-announcement drift, as identified by Ball and Brown (1968), was very likely to reflect inefficiency.

The second force leading to a resurgence of behavioral financial accounting research was the technological advances that allowed experimental researchers to address the deficiencies Gonedes and Dopuch (1974) indicated at the end of their quotation above: to establish equilibrium prices within a competitive market. As discussed in Chapter 7 of this volume, these studies show little evidence that markets de-bias pricing.

Libby et al. (2002) downplayed what might have been the most important aspect of the resurgence: Many accounting departments included researchers who were actively conducting behavioral research in other areas. While many of the most prestigious departments had purged their ranks of behavioralists, including the University of Chicago, Stanford University, University of Pennsylvania (Wharton), and the University of Michigan, behavioral research was active at many of the top state institutions, especially the University of Illinois, University of Texas, and University of Washington. This activity had two positive effects on the resurgence of behavioral financial reporting research. First, it meant that trained behavioralists were able to quickly shift topics back to financial reporting once they believed such research might be published in top journals, which now occurs with regularity. Second, it meant that many traditionalist researchers had been exposed to behavioral research ideas and had developed amicable working relationships with behavioral researchers in their departments.

What does this history of financial reporting research augur for behavioralists in finance? On the optimistic side, this history shows that evidence can overcome Fama's (1998) objections, just as it overcame those of Gonedes and Dopuch (1974). However, finance departments lack a faction of researchers who are applying behavioral theories to areas of finance in arguments about the discipline of market institutions that are less compelling. The next section proposes a research program that can address this sociological challenge, while also addressing Fama's substantive objections.

A RESEARCH PROGRAM FOR BEHAVIORAL FINANCE

Behavioralists in finance are working hard to address Fama's (1998) critique. The bulk of behavioral finance work still consists of empirical studies demonstrating that markets or firms behave in ways that are anomalous with respect to traditional models, but are consistent with one of the many individual behavioral tendencies identified by psychological research. The best of this research uses psychological research to predict and demonstrate an anomaly that has not yet been previously demonstrated. Traditionalists naturally rebut individual studies, leading to a back-and-forth debate over empirical methods and interpretation that is yielding a research literature in the best tradition of Kuhnian normal science. The collected mass of evidence makes headway in convincing new finance researchers that behavioral perspectives can improve predictive power, but still fails to address Fama's (1998) demand for a simple, unified, and refutable theory.

Modelers have made some progress toward simplicity and refutability by demonstrating that behavioral forces can be incorporated into otherwise traditional models. Some, such as Barberis et al. (1998) and Hong and Stein (1999), try to create simple models that yield apparently incompatible outcomes (those papers seek to reconcile short-term underreactions and long-term overreactions). Others seek to identify counterintuitive results of known behavioral forces such as the Barberis and Huang (2008) model incorporating loss aversion and framing into asset pricing to understand the equity premium puzzle. To the extent subsequent evidence supports these predictions, behavioralists can counter criticisms that their alternative is entirely post hoc.

Whether modelers will ever be able to address Fama's (1998) demand for simplicity and refutability is doubtful. Individual behavior is inherently complex and the deviations from *Homo economicus* are so numerous that traditionalists will always be able to point to a profusion of models as evidence that behavioral finance is not simple or refutable.

What should behavioralists do? One answer is for behavioralists in finance to strive to demonstrate *interactions* between behavioral forces and institutional features. The areas of the most strident tension are those in which disciplinary institutions seem the strongest: competitive and liquid securities markets. However, traditionalists rarely argue that individuals who are not disciplined by market institutions still act like *Homo economicus*. Many traditionalists are even willing to accept that behavioral forces acting on individual managers can influence the behavior of large firms, even in the absence of labor markets, compensation schemes, and corporate governance institutions. This suggests a possible common ground among behavioralists and traditionalists. Researchers in both camps are likely to agree with the following statement: Behavioral forces have a greater impact on market and firm behavior when institutions have weaker disciplinary power. This statement can be tested through a research design like that presented in Exhibit 2.2.

		Weak Behavioral Forces	Strong Behavioral Forces
Institutions	Strong Disciplinary Institutions	*(Cell 1)*	*(Cell 2)*
	Weak Disciplinary Institutions	*(Cell 3)*	*(Cell 4)*

Exhibit 2.2 A Research Design for Behavioral Finance Studies.

Note: This research design clarifies the interaction between the strength of behavioral forces on individual decision making and the ability of the finance institution in which individuals make decisions to eliminate behavioral forces in aggregate phenomena.

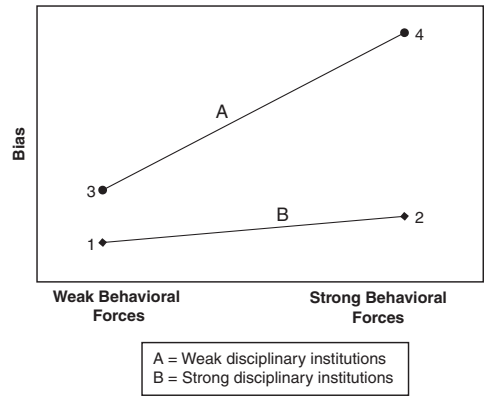

Exhibit 2.3 Hypothesized Results of a Study Crossing Behavioral Forces with the Disciplinary Strength of Institutions.

Note: Strengthening a behavioral force that induces biases in individual decisions should have a greater effect on aggregate phenomena in an institution with weak disciplinary forces than in an institution with strong disciplinary forces.

For simplicity, consider a hypothetical laboratory study using a market setting similar to that in Bloomfield, O'Hara, and Saar (2009), but in which some traders are given information about asset values and others are not. The uninformed traders are given injections of testosterone in cells 3 and 4, but are injected with a placebo in cells 1 and 2. Behavioral research suggests that testosterone will make the uninformed traders more aggressive, lose more money, and drive excess price volatility. However, assume that the market used in cells 2 and 4 allows informed traders to borrow on margin and discipline market prices, while cells 1 and 3 do not permit this.

The statement above predicts that, as shown in Exhibit 2.3, the slope of line B will be flatter than the slope of line A, because disciplinary forces would limit the effect of testosterone on market prices (as informed investors use their extra access to capital to drive price closer toward fundamental values). The most hard-core traditionalists might argue that even the weakest institutions, such as labor markets, are still adequate to eliminate individual behavioral forces, so that observed excess volatility is 0 in all four cells. The market hard-core behavioralists might argue that even the strongest institutions, such as global equity markets for Fortune 100 companies, are insufficient to discipline bias, so that observed bias is above 0 in all four cells—but they would probably still agree that the slope of line B will be flatter than that of line A.

Focusing on the interaction between institutional and behavioral factors has three key advantages for the behavioralists. First, it converts the distinction between traditionalists and behavioralists from a qualitative one to a quantitative one: The question is not whether behavioral forces always or never matter, but which institutions do a more effective job at disciplining those forces. Traditionalists have difficulty maintaining an absolutist position (effects of behavioral forces are always completely eliminated by all institutions) when the question is posed this way.

Second, focusing on disciplinary forces helps behavioralists respond to demands for simplicity. Human behavior will never be explained by simple theories. However, simple and traditional theories may determine what types of finance institutions will scrub aggregate behavior of the idiosyncrasies of individual human beings. To use a physics analogy, Newtonian physics has excellent predictive power when describing behavior of objects with low velocities and moderate sizes; otherwise, much more complex relativistic and quantum theories are required. Similarly, traditional finance will have good predictive power when institutions are highly competitive, and checks and balances scrub aggregate behavior of human idiosyncrasies. Otherwise, much more complex behavior theories are required.

The third benefit is sociological. As discussed earlier, accounting departments had a continuing presence of behavioral researchers who studied settings with weak disciplinary institutions. These researchers were able to develop behavioral theory without the added hurdle of convincing traditional researchers to accept a new paradigm in its most challenging setting (highly competitive financial markets). As evidence began to support behavioral hypotheses in those markets, these researchers were poised to address the topic. In the same way, the overall prospects of behavioral finance, particularly for those who want to address the most competitive institutions, will be strengthened by a corps of researchers applying behavioral theory to the behavior of corporate managers and others operating in institutions of relatively weak disciplinary power.

These efforts will require behavioral researchers to think carefully about the nature of finance institutions and to characterize finance institutions in ways that emphasize the roles of both human decision making and institutional discipline. Most financial market models do a rather poor job of this by ignoring most of the decision points and institutions. For example, the model of Barberis et al. (1998) focuses on a single representative investor subject to behavioral forces, but makes little mention of institutions (such as competition) that discipline those forces. At the other extreme, models like DeLong, Shleifer, Summers, and Waldmann (1991) show how market institutions can fail to discipline pricing errors, but the errors are generic, rather than the result of behavioral forces.

Substantial progress will come from applying behavioral perspectives to models of market microstructure, which explicate specific decisions in a clear institutional context. For example, the seminal models of Glosten and Milgrom (1985) and Kyle (1985) differ significantly in the decisions made by traders and market makers. Glosten and Milgrom assume that market makers first quote competitive prices and then investors decide whether to buy or sell at those prices. Prices change after every trade, ultimately allowing complete revelation of traders' information. Kyle assumes that investors first enter their orders to buy and sell, and the market makers compete to fill the orders at competitive prices.

Kyle and Wang (1997) show that in a Kyle-type model, overconfident traders can bias prices and survive in the long run because their aggressiveness makes others order less aggressively, allowing overconfident traders to create "elbow room" from which they can profit, despite their bias. Such a result would not be obtained in a Glosten-Milgrom (1985) model, because overconfident traders would simply lose money on their unwise trades, to the benefit of the informed and unbiased traders. These models provide a clear identification of the biased

decision makers and the disciplinary institutions, as well as the reason that one institution (the Glosten-Milgrom market) provides more discipline.

SUMMARY AND CONCLUSIONS

What will finance departments look like in 20 years? Richard Thaler (1999, p. 17), in an article titled "The End of Behavioral Finance," makes this prediction:

> *Behavioral finance is no longer as controversial a subject as it once was. As financial economists become accustomed to thinking about the role of human behavior in driving stock prices, people will look back at the articles published in the past 15 years and wonder what the fuss was about. I predict that in the not-too-distant future, the term "behavioral finance" will be correctly viewed as a redundant phrase. What other kind of finance is there? In their enlightenment, economists will routinely incorporate as much "behavior" into their models as they observe in the real world. After all, to do otherwise would be irrational.*

Thaler's view is likely to prove optimistic. Many (or most) finance researchers are likely to be studying large, highly competitive asset markets and largely ignore behavioral modifications to traditional theory. Traditional theory will work well for these researchers, as long as they are focusing on the first-order effects of changes in finance institutions that are likely to diminish behavioral forces. Even absent these benefits, research trends simply do not allow for much more rapid change from the status quo.

Traditional researchers are likely to be joined by three groups of behavioralists. Some, who will attract the bulk of controversy, will be demonstrating that behavioral modifications can provide useful insights and incremental predictive power in even the most competitive and disciplinary institutions. Others will be demonstrating that some institutions are less effective than others at disciplining individual deviations from the *Homo economicus* assumption. These researchers will be providing the fundamental groundwork needed to identify the settings in which behavioral finance is most useful, and equally important, will be stating arguments that are difficult for traditionalists to refute: Behavioral approaches are more useful in some finance settings than others. The final group will be those who identify the finance settings in which behavioral forces are widely viewed to be only weakly disciplined such as decisions by individual managers in poorly functioning labor markets. These researchers will generate little controversy, as they will engage least directly with the traditionalists. However, they will be able to provide finance departments with a continuing presence of researchers who are well trained in behavioral finance. They can turn their attention to other fields as traditionalists lose their resistance to behavioral techniques and are convinced by new theory and evidence, or (as Kuhn would suggest) simply retire and are replaced by others who are willing to embrace the behavioral paradigm.

DISCUSSION QUESTIONS

1. How can a scientific discipline succeed if it is based on an assumption that is demonstrably false (such as the assumption that humans always rationally maximize expected utility)?

2. How can sociological factors influence the path of scientific fields that are supposed to be based on the predictive power of theories?
3. Will behavioralists in finance ever "win over" traditionalists, will the two groups simply co-exist side by side, or will behavioral finance die out?
4. How can behavioralists ever achieve simplicity in their field when human behavior is inherently complex?

REFERENCES

Abarbanell, Jeffery S., and Victor L. Bernard. 1992. Tests of analysts' overreaction/underreaction to earnings information as an explanation for anomalous stock price behavior. *Journal of Finance* 47:3, 1181–1207.

Ball, Ray, and Phillip Brown. 1968. An empirical evaluation of accounting income numbers. *Journal of Accounting Research* 6:2, 159–178.

Barberis, Nicholas, and Ming Huang. 2008. The loss aversion/narrow framing approach to the equity premium puzzle. NBER Working Paper No. W12378.

Barberis, Nicholas, Andrei Shleifer, and Robert Vishny. 1998. A model of investor sentiment. *Journal of Financial Economics* 49:3, 307–343.

Bernard, Victor L., and Jacob K. Thomas. 1990. Evidence that stock prices do not fully reflect the implications of current earnings for future earnings. *Journal of Accounting and Economics* 13:4, 305–340.

Bloomfield, Robert J., and Kristina Rennekamp. 2009. Experimental research on financial reporting: From the laboratory to the virtual world. *Foundations and Trends in Accounting* 3:2, 135–221.

Bloomfield, Robert J., Maureen O'Hara, and Gideon Saar. 2009. How noise trading affects markets: An experimental analysis. *Review of Financial Studies* 22:6, 2275–2302.

DeBondt, Werner F. M., and Richard H. Thaler. 1985. Does the stock market overreact? *Journal of Finance* 40:3, 793–805.

DeBondt, Werner F. M., and Richard H. Thaler. 1987. Further evidence on investor overreaction and stock market seasonality. *Journal of Finance* 42:3, 557–581.

DeLong, J. Bradford, Andrei Shleifer, Lawrence H. Summers, and Robert J. Waldmann. 1991. The survival of noise traders in financial markets. *Journal of Business*, 64:1, 1–19.

Dyckman, Thomas. 1964. The effects of alternative accounting techniques on certain management decisions. *Journal of Accounting Research* 2:1, 91–107.

Einstein, Albert. 1920. *Relativity: The special and general theory*. New York: Henry Holt. Available at www.bartleby.com/173/.

Fama, Eugene F. 1970. Efficient capital markets: A review of theory and empirical work. *Journal of Finance* 25:2, 383–417.

Fama, Eugene F. 1998. Market efficiency, long-term returns, and behavioral finance. *Journal of Financial Economics* 49:3, 283–306.

Friedman, Milton. 1953. *Essays in positive economics*. Chicago: University of Chicago Press.

Glosten, Lawrence R., and Paul R. Milgrom. 1985. Bid, ask, and transaction prices in a specialist market with heterogeneously informed traders. *Journal of Financial Economics* 14:1, 71–100.

Gonedes, Nicholas, and Nicholas Dopuch. 1974. Capital market equilibrium, information production, and selecting accounting techniques: Theoretical framework and review of empirical work. *Journal of Accounting Research* 12 (Supplement):48–129.

Hong, Harrison, and Jeremy C. Stein. 1999. A unified theory of underreaction, momentum trading and overreaction in asset markets. *Journal of Finance* 54:6, 2143–2184.

Kuhn, Thomas S. 1962. *The structure of scientific revolutions*. Chicago: University of Chicago Press.

Kyle, Albert S. 1985. Continuous auctions and insider trading. *Econometrica* 53:6, 1315–36.
Kyle, Albert S., and F. Albert Wang. 1997. Speculation duopoly with agreement to disagree: Can overconfidence survive the market test? *Journal of Finance* 52:5, 2073–2090.
Libby, Robert. 1981. *Accounting and human information processing: Theory and applications*. Upper Saddle River, NJ: Prentice Hall.
Libby, Robert, Robert J. Bloomfield, and Mark W. Nelson. 2002. Experimental research in financial accounting. *Accounting, Organizations and Society* 27:8, 775–811.
Newton-Smith, William H. 1981. *The rationality of science*. New York: Routledge.
North, Douglass C. 1990. *Institutions, institutional change and economic performance*. Cambridge: Cambridge University Press.
Scott, W. Richard. 2007. *Institutions and organizations: Ideas and interests*. 3d ed. Thousand Oaks, CA: Sage.
Thaler, Richard. 1999. The end of behavioral finance. *Financial Analysts Journal* 56:6, 12–17.

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CHAPTER 3

Behavioral Finance: Application and Pedagogy in Business Education and Training

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INTRODUCTION

Slovic (1972, p. 779) provides the following quote from Adam Smith's *The Money Game*:

> *You are—face it—a bunch of emotions, prejudices, and twitches, and this is all very well as long as you know it. Successful speculators do not necessarily have a complete portrait of themselves, warts and all, in their own mind, but they do have the ability to stop abruptly when their intuition and what is happening Out There are suddenly out of kilter. If you don't know who you are, this is an expensive place to find out.*

Traditional finance theory stands directly on the notion of the "rational man," a person who is much different from the individual discussed in Jensen and Meckling (1994). The rational construct assumes that individuals, both investors and managers, are "capable of understanding vastly complex puzzles and conduct endless instantaneous optimizations" (Montier, 2002, p. xiii). Consequently, the main results of such thinking are the concepts of market efficiency and arbitrage, with major theoretical and practical implications for the investor and the corporate financial decision maker.

Since the publication of Kahneman and Tversky's seminal works (Tversky and Kahneman, 1971; Kahneman and Tversky, 1979) and that of Slovic (1972), there have been major challenges to the rationality assumption that has served as the foundation for modern finance theories, as well as classroom teachings in the United States and abroad. Such challenges come from the behavioral

finance scholars and practitioners who continue to advance the argument that traditional finance's theoretical and empirical constructs fail to explain and/or predict many occurrences in the financial markets and corporations. Powerful models are expected to have accurate predictability powers and explain real-life phenomena. Furthermore, researchers continue to publish rigorous theoretical and empirical arguments against the notion of expected utility (EU) and the efficient market hypothesis (EMH) in the mainstream finance journals.

If this is the scene from both the theoretical front and the empirical/practitioner front, then finance educators should start systematically incorporating the behaviorists' perspectives into curricula. From the perspective of training future managers and investment professionals, can any finance department at any university claim to be relevant and truthful to the profession when it avoids teaching some of the most influential factors of financial and managerial markets in the real world? Behavioral finance can, at the very minimum, complement traditional finance. Behavioral finance actually equips finance professionals with a set of new lenses, which allows them to understand and overcome many proven psychological traps that are present involving human cognition and emotions. This includes corporate boards and managers, individual and institutional investors, portfolio managers, analysts, advisors, and even policy makers. Behavioral traps exist and occur across all decision spectrums because of the psychological phenomena of heuristics and biases. These phenomena and factors are systematic in nature and can move markets for prolonged periods.

The finance profession is now much more able than in the past to answer some unresolved questions that continue to occur for both investors and corporate decision makers. Behavioral finance questions such basic ideas as risk and uncertainty, or what Olsen (2009) calls "qualia," as well as those specifically dealing with such key corporate finance issues as valuation, mergers and acquisitions (M&As), capital budgeting, capital structure, dividend policy, corporate governance, and agency conflicts.

The purpose of this chapter is two-fold. First, the chapter stresses the need for offering new courses and training programs in the fast-growing field of behavioral finance. This will be done by building upon the extant literature from both the traditional and behavioral finance paradigms. The guiding light in this effort will be the obvious vacuum for real-life guidelines for many of the managerial and investment tasks mentioned above. Second, the chapter discusses the key elements and resources needed to develop a highly interactive behavioral finance course at the graduate or undergraduate level based on the authors' experience in designing, developing, and teaching such a course.

The remainder of the chapter consists of three major sections. The first section presents a brief and selective review of the literature in the field of behavioral finance. This synthesis includes a discussion of the key concepts, theories, and tools that the finance discipline has borrowed from the field of psychology. The next section discusses how to organize and place into instructional packages and courses subject matter about behavioral finance. The last section concludes the chapter and makes some recommendations for future work in this fast-growing area.

A REVIEW OF THE LITERATURE IN BEHAVIORAL FINANCE

This section provides a brief review of some theoretical and empirical underpinnings of behavioral finance. The discussion includes the primary features of theories drawn mainly from the discipline of cognitive psychology. The chapter provides a discussion of research involving four themes: prospect theory, framing effects, heuristics and biases, and affect theory.

Prospect Theory

As a reference point in developing prospect theory, Kahneman and Tversky (1979) employ the classic version of expected utility (EU) theory as proposed by Bernoulli in 1738. This is the same theoretical construct that forms the basis of the mean variance–based modern portfolio theory of Markowitz (1952).

From their empirical work in cognitive psychology, Kahneman and Tversky (1979) argue that the evaluation of decision outcomes has to be reference-dependent ("reference" in this context refers to the current state of wealth), a principle that is incompatible with the EU framework and hence with modern portfolio theory. The EU framework is reference-independent because the decision maker's initial state of wealth does not enter into the decision or valuation processes. Instead, what matters in EU is the effect of a decision's outcome on an investor's final state of wealth. This is equivalent to saying that the utility directly derived from an outcome is of no interest to the EU theorist. What really matters, then, is the indirect utility contribution of the outcome to the investor's total utility derived from her final consumption or wealth. This obviously goes against the very nature of human beings with "a bunch of emotions, prejudices, and twitches. . ." as cited above by Slovic (1972).

To see this, consider a gamble with two outcomes: x with probability p, and y with probability $1 - p$; where $x \geq 0 \geq y$. Also assume an initial level of wealth (W) is the reference point in this example. According to EU, the value of this gamble or prospect is

$$V = pu(W + x) + (1 - p)u(W + y)$$

However, according to prospect theory, the value of the gamble (or prospect) is

$$V = \pi(p)u(x) + \pi(1 - p)u(y)$$

where π is a probability-weighing function. Kahneman and Tversky's (1979) value function is shown in Exhibit 3.1.

The value in prospect theory is defined in terms of expected gains and losses and not in terms of the expected level of final wealth. Also, the probability-weighting function $\pi\ (p)$ is not the same as probability p, as can be seen from Exhibit 3.2.

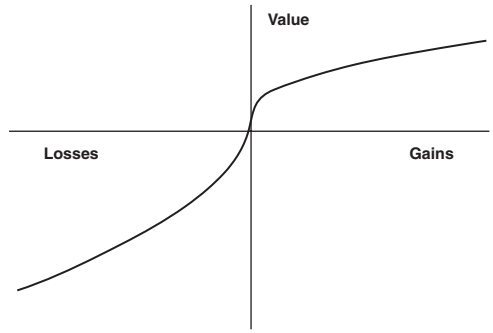

Exhibit 3.1 An Hypothetical Value Function

Note: The value function is defined by gains and losses on deviations from a reference point, where the function is concave for gains and convex for losses. This function is steeper for losses than gains (loss aversion). This means a loss causes a greater feeling of pain than a joy caused by the same amount of gain.

Key Features of Prospect Theory

Prospect theory has five key features, which are compared and contrasted with those of the modern portfolio theory.

People in mean-variance (EU or portfolio) theory choose among alternatives based on the effect of the outcomes on the levels of their final wealth, as in $u(W + x)$ above. Under prospect theory, people make choices based on the effect of outcomes on changes in their existing wealth, that is, changes relative to their reference point (or current wealth), as in $u(x)$ above. That is, under prospect theory, people choose based on gains and losses.

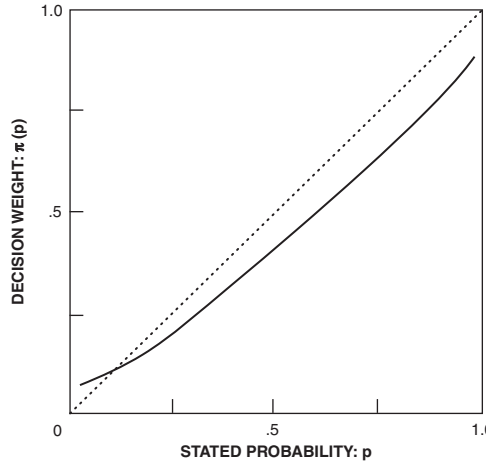

Exhibit 3.2 An Hypothetical Probability Weighting Function

Note: According to prospect theory, a probability p has a decision weight $\Pi(p)$. Probability weighting functions overweight low probabilities and underweight high probabilities.

Source: Figure 4 of Kahneman and Tversky (1979). This figure is reproduced with permission from The Econometric Society.

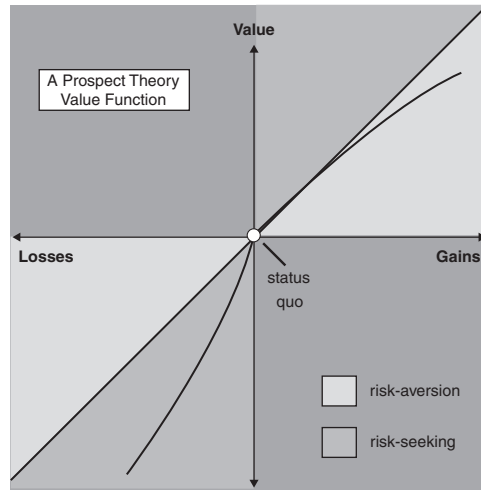

Exhibit 3.3 Kahneman and Tversky's Value Function
Note: This graph illustrates that people are generally risk averse in the gains domain but loss averse in the domain of losses. Furthermore, losses cause greater feelings of pain than joys caused by the same amount of gain. (Courtesy of Professor Ralph Byrns.)

People in a mean-variance framework are risk averse in all of their choices. However, under prospect theory, people are risk averse in the gains domain and risk-seekers in the losses domain.

Under prospect theory, and as can be seen from the kink at the origin in Exhibit 3.3, losses cause more severe pains (almost twice as much) than the pleasure derived from a gain of the same magnitude. This is called "loss aversion."

People in mean-variance theory treat risk objectively by its probabilities. Under prospect theory, people overweight low probabilities, as reflected in their behaviors of simultaneously choosing lottery and insurance options.

Mean-variance theory is reference-independent, that is, the framing of alternatives does not affect choice. In prospect theory, framing affects choice, as further described in the next section.

Prospect Theory: Implications and Examples

Given the experiential nature of behavioral finance, most of the implications derived from such a theory are experimental and pragmatic.

Implication for individual risk-taking behavior: Individual investors are both risk-seekers and risk-averters at the same time. This is exhibited by their investing behavior, where they buy not only bonds, mutual funds, and insurance policies (acting as if they were risk averse), but also where they buy individual stocks, options, and lotteries (acting as if they were risk seeking).

Implication for holding stocks/portfolios: Both individual and professional investors sell winners too early and hold losers too long, a phenomenon mainly attributed to "loss aversion" behavior. Losses cause more severe pains (almost twice as much) than the pleasure resulting from a gain of the same magnitude. This is also known as "disposition effect" as coined by Shefrin and Statman (1985).

This type of behavior is inconsistent with normative/traditional approaches to investment such as those based on tax losses.

By-product of the above implications: Individual investors do not select well-diversified portfolios. In reality, people ignore covariance among security returns and choose stochastically dominated portfolios that lie below the efficient frontier.

Implication for equity premiums: Prospect theory's loss aversion also explains why U.S. equities have outperformed U.S. bonds by around 7 percent per year over long periods, while this should only be in the vicinity of 1–2 percent at the maximum in a traditional finance framework.

Implication for capital structure–debt (also known as debt aversion): Capital structure theory is mainly based upon the tradeoffs between two key factors: tax benefits and default risks. According to prospect theory, for some companies the potential losses due to financial distress can appear larger than the potential gains stemming from tax benefits. For example, companies with a high ratio of intangible assets to total assets, such as research and development, heavy pharmaceutical and biotech firms, and even other hi-tech companies fall into this category.

Framing Effects

Rooted in Kahneman and Tversky's (1979) prospect theory, framing effects are other key psychological factors that seriously call into question traditional finance theory's rationality assumption. According to Kahneman and Tversky, framing effects in decision situations arise when different imagery and descriptions of the same problem highlight different aspects of the outcomes. Choices often depend on the manner in which alternatives are framed (described) and presented, something not allowed in EU and EMH theory. As Tversky and Kahneman (1981, p. 453) note, "The frame that a decision maker adopts is controlled partly by the formulation of the problem and partly by the norms, habits, and personal characteristics of the decision maker."

Tversky and Kahneman (1981) demonstrate that each decision choice has two distinct phases: (1) an initial phase where acts, related contingencies, and outcomes for each decision choice are framed; and (2) a second phase where acts, related contingencies, and outcomes for each decision choice are evaluated. According to Tversky and Kahneman, many concurrent decisions in the real world are in fact framed independently. Consequently, in the majority of such cases, the preference orders would often be reversed if the decisions were combined. Outcomes are perceived as positive or negative relative to a reference outcome that is judged neutral. Varying the reference point can affect an outcome to be positive or negative, and consequently change the preference order between options.

Framing Effects: Implications, Applications, and Examples

Many concurrent decisions in practice are framed independently and the preference order would often be reversed if the decisions were combined. A direct implication relevant to investing behavior is that people change their views on their investments and the markets based on information and data that may have nothing to do with the related investment or market fundamentals. In effect, people ignore covariance among security returns and therefore choose stochastically

dominated portfolios that lie below the efficient frontier (Shefrin and Statman, 2003).

People generally evaluate acts based on the direct consequences of the act, such as the money lost or gained. That is, they assess events in terms of a mental account, which includes only the direct consequences of the act. For example, the mental account associated with the decision to accept a gamble includes money won or lost in that gamble and excludes other assets or the outcome of previous gambles. People adopt mental accounts due to this mode of framing: (1) simplifies evaluation and reduces cognitive strain; (2) reflects the intuition that consequences should be causally linked to acts; and (3) matches the properties of hedonic experience, which is more sensitive to desirable and undesirable changes than to steady states.

Heuristics and Biases Framework

A heuristics and biases framework can be envisioned as a counterpart to standard finance theory's asset pricing model. When faced with huge amounts of data and information and an array of decision problems, people are incapable of doing the complex optimization calculations that are expected of them under standard finance theory. Instead, they rely on a limited number of cognitive strategies or heuristics that simplify the complex scenarios faced by them in making decisions. Heuristics are information processing shortcuts that mainly result from one's experiences in a field of work. Of course, such simplifying shortcuts are productive and allow humans to function in daily life. By nature, heuristics are imperfect and consequently will result in biases and errors.

In traditional theory, unsystematic biases are expected to average out at the market level and consequently have no effect on asset prices. Behavioralists argue, however, that both heuristics and biases are *systematic*, thereby potentially lasting for long periods and affecting prices accordingly. Tversky and Kahneman (1974) among others identify many systematic biases including a few discussed below.

Representativeness (Similarity)

According to Tversky and Kahneman (1974, p. 1124), many of the probabilistic questions about which people are concerned can be characterized by "What is the probability that object A belongs to class B? What is the probability that event A originates from process B?" To answer these questions, people use the representative heuristics, where probabilities are evaluated by the degree to which A resembles B. For example, when A is highly representative of B, the probability that A originates from B is judged to be high.

In such cases, the representative heuristic assists in evaluating the probabilities dealing with objects or processes A and B. As an example, when A is highly representative of B, the probability that A originates from B is judged to be high, and so forth. The problem is that representativeness (similarity) should not affect the judgment of probability. What should be considered in the judgment to probability is "prior probability" or "base rate." The latter is not the case in practice and violates Bayes' rule.

In summary, the representativeness heuristic is a built-in feature of the brain for producing rapid probability judgments, rather than a consciously adopted

procedure. Humans are unaware of substituting judgment of representativeness for judgment of probability.

Availability

To understand the availability heuristic requires recognizing that people disproportionately recall the salient events, that is, those that are very recent and/or those that they are or were emotionally involved with, especially in the recent past. The more salient an event, the more likely is the probability that a person will recall that event. This bias prevents people from considering other potential and related outcomes. For example, one may assess the risk of getting mugged in New York City by recalling such incidences among friends and family. With the availability heuristic, people search their memories for relevant information.

The problem is that not all memories are equally retrievable or available, which leads to error in judgment. For example, more recent incidences and more salient events (e.g., getting mugged in New York City) will weigh more heavily and will lead to prediction biases and distort the judgment or estimate. Thus, biases implicit in the availability heuristic affect estimates of risk.

Anchoring, Adjustment, and Contamination

According to Tversky and Kahneman (1974), when forming estimates and predictions, people usually start with some initial arbitrary value and adjust from it. People also make estimates by starting from an initial value that is adjusted to yield the final answer. The initial value may be suggested by the formulation of the problem, or it may be the result of a partial calculation. Regardless, Tversky and Kahneman (p. 1128) argue that "adjustments are typically insufficient," and "Different starting points yield different estimates which are biased toward the initial value." This is called anchoring. Anchoring happens when the starting point is given to the subject, as well as when the subject bases her estimate on the result of some incomplete computation.

According to the anchoring heuristic, information that is visibly irrelevant still anchors judgments and contaminates guesses. When people start from information known to be irrelevant and adjust until they reach a plausible-sounding answer, they under-adjust. People under-adjust more severely in cognitively busy situations and other manipulations that make the problem harder. People deny they are anchored or contaminated, even when experiment shows that they are. These effects are not diminished or are only slightly diminished by financial incentives, explicit instruction to avoid contamination, and real-world situations.

Contamination Effects

Almost any information could work its way into a cognitive judgment (Chapman and Johnson, 2002). Anchoring or contamination effects cannot be decreased (Tversky and Kahneman, 1974; Wansink, Kent, and Hoch, 1998). Several examples illustrate such contamination effects. One example is that people typically have great confidence in judgments based upon overconfidence. For instance, events to which subjects assigned a probability of 2 percent happened 42.6 percent of the time (Alpert and Raiffa, 1982).

Another example is hindsight bias, which occurs when subjects, after learning the eventual outcome, give a much higher estimate for the predictability of

that outcome than subjects who predict the outcome without advance knowledge. Hindsight bias is sometimes called the "I-knew-it-all-along effect." Hindsight bias is important in legal cases, where a judge or jury must determine whether a defendant was legally negligent in failing to foresee a hazard (Sanchirico, 2003).

A third example is the black swan phenomenon (Taleb, 2007), which means that sometimes most of the variance in a process comes from exceptionally rare or large events. For instance, consider a financial instrument that earns $10 with 98 percent probability, but loses $1,000 with 2 percent probability. This investment is a poor net risk, but it looks like a steady winner.

Heuristics and Biases: Implications and Examples

These heuristics and biases have several implications, a few of which are discussed below.

Implication for performance-based management contracts: Managers generally prefer performance-based incentive schemes more often than standard theory predicts. This can be attributed to the overconfidence trait. Due to overconfidence, managers prefer riskier projects because they think that they can beat the odds. This goes against the standard theory, which predicts that, as output variance increases, principals should offer less output-sensitive contracts to agents because under standard theory, agents are assumed to dislike risk. According to Camerer and Lovallo (1999), some evidence supports this phenomenon.

Implication for stock selections due to availability bias: People easily recall the information that has recently arrived, especially in the media and corporate releases, because their broker's or advisor's recommendations are fresh in their memory. As Barber and Odean (2008) find, stocks with very high level of press coverage underperform in the subsequent two years following the news.

Implication for asset valuation due to anchoring bias: Northcraft and Neale (1987) ask subjects to give their opinions on the appraisal value, the appropriate listing price, and the lowest price they would accept if they were the seller. The authors requested this information after giving the subjects detailed and identical information about the house they had been shown. The only information that the authors changed in this study was the asking price (the anchoring factor). The results show that individual valuations of houses directly related to the asking price given to them.

The Affect Theory

According to Finucane, Alhakami, Slovic, and Johnson (2000), the affect heuristic refers to the way in which subjective impressions of "goodness" or "badness" can act as a heuristic capable of producing fast perceptual judgments and also systematic biases. For example, as Ganzach (2001) shows, people judge stocks that they perceive as "good" to have low risks and high returns and judge stocks that they perceive as "bad" to have low returns and high risks. For unfamiliar stocks, perceived risk and perceived return are negatively correlated, as predicted by the affect heuristic. For familiar stocks, perceived risk and perceived return are positively correlated; riskier stocks are expected to produce higher returns, as predicted by ordinary economic theory.

TEACHING BEHAVIORAL FINANCE: PEDAGOGICAL ISSUES AND EXAMPLES

Before discussing course design, considering how a behavioral finance approach might differ from a traditional finance course is worthwhile. When developing a course in such areas as corporate finance, investment, and international finance, the body of knowledge encompassing the desired skill sets is reasonably well defined. For example, to develop an investments course, many texts are available that use the same set of finance concepts, theories, and principles.

Behavioral finance is different in two primary ways. First, behavioral finance is a highly interdisciplinary field of study. Research into the psychology of decision making and supported by the findings from brain research/neuroscience provides a framework for understanding the basis of behavioral finance decision making and its implications for individuals and organizations. Second, behavioral finance is still an emerging and evolving field of study within finance. Because of these two factors, benchmark behavioral finance syllabi and pedagogy are in their developmental stages. Given these considerations, the following outlines the steps in designing and delivering a behavioral finance course.

Identify the Target Audience

Due to the interdisciplinary nature of behavioral finance, identifying the characteristics of the target audience is crucial. For simplicity, this discussion groups potential audiences into three categories. The first group consists of those individuals with little corporate work experience. The course should emphasize an approach geared to decision making from a personal or investor perspective (75 percent course content), along with less emphasis on decision making in a corporate context (25 percent course content). The second group, which consists of individuals with some corporate working experience (e.g., five years or less), calls for a more balanced focus consisting of 50 percent personal or investor decision making and 50 percent corporate financial management decision making. The third group, consisting of seasoned adult learners, requires a focus tilted toward a corporate context with 25 percent of the content focusing on personal or investor decision making and 75 percent on corporate financial management decision making.

Being able to relate the material, examples, and cases to the students' experiences is particularly important for behavioral finance because of the multiple disciplines involved, such as economics, finance, neuroscience, and psychology, as well as the experiential nature of the subject matter. For example, audiences with less work experience are less likely to see the relevance of behavioral finance in a corporate context compared to that of an individual investor making personal decisions. The vantage point of an individual investor tends to be narrower in view of the EMH and large body of research on market anomalies. Such an emphasis would be particularly important when the audience consists of professionals with aspirations to work on Wall Street or as professional investors.

Identify What the Target Audience Needs to Learn

This step involves identifying the competencies and skill sets needed by the students as the basis for generating the course objectives. For example, assume that

the target audience consists of seasoned adult learners. Focusing on a corporate perspective allows exploring the impact of biases, heuristics, and framing effects on a range of financial decision making such as strategic planning, capital investment, capital structure, dividend policy, and M&As.

The following example expresses what students need to know in terms of a course description and learning objectives.

Course Description

This course identifies the key psychological obstacles to value maximizing behavior from the perspective of the financial decision maker, along with the steps that managers can take to mitigate the effects of these obstacles.

Students learn how to put the traditional tools of corporate finance to their best use and to mitigate the effects of psychological obstacles that reduce value.

Topics covered include financial decision making in the areas of valuation, capital budgeting, perceptions about risk and reward, capital structure, dividend policy, agency conflicts, corporate governance, and M&As.

The main theme of the course described above is complemented with readings and exercises exploring the psychological basis of non-optimal decision making from the vantage point of the individual investor.

Learning Objectives

Explain why reliance on heuristics and susceptibility to framing effects make managers vulnerable to making faulty decisions that reduce firm value.

Apply the effects of potential biases with the use of valuation heuristics to real-world scenarios.

Distinguish between the remedies appropriate to agency conflicts and those appropriate to behavioral biases in financial decision making as they pertain to valuation, capital budgeting, perceptions about risk and reward, capital structure, dividend policy, agency conflicts, corporate governance, and M&As.

Analyze how the representativeness heuristic leads managers, investors, and market strategists to form biased judgments about the market risk premium.

Analyze how stock option–based compensation can exacerbate agency conflicts in the presence of loss aversion and overconfidence.

Develop a Course Framework

The following strategy is suggested for assessing the topics to teach. The strategy begins by providing the background needed to understand behavioral finance. For example, this strategy could consist of the following: (1) describing the research in neuroscience and psychology that affects financial decision making; (2) describing the types of biases, heuristics, and framing effects covered in the course; (3) involving students in examples from psychological experiments to demonstrate the systematic effects of various psychological factors; and providing simple scenarios from corporate decision making and asking students to identify the specific biases, heuristics, or framing effects at play.

The next stage involves building the remainder of the course around corporate decisions (e.g., strategic planning, capital investment, capital structure, dividend policy, and M&As) and investor decisions (e.g., asset allocation, valuation, portfolio

management, risk management, and arbitrage strategies). This approach involves the following: (1) reviewing finance theory relevant to the financial management or investor decision; (2) considering psychological factors (biases, heuristics, and framing effects) and how they can destroy value; (3) providing examples or scenarios and asking what psychological considerations are demonstrated; and (4) using a case analysis to integrate the application of material to specific decisions being addressed.

In developing a course framework, special attention is needed to motivate student-to-student interaction through the design of specific assignments. For example, one approach could be to use short papers that summarize an article related to relevant research and discussing applications of the material in real-world instances that the student finds and investigates. If the course is an online class, the papers could be posted as part of the online classroom environment where the students and instructor can discuss these papers. If the course is a live class, the papers can be posted on the instructor's web page or corresponding teaching platform. Many schools accompany live courses with classroom space on one of the online teaching platforms, such as WebCT or Blackboard. An alternative is to have the students provide copies of their paper to classmates and make a short presentation, accompanied by a question-and-answer session.

Another way to stimulate motivation and integration of the course material is to have students locate and research a situation in which corporate decision making exhibits multiple instances of management behavioral biases, heuristics, and responses to framing effects. The end result would be a mini-case analysis that is posted for review and discussion by the class. Alternatively, the instructor could assign a case, divide the class into groups, and require each group to analyze and present its findings.

Identify the Course Materials

The task of identifying materials that encompass the body of knowledge to cover in the course can be difficult when few textbooks exist that provide a good fit for the course being designed. This is especially true in addressing how behavioral finance helps explain non-optimal decision making in a corporate finance environment. Until recently, this important area had not received much attention in texts or published papers, because the more popular approach has been to teach behavioral finance as anomalies to EMH or as non-finance examples in the Kahneman and Tversky (1979) model. Besides using a text, selecting appropriate articles describing the latest research findings in neuroscience and the psychology of decision making as they relate to behavioral finance can be useful. This book references many such articles. In addition, many new working papers become available every month on the behavioral and experimental finance as part of the Social Science Research Network (SSRN).

The following suggested schedule provides a framework based on the main decisions faced by corporate financial managers, with less focus on anomalies to the EMH and the familiar examples contained in the Kahneman and Tversky literature. An important feature of this course schedule is that it closely follows the topics covered in a traditional corporate finance course. In fact, another approach to course design would be to marry the behavioral finance implications with the traditional concepts, principles, and theories as they are addressed

in a corporate finance course. This combined approach is risky because students may become confused and not get the foundation in traditional finance needed to consider the complexities introduced with the behavioral finance perspective. Instead, the students should first receive a solid foundation in corporate finance and then be exposed later in their program to behavioral finance concepts.

The treatment of behavioral finance would not be complete without discussing some criticisms aimed at this growing field of research. The criticisms can best be covered in the latter portion of the course and serve as an integrating vehicle. For example, Pesendorfer (2006) describes a problem analyzing biases in an economic model. He points out that the typical technique is to introduce a "free variable" to reflect that some aspect of the optimization procedure is done incorrectly and to solve the model showing that the expected utility assumptions do not hold. He then explores the consequences. The paradox or inconsistency is in justifying why humans would go to the trouble of maximizing objective functions and formulating complex beliefs only to consistently make mistakes. Another criticism described by Pesendorfer is that identifying the reference point in non-experimental settings is almost impossible.

Ritter (2003) provides another criticism of behavioral finance. While strong empirical evidence supports the existence of biases, heuristics, and framing effects in agent decision making, current models can predict underreaction or overreaction depending upon which bias is emphasized. Thus, ample evidence exists that people seem to systematically incorporate biases, heuristics, and framing effects into their decision making, but to date, no robust, all-encompassing theory explains this behavior.

Specify the Assignments

Of particular importance is reemphasizing to students that behavioral finance is largely experiential. Students learn by experiencing some of the dilemmas created by biases, heuristics, and framing effects. As indicated earlier in this chapter, this important component can be incorporated into the course by summarizing some examples from the literature on anomalies to the EMH, psychology of decision-making research, and selected examples from recent work in neuroscience. For example, a course could replicate some experiments and "games" derived from psychological research to demonstrate the violations of EU theory through framing effects, biases, and heuristics or use case studies.

Case studies are particularly powerful vehicles in helping students to understand the complexities involved in corporate decision making and then developing personal traits and strategies to avoid psychological traps. Examples from the literature and demonstrations where students participate can be effectively employed to help them gain an intellectual awareness. However, case studies offer much richer examples than demonstrations because cases capture real-world complexities and more closely represent situations that students are likely to face in their careers.

Several sources for case studies are available. Some textbooks have cases based on examples of situations faced by real companies. Also, numerous cases are available from Harvard Business Publishing and Darden Business Publishing. Alternatively, the instructor can develop mini-cases and scenarios.

Exhibit 3.4 Example of a Course Schedule

Note: Course schedule and assignments for a 14-week graduate behavioral finance class.

Topics and Readings	Deliverables	Resources/Links
Session 1. Behavioral Foundations of Finance Readings	Participate in discussions Psychological scenarios Form teams for case analyses	PowerPoints, web sites, lecture notes, videos if available
Session 2. Risk and Return: Psychological Considerations Readings	Homework problems Participate in discussions	
Session 3. Corporate Valuation Readings	Homework problems Participate in discussions	
Session 4. Capital Budgeting Readings	Homework problems Participate in discussions Conference discussions Group project 1 due (report and presentation/posting to public area)	
Session 5. Investing and Stock Valuation Readings	Homework problems Participate in discussions	
Session 6. Inefficient Markets and Corporate Decisions Readings	Homework problems Participate in discussions Mid-term examination	
Session 7. Capital Structure Readings	Homework problems Participate in discussions Group project 2 due (report and presentation/post to public area)	
Session 8. Dividend Policy Readings	Homework problems Participate in discussions	
Session 9. Agency Conflicts and Corporate Governance Readings	Homework problems Participate in discussions Short paper due (post for discussion)	
Session 10. Group Decision Making: Behavioral Pitfalls Readings	Homework problems Participate in discussions Group project 3 due (report and presentation/post to public area)	
Session 11. Mergers and Acquisitions Readings	Homework problems Participate in discussions	
Session 12. Capital Budgeting Readings	Homework problems Participate in discussions	
Session 13. Capital Structure Readings	Homework problems Participate in discussions	
Session 14. Corporate Finance Implications: Special Topics Criticisms of Behavioral Finance Readings	Homework problems Participate in discussions Final examination	

Here are several examples involving behavioral finance and corporate finance. For instance, a capital investment proposal can exhibit representativeness or availability of information. Project analysis is subject to excessive optimism bias in cash flow estimates, depending upon the background of the analyst. Project selection can be affected by loss aversion in setting hurdle rates that exclude positive NPV projects. Failure to back out of a failed investment can be the result of aversion to a sure loss by a decision maker with an emotional investment in the project.

Another example involves M&As. Both overconfidence and excessive optimism may be at work in the impulse to make a deal and in the estimates of savings and synergies expected from the transaction. Many M&As documented in the literature provide the basis for a self-developed case study. A variation of this approach is to require that students identify a real company that has destroyed wealth through decision making characterized by biases, heuristics, and framing effects.

Complete the Course Schedule

Once the instructor has completed the previous steps, the last step is to complete the course schedule. Exhibit 3.4 provides an example of a course schedule.

SUMMARY AND CONCLUSIONS

Behavioral finance could equip finance professionals with a set of new lenses, which allows them to understand and overcome many psychological and behavioral traps involving human actions and emotions. Behavioral finance is relevant to a wide range of people, including members on corporate boards, corporate managers, individual and institutional investors, portfolio managers, analysts, advisors, and policy makers. Psychological traps exist across all decision spectrums because of behavioral phenomena, including heuristics and biases. These phenomena are systematic in nature and can move markets for prolonged periods, as witnessed in the present market environment in the United States and abroad.

Behavioral finance is not new. It has its roots in the paper by Slovic (1972) and the seminal work in prospect theory by Tversky and Kahneman (1971) and Kahneman and Tversky (1979). For many subsequent years, the finance work in this area has largely concentrated on researching and discovering anomalies to the EMH. Accordingly, there has been a long period of incubation and a general reluctance to formally recognize the cognitive underpinnings of financial decision making as a fully legitimate field of study within finance, except as anomalies residing outside the accepted theoretical constructs. Even now, the incorporation of behavioral finance in higher education finance curricula is the exception and is generally oriented at explaining anomalies to the EMH.

The behavioral finance field is quickly evolving, as evidenced by the publication of books by Thaler (1993, 2005) and others, establishment of the *Journal of Behavioral Finance* in 2000, and the founding of the Academy of Behavioral Finance and Economics in 2008. Recent findings from brain research are providing more robust explanations for the neurological reasons people employ biases, heuristics, framing effects, and emotion in their decision making. Increasingly, psychologists and neurologists are authoring papers that use these scientific findings as a means of explaining financial decision-making behavior.

Until recently, the treatment in finance texts has largely concentrated on anomalies and market inefficiencies as limits to arbitrage. Now, along with the implications that cognitive psychology has for investors, more attention is being given to the psychological underpinnings of financial decision making within a corporate and market context. Much work still needs to be done in this area, both in terms of research and the inclusion of new knowledge into the finance curriculum.

Substantial potential payoffs exist to society in knowing more about this area and developing strategies to mitigate the adverse effects that biases, heuristics, affect, and framing factors have on corporate financial decision making. The interests of shareholders and employees' 401K plans and the smooth functioning of the economy all depend upon the quality of such decision making. The time is right for systematically including behavioral finance in the curricula of colleges and universities. Such courses should incorporate the findings from cognitive psychology and neuroscience, as well as the limits to arbitrage and violations of expected utility through market anomalies and inefficiencies. As the field of behavioral finance matures and faculty members gain experience in developing and delivering the next generation of courses, the profession should become more effective in teaching this interdisciplinary subject.

Finally, to contribute to the field's growth and maturity, more effort is needed especially in content development and content delivery. This opportunity is particularly needed for professional development for all involved parties: educators, administrators, publishers, and the business community. Specifically, aside from the obvious need for further theory development, the more immediate need is in the area of content development for teaching and learning. New user-friendly textbooks both for investments and corporate finance are needed. Such books should cover the conceptual and theory side as well as the quantitative side, just as for traditional finance courses. Equally important is the development of cases that cover both theoretical and quantitative aspects of behavioral finance.

DISCUSSION QUESTIONS

1. What are some differences in teaching a behavioral finance class as compared with teaching a traditional finance class?
2. Can behavioral finance be taught as a supplement to traditional finance? Why?
3. What would behavioral finance cases look like, and what areas of finance could they cover?
4. Traditional finance texts often address behavioral finance as an extension of the concepts, principles, and theories of the discipline. Is that sufficient, or would a finance curriculum benefit by having one or more courses dedicated to behavioral finance?

REFERENCES

Alpert, Marc, and Howard Raiffa. 1982. A progress report on the training of probability assessors. In *Judgment under uncertainty: Heuristics and biases*, ed. Daniel Kahneman, Paul Slovic, and Amos Tversky, 294–305. New York: Cambridge University Press.

Barber, Brad, and Terrance Odean. 2008. All that glitters: The effect of attention and news on the buying behavior of individual and institutional investors. *Review of Financial Studies* 21:2, 785–818.

Camerer, Colin, and Dan Lovallo. 1999. Overconfidence and excess entry: An experimental approach. *American Economic Review* 89:1, 306–18.

Chapman, Gretchen, and Eric Johnson. 2002. Incorporating the irrelevant: Anchors in judgments of belief and value. In *Heuristics and biases: The psychology of intuitive judgment*, ed. Thomas Gilovich, Dale Griffin, and Daniel Kahneman, 120–138. Cambridge, England: Cambridge University Press.

Finucane, Melissa, Ali Alhakami, Paul Slovic, and Stephen Johnson. 2000. The affect heuristic in judgments of risks and benefits. *Journal of Behavioral Decision Making* 13:1, 1–17.

Ganzach, Yoav. 2001. Judging risk and return of financial assets. *Organizational Behavior and Human Decision Processes* 83:2, 353–70.

Jensen, Michael C., and William H. Meckling. 1994. The nature of man. *Journal of Applied Corporate Finance* 7:2, 4–19.

Kahneman, Daniel, and Amos Tversky. 1979. Prospect theory: An analysis of decision under risk. *Econometrica* 47:2, 263–91.

Markowitz, Harry. 1952. Portfolio selection. *Journal of Finance* 7:1, 77–91.

Montier, James. 2002. *Behavioural finance: Insights into irrational minds and markets.* West Sussex, England: John Wiley & Sons Ltd.

Northcraft, Gregory, and Margaret Neale. 1987. Experts, amateurs and real estate: An anchoring-and-adjustment perspective on property pricing decisions. *Organizational Behavior and Human Decision Processes* 39:1, 84–97.

Olsen, Robert. 2009. Toward a theory of behavioral finance: Implications from the natural sciences. Working Paper, Decision Research.

Pesendorfer, Wolfgang. 2006. Behavioral economics comes of age: A review essay on advances in economics. *Journal of Economic Literature* 44:3, 712–721.

Ritter, Jay. 2003. Behavioral finance. *Pacific-Basin Finance Journal* 11:4, 429–437.

Sanchirico, Chris. 2003. Finding error. *Michigan State Law Review* 102:5, 1189.

Shefrin, Hersh, and Meir Statman. 1985. The disposition to sell winners too early and ride losers too long: Theory and evidence. *Journal of Finance* 40:3, 777–790.

Shefrin, Hersh, and Meir Statman. 2003. Editorial commentary: The contributions of Daniel Kahneman and Amos Tversky. *Journal of Behavioral Finance* 4:2, 54–58.

Slovic, Paul. 1972. Psychological study of human judgment: Implications for investment decision making. *Journal of Finance* 27:4, 779–799.

Taleb, Nassim. 2007. *The black swan: The impact of the highly improbable*. New York: Random House.

Thaler, Richard, ed. 1993. *Advances in behavioral finance*. New York: Russell Sage Foundation.

Thaler, Richard, ed. 2005. *Advances in behavioral finance: Volume II*. Princeton, NJ: Princeton University Press.

Tversky, Amos, and Daniel Kahneman. 1971. Belief in the law of small numbers. *Psychological Bulletin* 76:2 101–110.

Tversky, Amos, and Daniel Kahneman. 1974. Judgment under uncertainty: Heuristics and biases. *Science* 185:4157, 1124–1131.

Tversky, Amos, and Daniel Kahneman. 1981. The framing of decisions and the psychology of choice. *Science, New Series* 211:4481, 453–458.

Wansink, Brian, Robert Kent, and Stephen Hoch. 1998. An anchoring and adjustment model of purchase quantity decisions. *Journal of Marketing Research* 35:1, 71–81.

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CHAPTER 4

Heuristics or Rules of Thumb

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INTRODUCTION

Heuristics, often referred to as rules of thumb, are means of reducing the search necessary to find a solution to a problem. They are shortcuts that simplify the complex methods of assessing the probabilities and values ordinarily required to make judgments, and eliminate the need for extensive calculation. Heuristics provide subjectively compelling approaches and reflect the fact that people's assessments of likelihood and risk do not usually conform precisely to the laws of probability. People tend to relate probability not to events, but to descriptions of events (Tversky and Kochler, 2002). Although people may use heuristics to simplify preferences or data sets, heuristics are best viewed as devices for simplifying the process of choosing between alternatives. Heuristics become particularly important in the presence of uncertainty, which undermines the usefulness of complex logical calculations.

In the late 1950s, Simon and Newell (1982) developed detailed algorithms for coping with specific problems, initially as a means of approximating optimization. Increased focus on heuristics as calculation shortcuts mushroomed with the work of cognitive psychologists known as behavioral decision theorists in the late 1960s and early 1970s, culminating with the studies of Tversky, Kahneman, and others, brought together in the volume edited by Kahneman, Slovic, and Tversky (1982). That work and the contributions in the volumes edited by Kahneman and Tversky (2000a) and Gilovich, Griffin, and Kahneman (2002) are generally referred to as the heuristics and biases program. Those studies deal primarily with pervasive general rules of thumb and the deviations from rational calculation that they tend to yield, referred to as biases. Initially, these heuristics dealt explicitly with cognitive processes, but they have come to openly incorporate emotional factors. Indeed, emotional factors always were implicit even in the initial analysis of Kahneman and Tversky (2000b). This is evidenced by their references to intuitive judgment, which they characterized as different from strictly rational models of choice. In breaking from those traditional models of rational choice, Kahneman and Tversky were not aiming for what might be termed rationality in some broader sense, but models that were more descriptive of the real-world choices actually being made.

A leading objective of the heuristics and biases program has been to categorize the deviations from what is indicated by rational choice models, and, where

possible, to improve heuristics so as to reduce those biases. First and foremost, the program sought to verify the small group of general heuristics presumed to underlie most decision making. While those analysts who continued to advocate complete rational calculation recognized that practitioners would make errors in judgment, the behavioral decision group shows that, contrary to expectations, the mistakes are not random but often systematic and predictable. As the formulation of specific heuristics began to receive more attention, Gigerenzer and some other researchers questioned the emphasis on biases. In the spirit of Simon's bounded rationality (Simon 1957, 1982, 1986), Gigerenzer and associates maintain that judgments need only be satisficing and should be evaluated to take account of the fact that humans possess a limited search and computational capacity, which is accentuated by the usually prevailing time constraints. Out of necessity, people use approximate methods to handle most tasks, developing what they term "fast and frugal" heuristics (Gigerenzer and Selten, 2001; Gigerenzer, Czerlinski, and Martignon, 2002). The purpose of this chapter is to explain the nature of heuristics and to outline their strengths and weaknesses. The remainder of the chapter consists of four sections. The next section examines the rationale for heuristics followed by a section on guidelines for using heuristics. The third section presents various categories of heuristics including representativeness, availability, anchoring and adjustment, overconfidence, memory, and other heuristics. In addition, this discusses biases of heuristics and the affect heuristic. The final section provides a summary and conclusion.

THE RATIONALE FOR HEURISTICS

There are many reasons for using heuristics.

- Decision makers may be unaware of the optimal way to solve a problem, even when an ideal solution exists. Moreover, they may not have the resources (or the access to credit) to obtain help from others, or the deliberation costs involved may be excessive.
- Decision makers may be unable to obtain all the information necessary for an optimizing solution, or may not be able to do so by the time a decision must be made. Even if they can obtain all the information, decision makers may be unable to complete the optimization calculations in time.
- While optimization techniques may be feasible, they may not yet have been devised for some types of problems.
- Where there are multiple objectives, unique, optimal solutions are unlikely.
- The use of rules of thumb that decision makers can rapidly apply may enable them to keep certain matters secret until they decide to make the decision known.
- The problem may not lie in obtaining the information, but in perceiving it correctly and avoiding attempts to deal with what is actually a variant of the matter under consideration.
- An extraordinary amount of information may overwhelm decision makers. A decision maker may have insufficient familiarity with the programs necessary to process the data. In addition, the emotional character of the decision (or the decision maker) might be overwhelming, at least in the context in

question. Finally, the state of awareness of decision makers at the time in question or the particular framing of the problem may pose issues.

- Seemingly winning formulas of some market participants may induce decision makers who ordinarily make full calculations to stray from that course, even if only temporarily. Unfortunately, those seemingly winning formulas may involve so much additional risk and uncertainty that they are unwarranted by traditional rational considerations.
- The use of heuristics may be advisable if implementation of what is calculated presents major problems.
- The use of heuristics may be the only plausible approach in cases of appreciable uncertainty. The enthusiasm surrounding publication of the book *Dow 36,000* by Glassman and Hasset (1999) reveals the degree to which people have underestimated prevailing uncertainty. The authors argued that stocks earned so much more than bonds during the last generation because of a risk premium associated with stocks. They contended that the level of risk and uncertainty had since declined, and because of that, the Dow Jones industrial stock market index was likely to rise sharply, indeed to 36,000 in the foreseeable future.
- The use of heuristic shortcuts is most appropriate where they closely approximate the result of optimization calculations. "Fast and frugal" heuristics, in particular, are appropriate for situations in which there are "flat maxima," that is, in which several options lead to similarly high rates of return.

Mainstream economics provides a suitable set of tools for dealing with a well-defined and usually small set of alternatives. Yet, as Nelson and Winter (1982) note, decision makers frequently confront a poorly defined set of choices that calls for a response that is vastly different from what is indicated to optimize from among several clearly enunciated alternatives. This helps point to the role of measures such as heuristics that often involve some intuition. Moreover, as Simon (1982) observed, the first major challenge in decision making may arise in the search for all the feasible or most important alternatives. Even when decision makers discern all of these, they may not fully grasp, in advance, the consequences of all options. In that case, as Slovic (2000) explains, the decision maker may need to construct the preferences required for decision making. For decisions based on evolving technologies, heuristics that aid in horizon scanning may be more useful than any calculations, as successful innovators insist. None of this is to deny that decision makers sometimes use overly simple or otherwise incorrect heuristics. Indeed, they may use heuristics when traditional optimization calculations are both feasible and advantageous. In addition, whether or not they do that, the decision makers may neglect to take the biases associated with heuristics sufficiently into account.

GUIDELINES FOR USING HEURISTICS

Ideally, heuristics should have clear guidelines for the search for information, the point at which that search should end (the stopping rule), and the way in which a decision should be made using the information obtained (Rieskamp, Hertweg, and Todd, 2006). Behavioral economics has not given these guidelines careful attention

in dealing with general heuristics, but they have received more attention in devising the specific heuristics appropriate for problems such as those of behavioral finance.

THE CATEGORIES OF HEURISTICS AND THEIR BIASES

Tversky and Kahneman (1982a) argue for the prevalence of three general-purpose heuristics: representativeness, availability, and anchoring and adjustment. Later, Slovic, Finucane, Peters, and MacGregor (2002) bring together the work of many other researchers and explicitly include emotional factors as a general-purpose heuristic under the term the *affect heuristic*. Gilovich and Griffin (2002) list six general-purpose heuristics: affect, availability, causality, fluency, similarity, and surprise.

This chapter focuses on the four heuristics noted by Kahneman, Slovic and Tversky (1982) and Slovic et al. (2002), namely, representativeness, availability, anchoring and adjustment, and affect. To a lesser extent, the chapter considers what has been termed a two-system or dual processing approach. This approach involves an intuitive, "associative" mental system with rapid, essentially automatic assessment, and a more deliberative and rational but usually slower system. The latter may or may not override the more intuitive approach (Sloman, 2002). Various researchers have written of special-purpose heuristics long used by practitioners, but these have only recently become a major focus of attention.

Problems may arise in acquiring information including considerations related to availability, perception, the frequency of data presentation, the concreteness and vividness of information, and the order of presenting data. Availability biases may arise as a result of the ease with which people can recall specifics from memory. The content of the specifics also may influence assessments about their relative importance. Availability acquisition biases can lead to overestimation of the probability of well-publicized or dramatic events, especially recent ones, indeed, rising to what a number of analysts have referred to as "availability cascades." An example of a prominent availability bias is the belief of most people that homicides, which are highly publicized, are more common than suicides. In fact, the reverse is true. Availability cascades can lead to costly overreactions, even in confronting serious problems. This seems to have occurred, for example, in the case of New York State's Love Canal pollution tragedy of the 1970s, in which the illnesses and deaths of children received intensive but somewhat misleading coverage in the press and on television. Imperfect perception of data also can be serious and is accentuated by differences in educational background, life experiences, basic personality, and context. Efforts to grapple with problems are sometimes less successful than necessary because of reliance on data that are incorrectly perceived, leading to a focus on problems that differ from those actually confronted.

Biases in processing information may begin with incorrect understanding and incorporation of information, for example, about profitability and dividends. There may be a tendency to overvalue certainty, even the appearance of certainty, in which certainty characterizes only the second and conditional step in some two-stage sequences (Tversky and Kahneman, 2002). Another common occurrence is the tendency to ignore very low probabilities, especially of prospective natural disasters,

but then to act after their occurrence as if the probabilities of the events were temporarily higher than in actuality. Long Term Capital Management (LTCM), a major 1990s hedge fund, exemplifies another type of case. LTCM, which was advised by two Nobel laureate economists, made highly speculative investments and gambles, assuming that certain potentially adverse events were highly unlikely and not related to one another. In part, this illustrates a tendency to fail to recognize true probabilities because of the use of data from too short a time period. The same propensity applies to continuing overly optimistic predictions of security analysts, who often base their predictions on financial data from only a few recent years. Tversky and Kahneman (1982b) and Kahneman and Tversky (2000b) emphasize tendencies to overestimate low probabilities but also note that people sometimes ignore low probabilities. In both cases, this reflects the difficulty in evaluating low probabilities correctly.

Errors that arise in evaluating statistical relationships can lead to the selection of inappropriate heuristics. Among other factors, there are illusory associations or correlations, a tendency to attribute causality to correlations, inappropriate use of linear extrapolations, and incorrect approaches to estimating nonlinear extrapolations. In addition, there is often a failure to incorporate new information correctly in estimating probabilities, referred to as conservatism, and sometimes even to being *consistent* in incorporating new information. Frequently there is a tendency to seek feedback that confirms the results previously obtained rather than to attempt to find contrary evidence. Finally, humans find it difficult to apply criteria consistently. In some cases, models based on the enunciated criteria of experts are better predictors than the ongoing judgments of the same experts, as shown by Slovic (1972).

One stream of research on heuristics emphasizes attributes. For example, some attributes to which people may assign little importance, or about which they lack awareness, can still affect certain choices. This applies to some attitudes as well as attributes. The work on attributes has involved compensatory and noncompensatory decision rules. Kahneman and Frederick (2005) have written of attribute substitution, whereby people resolve difficult judgments by substituting conceptually or semantically related assessments that are simpler and more accessible. Nominal money estimates may figure in this category, insofar as they serve as a kind of heuristic, and can be reasonable measures in periods of low inflation. The other line of simplifying analyses has emphasized general heuristics such as representativeness, availability, anchoring and adjustment, and affect.

Representativeness

Representativeness involves judgments of the likelihood of an event or identification, based on its similarity to a class of events or individuals. (Chapter 14 provides a more detailed discussion of the bias of representativeness.) As with the other general heuristics, there are no uniform guidelines on the degree to which representativeness affects judgments of likelihood. Use of the representativeness heuristic sometimes reflects a failure to take into account relevant "base-rate" information before a judgment is made or demonstrates a statistically invalid reliance on small samples (the so-called law of small numbers). In an early experiment (Kahneman and Tversky, 1982a, 1982b), participants appear to have ignored

base-rate data and focused on stereotyped characteristics in judging whether the profiles of those submitted were engineers or lawyers. There may be valid reasons for ignoring base-rate information, however. For example, stock selection depends much less on base-rate information of an industry than on other factors. Therefore, as Wärneryd (2001) explains, this source of bias appears to be less common in finance. Moreover, the past earnings of a company, though publicized as representative, may not provide much in the way of guidelines as the small print accompanying such earnings data usually states. Somewhat akin to the "law of small numbers" bias, the representativeness heuristic appears to underlie much reasoning by analogy.

Failure to allow for "regression toward the mean," which is the reversion of outcomes toward computed averages, is another bias associated with representativeness. This has been revealed in numerous contexts, as in a study by Gilovich, Vallone, and Tversky (2002), that shows that most observers and most participants mistakenly believe in the "hot hand" in basketball. Continued belief in the "hot hand" surfaced in the 2006 NCAA March Madness when the virtually unrated George Mason University (GMU) basketball team defeated several teams with higher national rankings. GMU eventually lost in the semifinals as its shooting average declined, reverting toward the season's mean.

Another major bias associated with representativeness is the conjunction bias, where someone or something is judged to be more probable than the larger group to which the person or matter belongs. Perhaps the most prominent example involves Kahneman and Tversky's (1982a, 1982b, 2000b) experiment in which the participants identified Linda as a *feminist* bank teller even more than as a bank teller.

In the case of the representative and the availability heuristics, the weight of a stimulus or association is enhanced by response compatibility. The lack of response compatibility seems to be a major factor in explaining cases of preference reversal, reflecting what seems to be a lack of transitivity of preferences. An example of this is in the expression of preference for one option when the outcome is determined by probabilities, but the alternative option when price rather than probability is involved in determining the outcome (Tversky, Sattath, and Slovic 2000; Slovic, Griffin, and Tversky, 2002). The example refers to the Lichtenstein and Slovic (1971, 1973) laboratory and real life experiments. Those experiments showed that many individuals who preferred the low probability of a large sum of money to the high probability of a small amount, when given the opportunity to place a price on both options and sell the options, then assigned a lower price to the alternative that they had just indicated that they preferred. Heuristics dependent on probability do not always yield the same result as heuristics dependent on price. The degree to which this type of phenomenon presents itself is not yet clear.

Availability

Availability, discussed above in considering access to information, is the heuristic reflecting the weight given to information in place of probability or frequency. That weighting is attributable to the ease of recall and the content of what is recalled. Availability may be due to some recent dramatic news event. In general, as Wärneryd (2001) notes, availability can be experience-based, memory-based,

or imagination-based. Unfortunately, there is no agreement as to what constitutes different degrees of availability or the weight that should be given to those differences in availability. One type of recognition of the importance of availability can be observed from the behavior of a successful mutual fund manager, who is supposed to have reflected that he tended to avoid stocks that most analysts and managers were celebrating because he was convinced that such "availability" increased the likelihood that the shares of those companies were overvalued. The tendency of investors to focus so overwhelmingly on national rather than international stocks, particularly until the mid-1990s, and to miss profitable opportunities abroad, probably reflects reliance on the availability heuristic. Perhaps the main bias of availability is due to its extreme lack of sensitivity to sample size; by its nature, information that is dramatically available may reflect a small sample.

Anchoring and Adjustment

Anchoring and adjustment is a heuristic that involves adjustment from some starting point. The starting point may refer to recent data such as the current rate of inflation or economic growth, but often, the relevant starting point is much less known to those who make judgments. Indeed, the anchor may involve random data and even false data deliberately injected by individuals serving as "plants" hired by the organizers of experiments to respond with irrelevant numbers. Such situations affect the results of isolated experiments in a major way, but whether the results are indicative of what happens in many types of real-life situations is unclear. To the contrary, most individuals show considerable potential to learn from experience. Field experiments are only of limited help in this regard and are much more useful in dealing with the behavior of aggregates than individuals. There are real-world situations in which seemingly irrelevant data serve as the starting points of judgments. While there are no guidelines concerning the extent of adjustment to anchors, people in all walks of life frequently resort to anchoring and adjustment heuristics, particularly for unique events.

Overconfidence

Many analysts maintain that use of heuristics, particularly the representativeness heuristic, tends to lead to unwarranted overconfidence (Kahneman, Slovic, and Tversky 1982; Kahneman and Tversky 2000a; Gilovich et al., 2002). Overconfidence seems to be a general phenomenon of human response, presenting itself even in assumptions about data such as the basic facts that constitute elements of the decision problem. Excess confidence makes people feel good and moves them to do things they might not otherwise have done. Overconfidence is sometimes attributable to an illusion of control and to exaggerating what can be expected from admittedly better-than-average capability and performance.

Overconfidence seems to be a common phenomenon. For example, evidence suggests that most people believe they are better-than-average drivers or citizens and that their children are better than average in many respects. Yet some express less confidence than warranted in some contexts. Both overconfidence and underconfidence may lead to decisions that are less than fully rational, whether they are "predictably irrational" or not (on the latter, see Ariely, 2008). Many analysts

have written of overconfidence, but Benoît and Dubra (2008) show that the claims and alleged proofs of overconfidence are not adequately supported. Support for the claims of overconfidence may be possible with the explanations of individuals in open-ended-in depth, interview-based studies. Chapter 13 provides a more extended discussion of overconfidence and Chapter 20 deals with open-ended, in-depth, interview-based studies.

Memory

Problems with memory also introduce biases into heuristics. The difficulty of achieving accurate recall weakens what Tversky and Kahneman (2002) refer to as extensionality, encompassing conjunction situations like that involving Linda, the feminist bank teller, in which a category that strikes people most, actually is only a component of another larger category. Memory problems occur more frequently with some people and in some contexts more than others. Studies such as Kahneman (2000a, 2000b) indicate that people are inclined to assign a larger weight to their recall of initial and closing moments of an experience, and to underweight the rest. This represents an affective reaction more than a cognitive assessment. It is not that they overestimate those end moments but that they assign greater weight to them. All of this biases the recall that enters into the formation of heuristics, which may reflect a quasi-statistical but imperfect association, given the problems with memory.

There are times when the brain holds two conflicting thoughts at the same time. For example, one might believe that he is a good investor, but also be faced with poor investing performance. This uncomfortable feeling is referred to as *cognitive dissonance*. In order to reduce this discomfort, the brain alters its attitudes, beliefs, and even memory of events over time. Also, people tend to focus on news and information that confirms reduction of the dissonance and discounts information that increases it. The classic example from the psychology literature is smoking (Aronson, Wilson, and Akert, 2006). A widely accepted premise is that smoking causes lung cancer, shortened life, and a reduction in the quality of life. To reduce the conflict between the intelligent self-image and this knowledge, the smoker ignores and/or rationalizes this information.

People who view themselves as good investors will tend to pay more attention to information that confirms their views and discount news that refutes their views. This may cause investors to overestimate their past investment portfolio returns because they remember more clearly their successes than their failures. Goetzmann and Peles (1997) asked two groups of investors (members of the American Association of Individual Investors [AAII] and architects) about their past mutual fund investment returns. The authors compared the responses of these two groups to their actual returns and found that the AAII members overestimated their past returns by 3.4 percent while the architects overestimated by 6.2 percent. Clearly, they remembered much better performance than they actually earned. They also overestimated how they performed compared with the market benchmark. Glaser and Weber (2007) find that the difference between estimated return and actual return for German investors was more than 10 percent. They conclude that investors will have difficulty learning from their mistakes if they do not know or remember those mistakes.

Other Heuristics

Much reasoning not involving complete calculation is characterized by a bias favoring status quo decisions (Kahneman, Knetsch, and Thaler 1991). Independent of the amount of calculation involved, the same also holds for much reasoning about decisions in which there is substantial uncertainty. This bias favoring the status quo appears to be particularly important in finance. Investors sometimes leave portfolios unmodified even after major changes in financial trends cause the relative shares of components to shift dramatically. More than a bias, this phenomenon now is also recognized as an automated choice heuristic—choosing by default (Frederick, 2002). Field experiments have shown that the default heuristic affects auto insurance choices, among others (Levitt and List, 2009). Moreover, employers have discovered that they can get individuals to increase their savings by using a default option, the option that prevails in the event that an individual does not make an active choice (Choi, Laibson, Madrian, and Metrick, 2004). Thaler and Benartzi (2004) show that substantially increasing savings is possible by postponing the decision but accepting a commitment to "Save More Tomorrow." Many corporations have adopted this approach. Thaler and Benartzi refer to this program of automatic escalation of contributions as a choice-architecture program that was constructed with close reference to five psychological principles underlying human behavior (also see Thaler and Sunstein, 2008). The default option heuristic and the choice-architecture heuristic program represent particularly innovative approaches to decision making. Chapter 31 contains additional information related to retirement account saving.

Psychologists and economists have also been taking note of other general heuristics. Perhaps the most notable of these is loss aversion. Loss aversion was first observed as an anomaly in revealing the changing attitudes toward risk, according to whether gains or losses are involved. It refers to the tendency of individuals to value strikingly negative outcomes (such as bankruptcy) more than expected values that reflect the probabilities of those outcomes. (See also the discussion in Chapter 11.) Ambiguity aversion, the tendency to avoid choices with ambiguous as compared to just simply unknown information also comes to mind, though more as a bias in interpreting options.

Regret theory is another general heuristic (Loomes and Sugden, 1982), but one with mixed empirical support. This theory involves contrafactual and introspective thinking. It uses strategies to avoid the intense negative emotions that can arise from imagining a situation that would have been better had one decided differently. To the extent that regret theory guides investors, they are inclined to be more passive. Chapter 17 contains more on regret theory.

Analysts often conclude that heuristics or shortcuts to the search for solutions involve biases, which are large and often differ from one another. An exception to this is the work of Gigerenzer and the Max Planck Institute (see Gigerenzer et al., 2002; Rieskamp et al., 2006; Gigerenzer and Selten, 2001), which harks back to Simon (1957, 1982, 1986) and his insistence on procedural rationality within bounded rationality and, thus, on satisficing. For them, the emphasis on biases is misplaced. They maintain that aspects of the environment and prevailing context shape the nature of the heuristics; people search for and respond to cues. The best of the "fast and frugal" heuristics they develop (simple heuristics that require relatively little calculation effort) perform well in comparison with correlations,

multivariate analyses, and other objective measures. The fast and frugal approach offers possibilities for specific financial heuristics, particularly where there is considerable time pressure, but does not avoid the problem of biases. Indeed, the fast and frugal approach is subject to the bias of selecting overly familiar factors, and may not perform well in making judgments unless the rate of return is roughly comparable for the alternative options.

The solution for many problems requires more than a single heuristic. Such heuristics may take into account the type of decision making involved (sometimes referred to as the region of rationality), the particular context (clues from the environment, in the terminology of those involved in the fast and frugal program), and the likely importance of missing information. Data on heuristics and their biases (or the degree to which they fall shy of certain alternatives to resolving options, in the context of the fast and frugal program) should be recorded to be sure that they are adequately taken into account, and also so that there will be a better basis for improving the heuristics. Unfortunately, decision makers rarely record those data.

There are few published guidelines for determining biases. Fischoff (2002) outlines the best of what is publicly available and emphasizes the assessment of hindsight and overconfidence. He lists three categories of assumptions and strategies for dealing with the biases. Fischoff categorizes biases as attributable to the following: (1) faulty tasks (divided into unfair and misunderstood tasks); (2) faulty judges (divided into perfectible and incorrigible individuals); and (3) a mismatch between judges and tasks (divided into restructuring and education). The first of these may be the most useful for behavioral finance.

As strategies for dealing with unfair tasks, Fischoff (2002) suggests raising stakes, clarifying instructions/stimuli, discouraging second-guessing, using better response modes, and asking fewer questions. For misunderstood tasks, he proposes demonstrating alternative goals, semantic disagreement, the impossibility of a task, and overlooked distinctions. He also outlines strategies for dealing with faulty judges and for a mismatch between judges and tasks. Both Fischoff (2002) and Tetlock (2002) wrestle with the predictive use of heuristics, which emphasizes the need to be open to changes when predictions are not well borne out. That is something to which practitioners, who can profit from a good track record, should be particularly attentive. However, the finance community is often as reticent to modify or replace its heuristics as most other groups.

Some problems are so complex that they may not be solved in a reasonably efficient manner in the time available. Such problems lend themselves best to solution by an informal and unstructured approach: by pure intuition or by a kind of expertise that has been referred to as pattern recognition. The latter seems to be the way in which grand masters function in chess. Their situations involve alternatives that are not nearly as complex as those presented by the changes in expectations and uncertainty confronting leaders in business and public life. Yet, even finance experts have a mixed record with many having sensed economic patterns that have not been borne out in practice.

Some Final Words on Biases to Cognitive Heuristics

A major issue in processing of information is how people frame information. Differences in framing change the weight given to certain factors and may draw

attention to different aspects of outcomes. Beyond that, large differences in response may be triggered by a positive as contrasted to a negative framing of the identical information, akin to what Tversky and Kahneman (1982a, 2000a) show. Trial lawyers and marketing managers have long recognized the potential of differences in framing. Traditionally, most classroom presentations in finance and economics have assumed that there is no such potential. This has begun to change, particularly with acceptance of the findings of many researchers (Kahneman et al., 1982; Gilovich et al., 2002).

Dubious recall of information and imperfect feedback can influence the evaluation of judgments and the degree to which decision makers use the same approach in the future. The presence of large numbers of options, even irrelevant options, can impede or distort judgment (Chapman and Johnson, 2002) perhaps more so when using certain heuristics than others. Hindsight bias is of considerable importance in matters such as finance. However, other factors also play a role such as the reliability of feedback and erroneous recall of reasoning processes. Another factor is the misunderstanding of chance fluctuations such as the "gambler's fallacy." According to this fallacy, observers raise their expectation for the appearance of an opposite occurrence (the appearance of "heads," for example, after a succession of flips showing "tails,") even though the probability of that outcome remains unaltered. The gambler's fallacy may conflict with any tendency toward pattern recognition, noted above.

The Affect Heuristic

An affect heuristic provides a first and almost automatic reaction to stimuli, often without consciousness, and tends to orient information processing and judgment. It is characteristic of what psychologists term the experiential system, which draws on past experiences. Based on their analysis of evidence from many studies, Slovic et al. (2002) indicate an affect heuristic incorporates images marked by positive or negative feelings that provide cues for judgment and decision making. Such imagery influences people's preferences for visiting specific cities, their reaction to certain technologies, and their views favoring health-enhancing behavior. Of particular interest to behavioral finance is evidence cited by Slovic et al. (2002) showing that the imagery of affect heuristics manifests itself in an inclination for investing in new versus old companies, and in "growth" stocks. The precision of an affective impression influences judgments. Experiments show that respondents react more favorably to the probability of winning a lottery than to the actual monetary payoff. In general, when consequences have a strong affective sense, there is insensitivity to probability. Moreover, presenting a dominant proportion (e.g., four-fifths) is usually more influential in affecting people than a similar finding with respect to probability (0.8). Finally, regarding situations involving lives saved, the proportion saved seems to register even more than actual numbers.

The perception of risk is strongly linked to the degree to which a hazard evokes feelings of dread. This is a major factor in influencing decisions concerning the need for regulation. There is a negative correlation between the judgment of risk and benefit, particularly in the short run. In financial matters, this relationship holds for new but not for older companies. Affect-laden images of frequencies and individual cases weigh more heavily than probabilities. In addition, people

assess the perception of the risk of death to be much greater for those adversities highly reported in the media such as accidents, homicides, fires and tornados than for less publicized causes such as diabetes, asthma, tuberculosis, and stroke. Attitudes often play a more important role than economic and financial indicators in explaining the willingness to pay for a public good or the punitive damage awarded by juries.

Affective reactions may trigger cognitive reasoning but they also may undermine it. For example, the smiling faces in advertisements even for mediocre products can manipulate perceptions of values. Background music can increase interest even in similarly ordinary movies. Affective reactions seem to numb reasoning in some cases, as in the dangers from smoking, particularly where a lack of personal experience often makes it difficult to appreciate the likely effects on future health. Finally, Slovic et al. (2002) present evidence showing that a happy mood increases the likelihood of heuristic processing while a sad mood increases the likelihood of systematic processing. Statman, Fisher, and Anginer (2008) show that affect plays a significant role in the pricing of assets. They provide an analysis of the difference in the return to the portfolios of 587 U. S. companies reported in *Fortune* as Admired or Spurned. Chapter 6 on emotional finance and Chapter 36 on mood provide additional material related to the affect heuristic.

SUMMARY AND CONCLUSIONS

Heuristics are shortcuts that facilitate problem solving. They simplify calculations and substitute for more formal and complex measures that require knowledge of probabilities. Heuristics describe the decision-making process that people actually undertake, incorporating emotional factors as well as cognitive processes. Virtually all heuristics involve biases.

General-purpose heuristics have received the most attention. Among them are representativeness, availability, anchoring and adjustment, and the affect heuristic. In addition, most day-to-day activities require the application of special-purpose heuristics. Resolving many decisions requires more than a single heuristic.

Problems may arise in the acquisition and processing of information and in interpreting the results after using heuristics to arrive at decisions. Decision-maker experience may help reduce biases over time, but analyses show that the biases are relatively predictable and can be taken into account. The most common biases are attributable to loss aversion, lack of sufficient sensitivity to sample size, failure to allow for regression toward the mean, conjunction situations, overconfidence, undue anchoring, framing the information, and ignoring prior probabilities (base-rate data). The last of these is not as serious for finance as for many other areas of decision making. Problems with memory introduce biases into all heuristics.

Loss aversion, first noted as a major bias, can be regarded as a general heuristic as well. The status quo bias has also emerged as a heuristic—the default heuristic. Using the latter has been successful in increasing the saving of employees in normal times and has led to the construction of a related "automatic escalation" heuristic based on several psychological principles. The automatic escalation heuristic has proved to be even more successful than the default heuristic as a means of increasing employee savings and emphasizes the promise of heuristics for behavioral finance and macroeconomic public policy. Public and private institutions

have recognized other general heuristics. An increasing number of activity-specific heuristics have been devised, including some fast and frugal heuristics with minimal biases.

The cost and sometimes impossibility of undertaking optimizing calculations lead to shortcuts when making decisions. General heuristics can often be thought of as strategies and have been subjected to much analysis. Considerations such as the nature of the biases involved affect choices among the context-specific heuristics that might be used. Decision makers often require heuristics of both types to resolve problems in areas such as finance.

The lack of a satisfactory theory of heuristics manifests itself in the sometimes offsetting nature of the tendencies and biases of various heuristics, as noted in the analyses that led to recognition of preference reversal. The problem is compounded when it becomes essential to use more than two heuristics to deal with decisions, and often when the context and environment change as well. Unfortunately, different heuristics can lead to different results. How to take these factors into account is a task that remains relatively unresolved although exceptional familiarity with context and environment can help. Familiarity with the details of history can also be valuable because some heuristics owe their existence to evolutionary explanations. As an example of the importance of familiarity with context, consider the observation of some financial analysts that the implications of mark-to-market models may differ from one class of assets to another.

The importance of constructing heuristics rather than just accepting long-held, largely intuitive heuristics derives from the fact that people often make quick intuitive judgments to which they are not deeply committed. In some cases, these individuals concede they were mistaken. To the extent that there is to be more attention to the construction of heuristics, this points to the importance of debiasing criteria. Beyond that, it argues for increased training and refresher courses in probability and statistics in order to add more of such reasoning to underlying intuitive inclinations.

DISCUSSION QUESTIONS

1. Explain whether heuristic judgments are the same as intuitive judgments.
2. Why are people paying so much attention to calculation shortcuts such as heuristics (rules of thumb) today, given that they have always existed?
3. How can incorporating emotional factors, as with the affect heuristic, help in determining choices that are better by rational standards?
4. If the nature of biases is so important, why are there only limited guidelines for dealing with them, particularly with respect to the guidelines for the specific heuristics required for most day-to-day judgment and decision making? Why are so few researchers focusing on this?

REFERENCES

Ariely, Dan. 2008. *Predictably irrational: The hidden forces that shape our decisions*. New York: Harper.

Aronson, Elliot, Timothy D. Wilson, and Robin M. Akert. 2006. *Social psychology*. 6th ed. Upper Saddle River, NJ: Prentice Hall.

Benoît, Jean-Pierre, and Juan Dubra. 2008. Overconfidence. Unpublished SSRN manuscript 1088746.

Chapman, Gretchen B., and Erich J. Johnson. 2002. Incorporating the irrational: Anchors in judgments of belief and value. In *Heuristics and biases: The psychology of intuitive judgment*, ed. Thomas Gilovich, Dale Griffin, and Daniel Kahneman, 120–138. New York and Cambridge, England: Cambridge University Press.

Choi, James J., David Laibson, Brigitte Madrian, and Andrew Metrick. 2004. For better or for worse: Default effects and 401(k) savings behavior. In *Perspectives in the economics of aging*, ed. David Wise, 81–121. Chicago: University of Chicago Press.

Fischoff, Baruch. 2002. Heuristics and biases in application. In *Heuristics and biases: The psychology of intuitive judgment*, ed. Thomas Gilovich, Dale Griffin, and Daniel Kahneman, 730–748. New York and Cambridge, England: Cambridge University Press.

Frederick, Shane. 2002. Automated choice heuristics. In *Heuristics and biases: The psychology of intuitive judgment*, ed. Thomas Gilovich, Dale Griffin, and Daniel Kahneman, 548–558. New York and Cambridge, England: Cambridge University Press.

Gigerenzer, Gerd, and Reinhard Selten, eds. 2001. *Bounded rationality: The adaptive toolbox*. Cambridge, MA: MIT Press.

Gigerenzer, Gerd, Jean Czerlinski, and Laura Martignon. 2002. How good are fast and frugal heuristics? In *Heuristics and biases: The psychology of intuitive judgment*, ed. Thomas Gilovich, Dale Griffin, and Daniel Kahneman, 559–581. New York and Cambridge, England: Cambridge University Press.

Gilovich, Thomas, and Dale Griffin. 2002. Introduction—Heuristics and biases: Then and now. In *Heuristics and biases: The psychology of intuitive judgment*, ed. Thomas Gilovich, Dale Griffin, and Daniel Kahneman, 1–18. New York and Cambridge, England: Cambridge University Press.

Gilovich, Thomas, Dale Griffin, and Daniel Kahneman, eds. 2002. *Heuristics and biases: The psychology of intuitive judgment*. New York and Cambridge, England: Cambridge University Press.

Gilovich, Thomas, Robert Vallone, and Amos Tversky. 2002. The hot hand in basketball: On the misperception of random sequences. In *Heuristics and biases: The psychology of intuitive judgment*, ed. Thomas Gilovich, Dale Griffin, and Daniel Kahneman, 601–616. New York and Cambridge, England: Cambridge University Press.

Glassman, James, and Kevin Hasset. 1999. *Dow 3600: The new strategy for profiting from the coming rise in the stock market*. New York: Times Books.

Glaser, Markus, and Martin Weber. 2007. Why inexperienced investors do not learn: They do not know their past portfolio performance. *Finance Research Letters* 4:4, 203–216.

Goetzmann, William N., and Nadav Peles. 1997. Cognitive dissonance and mutual fund investors. *Journal of Financial Research* 20:2, 145–58.

Kahneman, Daniel. 2000a. Experience utility and objective happiness: A moment-based approach. In *Choices, values, and frames*, ed. Daniel Kahneman and Amos Tversky, 673–692. New York and Cambridge, England: Russell Sage Foundation and Cambridge University Press.

Kahneman, Daniel. 2000b. Evaluation by moments: Past and future. In *Choices, values, and frames*, ed. Daniel Kahneman and Amos Tversky, 693–708. New York and Cambridge, England: Russell Sage Foundation and Cambridge University Press.

Kahneman, Daniel, and Shane Frederick. 2005. A model of heuristic judgment. In *The Cambridge handbook of thinking and reasoning*, ed. Keith J. Holyoak and Robert G. Morrison, 267–293. Cambridge, England: Cambridge University Press.

Kahneman, Daniel, Jack L. Knetsch, and Richard H. Thaler. 1991. The endowment effect, loss aversion, and status quo bias. *Journal of Economic Perspectives* 5:1, 193–206.

Kahneman, Daniel, Paul Slovic, and Amos Tversky, eds. 1982. *Judgment under uncertainty: Heuristics and biases.* New York and Cambridge, England: Cambridge University Press.

Kahneman, Daniel, and Amos Tversky. 1982a. Subjective probability: A judgment of representativeness. In *Judgment under uncertainty: Heuristics and biases*, ed. Daniel Kahneman, Paul Slovic, and Amos Tversky, 32–47. New York and Cambridge, England: Cambridge University Press.

Kahneman, Daniel, and Amos Tversky. 1982b. On the study of statistical intuition. In *Judgment under uncertainty: Heuristics and biases*, ed. Daniel Kahneman, Paul Slovic, and Amos Tversky, 493–508. New York and Cambridge, England: Cambridge University Press.

Kahneman, Daniel, and Amos Tversky, eds. 2000a. *Choices, values, and frames.* New York and Cambridge, England: Cambridge University Press.

Kahneman, Daniel, and Amos Tversky. 2000b. Prospect theory: An analysis of decision under risk. In *Choices, values, and frames*, ed. Daniel Kahneman and Amos Tversky, 17–43. New York and Cambridge, England: Cambridge University Press.

Levitt, Stephen D., and John A. List. 2009. Field experiments in economics: The past, the present, and the future. *European Economic Review* 53:1, 1–18.

Lichtenstein, Sarah, and Paul Slovic. 1971. Reversals of preference between bids and choices in gambling decisions. *Journal of Experimental Psychology* 89:1, 46–55.

Lichtenstein, Sarah, and Paul Slovic. 1973. Response-induced reversals of preference in gambling: An extended replication in Las Vegas. *Journal of Experimental Psychology* 101:1, 16–20.

Loomes, Graham, and Robert Sugden. 1982. Regret theory: An alternative theory of rational choice under uncertainty. *Economic Journal* 92:368, 805–824.

Nelson, Richard R., and Sidney G. Winter. 1982. *An evolutionary theory of economic change.* Cambridge, MA and London: Belknap Press of Harvard University Press.

Rieskamp, Jörg, Ralph Hertweg, and Peter M. Todd. 2006. Bounded rationality: Two views from psychology. In *Handbook of contemporary behavioral economics*, ed. Morris Altman, 218–237. Armonk, NY: M.E. Sharpe.

Simon, Herbert A. 1957. A behavioral model of rational choice. In *Models of man: Social and rational*, ed. Herbert A. Simon, 24–60. New York: John Wiley & Sons, Inc.

Simon, Herbert. 1982. *Models of bounded rationality: Behavioral economics and business organization*, Vol. 2, 84–121, 408–494. Cambridge, MA: MIT Press.

Simon, Herbert. 1986. Rationality in psychology and economics. In *Rational choice: The contrast between economics and psychology*, ed. Robin M. Hogarth and Melvin W. Reder, 25–40. Chicago: University of Chicago Press.

Simon, Herbert. 1998. Personal communication to Hugh Schwartz, cited in Hugh Schwartz, *Rationality gone awry? Decision making inconsistent with economic and financial theory*, 43. Westport, CT and London: Praeger.

Simon, Herbert, and Allen Newell. 1982. Heuristic problem solving: The next advance in operations research. In *Models of bounded rationality: Economic analysis*, Vol. 1, ed. Herbert A. Simon, 380–389. Cambridge, MA: MIT Press.

Sloman, Steven A. 2002. Two systems of reasoning. In *Heuristics and biases: The psychology of intuitive judgment*, ed. Thomas Gilovich, Dale Griffin, and Daniel Kahneman, 379–396. New York and Cambridge, England: Cambridge University Press.

Slovic, Paul. 1972. Psychological study of human judgment: Implications for investment decision making. *Journal of Finance* 27:4, 779–799.

Slovic, Paul, 2000. The construction of preference. In *Choices, values, and frames*, ed. Daniel Kahneman and Amos Tversky, 489–502. New York and Cambridge, England: Cambridge University Press.

Slovic, Paul, Melissa Finucane, Ellen Peters and Donald G. MacGregor, 2002. The affect heuristic. In *Heuristics and biases: The psychology of intuitive judgment*, ed. Thomas Gilovich, Dale Griffin, and Daniel Kahneman, 397–420. New York and Cambridge, England: Cambridge University Press.

Slovic, Paul, Dale Griffin, and Amos Tversky, 2002. Compatibility effects in judgment and choice. In *Heuristics and biases: The psychology of intuitive judgment*, ed. Thomas Gilovich, Dale Griffin, and Daniel Kahneman, 217–229. New York and Cambridge, England: Cambridge University Press.

Statman, Meir, Kenneth L. Fisher, and Deniz Anginer. 2008. Affect in a behavioral asset-pricing model. *Financial Analysts Journal* 64:2, 20–26.

Tetlock, Philip E. 2002. Theory-driven reasoning about plausible pasts and probable futures in world politics. In *Heuristics and biases: The psychology of intuitive judgment*, ed. Thomas Gilovich, Dale Griffin, and Daniel Kahneman, 749–762. New York and Cambridge, England: Cambridge University Press.

Thaler, Richard H., and Shlomo Benartzi. 2004. Save more tomorrow: Using behavioral economics to increase employee saving. *Journal of Political Economy* 112:S, 164–187.

Thaler, Richard H., and Cass R. Sunstein. 2008. *Nudge: Improving decisions about health, wealth, and happiness*. New Haven and London: Yale University Press.

Tversky, Amos, and Daniel Kahneman. 1982a. Judgment under uncertainty: Heuristics and biases. In *Judgment under uncertainty: Heuristics and biases*, ed. Daniel Kahneman, Paul Slovic, and Amos Tversky, 3–20. New York and Cambridge, England: Cambridge University Press.

Tversky, Amos, and Daniel Kahneman. 1982b. Belief in the law of small numbers. In *Judgment under uncertainty: Heuristics and biases*, ed. Daniel Kahneman, Paul Slovic, and Amos Tversky, 23–31. New York and Cambridge, England: Cambridge University Press.

Tversky, Amos, and Daniel Kahneman. 2002. Extensional versus intuitive reasoning: The conjunction fallacy in probability judgment. In *Heuristics and biases: The psychology of intuitive judgment*, ed. Thomas Gilovich, Dale Griffin, and Daniel Kahneman, 19–48. New York and Cambridge, England: Cambridge University Press.

Tversky, Amos, and Derek J. Kochler. 2002. Support theory: A nonextensional representation of subjective probability. In *Heuristics and biases: The psychology of intuitive judgment*, ed. Thomas Gilovich, Dale Griffin, and Daniel Kahneman, 441–473. New York and Cambridge, England: Cambridge University Press.

Tversky, Amos, Shmuel Sattath, and Paul Slovic. 2000. Contingent weighting in judgment and choice. In *Choices, values, and frames*, ed. Daniel Kahneman and Amos Tversky, 503–517. New York and Cambridge, England: Cambridge University Press.

Wärneryd, Karl-Erik. 2001. *Stock market psychology: How people value and trade stocks.* Cheltenham, England, and Northampton, MA: Edward Elgar.

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Hugh Schwartz received a PhD in economics from Yale University and has taught at the University of Kansas, Yale University, and Case Western Reserve University. He served as an economist in the Inter-American Development Bank (IDB); he was a Fulbright lecturer in Uruguay and Brazil, as well as a visiting professor in both countries and in the Department of Finance of the Technological Institute of Monterrey in Mexico. Schwartz edited volumes on cost-benefit analysis and manufacturing exports for the IDB. He has written many articles and three books. Two of his books concern behavioral economics; the most recent is *A Guide to Behavioral Economics* (2008), published by Higher Education Publications, Falls Church, VA. In July 2009, he participated in two panels at the conference of the Society for the Advancement of Behavioral Economics (SABE) and the International Association for Research in Economic Psychology (IAREP) in Halifax, Nova Scotia.

CHAPTER 5

Neuroeconomics and Neurofinance

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INTRODUCTION

Behavioral finance studies typically identify and *describe* market price anomalies and individual decision biases. Unfortunately, such descriptions of behavior do not *explain the causes of* behavior, and as a result they have not proven amenable to generalization or predictive modeling. Neuroeconomic research illuminates the fundamental biological and psychological mechanisms that underlie the emergence of individual biases, irrational behavior, and collective buying and selling decisions. Using research tools and techniques borrowed from the field of neuroscience, neuroeconomists are gaining the necessary insights to build comprehensive economic models of human economic behavior and decision making.

Several fields of study contribute to and are advanced through neuroeconomics research including neuroscience, economics, psychology, decision science, psychiatry, neurology, sociology, evolutionary biology, and law and ethics. Neuroeconomics is not a separate field so much as a set of experimental techniques and tools that have been adopted by practitioners in many other fields to investigate questions of central interest.

Neuroeconomics experimentation is defined by the use of the scientific method to identify drivers and modifiers of choice behavior. Experimental apparati including neuroimaging and behavioral monitoring equipment are frequent tools of choice in such research. The use of neuroscientific research tools allows economists to look at the fundamental biological drivers of decision making. In particular, many economists are interested in investigating the origins of nonoptimal decision making.

Open economic and financial issues addressed by neuroeconomics range from the mechanistic details of everyday consumer choices to overarching questions of policy and morality. Recent research includes advances in our understanding of how mental processes underlie: (1) financial risk taking; (2) the utility function and valuation; (3) expectation formation; (4) the process of learning; (5) information interpretation, such as under conditions of framing, reference points, and affective loading; (7) probability assessments; (8) social influences on choice; and (9) reciprocity, altruism, and morality. As you can see by the list above, the range of

practical and philosophical investigations undertaken by neuroeconomists is wide. As a result of this breadth and novelty, the reliability of research findings can vary. Reproducible experimental research depends on the reducibility of complex problems into testable hypotheses in a controllable experimental environment, which is time-consuming and complex. Neureconomists are incrementally advancing the *science* of economics and decision theory through ingenious experimental design and deliberate testing of defined hypotheses.

This chapter primarily describes the progress neuroeconomists have made in contributing to our understanding of financial risk taking (including concepts of utility, emotional priming, probability assessments, and reference points) and social influences on financial choice (including moral concepts such as reciprocity, cooperation, trust, and revenge). As such, the remainder of the chapter consists of four sections: neuroscience primer, research methods, decisions and biases, and summary and conclusions.

NEUROSCIENCE PRIMER

The human brain evolved over millenia by navigating our ancestors successfully through self-preservation and reproduction. The brain is well designed for efficiently perceiving and interpreting information, successfully competiting in a social hierarchy, and achieving beneficial goals while avoiding danger. The human brain evolved to optimally interface with a stone-age world where dangers and opportunities were largely immediate and social interactions were limited to other members of a hereditary clan. The stone-age human brain is not optimized for managing many of the informational complexities of modern economic decision making. It is possible that many of the biases identified in behavioral finance are traceable to the brain's evolutionarily biology.

There are many levels of function in the brain, from the microscopic actions of individual molecules to broad communications between lobes. At a molecular level, neural activity is driven by neurochemicals, small electrical currents, genetic (protein) transcription, and the epigenetic cellular milieu. On the anatomical level, there are neural circuits that cross brain regions and give rise to complex thoughts and behaviors. The complex interdependence of the micro- and macromechanisms of brain activity underpin a complete neurological understanding of the brain.

In the neuroeconomic academic literature, findings of interest typically reference significant statistical correlations between subject biology (e.g., genetic endowment, neural activations, and personality traits) and behavior (e.g., stated preferences, buying and selling decisions, and observed behavior). To neuroeconomists, changes in neurophysiology (e.g., fluctuations in blood flow, electrical activity, neurotransmitter activity, and cellular metabolism) and aberrations in neuroanatomy (e.g., brain lesions or structures, hormone levels, and neurotransmitter receptors) are of interest in their relation to economic and strategic decision making. Understanding the implications of neuroeconomic research first requires an appreciation of basic neurobiology.

The Triune Brain

The brain can be conceptualized as having three major anatomical divisions of interest. Each division is like the layer of an onion, with complex processes such as analytical decision making in the outer layer, motivations, emotions, and drives arising from the middle layer, and life-sustaining physiological processes originating in the innermost core. This conceptual schema is termed the "triune" brain (MacLean, 1990).

The outer layer is called the cortex, which is the brain's logistical center. It is the director of executive function and motor control. The part of the cortex called the prefrontal cortex is of most interest to this chapter. The prefrontal cortex is involved in abstract thinking, planning, calculation, learning, and strategic decision making (Prabhakaran, Rypma, and Gabrieli, 2001). One part of the cortex, called the insular cortex, is evolutionarily distinct from the neocortex. When using the word *cortex,* this chapter broadly refers to the neocortex and the prefrontal cortex, but excludes the insular cortex, which is considered an evolutionarily older part of cortex and anatomically part of the brain's limbic system.

The brain's limbic system is the emotional driver of the brain. The limbic system is the source of primitive motivations and emotions including fear and excitement. Both the cortex and the limbic system are displayed in Exhibit 5.1. The third division of the brain is called the midbrain (also know as "the reptilian brain"). The midbrain manages the body's basic physiological processes, including respiration, wakefulness, and heart rate, and it will not be discussed further in this chapter.

Traversing the three "layers" of the brain are neuronal pathways that deliver, integrate, and process information. In particular, two pathways have been found highly relevant to financial decision making. Since the time of Aristotle, scientists and philosophers have loosely hypothesized the existence of two major brain functions that are fundamental to almost all human behavior—the *reward approach*

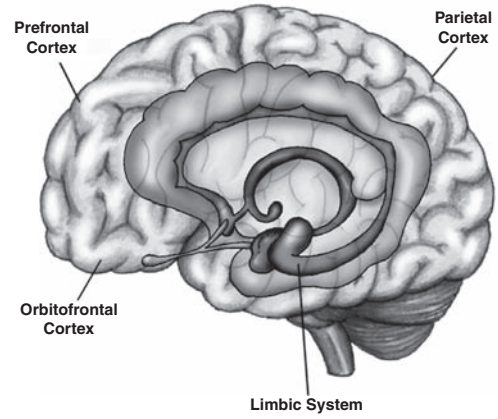

Exhibit 5.1 A Depiction of the Whole Brain.

Note: The limbic system is seen situated underneath the cortex. The prefrontal cortex lies behind the forehead. The orbitofrontal cortex (OFC) is located behind the eyes and above the sinuses. The parietal cortex is situated at the posterior of the brain.

(pleasure-seeking) and the *loss-avoidance* (pain-avoidance) systems (Spencer, 1880). These two motivational systems can be activated or deactivated independently. When people face potential financial gains or losses, one or both of these systems may be utilized in the process of decision making. This chapter will present a review of empirical evidence of the direct link between brain activation specific to these two systems, affective (emotional and feeling) states, and financial decision making.

The Reward System

Perceiving a potential reward in the environment sets the brain's reward approach system into action. Overall, the reward system coordinates the search for, evaluation of, and motivated pursuit of potential rewards. The neurons that carry information in the reward system transmit signals primarily via the neurotransmitter dopamine. The reward system lies along one of the five major dopamine pathways in the brain, the meso-limbic pathway (as shown in Exhibit 5.2), which extends from the base of the brain, through the nucleus accumbens (NAcc) in the limbic system to the gray matter of the frontal lobes (MPFC) and the Anterior Cingulate Gyrus (ACG) (Bozarth, 1994).

Dopamine was historically called the "pleasure" chemical of the brain. Dopamine has more recently been found to play a role in attention, mood, learning, motivation, and reward valuation and pursuit (among other functions). People who are electrically stimulated in brain regions with high concentrations of dopamine terminals report intense feelings of well-being (Heath, 1964). The dopaminergic pathways of the reward system are activated by illicit drug use. Dopamine activity in the reward system appears to correlate with subjective reports of positive feelings (Knutson, Adams, Fong, and Hommer, 2001).

The reward system facilitates the rapid assessment and valuation of potential opportunities and threats in the environment. Of course, many items and goals

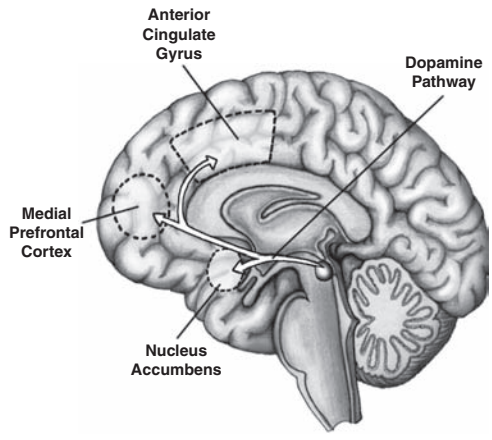

Exhibit 5.2 A Depiction of the Brain's Reward System.
Note: The dopamine tract underlying the reward system extends from the midbrain through several structures key for reward valuation and motivation.

are perceived as valuable, including pleasant tastes (especially fatty, sweet, and salty foods) (O'Doherty, Dayan, Friston, Critchley, and Dolan, 2003), sex appeal (Karama, Lecours, and Leroux, 2002), generosity (Rilling, Gutman, Zeh, Pagnoni, Berns, and Kilts, 2002), status symbols, such as luxury goods and sports cars (Erk, Spitzer, Wunderlich, Galley, and Walter, 2002), laughing (Mobbs, Greicius, Abdel-Azim, Menon, and Reiss, 2003), and revenge and the punishment of deviants (de Quervain, Fischbacher, Treyer, Schellhammer, Schnyder, Buck, and Fehr, 2004). These valued events all activate the brain's reward system.

The personality trait of extraversion is characterized by both reward-seeking and sociability (e.g., gregariousness). Neuroscience researchers find that activation of the brain's reward system is positively correlated with extraversion scores (Cohen, Young, Baek, Kessler, and Ranganath, 2005). Additionally, Cohen et al. report that the presence of the dopamine D2 receptor A1 allele correlated both with the personality trait extraversion and the strength of reward system activation when receiving financial rewards.

Hypoactivation or desensitization of the reward system results in a propensity to feel apathetic, have low energy, and engage in compensatory excitement and novelty-seeking financial behaviors such as pathological gambling and compulsive shopping. Short-term gains energize dopamine flow in the reward circuit.

Loss Avoidance

A second fundamental motivational circuit governs "loss avoidance." The "loss-avoidance system" is activated when the brain recognizes potential threats or dangers in one's environment. Anxiety, fear, and panic are emotions that arise from the loss-avoidance system, and pessimistic and worried thoughts are the cognitive sequelae of loss system activation.

The brain's loss-avoidance system is less defined than the reward system. It runs through several regions of the brain's limbic system, in particular, the amygdala and the anterior insula. Its activity is mediated by serotonin and norepinephrine (among other neurotransmitters) and can be modulated with antidepressant medication such as selective serotonin reuptake inhibitors (SSRIs). Acute activations of the loss-avoidance system lead to the subjective experience and physiological signs of anxiety (Bechara, Damasio, and Damasio, 2000).

Activation of the brain's loss system results in stress, anxiety, disgust, pain, and even panic. The behavioral bias of loss aversion is fueled by fears of disappointment and regret, and appears to arise from amygdala activation (DeMartino, Kumaran, Holt, and Dolan, 2009). The anterior insula is an area of primitive cortex that governs the experiences of disgust, pain, and loss (Wright, Shapira, Goodman, and Liu, 2004). Anterior insula activation precedes excessive risk aversion in one investment experiment. The physical and mental effects of stress are generated by hormonal and chemical pathways in the loss-avoidance system.

Loss system activation affects the entire body through bloodstream hormone and neurotransmitter release. The perception of a threat activates the hypothalamus-pituitary-adrenal axis (HPA axis), which results in stress hormone and epinephrine ("adrenaline") secretion into the bloodstream. The body's sympathetic nervous system (SNS) prepares the whole body for the "fight-or-flight" response to danger with nerve signals transmitted to every major organ system.

When under threat and experiencing fear, signs of SNS activation include trembling, perspiration, rapid heart rate, shallow breathing, and pupillary dilation. The SNS is also responsible for the physical signs and symptoms of panic. As discussed later in the chapter, the experience of market volatility raises cortisol (a stress hormone) levels in traders (Coates and Herbert, 2008).

Chronic activation of the loss-avoidance system is indicated by the personality trait of neuroticism (Flory, Manuck, Mattews, and Muldoon, 2004). Neuroticism is characterized by risk aversion. The prevalence of neuroticism has been weakly associated with the short form (s-allele) of the serotonin transporter gene, which leads to a decrease in serotonin sensitivity (Arnold, Zai, and Richter, 2004).

The brain's insula is involved in the anticipation of aversive affective and noxious physical stimuli (Simmons, Matthews, Stein, and Paulus, 2004) and in selective disgust processing (Wright et al., 2004). Paulus, Rogalsky, Simmons, Feinstein, and Stein (2003) show that insula activation is related to risk-averse decision making. Paulus et al. report that insula activation was significantly stronger when subjects selected a "risky" response versus selecting a "safe" response in an experimental task. Second, the researchers find that the degree of insula activation is related to the probability of selecting a "safe" response following a punished response. Third, the degree of insula activation is related to the subjects' degree of harm avoidance and neuroticism as measured by personality questionnaires.

Because the reward and loss systems influence thought and lie beneath awareness, they often direct behavior automatically through subtle (and overt) emotional influences on judgment, thinking, and behavior. Fortunately, investigators have a number of tools for assessing the health of the brain's reward and loss-avoidance systems.

RESEARCH METHODS

Researchers use a variety of sophisticated tools to investigate how the brain works. In most cases, neuroeconomists' key findings are established by identifying population (group) effects, key individual differences in decision making, and via manipulation of the information and frame of a decision task.

Neuroimaging is perhaps the most widely used technology for understanding decision making among neuroeconomists. Most of the neuroimaging studies cited in this chapter use functional magnetic resonance imaging (fMRI). Using fMRI allows researchers to visualize changes in oxygenated blood flow, which serves as a proxy for brain metabolism. fMRI can yield resolution of brain voxels as small as $1 \times 1 \times 1$ millimeters over time intervals of one second. Positron emission tomography (PET), which is an alternative neuroimaging technique to fMRI, has a larger spatial resolution of approximately $3 \times 3 \times 3$ millimeters and can detect changes in glucose metabolism and blood flow only when a radioactive tracer has been injected into the subject. Other, less widely used imaging techniques include Magnetic Resonance Spectroscopy (MRS), electroencephalogram (EEG), and optical tomography (a brain activity monitoring technique using infrared light). Since the mid-1990s, fMRI has become the most common neuroimaging technique due to its low invasiveness, lack of radiation exposure, and relatively wide availability.

Other investigative technologies include genetic tests, behavioral measures, subjective reports, psychological tests, hormone assays, and electrophysiology. Electrophysiology involves measurements of heart rate, blood pressure, galvanic skin response (sweating), and other physical variables, many of which are indicators of reactive brain activation in limbic and midbrain regions. Pupillary eye measurements allow researchers to directly monitor the activity of the sympathetic nervous system (SNS). The SNS is involved in the "fight-or-flight" panic response.

Electromyograghs (EMGs) measure electrical activity during muscle contraction. When EMGs are used on facial muscles, very subtle states of happiness and concern can be measured. For example, analysts who are excited about an investment idea may have greater activation of their *zygomatic* facial muscles when they talk about that investment. The zygomatic muscles control smiling. The frontalis muscle on the forehead is activated by concern, revealed in a furrowed brow, and may be more active in traders during stressful market volatility.

In the 1970s and 1980s, many decision-making researchers used electroencephalograms (EEGs) for experimentation. An EEG is a test used to detect fluctuations in the electrical activity of the surface of the brain's cortex. EEGs are often used clinically to diagnose seizures. Some psychotherapists use EEGs for emotional biofeedback (so called "neurofeedback").

Single-neuron recording techniques are physically invasive and are performed primarily on monkeys and rats. Such techniques have allowed researchers to model the activity of tiny neuronal bundles, including those used while computing the expected value of various decision options (Glimcher, 2003). Genetic sequencing technologies such as the polymerase chain reaction (PCR) have revealed that genes correlate with prominent personality and behavioral traits, including financial risk taking. Assays of blood, saliva, and cerebrospinal fluid allow researchers to measure hormones (such as those mediating trust, aggression, and the stress response) and neurotransmitters (including those involved in impulsiveness), although using current techniques saliva can only be used to measure stress hormones and for gene collection.

A research technique most often used by neurologists is the study of patients with specific brain lesions. This technique caught the interest of behavioral economists in the mid-1990s. Small brain lesions secondary to focused strokes or tumors can cause isolated impairments. These impairments provide information about the function of specific brain regions.

Manipulations of diet, including dietary restrictions (e.g., of branched amino acids to lower endogenous tryptophan levels), and administration of exogenous chemicals such as medications, foods, vitamins, hormones, and intoxicants (benzodiazepines, amphetamines, cocaine, THC, and alcohol) significantly affect financial decision making through known neural mechanisms.

Standard psychological research tools such as self-report surveys, behavioral observation (most neuroeconomic experiments attempt to correlate behavioral observation with neural or hormonal activity), personality testing, and other specific psychometric instruments including affect, depression, anxiety, psychoticism, impulsivity, and intuition rating scales are widely utilized by neuroeconomists. Additionally, psychological states such as anticipation, deliberation, learning, updating, and calculation can be measured and observed using neuroimaging techniques such as fMRI.

A newer approach to monitoring individual states of arousal is layered voice analysis (LVA), which can measure stress in the voice. Textual analysis of one's stated preferences or affects may also be a useful technique in measuring and quantifying attitudes, beliefs, and affect states in written documents or transcripts of audio recordings. Neuroeconomic experiments often attempt to draw conclusions about the decision-making process, typically via correlations of observed biological markers with behavioral outcomes. To address the criticism that "correlation is not causation," many neuroeconomists are working on behavioral prediction, and many of the studies cited in this chapter utilize predictive techniques.

Neuroeconomic research relies on experimental designs that elicit value-based decision making. Money is a useful experimental tool because it can be used as both an incentive and a punishment, and it is scalable and universally valued. Besides money, many experiments use consumer products as performance incentives. In prospective studies, the actual spending, purchasing, borrowing, and portfolio activities of subjects is monitored over time in order to investigate short-term influences and long-term outcomes.

DECISIONS AND BIASES

Numerous factors bias individual financial decisions on each anatomical level of brain function. Genetic influences appear to have substantial and profoud effects on financial risk taking. On the molecular level, ingested chemicals such as medications, drugs of abuse, herbs, and foods can alter financial decision making via their alterations of the intracellular environment. On the anatomical level, fMRI studies have demonstrated that the style of information presentation, establishment of reference points, and framing effects all alter financial decisions, as predicted by shifts in oxygenation in cerebral blood flow in the brain's limbic system. Some key neuroeconomic studies are reviewed in this section.

Medications and Drugs of Abuse Alter Financial Risk Taking

If decision making is dependent to some extent on the brain's underlying neurochemical milieu, then dietary changes, medications and illicit drugs, exercise, and other techniques shown to alter the brain's neurochemical activity might affect decision making. Numerous studies have been performed with medications, which are easy to administer and monitor. Researchers have identified medications that directly alter risk/return perceptions in behavioral experiments. This should not be surprising when considering that anxiety disorders, which are successfully treated by many pharmaceuticals, are disorders of risk perception.

Rogers, Lancaster, Wakeley, and Bhagwagar (2004) report that a common high blood pressure medication in the beta-blocker family decreased experimental subjects' discrimination of potential financial losses during a risky task.

Drugs of abuse have also been demonstrated to affect financial decisions. Researcher Scott D. Lane designed an experiment in which subjects were given a choice between a certain but low-value positive expected value option ($0.01) or a zero expected value option with high return variability (the risky option). THC-intoxicated subjects preferred the risky option significantly more than control subjects who had been administered a placebo (Lane, Cherek, Tscheremissine,

Lieving, and Pietras, 2005). If they lost money after selecting the risky option, THC-intoxicated subjects were significantly more likely to persist with the risky selection, while controls were more likely to move to the positive expected value option. Lane, Cherek, Pietras, and Tcheremissine (2004) report a similar preference and persistence with the risky option in alcohol-intoxicated subjects as compared to controls.

Deakin, Aitken, Dowson, Robbins, and Sahakian (2004) show that a dose of the benzodiazepine Valium increased the number of points wagered in a risk-taking task only in those trials with the lowest odds of winning but the highest potential payoff. Lane, Tcheremissine, Lieving, Nouvion, and Cherek (2005) report that administration of the benzodiazepine Alprazolam produced increased selection of a risky option under laboratory conditions. Interestingly, the strength of a subject's risk-seeking personality traits may be predictive of acute drug effects on risk-taking behavior. The above studies illustrate that common chemical compounds, such as medications and intoxicants, can alter an individual's propensity toward risky choice.

Financial Risk Taking and the Reward and Loss-Avoidance Systems

Neuroeconomists have made headway in changing the consensus conception of risky decision making. In particular, several biological and psychological states have been found to increase the likelihood of "excessive" risk taking.

The roles of the reward and loss-avoidance systems in portfolio choices and investment errors are demonstrated in a 2005 study published by Kuhnen and Knutson. The goals of their study were twofold: (1) to determine whether anticipatory brain activity in the NAcc and anterior insula would differentially predict risk-seeking versus risk-averse choices, and (2) to examine whether activation in these regions would influence both suboptimal and optimal choices. The Kuhnen and Knutson (2005) study finds that while NAcc activation preceded both risky choices and risk-seeking mistakes, anterior insula activation preceded both riskless choices and risk-aversion mistakes. These findings are consistent with the hypothesis that NAcc activation represents gain prediction (Knutson, Fong, Adams, and Hommer, 2001), while anterior insula activation represents loss prediction (Paulus et al., 2003). Therefore, the results indicate that above and beyond contributing to rational choice, anticipatory neural activation may also be a predictor of impending irrational choice. Thus, optimal financial decision making may require a delicate balance—recruitment of distinct emotion-generating anticipatory mechanisms may be necessary for taking or avoiding risks, but excessive activation of one mechanism or the other may lead to mistakes.

Overall, the authors findings suggest that risk-seeking choices (such as gambling at a casino) and risk-averse choices (such as buying insurance) may be driven by two distinct neural mechanisms involving the NAcc and the anterior insula. The findings are consistent with the notion that activation in the NAcc and the anterior insula, respectively, index positive and negative anticipatory affective states, and that activating one of these two regions can lead to a shift in risk preferences. This may explain why casinos surround their guests with reward cues (e.g., inexpensive

food, free liquor, surprise gifts, and potential jackpot prizes)—anticipation of rewards activates the NAcc, which may lead to an increase in the likelihood of individuals switching from risk-averse to risk-seeking behavior.

Researchers find that such "racy" environmental cues do in fact increase financial risk taking. Seeing a sexy picture activates the NAcc and makes subjects more likely to take a lower expected value gamble (Knutson, Wimmer, Kuhnen, and Winkielman, 2008a). Furthermore, having experienced a recent "win" in an investment simulation predict that subjects will be likely to take an "irrational" risk as compared to a Bayesian-optimal decision (Kuhnen and Knutson, 2005). Recent gains as a result of risk taking and emotionally exciting "primes" activate the reward centers and lead to further increased risk taking.

Knutson, Wimmer, Rick, Hollon, Prelec, and Loewenstein (2008b) identify two clear predictors of purchasing. Activation of the NAcc demonstrated "liking" of consumer products, which predicted buying. This makes sense—consumers will pay more for items that they like. However, perceiving that a consumer item is "cheap" or "on sale" leads to activation of the MPFC, which further predicts buying behavior (Knutson, Rick, Wimmer, Prelec, and Loewenstein, 2007). Thus, individuals may be driven to buy consumer products that they do not necessarily like if they believe that such items are "a good deal."

In the financial markets, genetic markers have been found that predispose individuals to higher levels of risky financial decision making and susceptibility to framing effects. In one genetic study, subjects who have the DRD4 gene 7-repeat allele take 25 percent more risk in an investment task, while those with two copies of the short serotonin transporter gene (5-HTTLPR s/s) take 28 percent less risk (Kuhnen and Chiao, 2009). Neuroeconomists have also found alterations in risk taking over the lifespan, with age-related changes in financial risk taking (Mohr, Li, and Heekeren, 2009). For example, as a presumed result of the biological changes that accompany early life experiences and changes in dopaminergic and serontonergic transmission over the lifespan, the saving and investment patterns of people who came of age during traumatic economic events (e.g., the Great Depression or periods of low stock returns) are different from those who did not (Malmendier and Nagel, 2009).

While genetic factors appear to have a life-long influence, developmental influences such as family and childhood experiences have a significant effect on lifelong behavior. However, developmental influences have been found to diminish over time if individuals learn from their own lifetime investment experiences.

Loss Aversion

Several neuroeconomists have investigated the tenets of prospect theory (see Chapter 11), with examinations of the neural correlates of loss aversion, reference point setting, and the endowment effect.

Neuroeconomists find that some investors are more susceptible to the disposition effect (taking excessive risk in the realm of losses; see Chapter 8) and that this increased susceptibility can be traced to specific neural activations. Personality studies identify individuals with high neuroticism scores as having more reactive anterior insulas in the context of experiencing losses. When personality testing and

neuroimaging are employed in tandem, the accuracy of predicting which individuals will exhibit risk seeking in the realm of losses may increase.

Neuroscientists in London designed an experiment that used framing to elicit the neural process underlying loss aversion. In an fMRI study at University College London, Benedetto De Martino recruited 20 men and women to undergo three 17-minute brain scans. At the start of each trial, the subjects were given English pounds worth about $95. They were then asked to make a choice between receiving a certain outcome (a gain or a loss) and taking a gamble. The gamble they could accept was a simple 50–50 bet in which they wagered a predefined amount of their money. The gamble's expected value was equivalent to that of the certain option, so there was no financial reason subjects should show a preference for either the certain outcome or the gamble (De Martino, Kumaran, Seymour, and Dolan, 2006).

When the choice was framed as a decision between "keeping" a certain amount of money and gambling, most participants chose to "keep" their money. For example, told they would "keep" 40 percent of the starting sum if they chose not to gamble (as in "Keep $38"), the volunteers typically played it safe, choosing to take the 50–50 gamble only 43 percent of the time. When told they would "lose" 60 percent of their initial pot if they did not gamble, they took the risk 62 percent of the time, even though the gambles always had the same expected value as the certain option. Interestingly, De Martino et al.'s (2006) results provide evidence that loss aversion is induced by the language used to frame a risky choice.

The subjects had the odds explained to them in detail before the experiment, and they knew that the probabilities in each situation were identical. Nonetheless, the language altered their decisions: "Keep $38" put them in a gain frame, and "Lose $38" induced a loss frame. When succumbing to loss aversion, the subjects' amygdalas (stimulated by danger) activated vigorously. When participants resisted the framing effect, the orbitofrontal cortex (involved in integrating emotion and reason) and the anterior cingulate cortex (responsible for sorting out internal conflicts) both activated. Vegano (2006, p. D4) notes that De Martino said, "We found everyone showed emotional biases, more or less; no one was totally free of them." Four of the study participants acknowledged that they had been inconsistent in their decision making, choosing according to the frame rather than the odds, and in explanation they said, "I know, I just couldn't help myself," according to De Martino (Vergano, p. D4).

In a subsequent fMRI study, De Martino, Kumaran, Holt, and Dolan (2009) demonstrate that two distinct neural circuits activated in response to expected value computation (reference point–independent values) and value computation that was distorted by a reference point (in this case, ownership, as seen in the endowment effect). Their results show that activity in the orbitofrontal cortex and dorsal striatum tracked parameters such as expected value. In contrast, activity in the ventral striatum indexed the degree to which stated prices were distorted with respect to a reference point.

Knutson et al. (2008b) identify the right anterior insula as the brain structure whose activation is most predictive of the endowment effect (see Exhibit 5.3). When the potential pain of losing an endowed item (via selling the item) is experienced by an individual more acutely (seen in their greater activation of the right anterior insula), then they are more likely to exhibit the endowment effect (demanding a much higher sale price).

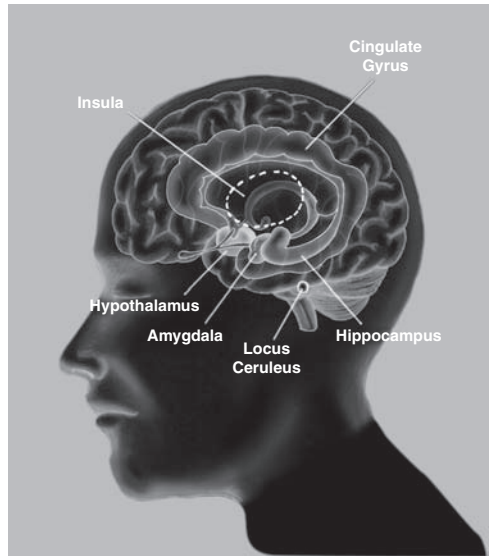

Exhibit 5.3 An Illustration of Several Structures in the Brain's Loss Avoidance System.
Note: The loss avoidance system is distributed throughout several brain structures. These underlying structures are involved in detecting, processing, learning about, and responding to potential threats.

As would be expected if a human brain evolved from those of other primates, capuchin monkeys are susceptible to loss aversion and the endowment effect (Chen, Lakshminarayanan, and Santos, 2006). Furthermore, loss aversion is not age-dependent. Human children, while unable to express gambles in terms of expected value, also demonstrate loss aversion, with no age-diminishing influence through college (Harbaugh, Krause, and Vesterlund, 2002).

Intertemporal Choice and Impulsivity

In experiments, most subjects discount future rewards, pursuing smaller, sooner rewards rather than waiting for larger, later ones, thus sacrificing a rate of return on their money far greater than any they could earn via an average investment. The fact that most individuals "leave money on the table" by seeking rewards immediately rather than waiting has prompted inquiry from neuroeconomists into the mechanisms by which such discounting occurs.

Samuel McClure, a neuroscientist at Princeton University, performed a brain-imaging experiment with colleagues on volunteers engaged in a time discounting task. Subjects were given several decision pairs between which they were asked to state their preference. For example, they could choose between an Amazon.com gift certificate worth $20.28 today and one worth $23.32 in one month. In a longer-term example, they asked subjects to, for example, choose between $30 in two weeks and $40 in six weeks (McClure, Laibson, Loewenstein, and Cohen, 2004).

McClure et al. (2004) find that time discounting results from the combined influence of two neural systems. Limbic regions drive choices in favor of immediately available rewards. The frontal and parietal cortices are recruited for all choices.

These two systems are separately implicated in emotional and cognitive brain processes, and there appears to be a competition between the two systems during discounting-type decisions, with higher limbic activation indicating a greater likelihood that immediate gratification will be pursued.

McClure et al. (2004) also find that when experimental subjects choose larger delayed rewards, cortical areas such as the lateral and prefrontal cortex show activity enhancement. These brain regions are associated with higher-level cognitive functions including planning and numerical calculation. McClure's theory is supported by a finding that in prisoners the cortical regions activated by delayed gratification are thinned. This may explain why their decisions are more often shortsighted than others' (Yang, Raine, Lencz, Bihrle, LaCasse, and Colletti, 2005). According to McClure et al. (p. 506), "Our results help to explain why many factors other than temporal proximity, such as the sight or smell or touch of a desired object, are associated with impulsive behavior. If limbic activation drives impatient behavior, it follows that any factor that produces such activation may have effects similar to that of immediacy." According to McClure et al., immediacy in time may be only one of many factors that, by producing limbic activation, engenders impatience and impulsive action.

Researchers have identified that temporal discounting may be a result of dual competing valuation mechanisms in the brain. In one circuit, the reward system values the magnitude of potential gains, while in the other network, the dorsolateral prefrontal cortex and other structures deactivate in response to the delay that must be experienced (Ballard and Knutson, 2009).

The delay of a potential reward introduces uncertainty. Uncertainty decreases financial risk taking, especially when it is associated with ambiguity in payout probability or outcome magnitude, and the difference between uncertain versus ambiguous financial risks can be seen and tracked in neural activation patterns (Hsu, Bhatt, Adolphs, Tranel, and Camerer, 2005).

Beyond impatience for financial rewards, a study of dieting found that gastronomic impulse control appeared to be based in circuitry shared with financial prudence. Based on a study of dieters, self-control appeared to be biologically modulated by a value signal encoded in ventromedial prefrontal cortex (vmPFC). Exercising self-control involved the modulation of that value signal by the dorsolateral prefrontal cortex (DLPFC) (Hare, Camerer, and Rangel, 2009).

Trust, Morality, and Altruism

Issues of trust and reciprocity are explored in experiments involving the dictator game, the trust game, and the prisoner's dilemma. These studies shed light on the nature of individual morality (such behaviors as fairness, generosity, altruism, and punishment) in financial decision making.

The ultimatum game is commonly used to study generosity, fairness, and punishment. Paul Zak at Claremont Graduate University has performed extensive experimentation using the ultimatum game and biological assays (blood hormone monitoring), personality testing, and medication administration (oxytocin). In the ultimatum game, a subject (the Proposer) is given a monetary sum to split (or not) with a second player (the Responder). After the Proposer presents the split offer to the Responder, the Responder may accept or reject it. If the offer is rejected, then

neither player receives money. If accepted, then each player receives their share of the proposed split.

Several amino acids, neurotransmitters, and hormones have been shown to alter generosity and rejection in the ultimatum game. The key protein mediator of generosity appears to be oxytocin. In one study, Zak, Stanton, and Ahmadi (2007) discover that administration of oxytocin intranasally led to increased generosity in the ultimatum game. In a related study, Morhenn, Park, Piper, and Zak, 2008) find that delivering a massage before the ultimatum game led to more generous offers and that physical contact such as massage increases blood oxytocin levels. In a subsequent study by Barraza and Zak (2009), participants rate the emotions they experience and then play a $40 ultimatum game to gauge their generosity. The researchers find that empathy ratings are associated with a 47 percent increase in oxytocin from baseline. They also report that the empathy-oxytocin response is stronger in women than in men. Higher levels of empathy are also associated with more generous monetary offers toward strangers in the ultimatum game. Oxytocin may be a physiologic signature for empathy, and empathy may mediate generosity.

Besides oxytocin, the neurotransmitter serotonin appears to have a role in generosity. One technique for lowering the brain's serotonin levels is dietary restriction of amino acids. As Crockett, Clark, Tabibnia, Lieberman, and Robbins (2008) find, participants who had dietarily depleted 5-HT (serotonin) levels rejected a greater proportion of unfair offers, but not fair offers, without showing changes in mood, fairness judgment, basic reward processing, or response inhibition during an ultimatum game.

Anatomical changes also affect generosity and rejection. Research shows that damage to the ventromedial prefrontal cortex (VMPC), an area critical for the modulation of emotional reactions, results in irrational economic decisions. Koenigs and Tranel (2007) find that during an ultimatum game, the rejection rate of a group with damaged VMPC is higher than the rejection rates of the comparison groups for each of the most unfair offers ($7/$3 dollars, $8/$2, $9/$1).

Even dietary components such as fat intake affects generosity and rejection. Emanuele, Brondino, Re, Bertona, and Geroldi (2009) find that in experimental participants who rejected unfair offers in an ultimatum game, there was a significant depletion of ALA, EPA and DHA (omega-3 lipids). Moreover, the ratio of serum omega-3/omega-6 fatty acids was significantly lower in patients who rejected unfair offers as compared to those who did not. Hormones such as oxytocin, neurotransmitters such as serotonin, dietary fats such as omega-3 lipids, and physical manipulations such as massage alter financial decisions (generosity and perceptions of unfairness) in the ultimatum game.

From the neuroimaging perspective, researchers such as de Quervain et al. (2004) report that the NAcc (reward system) activates when subjects mete out punishment on others for whom they feel the punishment is deserved (when they commit an act of revenge). Thus, that revenge may be rewarding to the avenger and this subjective pleasure is one motivation for vengeful acts.

Emotions and Testosterone in the Trading Pit

Several researchers have gathered neuroeconomic data directly from financial market traders. Lo and Repin (2002) took psychophysiological measurements from

10 traders during real-time intra-day trading and found that traders experienced physiological reactions during periods of market volatility. The study also shows that less experienced traders have significantly greater physiological reactivity to market volatility than their more experienced colleagues. Lo and Repin (p. 332) conclude, "Contrary to the common belief that emotions have no place in rational financial decision-making processes, physiological variables associated with the autonomic nervous system are highly correlated with market events even for highly experienced professional traders."

Coates and Herbert (2008) sampled, under real working conditions, endogenous steroids from a group of male traders in the city of London. They report that a trader's morning testosterone level predicts his day's profitability. They also find that a trader's cortisol rises with both the variance of his trading results and the volatility of the market. Their results suggest that higher testosterone may contribute to economic return for traders, whereas cortisol appears to increase under conditions of increased risk perception. The authors go on to postulate that testosterone and cortisol, because they are known to have cognitive and behavioral effects, may shift risk preferences and even affect a trader's ability to engage in rational choice as market conditions change.

Building on evidence that prenatal (in-utero) exposure to sex hormones (specifically androgens) affects future behavior, Coates, Gurnell, and Rustichini (2009) performed a follow-up study on the second-to-fourth digit length ratio (2D:4D), where a relatively longer fourth finger indicated higher prenatal androgen exposure. In a group of male traders engaged in high-frequency trading, the authors found that 2D:4D predicted the traders' long-term profitability, the number of years they remained in the business, and the sensitivity of their profitability to increases both in circulating testosterone and in market volatility.

The results of the above studies suggest that hormonal exposure, whether in utero or in real time as a result of market events, apparently affects profitability and risk-taking. This hormonal evidence contributes to our understanding neuroimaging data. Testosterone may increase dopamine secretion, such as is presumed to promote NAcc activation in the fMRI experiments above, thus leading to increased financial risk taking through a neural mechanism.

SUMMARY AND CONCLUSIONS

Neuroeconomics and neurofinance are emerging disciplines whose key findings are in need of replication and comprehensive modeling. Examples of biologically mediated influences on financial decision making demonstrated in this chapter include medications, drugs of abuse, hormones, dietary restrictions, dietary additions, expert financial advice, massage, recent events (gains and losses), early life events, and the framing of decision options.

Critiques

Important critiques of neuroeconomics address the lack of experimental replication of many early findings. Neuroeconomic studies are often expensive, and many

researchers push the boundaries of existing decision science rather than replicating the studies of colleagues.

Another critique focuses on sample sizes and composition. Because fMRI and other techniques are expensive and research funds can be difficult to procure for novel research, many fMRI studies use small samples of 20 or less. The subjects in these studies are typically students. Given that there are observed differences in the biological substrates of decision making over the lifespan, results found on young samples may not be confirmed for older individuals. Additionally, most samples are drawn from university student bodies, which may not reflect the learning and experience of "real-world" decision makers.

Another concern is the ultimate utility of neuroeconomic research. Findings from very specific studies may not represent noisy real-world decision making. Furthermore, there is concern that neuroeconomic thinking is too "reductionistic." The criticism goes that neuroeconomists try to explain and model human behavior based on small pieces of data and anatomical findings, without taking the entire complex person, with all their conflicts, contradictions, and mixed motives, into account. Taking account of these criticisms, there do appear to be many useful lessons to be gleaned from neuroeconomists for financial practitioners.

Implications for Financial Market Practitioners

The chief lesson from neuroeconomics for financial practitioners is that emotion underlies all financial decisions. We cannot observe our "biology" during a typical workday, but we can monitor subtle signs of that biology such as *feelings* or emotions. In order for practitioners to optimize their financial decisions, identifying the point at which the biological influences identified above are impacting one's decisions, often through an understanding of the course of one's feelings, ought to be helpful. Without self-awareness, biological and emotional influences on financial decisions cannot be systematically addressed.

As people become aware of the biological influences that impact their financial decisions, whether through blood work and genetic assays or a daily practice of decision monitoring and emotional self-awareness, a plan for minimizing vulnerabilities and maximizing strengths can be implemented. In order to improve the emotional balance in financial decision making, three techniques may be helpful. First, practitioners can observe and acknowledge both well made and non-optimal decisions in the course of their work. For this purpose, keeping a decision journal is highly recommended. Second, the emotional precursors of both strong and nonoptimal decisions—whether related to one's upbringing, genetic tendencies, hormones, diet, sleep patterns, recent financial gains, or emotional primes—should be identified. Beyond genetic and blood tests, a meditation practice can hone one's awareness of fleeting emotions and their impact on decision making. Third, a behavioral plan for minimizing identified mistakes should be put in place. Such a plan can be generated by first noticing one's emotional reactions to an event and developing a plan to deal with destructive reactions. For example, a long-term investor may feel strong emotional reactions (and engage in maladaptive trading behaviors) while watching ticker prices moving intraday. As a result, that investor

should limit price checking and commit to (and behaviorally enforce) price observations only at necessary and pre-scheduled intervals.

One psychological "reframing" technique for reducing the biases that arise during financial decision making is to maintain non-judgmental beliefs and flexible expectations. In particular, practitioners must not see their decisions as so weighty as to require absolute perfection. Soros (1995) provides an excellent example with his well-publicized "Belief in Fallibility." Soros explains that to others, being wrong is a source of shame. But for Soros recognizing his mistakes is a source of pride. Soros explains that realizing that imperfect understanding is the human condition leads to no shame in being wrong, only in failing to correct our mistakes.

Biais, Hilton, Mazurier, and Pouge (2002, p. 3) find that "highly self-monitoring" traders perform better than their peers in an experimental market. While noticing emotional states is important, avoiding placing any value judgment on them is crucial. Judgments such as "I shouldn't be feeling this" or "I'm really good at this" further interfere with the exercise. Value judgments themselves give rise to further emotional reactions such as annoyance, disgust, anger, frustration, and self-congratulation.

Meditation, peaceful reflection, and contemplation are disciplines used for millennia to improve self-awareness. Financial practitioners could practice noticing the thoughts, feelings, and attitudes that underlie their decision making. They may notice patterns and unseen relationships between their feelings, beliefs, and actions during such self-reflection. Emotionality, impulsivity, or irritability that are noticed during meditation should be noted, as they often grow into significant influences on financial decision making when one is under stress.

Successful financial practitioners systematize as much of their decision-making process as possible. Professionals who are better prepared for contingencies, approach unexpected outcomes with curiosity, rather than the dread, fear, or denial of the novice. As Lo and Repin (2002) and Coates and Herbert (2008) demonstrate, professionals are physiologically reactive and release stress hormones (cortisol) in response to market volatility, so for improved practitioner decision making, such reactivity should be better monitored and managed. Inoculation against market stress via conditioning and experience can prevent the emergence of overwhelming emotions that override a rational decision process. Further, planning in advance for potential crises can improve one's decision making for moments when such a crisis actually occurs by enhancing feelings of preparedness, competency, and control.

More controversially, the data presented in this chapter indicate that some individuals are biologically predisposed to perform better in specific financial decision contexts, and biological tests could guide hiring practices leading to improved corporate performance. Similar considerations are being exploited by Human Resource departments who employ psychological testing of applicants. My own firm, MarketPsych LLC, has engaged in such cognitive and emotional technology development.

As we've reviewed in this chapter, there are numerous findings emerging on the various biological factors that can predict individual economic decision making in economic contexts. For practitioners, working to improve one's own financial decisions remains an enduring, but achievable, challenge.

DISCUSSION QUESTIONS

1. As compared to descriptive studies in behavioral finance, how does neuroeconomics approach non-optimal financial decision making and behavior?
2. Biologically speaking, what are some brain structures and chemicals that influence financial decision making?
3. What lessons does neuroeconomics provide for financial practitioners (traders, portfolio managers, and others)?
4. What are chief criticisms of neuroeconomic studies?

REFERENCES

Arnold, Paul D., Gwyneth Zai, and Margaret A. Richter. 2004. Genetics and anxiety disorders. *Current Psychiatry Reports* 6:4, 243–254.

Ballard, Kacey, and Brian Knutson. 2009. Dissociable neural representations of future reward magnitude and delay during temporal discounting. *NeuroImage* 45:1, 143–150.

Barraza, Jorge A., and Paul J. Zak. 2009. Empathy toward strangers triggers oxytocin release and subsequent generosity. In *Annals of the New York Academy of Sciences. Values, empathy, and fairness across social barriers*, 182–189. New York: New York Academy of Sciences.

Bechara, Antoine, Hannah Damasio, and Antonio R. Damasio. 2000. Emotion, decision making and the orbitofrontal cortex. *Cerebral Cortex* 10:3, 295–307.

Biais, Bruno, Denis Hilton, Karine Mazurier, and Sébastien Pouge. 2002. Psychological traits and trading strategies. Center for Economic Policy Research (CEPR) Discussion Paper No. 3195. Available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=302026.

Bozarth, Michael A. 1994. Pleasure systems in the brain. In *Pleasure: The politics and the reality*, ed. David M. Warburton, 5–14. New York: John Wiley & Sons, Inc.

Chen, M. Keith, Venkat Lakshminarayanan, and Laurie R. Santos. 2006. How basic are behavioral biases? Evidence from capuchin monkey trading behavior. *Journal of Political Economy* 114:3, 517–537.

Coates, John M., and Joe Herbert. 2008. Endogenous steroids and financial risk-taking on a London trading floor. *Proceedings of the National Academy of Sciences* 105:16, 6167–6172.

Coates, John M., Mark Gurnell, and Aldo Rustichini. 2009. Second-to-fourth digit ratio predicts success among high-frequency financial traders. *Proceedings of the National Academy of Sciences* 106:2, 623–628.

Cohen, Michael X., Jennifer Young, Jong-Min Baek, Christopher Kessler, and Charan Ranganath. 2005. Individual differences in extraversion and dopamine genetics predict neural reward responses. *Brain Research. Cognitive Brain Research* 25:3, 851–861.

Crockett, Molly J., Luke Clark, Golnaz Tabibnia, Matthew D. Lieberman, and Trevor W. Robbins. 2008. Serotonin modulates behavioral reactions to unfairness. *Science* 320:5884, 1739.

Deakin Julia B., Michael Aitken, Jonathon Dowson, Trevor Robbins, and Barbara Sahakian. 2004. Diazepam produces disinhibitory cognitive effects in male volunteers. *Psychopharmacology* 173:1–2, 88–97.

De Martino, Benedetto, Dharshan Kumaran, Ben Seymour, and Raymond J. Dolan. 2006. Biases and rational decision-making in the human brain. *Science* 313:5787, 684–687.

De Martino, Benedetto, Dharshan Kumaran, Beatrice Holt, and Raymond J. Dolan. 2009. The neurobiology of reference-dependent value computation. *Journal of Neuroscience* 29:12, 3833–3842.

de Quervain, Dominique J.-F, Urs Fischbacher, Valerie Treyer, Melanie Schellhammer, Ulrich Schnyder, Alfred Buck, and Ernst Fehr. 2004. The neural basis of altruistic punishment. *Science* 305:5688, 1254–1258.

Emanuele, Enzo, Natascia Brondino, Simona Re, Marco Bertona, and Diego Geroldi. 2009. Serum omega-3 fatty acids are associated with ultimatum bargaining behavior. *Physiology & Behavior* 96:1, 180–183.

Erk, Susanne, Manfred Spitzer, Arthur P. Wunderlich, Lars Galley, and Henrik Walter. 2002. Cultural objects modulate reward circuitry. *Neuroreport* 13:18, 499–503.

Flory, Janine D., Stephen B. Manuck, Karen A. Matthews, and Matthew F. Muldoon. 2004. Serotonergic function in the central nervous system is associated with daily ratings of positive mood. *Psychiatry Research* 129:1, 11–19.

Glimcher, Paul W. 2003. *Decisions, uncertainty, and the brain: The science of neuroeconomics*. Cambridge, MA: MIT Press.

Harbaugh, William, Kate Krause, and Lise Vesterlund. 2002. Prospect theory in choice and pricing tasks. Working Paper, Economics Department, University of Oregon.

Hare, Todd A., Colin F. Camerer, and Antonio Rangel. 2009. Self-control in decision-making involves modulation of the vmPFC valuation system. *Science*. 324:5927, 646–648.

Heath, Robert Galbraith. 1964. Pleasure response of human subjects to direct stimulation of the brain: Physiologic and psychodynamic considerations. In *The role of pleasure in human behavior*, ed. Robert Galbraith Heath, 219–243. New York: Hoeber.

Hsu, Ming, Meghana Bhatt, Ralph Adolphs, Daniel Tranel, and Colin F. Camerer. 2005. Neural systems responding to degrees of uncertainty in human decision-making. *Science* 310:5754, 1680–1683.

Karama, Sherif, André Roch Lecours, and Jean-Maxime Leroux, 2002. Areas of brain activation in males and females during viewing of erotic film excerpts. *Human Brain Mapping* 16:1, 1–13.

Knutson, Brian, Christopher Adams, Grace W. Fong, and Daniel Hommer. 2001. Anticipation of increasing monetary reward selectively recruits nucleus accumbens. *Journal of Neuroscience* 21:RC159, 1–5.

Knutson, Brian, Grace Fong, Christopher S. Adams, and Daniel Hommer. 2001. Dissociation of reward anticipation versus outcome with event-related FMRI. *NeuroRepor*t 12:174, 3683–3687.

Knutson, Brian, Scott Rick, G. Elliott Wimmer, Drazen Prelec, and George Loewenstein. 2007. Neural predictors of purchases. *Neuron* 53:1, 147–57.

Knutson, Brian, G. Elliott Wimmer, Camelia M. Kuhnen, and Piotr Winkielman. 2008a. Nucleus accumbens activation mediates the influence of reward cues on financial risk taking. *NeuroReport* 19:5, 509–513.

Knutson, Brian, G. Elliott Wimmer, Scott Rick, Nick G. Hollon, Drazen Prelec, and George Loewenstein. 2008b. Neural antecedents of the endowment effect. *Neuron* 58:5, 814–822.

Koenigs, Michael. and Daniel Tranel. 2007. Irrational economic decision-making after ventromedial prefrontal damage: Evidence from the ultimatum game. *Journal of Neuroscience* 27:4, 951–956.

Kuhnen, Camelia M., and Brian Knutson. 2005. The neural basis of financial risk-taking. *Neuron* 47:5, 763–770.

Kuhnen, Camelia M., and Joan Y. Chiao. 2009. Genetic determinants of financial risk taking. Available at *PLoS ONE* 4:2, e4362. doi:10.1371/journal.pone.0004362.

Lane, Scott D., Don R. Cherek, Cynthia J Pietras, and Oleg V Tcheremissine. 2004. Alcohol effects on human risk taking. *Psychopharmacology* 172:1, 68–77.

Lane, Scott D., Don R. Cherek, Oleg V. Tcheremissine, Lori M. Lieving, and Cynthia J. Pietras. 2005. Acute marijuana effects on human risk taking. *Neuropsychopharmacology* 30:4, 800–809.

Lane, Scott D., Oleg V. Tscheremissine, Lori M. Lieving, Sylvain Nouvion, and Don R. Cherek. 2005. Acute effects of alprazolam on risky decision making in humans. *Psychopharmacology* 181:2, 364–373.

Lo, Andrew, and Dmitry Repin. 2002. The psychophysiology of real-time financial risk processing. *Journal of Cognitive Neuroscience* 14:3, 323–339.

MacLean, Paul D. 1990. *The triune brain in evolution: Role in paleocerebral functions*. New York: Plenum Press.

Malmendier, Ulrike, and Stefan Nagel. 2009. Depression babies: Do macroeconomic experiences affect risk-taking? NBER Working Paper Series, Volume 14813. Available at SSRN: http://ssrn.com/abstract=1369049.

McClure, Sam M., David I. Laibson, George Loewenstein, and Jonathan D. Cohen. 2004. Separate neural systems value immediate and delayed monetary rewards. *Science* 306: 5695, 503–507.

Mobbs, Dean, Michael D Greicius, Eiman Abdel-Azim, Vinod Menon, and Allan L Reiss. 2003. Humor modulates the mesolimbic reward centers. *Neuron* 40:5, 1041–1048.

Mohr, Peter N. C., Shu-Chen Li, and Hauke R Heekeren. 2009. Neuroeconomics and aging: Neuromodulation of economic decision making in old age. *Neuroscience & Biobehavioral Reviews*, forthcoming.

Morhenn, Vera B., Jang Woo Park, Elisabeth Piper, and Paul J. Zak. 2008. Monetary sacrifice among strangers is mediated by endogenous oxytocin release after physical contact. *Evolution and Human Behavior* 29:6, 375–383.

O'Doherty, John R., Peter Dayan, Karl Friston, Hugo Critchley, and Raymond J. Dolan. 2003. Temporal difference models and reward-related learning in the human brain. *Neuron* 38:2, 329–337.

Paulus, Martin P., Corianne Rogalsky, Alan Simmons, Justin S Feinstein, and Murray B. Stein. 2003. Increased activation in the right insula during risk-taking decision making is related to harm avoidance and neuroticism. *NeuroImage* 19:4, 1439–1448.

Prabhakaran, Vivek, Bart Rypma, and John Gabrieli. 2001. Neural substrates of mathematical reasoning: A functional magnetic resonance imaging study of neocortical activation during performance of the necessary arithmetic operations test. *Neuropsychology* 15:1, 115–127.

Rilling, James K., David A. Gutman, Thorsten R. Zeh, Giuseppe Pagnoni, Gregory S. Berns, and Clinton D. Kilts. 2002. A neural basis for social cooperation. *Neuron* 35:2, 395–405.

Rogers, R. D, M. Lancaster, J. Wakeley, and Z. Bhagwagar. 2004. Effects of beta-adrenoceptor blockade on components of human decision-making. *Psychopharmacology* 172:2, 157–164.

Simmons Alan, Scott C. Matthews, Murray B. Stein, and Martin P. Paulus. 2004. Anticipation of emotionally aversive visual stimuli activates right insula. *Neuroreport* 15:14, 2261–2265.

Soros, George. 1995. *Soros on Soros*. New York: John Wiley & Sons.

Spencer, Herbert. 1880. *Principles of psychology*. New York: Appleton Press.

Vergano, Dan. 2006. Study: Ask with care: Emotion rules the brain's decisions. *USA Today*, August 7, p. D4.

Wright Paul, G. He, Nathan A. Shapira, Wayne K. Goodman, and Yijun Liu. 2004. Disgust and the insula: fMRI responses to pictures of mutilation and contamination. *Neuroreport* 15:15, 2347–2351.

Yang, Yaling, Adrian Raine, Todd Lencz, Susan Bihrle, Lori LaCasse, and Patrick Colletti. 2005. Volume reduction in prefrontal gray matter in unsuccessful criminal psychopaths. *Biological Psychiatry* 57:10, 1103–1108.

Zak, Paul. J., Angela Stanton, and Sheila Ahmadi. 2007. Oxytocin increases generosity in humans. Available at http://thesciencenetwork.org/docs/BB3/Zak_Oxytocin.pdf.

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CHAPTER 6

Emotional Finance: The Role of the Unconscious in Financial Decisions

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INTRODUCTION

Traditional finance, derived from neo-classical economic theory, assumes a world dominated by *homo economicus*—people are "rational" utility maximizers. In contrast, behavioral finance is based on the insights of the experimental cognitive psychologists. It views people as "normal," and thus imperfect, decision makers prone to biased judgments stemming from their limited information-processing abilities. Although behavioral finance recognizes the important role of affects (feelings) in financial decisions, this tends to be explored in terms of the *affect heuristic*, which is the specific quality of "goodness" or "badness," or positiveness/negativeness, felt rapidly and automatically in decision making (Slovic, Finucane, Peters, and MacGregor, 2002). As with other heuristics, this mental shortcut facilitates fast and frugal decision making (Gigerenzer, 2004) but can also prompt behavior that would not occur with detailed reflection.

Nonetheless, formal study of how financial decisions are driven by people's emotions and associated universal human unconscious needs, fantasies, and fears has been largely ignored by finance researchers to date. This is despite the potential additional insights this perspective can provide and the general recognition of the key role Keynes's "animal spirits" play in explaining entrepreneurial and investor behavior, and thus shaping financial markets (Akerlof and Shiller, 2009).

Emotional finance is a new area in behavioral finance. It draws on the psychoanalytic understanding of the human mind and dynamic mental states explained originally by Sigmund Freud (and developed by later psychoanalytic thinkers such as Melanie Klein and Wilfred Bion) to describe how unconscious processes can drive investment decisions and financial activity. Specifically, emotional finance recognizes how a highly complex, opaque, unpredictable, and competitive

market environment inevitably leads to investors being caught up emotionally in a major way. As a result, investment judgments may be made under the sway of powerful and potentially debilitating unconscious forces with the implications often not recognized. Among other things, emotional finance suggests that a proper understanding of these issues, making the unconscious "conscious," can help to relieve the acute levels of anxiety and stress from which many market participants suffer (Cass, Lewis, and Simco, 2008), whether consciously acknowledged or not, and thus, the quality of investment decisions made.

This chapter outlines some of the underlying theory of emotional finance, and then illustrates its practical investment applications. It next explores the potential contribution emotional finance may provide in helping to explain asset pricing bubbles, such as the dot-com mania, and related market phenomena with which standard economic theory struggles including the recent sub-prime debacle. The chapter ends with a summary and stresses the nascent state of the development of this new branch of behavioral finance.

WHAT IS EMOTIONAL FINANCE?

Modern research in neurobiology has started to confirm Freud's view of the centrality of emotion and unconscious psychic processes in the way people relate to the world and the formative role early infant relationships and experiences play in adult mental states (Kandel, 1999; Sohms, 2004; Bechara and Damasio, 2005; Wolozin and Wolozin, 2007). Emotional finance views financial markets from the perspective of the unconscious. It draws on the rich insights of the psychoanalytic understanding of the human mind to elucidate how people's emotions and feelings help drive all investment activity.

The term "psychoanalysis" usually brings to mind a method of treatment. However, more importantly for the purposes of this chapter, it also provides a coherent set of ideas about the workings of the human psyche. In fact, as Eric Kandel (1999, p. 505), the 2000 Nobel prize-winning psychiatrist and neuroscientist, points out "... psychoanalysis still represents the most coherent and intellectually satisfying view of the mind." It focuses on individual subjective experience and meaning, and accords emotion a central role in human development, thought, and behavior. Psychoanalysis seeks to understand and explain the potential relationships between feeling, perception, thinking, and belief. In particular, it considers how people's feelings and perceptions make them endow what is true with their beliefs about what is happening. In their subjective unconscious, people *feel* what is true, rather than what actually is.

To greatly simplify, Freudian psychoanalysis postulates that the feelings created by thoughts are ultimately of two types: *pleasurable* (exciting) or *unpleasurable* (painful, anxiety generating, or loss provoking) (Freud, 1911). Mental functioning reflects the outcome of a developmental struggle between the *pleasure principle* and the ability to acknowledge reality, the *reality principle*, the capacity to sense reality as it is, however painful, rather than how people might wish it to be. The battle, of course, is never won as Freud (1908, p.144) points out: "But whosoever understands the human mind knows that hardly anything is harder for a man than to give up a pleasure which he has once experienced. Actually we can never give anything up; we only exchange one thing for another."

Moreover, most human life is conflictual, with experiences provoking *ambivalence*, which involves both pleasurable and painful feelings at the same time. Many professional investors, for example, are aware that holding stocks can evoke equivocal feelings; the danger of falling in love with a favored stock and holding it too long must be put beside the potential pain of "letting it go" too soon. Human beings deal with conflicting feelings "easily," by denying or repressing the painful ones and making them unconscious. People behave as though they never thought or felt whatever it is they do not like. Psychoanalysis is a dynamic psychological theory, rather than a static one, because it treats what has been made unconscious as becoming more, not less, influential.

Freud himself was not the first to posit the notion of the unconscious—the ways people are driven by ideas, conflicts, and feelings beyond their immediate awareness. However, he was the first to create a systematic model of how knowledge of the conflicting ideas and feelings that can coexist in an individual's mind is denied and then is triggered by new emotional circumstances. Unrecognized emotions, or *phantasies*, are viewed in psychoanalysis as the principal component of unconscious mental life and thus the deep drivers of human judgment. They are powerful because they remain unknown and so not subject to reflective thought. The *'ph'* is conventionally used to differentiate unconscious phantasies from fantasies in the vernacular sense of consciously constructed daydreams or wishful thinking (Moore and Fine, 1990).

Klein (1935, p. 290) suggests that the whole of an individual's psychic life is dominated by phantasies that originate in the earliest stages of emotional development: "... infantile feelings and phantasies leave, as it were, their imprints on the mind, imprints that do not fade away but get stored up, remain active, and exert a continuous and powerful influence on the emotional and intellectual life of the individual."

A familiar example is how people can both love and hate those close to them, and on whom they depend. They then tend to deal with this unconscious conflict through *splitting* (mentally separating the good and bad feelings with the latter being *repressed* and rendered unconscious) and *idealization* (the unrealistic exaggeration of attributes) (Moore and Fine, 1990). They may split those loved from their faults and idealize them, and see or project their faults onto others. The issue is not just how people experience these feelings about those close to them. There are very direct analogies with how they relate to, for example, the baseball or football teams they support, and crucially for the purposes of this chapter, the assets they actually hold. Once people feel let down and can no longer deny the bad feelings, then this process is reversed, and they start to see only the faults. This dynamic of the mind may provide an important insight into some ways financial actors behave and how financial assets are sometimes priced.

States of Mind

All judgments are made within states of mind. Klein (1935) describes two alternating basic mental states that people experience throughout life. In the *depressive state of mind*, people see themselves and others more or less as they are—complex with attractive and unattractive characteristics, good and bad, ultimately frail, inherently separate and distinct individuals. In the *paranoid-schizoid state of mind*,

they operate in a black-and-white world where good feelings are kept separate from bad ones. *Schizoid* refers to the splitting and projection process where the good or bad experiences are disowned and attributed to others who are then either idealized, or feared and hated. *Paranoid* refers to the outcome of the splitting when one feels persecuted by the now hated other. By developing Klein's descriptions of the paranoid-schizoid and depressive states of mind, which Bion (1970) terms *PS* and *D* respectively, and the oscillating relations between them, he locates this process of dealing with *ambivalence* at the heart of psychic life. Tuckett and Taffler (2008, p. 400) summarize the distinction between D and PS senses of reality: "... a D state involves giving up the feeling that one is all-powerful and all-knowing, ... feeling a certain amount of regret about the consequences of past actions, and a potential anticipatory feeling of depressive anxiety or guilt when contemplating potentially repeating past actions which led to failure or suffering. In a PS state all such feelings are evaded by evacuating them from awareness. ..."

As will be observed there is a constant tension between judgments grounded in reality made in a D state of mind and the phantastical judgments made in a PS state. Tuckett (2009) conveys these concepts more descriptively by the terms *divided* and *integrated* to represent individuals operating in PS and D senses of reality respectively. These terms are used in preference to the more technical language, in the rest of this chapter.

Groupthink

Psychoanalytic theory also provides another important potential contribution to the understanding of financial markets in terms of the relations between the individual investor and the group. Drawing on Freud (1921), Bion (1952) distinguishes between *work groups* and *basic assumption groups*, which function in quite different ways. The work group defines its task, is clear about its purpose, and promotes its members' cooperation. On the other hand, when a basic assumption group is operating, individuals do not think for themselves but engage collectively in *groupthink* (Janis, 1982). Groupthink provides comfort and good feelings to the group members through the unconscious defenses the group as a whole adopts against anxiety, rather than creative group reality-based thinking/functioning.

The two types of groups treat information differently. In a work group, individuals can use information in the service of thought and analysis of both the positive and negative. However, in the basic assumption group, people use the accumulation of information not for thought but to feel good by avoiding what its members would rather not know. A divided (or PS) state of mind takes over from reality-based thinking and information is evaluated to promote good excited feelings with the negative aspects split off from awareness. In a financial markets context, basic assumption group divided behavior, which may be manifest in "herding," can take over at times. This is not only in the case of asset pricing bubbles, but also with new financial innovations and ideas where investors become caught up in the phantasy, or *unconscious wishful thinking*, with the underlying risk *split off* and *denied*. In this context, Shiller (2005, p. 159) describes the paradox of how "completely rational people" become caught up in the basic assumption *zeitgeist*, which "... produces group behavior that is, in a well-defined sense, irrational."

Some Emotional Consequences of Uncertainty

Financial markets are essentially social settings where individuals engage with each other to set asset prices. Asset prices reflect views about the future. The markets themselves that impound these views are inherently unpredictable. Such uncertainty generates emotional responses at both the neurological and psychological levels, and these emotions are predominantly those of anxiety, which leads to stress. In addition, the actual process of asset valuation is often complex and highly problematic. As a result, people are forced back onto their intuition, which again adds to the degree of stress they experience. Investment activity depends on making judgments about available information to resolve two different orders of uncertainty: that caused by unavoidable information asymmetries at the moment of decision making and that determined by the fact the future is inherently unknowable. The anxiety that results is endemic and painful, and has to be managed in some way.

Anxiety can be viewed as the *prototypical emotion* in investor behavior. In a person's unconscious there is no such thing as a little anxiety, anxiety is experienced as *total*. Because making investment decisions creates both excitement and anxiety, it ushers in the opportunity to split off the good "exciting" experience from the bad "painful" thought of loss. From a psychoanalytic viewpoint, individuals experiencing this situation through time are at risk of attaining a divided rather than integrated state of mind. They can suffer the anxiety of uncertainty and wait in a realistic or integrated state of mind, which may become particularly difficult when events move against them, or they can split off the pain and enter into a divided state of mind of simultaneous excitement and paranoia.

Following from these ideas, an important insight of emotional finance is the formal recognition of the relationship:

$$\text{investment} \Rightarrow \text{uncertainty} \Rightarrow \text{anxiety} \Rightarrow \text{stress}$$

The process of investing means that the investor enters into a necessarily ambivalent emotional attachment, whether conscious or not, with something that can very easily let him down. That is, the investor becomes dependent on something inherently uncertain. The state of reality in which an investment decision is made can be dealt with in an integrated (or depressive) way, that is, with awareness of both the upside and downside, and recognition of the high degree of uncertainty. Or, alternatively, in a divided (or paranoid-schizoid) state of mind, splitting off doubt and unconsciously idealizing the investment, which the investor now views as all good. When an investment goes "wrong," it becomes all "bad"; there is an inclination to denigrate and hate it, much like the unconscious feelings of a jilted lover. Emotional finance suggests that if people are more aware of this inherent doubt, and its unconscious ramifications, they may be able to deal far more effectively with the associated anxiety and resulting stress.

The "Phantastic Object"

Investing is inherently exciting as well as uncertain. It may thus be useful to incorporate the role of excitement in the study of financial behavior more formally. In some sense, all such activity includes the unconscious belief that possessing

phantastic objects is possible, with the term emphasizing that any investment can have an exceptionally exciting and transformational meaning in unconscious psychic reality. This unconscious disposition creates the thrill and sometimes euphoria with which market participants are familiar, and which also functions to create a tendency for markets to operate in a divided sense of reality.

The term *phantastic object* is derived from two ideas (Tuckett and Taffler, 2008). The Freudian concept of *object* denotes a mental representation, that is, a symbol of something in our mind but not the actual thing itself. *Phantasy* or *phantastic*, as discussed above, is a technical term that psychoanalysts use to describe an individual's unconscious beliefs and wishes, which, it teaches, are derived from the earliest stages of an infant's mental development. Thus, a *phantastic object* is a mental representation of something (or someone, or an idea) that fulfills the individual's deepest (and earliest infantile) desires to have exactly what they want, and exactly when they want it. Possession of such phantastic objects allows people unconsciously to feel omnipotent like Aladdin, whose lamp could summon a genie, or the fictional bond trader Sherman McCoy, who felt himself a Master of the Universe (Wolfe, 1987). As Taffler and Tuckett (2008, p. 396) point out, phantastic objects are exciting and transformational; ". . .(they) appear to break the usual rules of life and turn aspects of 'normal' reality on its head."

In investors' subjective or psychic reality, all investments have the potential to become phantastic objects provoking extreme emotions with "love" turning to hate and revulsion when they do not perform as expected. This can be observed in how analysts sometimes write about the stocks they follow (Fogarty and Rogers, 2005), and manifested in interviews with fund managers (Smith, 1999; Tuckett, 2009). Asset pricing bubbles, such as the dot-com mania discussed subsequently, provide dramatic examples and are an inevitable consequence of the need for unconscious transformational phantastic objects in an environment where investors have to believe they are exceptional, but know on one level they cannot all be.

The power and seductiveness of the phantastic object is also demonstrated directly by the recent $65 billion Madoff Ponzi fraud. Bernie Madoff successfully exploited both his highly sophisticated and unsophisticated investors' unconscious search for investment phantasy: annual returns of 8 to 12 percent with no risk, seemingly forever. Being viewed as "the miracle worker," investors consistently ignored challenges to the phantasy of the omnipotent fund manager and his nonexistent investment strategy. This was not just in the due diligence processes of Madoff's many feeder funds (Eshraghi and Taffler, 2009), but by the regulators as well (Langevoort, 2009). In a divided state of mind, any doubt or questioning associated with the phantastic object has to be repressed, and rendered unconscious, for the emotionally very satisfying wish fulfillment phantasy to be able to survive. Belief in the phantastic object can result in such basic assumption group pressure that anyone being viewed as wanting the party to end is dismissed and ostracized. When the phantasy is ultimately shown to be only a phantasy, desire is replaced by anger and blame. Even those who benefited most now view themselves equally as victims of the fraud (Eshraghi and Taffler, 2009), rather than acknowledging how they were similarly caught up in the unconscious phantasy.

Ultimately, emotional finance theory suggests that all investments have the potential to become represented in investors' subjective, or psychic, reality as phantastic objects. This occurs not only during asset pricing bubbles and Bernie

Madoff–type fraud, but also in normal market conditions and day-to-day trading activity. Such understanding and associated awareness of the unconscious emotional drivers of investment behavior can be very helpful to investment professionals and other market participants.

EMOTIONAL FINANCE IN PRACTICE

The previous section outlined some of the theory of emotional finance, but how relevant is this to real-world capital markets? This section explores some areas where such ideas may add value: the emotional meaning of risk, some aspects of market anomalies, and the feelings that the need to save for a pension evokes. The following section explores more broadly the potential contribution of emotional finance theory to the understanding of asset pricing bubbles and associated market phenomena.

Emotional Finance and Risk

Traditional or standard finance views risk as objective and seeks to quantify this using such measures as beta, standard deviation of returns, value at risk (VaR), and the capital asset pricing model (CAPM). The underlying idea is that there is a trade-off between risk and return. Ricciardi (2008) provides a good summary of the literature listing no fewer than 63 different risk categories in traditional finance. Such measures are typically derived statistically from a long history of data observations, or using sophisticated risk simulation methods with emphasis on back testing and stress testing of resulting models. The implicit assumption is that the likelihood of future events occurring can be estimated from past events.

However, there is a clear distinction between *risk* and *uncertainty*. Risk is recognizable, measurable, and known; uncertainty is unidentifiable, immeasurable, and unknown (Ricciardi, 2008). And whereas risk expressed in the form of statistically or subjectively estimated probabilities can provide the emotional comfort of rational calculus, uncertainty or unpredictability generates extreme anxiety. In this way, emotional finance can help people understand the real meaning of risk to market participants. Although there are a myriad of conventional measures of, and controls for, risk employed in financial markets, these can also be viewed from an emotional finance perspective as *unconscious pseudo-defenses against uncertainty*, that is, *real* risk. Attempts to measure risk may, on one level, be viewed as a way of seeking to deal with the unconscious panic associated with the fact that the future is ultimately uncontrollable, rather than recognizing its inherent unpredictability. This is a very different perspective to the risk and return paradigm of standard finance.

Emotional Finance and Momentum

Fund managers often claim to be able to identify undervalued stocks based on fundamental analysis of value. However, there is much evidence consistent with the need for the market prices of these stocks to have already moved up for actual commitment to the risky investment to take place. There is the need for confirmation that the stock is already a "good" stock, and an ongoing "justifying" story.

This serves to alleviate the anxiety associated with an emotional involvement with an asset that can let an investor down. Interestingly, emotional excitement in the unconscious itself has momentum. The experience of emotion tends toward infinity exponentially (Rayner and Tuckett, 1988). People want more and more, colloquially expressed by the word *greed*, which is sometimes also used more generally to explain investor behavior (Shefrin, 2002). Emotional finance also views momentum as potentially related to the need to idealize those stocks that are doing well (those that have gone up previously), and demonize those stocks that are doing badly (those that have fallen in value).

There may also be parallel processes at work with the preference of investment analysts and many fund managers for growth stocks, which are exciting, glamorous, and fulfilling compared with value stocks, which are boring and unexciting (Jegadeesh, Kim, Krische, and Lee, 2004). The only problem is that the "book/market" anomaly suggests value stocks tend to outperform growth stocks, at least in the medium to long term (Lakonishok, Shleifer, and Vishny, 1994; Chan and Lakonishok, 2004).

Emotional Finance and the Bad News Anomaly

Although violating market efficiency, market underreaction to bad news is one of the best established and seemingly most robust of all stock market anomalies and takes many forms. For example, in their studies of market reaction to investment analyst stock recommendation changes, Womack (1996) and Mokoaleli-Mokoteli, Taffler, and Agarwal (2009) report that there is only weak and very short-term evidence of any post-recommendation drift in the case of new buys, whereas new sells continue to fall in value for up to a year. In a parallel vein, Dichev and Piotroski (2001) find large negative abnormal returns for more than a year following Moody's bond rating downgrades, but no reaction to upgrades. Kausar, Taffler, and Tan (2009), and Taffler, Lu, and Kausar (2004) in the United Kingdom, provide related results for firms reporting going-concern modified audit reports. Similarly, Dichev (1998) shows that stocks with the greatest bankruptcy risk underperform those with low bankruptcy risk over several subsequent years.

Although in many cases limits to arbitrage factors can help explain the time needed for the market fully to react to bad news events (Lesmond, Schill, and Zhou, 2004), emotional finance provides another perspective on this market anomaly. This is by recognizing that the delay in adverse information being fully incorporated in asset prices in a timely manner may well be inevitable in an emotional environment where there is a tendency to split good and bad. In a divided state of mind, people employ a range of unconscious defenses against the hurt of having to acknowledge that their previously idealized investments are now "faulty" with the consequent pain of loss, both financial and emotional. These mental defenses can be very powerful and entrenched. It can take some time for what is known ultimately to overwhelm them, leading to delay in the market fully responding to the pricing implications of the bad news.

Bad news is also associated with anxiety and stress, which people seek to avoid. Good news provokes the opposite emotions of excitement or pleasure, which people constantly seek. This can possibly explain why markets tend to respond immediately and appropriately to good news. Emotional finance additionally suggests

that such unconscious processes are deeply ingrained in people's psyches. Thus, bad news anomalies may well continue to exist even when investors know intellectually, as prospect theory in cognitive behavioral finance teaches, that "losses loom larger than gains" (Kahneman and Tversky, 1979).

Emotional Finance and Pension Provision

Emotional finance may also aid in the understanding of why individuals often fail to save adequately for retirement. Standard economic theories of saving (such as the life-cycle or permanent income models) assume savers accumulate and decumulate assets to maximize some explicit lifetime utility function rationally. In practice, however, they demonstrably do not (Benartzi and Thaler, 2007). Cognitive behavioral finance makes an important contribution to explaining such "irrational" behavior by describing a range of heuristics and biases that may be operating in retirement saving decisions. Practical solutions then follow (Thaler and Benartzi, 2004).

Emotional finance can complement this understanding of savers' cognitive limitations by explicitly recognizing the underlying, usually unconscious, threatening and fearful emotions and phantasies associated with retirement, such as ill health, infirmity, and ultimately death. This unconscious "meaning" of pensions may thus lead to the repressing or splitting off of the implications of inevitable old age and death from perhaps a currently healthy and fulfilled active middle age. This has serious consequences in terms of inadequate savings levels. Interestingly, mutual funds seem to recognize these factors implicitly by marketing their pension products with pictures of an idealized old age. From an emotional finance vantage point, there is risk to this as it can feed into a divided state of mind further encouraging denial of the associated underlying fears and panic, and thus inaction, so people can "avoid" unwanted reality. Savings decisions made in an integrated sense of reality need to be encouraged where the implications of old age and death can be properly acknowledged. An implication is that as such unconscious dynamic processes are deeply rooted, a realistic solution to inadequate pension provision may be to make an appropriate level of pension saving compulsory, and were it feasible, a return to defined benefit plans.

ASSET PRICING BUBBLES AND RELATED MARKET PHENOMENA

A cursory reading of such classic texts as Mackay (1995) or Kindleberger and Aliber (2005) shows common patterns in the frequent speculative manias that appear to grip financial markets. Triggered by a "displacement" or outside event that changes investment horizons, expectations, profit opportunities, or behavior, an emotionally driven process takes over from normal market processes, evolving into a state of *euphoria*. Even the most skeptical market participants are ultimately drawn in (Tuckett and Taffler, 2008). Kindleberger and Aliber (p. 24) note that, although mindful of earlier manias, the authorities usually have extensive explanations for why "this time it's different." However, reality cannot be denied indefinitely. The bubble collapses, and euphoria turns to panic and the blaming of others for the

resulting embarrassment and losses. Typically, lessons are not learned, leading to the danger of repetition.

Drawing on a psychoanalytic understanding of unconscious phantasy relationships, states of mind, and unconscious group functioning, emotional finance may be helpful in answering some outstanding questions about asset pricing bubbles and related market behaviors seemingly not fully explained by mainstream financial theories. The following discussion focuses on the case study of dot-com mania. Related concepts, including the key role of the phantastic object, are also shown to be helpful in understanding aspects of the hedge fund industry and the origins of the current financial crisis.

Dot-com Mania: An Emotional Finance Interpretation

The Dow Jones Internet Index rose by 500 percent in 18 months to its peak in March 2000, with total market capitalization of the sector of $1,000 billion. This occurred despite most firms losing large amounts of money and likely to continue making losses for many years even if they managed to survive. Six weeks later the index had halved in value, and by the end of 2002 it stood at 8 percent of its high. Emotional finance views investors as being caught up *emotionally* in the excitement of the drama with unconscious wishful phantasies at its core (Tuckett and Taffler, 2008), as with other speculative bubbles.

As Cassidy's (2002) seminal history of the period *Dot.con* eloquently shows, as Internet stocks began to be reported in the financial press, on television, and by the general media, they became an exciting spectacle with their young entrepreneurs presented as charismatic figures and superstars with amazing new powers. Such stocks possessed all the characteristics required of phantastic objects: exciting, new, exhibitable, and enriching. The possession of dot-com stocks seemed to have conveyed implicitly in the minds of investors that their deepest unconscious wishes could be fulfilled. Such assets became represented in psychic reality as infantile, phantastic objects.Owning dot-com stocks became endowed with magical expectations, expectations that transported their owners, *in unconscious phantasy*, from normal existence into an omniscient and omnipotent one. Not surprisingly, on this basis, normal valuation fundamentals would not feel relevant but instead boring and pedestrian. As Mary Meeker, Morgan Stanley's star analyst dubbed "Queen of the Net" by *Barron's*, stated in a research note on Amazon in September 1997: ". . .we believe that we have entered a new valuation zone. . .(the Internet) has introduced a brave new world for valuation methodologies" (Cassidy, 2002, p. 164). In such circumstances, the market's sense of subjective reality would become captivated by a magnetic new set of principles and by the phantastic object becoming "real" (a split-off idealization in the divided state of psychic reality).

Needless to say, there was the need for a new ideology capable of providing a superficially plausible popular theory or *manifest cover story* to rationalize the departure from reality into phantasy, from the "old economy" adult world of "bricks and mortar" into the "New Economy." In short, the old economy was dead (Tuckett and Taffler, 2008). The hubristic claims made about how the Internet would drive out traditional ways of doing business and the associated level of emotional excitement also signaled inter-generational rivalry and state of Oedipal triumph (Moore and Fine, 1990). The young seemed to be seeking to overthrow the

old with associated unconscious guilt and fear denied. As Josh Harris, the founder of Pseudo.com, a fledgling online television network reported when interviewed by CBS, his aim was "to take you guys out of business. I'm in a race to take CBS out of business" (Cassidy, 2002, p. 276).

Normal reality-orientated thought in an integrated state of mind, including the capacity to be anxious about potential risk and loss, was overridden. Via groupthink the reality principle became dominated by judgments based on the pleasure principle, from work group mentality to basic assumption group modality, through investors' imaginative identification with each other in the pursuit of the common phantasy. A divided state of mind dominated with contempt or dismissal of skeptical commentators felt to be denying the value of the phantastic object, and spoiling the party (Cassidy, 2002), and with any undesirable thoughts and fears repressed or split off.

Emotional finance also points out the mental pain involved in giving up a belief in the transformational power of a magical phantastic object. Anxiety will change into even more painful feelings of loss, humiliation, and guilt when unconscious defenses against the experience of unpleasant reality, denial, projection, and splitting no longer work. Ultimately, only when the split-off anxieties produced by available information could no longer be rendered unconscious in March 2000 did the market collapse (Tuckett and Taffler, 2008). The bubble then burst almost overnight. Panic set in, and the nature of the ambivalent relationship of investors with the phantastic object reversed direction dramatically.

Dot-com stocks were now hated. There was enormous anger associated with the feelings of being let down, embarrassment, fear, helplessness, and shame, which coexisted with the heavy financial losses dot-com investors had to endure. Similarly, those involved felt persecuted and, as a result, had to project the blame for being caught up in their phantasy onto others. For example, in a long series of articles, the *New York Times* blamed Wall Street research analysts (Morgenson, 2000), corporate and analyst valuation metrics (Morgenson, 2001a), investment banks (Sorkin, 2001), and IPO conflicts of interest (Morgenson, 2001b), while many similar articles appeared in other financial publications. High profile Internet investment analysts were prosecuted after the event and the $1.4 billion Global Settlement against 10 Wall Street banks was extracted for excesses during the dot-com bubble in 2003. Interestingly, general equity markets suffered contagion, with the S&P 500 falling by more than 40 percent over the three years following the bursting of the dot-com bubble. All stocks were seemingly tainted, even those that had nothing to do with the Internet!

Emotional finance shows the difficulties market participants have in recognizing when they are caught up in such a divided state of mind. Thus, they continue to split off the painful feelings of responsibility for their actions and blame others for their being let down. The investment process needs to be able to acknowledge individual responsibility for such a loss experience and distinguish wishful phantasies from reality. Only by relinquishing such lost objects through the mourning process can investors move from a divided state of mind to what is the "ordinary" nature of the financial markets and an integrated sense of reality.

Repeated asset pricing bubbles can be viewed on one level as an inevitable consequence of investors' unconscious search for transformational phantastic objects. Such bubbles will perpetuate unless recognized and managed by governments and

market regulators for what they really represent. For example, the recent Chinese speculative stock market bubble (Yao and Luo, 2009), which almost exactly mirrors the trajectory of dot-com mania just a few years earlier, suggests investors find learning from experience difficult when such powerful unconscious drives hold sway.

Emotional Finance and Hedge Funds

Hedge funds provoke extreme emotions. Total funds under management grew on a compound basis by more than 25 percent each year between 1998 and their peak in June 2008, with almost $2 trillion then managed by no fewer than 10,000 hedge funds and funds of hedge funds. In the following six months, however, total assets under management fell by around 30 percent as a result of heavy losses, major withdrawals by investors, and fund closures. To what extent can the attractions of hedge funds be viewed as reflecting the way in which their unconscious representation in the minds of investors has come to dominate their original investment purpose as providers of absolute returns less correlated with other asset classes?

There would appear to be close parallels with some aspects of dot-com stocks and dot-com entrepreneurs in the way high profile hedge funds and their enormously wealthy managers were reported on and treated as celebrities in the media (Eshraghi and Taffler, 2009). Because of the financial innovations that many of them claimed to represent, their limited regulation, their often complex and opaque trading strategies, and their frequently exclusive nature, it is easy to see how hedge funds could become represented as exciting phantastic objects in the minds of investors. Implicitly, exceptional returns were perceived as being promised with the underlying risks denied or split off. Other parallels with the dot-com mania suggest hedge funds were also being viewed in unconscious psychic reality through the cover story of a "new investment paradigm" as promoted by the media. Such coverage helped to legitimize the departure from reality into unconscious phantasy in a divided state of mind and basic assumption group thinking.

Similarly, as returns collapsed and hedge fund lock-ups, closures, and implosions increased, euphoria turned to collective anger, embarrassment, and shame for being caught up in the unconscious phantasy. Blame-driven accusations against all parties involved were prominent, accompanied by equally angry denials (Eshraghi and Taffler, 2009). This recent hedge fund experience again demonstrates how there is a tendency in financial markets for excitement, wishful thinking, and idealization to dominate at times, leading to the potential transformation of investment vehicles into phantastic objects and ending with the inevitable undesirable consequences.

The Current Financial Crisis

Although the underlying reasons for the current financial crisis are highly complex, formal analysis of the contributory role unconscious phantasies play in all market behavior and financial activities can be helpful in understanding what went wrong. The degree of the contagious excitement seemingly dominating financial markets until recently, which encouraged investors to expect exceptional returns in an environment of low yields—return without risk, may be inadequately

recognized. Governments, central bankers, and regulators became caught up with investment banks and other market participants in a basic assumption group euphoria that implicitly suggested there was no downside to speculation. All seemed to deny and repress the associated uncertainty and anxiety. The divided state of mind then dominating mortgage-backed securities (MBSs) and related financial products became represented in investor psychic reality as unconscious phantastic objects with the speculative loans "safely" split off and securitized into complex investment vehicles such as collateralized debt obligations (CDOs). The fear that property prices might ever fall was "denied" and the risk of lending to subprime borrowers rendered invisible through the "spreading" or avoidance of ownership of risk.

The comforting cover story of "new millennium finance" was rationalized around the idea of a further phantasy. This was that through an apparent magical sleight-of-hand the new masters of the universe, "rocket scientists" with PhDs in mathematics and nuclear physics, had managed to vanquish risk and unpredictability forever with their complex and opaque derivatives products. What was good (the excitement) was kept conscious and what was bad (the potential loss) was repressed and split off, even though on one level market participants clearly knew what they were doing. Consider former chief executive of CitiGroup Chuck Prince's now infamous words "...when the music stops, in terms of liquidity, things will be complicated. But as long as the music is playing, you've got to get up and dance. We're still dancing" (Nakamoto and Wighton, 2007).

Inevitably, the euphoric bubble had to burst. What people had always known could no longer be defended against and ignored (Tuckett, 2009). Bankruptcies of major financial institutions, government bailouts, and the inevitable panic and contagion to other markets with investors now unable to distinguish between "good" and "bad" followed. Collapse of trust in the debt markets leading to paranoia meant that banks refused to lend to each other. Clearly, the time needed for economic activity to recover is likely to be many years. Not surprisingly, those arraigned take no responsibility with blame and shifting of responsibility onto others to avoid personal "guilt." Lehman Brothers' former CEO, Dick Fuld's, performance in front of a Congressional Oversight committee on October 6, 2008 (Kirchgaessner and Farrell, 2008) is illustrative. Specifically, he blamed Lehman's collapse on a plague of short selling and U.S. regulators for not arranging a federal bailout as with AIG. Fuld even saw himself as the victim, not playing a major role in Lehman being the largest bankruptcy in recent history!

Such unwinding of the euphoric wish fulfillment associated with markets being taken over by the idea of a phantastic object, led to panic, turning very rapidly to blame. Those in the firing line included the previously venerated Alan Greenspan (who, himself, variously blamed people for getting greedy, the "will of Congress," and flawed bank processes for a two-decade-long "period of euphoria" (Beattie and Politi, 2008)). Others included the government, the Federal Reserve System, the Securities and Exchange Commission and other regulators, credit rating agencies, hedge funds and short sellers, bankers and investment bankers, accountants, and the financial media. This list notably does not include those market participants doing the blaming who had equally been just as caught up in the divided market state of mind themselves.

The insights of emotional finance suggest that to prevent future such financial crises, governments, financial regulators, and investors need to understand the inherent instability of a market where a paranoid-schizoid state of mind is allowed to dominate. Markets need an integrated (depressive) sense of reality to function appropriately, one in which their inherent uncertainties can be properly acknowledged and inform the decision making of market participants.

SUMMARY AND CONCLUSIONS

This chapter suggests that despite the major contribution to our understanding of financial markets and investor behavior provided by traditional finance and cognitive psychology-driven behavioral finance, a complementary perspective may be helpful. This is one based on an understanding of the role unconscious phantasies, fears, and drives play in all investment activity.

Drawing on psychoanalytic theory, the chapter describes the role of emotional attachment in investment, and the consequences of engaging in a necessarily ambivalent relationship with something that can let an investor down. It describes how investment decisions can be made in two oscillating basic states of mind termed *integrated* and *divided*, and suggests that all financial assets can potentially play the role of exciting and transformational *phantastic objects* in investors' psychic reality. The chapter further shows how the psychoanalytic theory of groups can help people understand how markets can be caught up in a mode of excited thinking, *groupthink*, that may have little to do with underlying reality, but makes their participants feel good.

The chapter applies these ideas in an attempt to help explain specific investor behaviors and, more generally, market-wide asset pricing bubbles and related phenomena. In particular, the chapter shows how conventional measures of risk used in capital markets may also have a different purpose, that of providing comfort against the fact that the future is inherently unpredictable, that is, *real* risk. The chapter further explores potential complementary emotional finance explanations for the well-known stock momentum and underreaction to bad news market anomalies. The chapter also illustrates how an understanding of the unconscious meaning of saving for retirement can help explain people's reluctance to invest adequately for a pension.

The chapter next provides an emotional finance interpretation of the dot-com mania. Related ideas are also shown to be helpful in understanding the emotional dynamic of investors in hedge funds and the origins of the current financial crisis. In particular, the chapter suggests how dot-com stocks appeared to possess all the desirable attributes of phantastic objects, with associated market consequences. Similarly, in seeking to understand the rapid growth of hedge funds' assets under management until their collapse very recently and their associated unconscious representation in the minds of investors, the chapter again identifies clear phantastic object-like characteristics.

Finally, the chapter considers how the acting out of enormously exciting unconscious phantasies may have played a role in the genesis of the current financial crisis. In particular, governments, central banks, and regulators seemed to have been caught up *willingly* with investment banks and other market participants in the same *groupthink* belief that there was no downside to speculation as anxiety and

risk had been vanquished by the phantastic object represented by "new millennium finance." Emotional finance theory predicts that a market in which a divided state of mind is allowed to dominate, and may even be indirectly encouraged, is inherently unstable.

The underlying premise in emotional finance is that knowledge of the subtle and complex way our feelings determine psychic reality may help people understand better how asset valuations and investment judgments are made, and how markets may occasionally break down. As asset valuations are driven jointly by cognition and emotion, these need to be studied together.

Nonetheless, this new branch of behavioral finance is only at a very early stage of its development as a coherent intellectual paradigm. What is known so far can only represent the first step in a long journey toward formally integrating an understanding of emotions with the workings of financial markets and investor behavior as a whole.

DISCUSSION QUESTIONS

1. How does emotional finance differ from behavioral finance?
2. What are some of the main theoretical contributions of the new area of emotional finance to our understanding of investment behavior?
3. What relevance might emotional finance have in practice?
4. How does emotional finance shed light on the appeal of hedge funds to investors, and explain Bernie Madoff in particular?
5. How can emotional finance help in understanding the dot-com mania?

REFERENCES

Akerlof, George E., and Robert J. Shiller. 2009. *Animal spirits: How human psychology drives the economy, and why it matters for global capitalism*. Princeton, NJ: Princeton University Press.

Beattie, Alan, and James Politi. 2008. "I made a mistake" admits Greenspan. *Financial Times*, October 24.

Bechara, Antoine A., and Antonio R. Damasio. 2005. The somatic marker hypothesis: A neural theory of economic decision. *Games and Economic Behavior* 52:2, 336–72.

Benartzi, Shlomo, and Richard H. Thaler. 2007. Heuristics and biases in retirement savings behavior. *Journal of Economic Perspectives* 21:3, 81–108.

Bion, Wilfred R. 1952. Group dynamics: A re-review. *International Journal of Psychoanalysis* 33:235–47.

Bion, Wilfred R. 1970. *Attention and interpretation: A scientific approach to insight in psychoanalysis in groups*. London: Tavistock.

Cass, Alden, John Lewis, and Ed Simco. 2008. Casualties on Wall Street: An assessment of the walking wounded. In *Bullish Thinking*, ed. Alden Cass, Brian F. Shaw, and Sydney LeBlank, Appendix A, 151–165. Hoboken, NJ: John Wiley & Sons.

Cassidy, John. 2002. *Dot.con: The greatest story ever sold*. New York: HarperCollins.

Chan, Louis K. C., and Josef Lakonishok. 2004. Value and growth investing: Review and update. *Financial Analysts Journal* 60:2, 71–86.

Dichev, Ilia D. 1998. Is the risk of bankruptcy a systematic risk? *Journal of Finance* 53:3, 1131–47.

Dichev, Ilia D., and Joseph D. Piotroski. 2001. The long-run returns following bond rating changes. *Journal of Finance* 56:1, 173–203.

Eshraghi, Arman, and Richard J. Taffler. 2009. Hedge funds and unconscious fantasy. Working Paper, University of Edinburgh Business School. Available at: http://ssrn.com/abstract=1522486.

Fogarty, Timothy J., and Rodney K. Rogers. 2005. Financial analysts' reports: An extended institutional theory evaluation. *Accounting, Organizations, and Society* 30:4, 331–56.

Freud, Sigmund. 1908. *Creative writers and day dreaming*. Standard Edition 9, 141–153. London: Hogarth Press.

Freud, Sigmund. 1911. *Formulations regarding the principles of mental functioning.* Standard Edition 12, 212–226. London: Hogarth Press.

Freud, Sigmund. 1921. *Group psychology and the analysis of the ego.* Standard Edition 18, 65–144. London: Hogarth Press.

Gigerenzer, Gerd. 2004. Fast and frugal heuristics: The tools of bounded rationality. In *Blackwell handbook of judgment and decision making*, ed. Derek J. Koehler and Nigel Harvey, 62–88. Malden, MA: Blackwell.

Janis, Irving L. 1982. *Groupthink,* 2d ed. Boston, MA: Houghton Mifflin.

Jegadeesh, Narasimhan, Joonghyuk Kim, Susan D. Krische, and Charles M. C. Lee. 2004. Analyzing the analysts: When do recommendations add value? *Journal of Finance* 59:3, 1083–124.

Kahneman, Daniel, and Amos Tversky. 1979. Prospect theory: An analysis of decision making under risk. *Econometrica* 47: 2, 263–91.

Kandel, Eric R. 1999. Biology and the future of psychoanalysis: A new intellectual framework for psychiatry revisited. *American Journal of Psychiatry* 156: 4, 505–24.

Kausar, Asad, Richard J. Taffler, and Christine Tan. 2009. The going-concern market anomaly. *Journal of Accounting Research* 47: 1, 213–39.

Kindleberger, Charles P., and Robert Z. Aliber. 2005. *Manias, panics and crashes*, 5th ed. New York: Palgrave Macmillan.

Kirchgaessner, Stephanie, and Greg Farrell. 2008. Fuld breaks silence on Lehman collapse. *Financial Times*, October 7.

Klein, Melanie. 1935. A contribution to the psychogenesis of manic-depressive states. *International Journal of Psychoanalysis* 16, 145–74.

Klein, Melanie. 1998. *Weaning*. Reprinted in *Love, guilt and reparation and other works*, 290–305. London: Vintage. Originally published in John Rickman, ed., *On the bringing up of children* (London: Kegan Paul, 1936).

Lakonishok, Josef, Andrei Shleifer, and Robert W. Vishny. 1994. Contrarian investment, extrapolation, and risk. *Journal of Finance* 49:5, 1541–78.

Langevoort, Donald C. 2009. The SEC and Madoff scandal: Three narratives in search of a story. Working Paper, Georgetown University Law Faculty. Available at http://ssrn.com/abstract=1475433.

Lesmond, David A., Michael J. Schill, and Chunsheng Zhou. 2004. The illusory nature of momentum profits. *Journal of Financial Economics* 74:2, 349–80.

Mackay, Charles. 1852. *Extraordinary popular delusions and the madness of crowds*, 2d ed. London: Office of the National Illustrated Library. Reprinted 1995. Ware, Herts: Wordsworth Editions.

Mokoaleli-Mokoteli, Thabang, Richard J. Taffler, and Vineet Agarwal. 2009. Behavioural bias and conflicts of interest in analyst stock recommendations. *Journal of Business Finance and Accounting* 36: 3–4, 384–418.

Moore, Burness E., and Bernard D. Fine. 1990. *Psychoanalytic terms and concepts.* New Haven, CT: Yale University Press.

Morgenson, Gretchen. 2000. How did so many get it wrong? *New York Times*, December 31.

Morgenson, Gretchen. 2001a. Those lofty "New Economy" Measures Fizzle. *New York Times*, March 18.
Morgenson, Gretchen. 2001b. I.P.O. conflicts bedevil analysts. *New York Times*, May 27.
Nakamoto, Michiyo, and David Wighton. 2007. Bullish Citigroup is "still dancing" to the beat of the buy-out drum. *Financial Times*, July 10.
Rayner, Eric, and David A. Tuckett. 1988. An introduction to Matte-Blanco's reformulation of the Freudian unconscious and his conceptualization of the internal world. In *Thinking, feeling, and being*, ed. Ignacio Matte-Blanco, Chapters 1, 3–42. London: Routledge.
Ricciardi, Victor. 2008. Risk: Traditional finance versus behavioral finance. In *Handbook of finance, 3: Valuation, financial modeling and quantitative tools*, ed. Frank J. Fabozzi, 11–38. Hoboken, NJ: John Wiley & Sons.
Shefrin, Hersh. 2002. *Beyond greed and fear: Understanding behavioral finance and the psychology of investing.* New York: Oxford University Press.
Shiller, Robert J. 2005. *Irrational exuberance*, 2d ed. Princeton, NJ: Princeton University Press.
Slovic, Paul, Melissa Finucane, Ellen Peters, and Donald G. McGregor. 2002. The affect heuristic. In *Heuristics and biases: The psychology of intuitive judgment*, ed. Thomas Gilovich, Dale Griffin, and Daniel Kahneman, 397–420. New York: Cambridge University Press.
Smith, Charles W. 1999. *Success and survival on Wall Street: Understanding the mind of the market*, 2d ed. Lanham, MD: Rowman and Littlechild.
Sohms, Mark. 2004. Freud returns. *Scientific American* 290:5, 82–8.
Sorkin, Andrew R. 2001. Just who brought those duds to market? *New York Times*, April 15.
Taffler, Richard J., Jeffrey Lu, and Asad Kausar. 2004. In denial? Market underreaction to going-concern audit report disclosures. *Journal of Accounting and Economics* 38, 260–96.
Thaler, Richard H., and Shlomo Benartzi. 2004. Save more tomorrow: Using behavioral economics to increase employee savings. *Journal of Political Economy* 112:1 pt.2, S164–S181.
Tuckett, David A. 2009. Addressing the psychology of financial markets. Economics Discussion Papers 2009-37. Available at http://www.economics-ejournal.org/economics/discussionpapers/2009-37.
Tuckett, David A., and Richard J. Taffler. 2008. Phantastic objects and the financial market's sense of reality: A psychoanalytic contribution to the understanding of stock market instability. *International Journal of Psychoanalysis* 89:2, 389–412.
Wolfe, Tom. 1987. *The bonfire of the vanities*. London: Picador.
Wolozin, Harold, and Benjamin Wolozin. 2007. The unconscious in economic decision-making: Convergent voices. *Journal of Socio-Economics* 36:6, 856–64.
Womack, Kent L. 1996. Do brokerage analysts' recommendations have investment value? *Journal of Finance* 51:1, 137–67.
Yao, Shujie, and Dan Luo. 2009. The economic psychology of stock market bubbles in China. *The World Economy* 32:5, 667–91.

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CHAPTER 7

Experimental Finance

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INTRODUCTION

Experiments are useful in finance because they allow researchers to isolate and manipulate one variable at a time, thereby illustrating its causal effects without resorting to complex and imperfect econometric techniques to filter out effects of other variables. Experiments also allow researchers to observe independent and dependent variables that might be unobservable outside the laboratory setting, and to avoid the complications of self-selection by assigning subjects randomly to different treatments.

A key challenge in experimental finance is to construct experiments that can test economic models in settings that are true to the models' assumptions, but in which alternative hypotheses are sufficiently plausible such that the experimental results are not foregone conclusions. One way to do so is to relax the structural, behavioral, or equilibrium assumptions underlying the model being tested; another is to examine settings that are too complex to be definitively modeled.

Experimentalists in finance and economics must distinguish more carefully between experiments and demonstrations. A true experiment entails the controlled manipulation of a specific variable, while holding all other variables constant. A demonstration simply examines behavior within a single setting. The lack of controlled manipulation leaves a demonstration susceptible to criticisms that any feature of the setting (such as the wording of instructions, labeling of strategies, or even the color of the laboratory) is driving observed behavior. Experiments are more robust to such criticisms because the feature in question does not vary across treatments, and thus is unlikely to drive the *difference* in behavior across settings. Researchers should conduct demonstrations only when experiments are impractical, which happens rarely.

The chapter proceeds as follows. The next section provides a discussion of how experiments complement theoretical and archival (econometric) research in finance. The following section describes the basic methods of experimental economics and discusses ways in which experiments can provide contributions above

and beyond the models they are testing. One section focuses on one of the most important streams in experimental finance that relates directly to behavioral finance: the ability of markets to aggregate information and eliminate individual biases. Next, a section compares methods of experimental economics and experimental psychology. A final section provides a summary and conclusions.

THEORY, ECONOMETRICS, AND EXPERIMENTS

Financial economics is grounded in analytical modeling, which uses mathematical methods to derive the implications of some fundamental assumptions about individual or aggregate behavior. Many of these models provide testable predictions about the behavior of markets, firms, and investors.

Archival data analysis tests financial theories using data that are generated and archived for another purpose. For example, asset pricing tests typically use Center for Research in Security Prices (CRSP) data that are generated as a natural outcome of trade in large stock exchanges, perhaps combined with accounting data from Compustat that are generated from the Securities and Exchange Commission (SEC) filings. A key challenge in archival data analysis is that the data are drawn from settings created for a purpose other than answering the research question at hand. As a result, almost any interpretation of the results can be challenged as ignoring other features that have changed. Key problems include omitted variables biases, self-selection biases, unobservable independent variables, and unobservable dependent variables.

Some examples will clarify how well-designed experiments can avoid these problems:

- ***Experimentalists avoid omitted-variables biases*** by creating settings that differ from one another in exactly one independent variable, controlling all other variables of the setting to eliminate alternative explanations for observed differences in the dependent variable. For example, Bloomfield and O'Hara (1999) address the role of transparency regulations in an experimental setting by having traders trade with market makers in three different market settings. In the "transparent" setting, all quotes and trades are publicly disclosed. In the "semi-opaque" setting, quotes are publicly disclosed but individual trades are not disclosed to any participants. In the "opaque" setting, quotes are disclosed only to traders while trades are again not disclosed. Cohorts of traders are assigned to trade in each of the different market settings in a random order. These market settings are identical in all aspects except the degree of market transparency. Therefore, any differences across settings will be due strictly to transparency differences. Bloomfield and O'Hara (2000) and Flood, Huisman, Koedijk, and Mahieu (1999) use similar techniques.
- ***Experimentalists avoid self-selection problems*** by randomly assigning subjects to treatments. For example Tosi, Katz, and Gomez-Mejia (1997) perform an experiment on the effects of monitoring and incentive alignment on corporate decision making. Subjects are randomly assigned to one of six treatments: high-incentive alignment (CEO pay was linked to a profit-maximizing strategy), low-incentive alignment (CEO pay was linked to a

sales-growth strategy), high-monitoring, low-monitoring, long-term CEO (the subject had been the CEO, and therefore was responsible, for previous investment decisions) and short-term CEO (the subject was recently appointed CEO and therefore was not responsible for previous investment decisions). The subjects then acted as the CEO of a firm and had to make an investment allocation decision, given information about the firm's prior poor investment decision. The authors find that incentive alignment is more effective than monitoring in making sure management acts in the interests of the shareholders. By randomly assigning subjects to these different treatment groups, the authors avoid the issues caused by self-selection and are able to directly observe the role of different governance practices on earnings.

- ***Experimentalists avoid problems of unobservable independent variables*** by creating settings themselves, so that they can observe all variables. For instance, the degree of risk aversion that investors have is unobservable in archival data sets. It is also unobservable in an experimental setting because experimenters cannot directly elicit this information from their subjects. However, Bossaerts and Plott (2004) demonstrate how good experimental design can help avoid this issue in their study addressing the equilibration of large-scale financial markets. By using the Capital Asset Pricing Model (CAPM) framework, Bossaerts and Plott can measure how far the market is from equilibrium at any point without directly knowing the level of risk aversion among the participants. They simply need to know the true expected return, which the experimental setting makes observable. They predict that risk premia will be proportional to the covariances between the risky assets and the market portfolio, as predicted by CAPM, and test this prediction using Sharpe ratios. Because expected returns and variances are directly measurable in the experimental setting, Sharpe ratios can be calculated, and the problem of unobservable independent variables is avoided.
- ***Experimentalists avoid problems of unobservable dependent variables*** by creating tasks that elicit them. For instance, Bloomfield and Hales (2006) conduct an experiment to study the role of mutual observation in analysts' forecasts. They find that, when analysts are able to see each other's forecasts, the consensus forecast is more extreme but more accurate. By conducting this study experimentally, Bloomfield and Hales are able to observe the analysts' prior beliefs. Additionally, they impose a structure that eliminates performance-based incentives and provides analysts with flexibility in adjusting their estimates. Therefore, their study can draw more precise results about the specific question at hand—whether mutual observation leads analysts to engage in free-riding or excessive extremity. In traditional archival data studies, extracting that role of mutual observation and differentiating between potential reasons that analysts may change their forecasts is difficult.

The most common form of experimentation is to construct a highly controlled setting in the laboratory. Laboratory experiments allow for extremely simple settings that facilitate clear inferences. For example, securities can have easily-known values with simple distributions. The ability to control the variables in the experiment provides for a greater degree of assessing causality. Laboratory settings allow

very clear inferences about causal relationships within the experiment (internal validity), but allow doubts about how well behavior in the laboratory will generalize to the outside world (external validity).

Field experiments have recently become popular in economics. In the field experiment, the researcher goes into a natural setting, with all of its messiness, but will manipulate variables one at a time (usually with the cooperation of someone with appropriate authority). As one example, Thaler and Benartzi (2004) conducted a field experiment on their Save More Tomorrow plan, which offered workers at actual firms the chance to commit to devoting more of their future income increases to their retirement savings. The goal was to avoid loss aversion by increasing savings only when the employee gets a raise, and then to take advantage of inertia and the status quo bias to keep people in the program and at the progressively high savings rates. Thaler and Benartzi implemented this program at several different firms and, despite some uncontrollable differences across implementations, obtained similar, positive results in all cases. While field experiments are a promising direction, they are rare enough in finance that the remainder of the chapter focuses exclusively on laboratory experiments.

THE FUNDAMENTAL METHOD AND CHALLENGE IN EXPERIMENTAL FINANCE

The fundamental method of experimental economics is to create a setting that implements some institutional features of interest and then provide participants with incentives to maximize utility within that setting. Smith (1982), who won the Nobel Prize in Economics for his work in experimental economics, places great emphasis on providing participants with incentives similar to those that economists would model, without unwanted distortion. For example, Smith requires that participants have a reward of real value they can pursue. He also argues that the incentive to pursue that reward should never be satisfied (no ceiling on incentives), that rewards are entirely private (to avoid the possibility of social pressures that would lie outside an economic model), and that the monetary payoffs are so large that they dominate any non-monetary rewards. This last requirement is called the principle of "dominance."

In Smith's view, the aim of experiments is to test economic theory by implementing the assumptions of the theory as faithfully as possible. However, Smith's vision of the economic experiment does present a very serious challenge to researchers—ensuring that the experimental data actually provide a contribution beyond the economic model being tested is difficult. To clarify the challenge, imagine an archetypal pricing experiment, in which a single trader is presented with two assets, *A* and *B*, each paying a single liquidating dividend. The dividends are distributed normally with identical means, but the variance of *A*'s dividend is lower than the variance of *B*'s dividend. The experimenter induces a negative exponential utility function using the Berg, Daley, Dickhaut, and O'Brien (1986) mechanism, by providing the payout in the form of lottery tickets, with each additional lottery ticket increasing the probability of a payout by slightly less than the previous one. Economic theory makes very clear predictions about the optimal choice: Every participant should prefer *A* to *B*, if each costs the same. In a large

market of traders, assuming the risk-free rate is zero, the price of B should be lower according to the following formulas:

$$S = \frac{E(R_A)}{\sqrt{Var(R_A)}} = \frac{E(R_B)}{\sqrt{Var(R_B)}} \tag{7.1}$$

$$\frac{\frac{D}{P_A}}{\sqrt{Var(R_A)}} = \frac{\frac{D}{P_B}}{\sqrt{Var(R_B)}} \tag{7.2}$$

$$P_B = \frac{\sqrt{Var(D_A)}}{\sqrt{Var(D_B)}} * P_A \tag{7.3}$$

Given this description of the model and experiment, the question can be asked: What is learned from conducting the experiment? As Kachelmeier (1996, p. 83) states:

> *If observed behavior is consistent with a model that is predicated on induced values, the skeptic may ask what behavioral insights we learn other than the demonstrated strategic preference for more money over less. However, if results contradict the model, the skeptic will be just as quick to raise the usual objections available whenever hypothesized findings are not observed.*

What are the usual objections? Typically, these entail a failure to ensure that the assumptions underlying the theory (such as expected utility maximization, negative exponential utility functions, and competitive markets) actually hold in the environment. But if experimentalists take this approach, they are simply viewing economic models as tautologies, which experiments could not possibly refute.

One way around this difficulty is to think more clearly about the nature of assumptions in economic models. Following the discussion in Bloomfield, Tayler, and Zhou (2009), experimentalists usually classify models as having three types of assumptions: *structural* assumptions describe the institutions in which agents interact, including the distribution of information, possible actions, and incentives; *behavioral* assumptions characterize agents' preferences and decision-making abilities (such as expected utility maximization and the form of the utility function); and *equilibrium* assumptions that describe the solution concepts used to predict behavior (such as Bayesian Nash equilibrium, rational expectations, or arbitrage free pricing).

The pricing experiment described above fails to contribute beyond the model on which it is based because the experiment imposes behavioral assumptions and (certainly in the one-person case) provides no plausible alternative to the equilibrium assumption. However, imagining slight relaxations that would make the experiment more interesting is not difficult. The remainder of this section is devoted to discussing various examples of studies that relax structural, behavioral, and equilibrium assumptions in different ways to allow experiments to make novel contributions.

Testing Behavioral Assumptions

Benartzi and Thaler (1999) conduct an experiment that relaxes, and thus tests, the behavioral assumption that people perfectly process information about risk. The experiment provides participants with information about the historical performance of debt and equity investments, and manipulates whether participants are informed of the yearly return for each of 30 years, or just summary information about returns over a 30-year period. Results indicate that the yearly feedback makes the more volatile equity investment seem far more risky, while the summary information reduces participants' concerns about volatility and highlights the higher expected return. Therefore, participants who are given the summary information are much more likely to invest in equities. By explicitly testing the behavioral assumption of perfect information processing in the model, Benartzi and Thaler are able to show that people in fact suffer from myopic loss aversion, and thus make a contribution beyond a simple pricing experiment.

Forsythe, Lundholm, and Reitz (1999) test a behavioral assumption in a different setting. Their study incorporates voluntary disclosure—the potential buyers learn about the possible dividends from the sellers, who report a range of values that must include the true value. In equilibrium, the buyers should assume that the value is the lowest element of the reported range, to protect themselves from sellers who attempt to inflate prices by including higher elements. The study is often known by the title "Half a sucker is born every minute" because sellers do engage in such attempts at price inflation, and it works—even though the same people alternate between roles as buyers and sellers. Thus, people seem to make shrewd reporting decisions but are gullible in interpreting others' reports, in a clear violation of the behavioral assumptions behind most cheap-talk models.

Equilibrium Assumptions: Multiple Equilibria

Many experimental studies relax equilibrium assumptions. The most natural direction is to examine contexts with multiple equilibria. Most modelers are fairly cavalier about their equilibrium assumptions. In rational expectations models with heterogeneous information, a standard conjecture is that demand is a linear function of expectation, but in fact there could be other equilibria. Thus, there is benefit in testing models of information aggregation by conducting laboratory markets—the experimental data demonstrate that the equilibrium assumption is in fact accurate, which need not be the case.

Equilibrium assumptions are particularly important in signaling models. Cadsby, Frank, and Maksimovic (1990) use a series of experiments to test the theoretical predictions of Myers and Majluf (1984) regarding the signaling of firms seeking investors. Participants are divided into two groups, firms and investors. Firms are told they are either of type H or type L, then make a decision to undertake a new project or not. Investors are then informed of the firms' decisions, but not their types, and participate in an auction to fund the projects. When theory predicts a unique equilibrium, subjects attain this equilibrium in all cases. However, if there are multiple equilibria predicted, whether participants should pool or separate is unclear. The authors argue that experiments provide an important tool to address these ambiguous cases. In all versions of the experiment in which theory predicted

multiple equilibria, subjects pooled, possibly because the pooling equilibrium is always Pareto superior to the separating and semi-separating equilibria. Therefore, experimental means can offer predictions in cases when theoretical approaches are insufficient.

Equilibrium Assumptions: Convergence

Even in settings with a unique equilibrium, there is no guarantee that the equilibrium can be achieved. An equilibrium is a fixed point—an outcome that, if obtained, will leave no participant wishing to deviate from it. Still, experimentalists are quickly forced to think about the process that would drive participants toward equilibrium if they are not already there (convergence), and also about the process that might drive participants away from an equilibrium if, having attained it, they drift infinitesimally far away (instability).

Laboratory studies of information aggregation are natural settings in which to think about the dynamics leading to equilibrium. Studies by Plott and Sunder (1982, 1988) provide a classic example. In these studies, security values are determined by which state of nature occurs, and each trader is given information about a state that has not occurred. Collectively, traders know the state that must have occurred. For example, in some markets the possible states are X, Y, and Z, and some traders know the state is not X, while others know the state is not Z; therefore, collectively traders know the state is Y.

An equilibrium analysis would predict that prices fully reflect the information held collectively. Plott and Sunder (1982) show that this is in fact the case in a simple one-period market in which some traders are informed of the true state. In this experiment, a security pays a state-dependent dividend that differs across individual traders. Some traders know the realized state, but it is unknown which traders are informed and which are uninformed. Double oral auctions between the traders should result in complete information aggregation in this setting. However, through another series of experiments, Plott and Sunder (1988) show that this is not always the case in more complex settings. Markets aggregate information much more effectively when the securities are Arrow-Debreu securities: That is, the market includes one security that pays off only in state X, another that pays off only in state Y, and a third that pays off only in state Z. Apparently, this setting allows participants to extract information more easily from the trades they observe. Additionally, if all traders have identical preferences, information can be fully aggregated even if there is only one security. In a market with only one security and diverse preferences, however, information aggregation is incomplete.

Bloomfield (1996) provides some additional insight into the process of information aggregation. In his study, the value of each security is the sum of four random numbers. In one setting, every random number is seen by two traders, and every trader sees one number. In another setting, every random number is seen by four traders, and every trader sees two numbers.

Although traditional theory predicts a fully revealing equilibrium, Bloomfield (1996) predicts and finds that the markets will impound information incompletely, and impound less completely when the information is less widely distributed. The reasoning is that traders make decisions to buy or sell on the basis of the information they personally hold, the information they extract from the market, and their

preferences. At the same time, traders invert that function to infer information from others' trades. This inversion and inference process is far more difficult when traders are endowed with less information individually, even though collectively the total amount of information is the same in both cases. Thus, the market may not be able to fully incorporate all of the available information; rather, the degree of convergence is dependent on how that information is distributed among individual traders.

As a final example of non-convergence to equilibrium, Bhojraj, Bloomfield, and Tayler (2009) construct a model with a single security, which all human participants are told will pay a liquidating dividend of 500 laboratory dollars. The market uses a robot specialist who sets a price of 500 + k(D–S), where D–S is the net cumulative demand for the security. The market also includes a robot buyer who buys shares steadily in each period of trade until a known ending time, and thus would drive prices upward. Bhojraj et al. assume that the market price constitutes a Nash equilibrium and show that a simple backward induction argument should keep prices at 500 in each period of trade, as long as the traders have access to enough capital.

Bhojraj et al. (2009) develop an alternative hypothesis by noting that the structure of the setting includes a social dilemma. Participants collectively make far more money by a strategy of front-running: buying shares at the beginning of trade to force the robot to buy at even higher prices, and selling those shares only after the robot has driven the price up. Extensive research on prisoners' dilemmas shows that people will initially choose disequilibrium strategies that would be socially optimal if everyone did so, and learn to play equilibrium strategies only as they gain experience. In the setting of Bhojraj et al., this shows that traders will initially engage in front-running to take advantage of the robot trader's positive sentiment. This is particularly true when investors have a small initial share endowment. Additionally, the authors find that looser margin restrictions, and therefore more short-selling, will result in delayed convergence to equilibrium because traders face the risk of a margin call if they go against the crowd and attempt to arbitrage the deviation from equilibrium too early.

Testing Models That Cannot Be Solved

A final way to avoid the problem of having no plausible alternative hypothesis is to construct a setting in which theory is simply unable to provide a unique prediction. This alternative is particularly relevant in market microstructure, which deals with extremely complex settings and strategic problems. The most common market used in laboratory settings is the double auction, which is simple in execution, but extremely difficult to model (Friedman, 1984). Modelers in microstructure will often look at simpler settings, such as Kyle-type or Glosten-Milgrom–type experiments. For example, Bloomfield (1996) uses a Glosten-Milgrom–type setup in which investors and market makers simultaneously submit the best bid and ask at which they are willing to trade. Crossing trades are then executed, all other orders are canceled, and trade moves on to the next period. Orders that are not immediately marketable do not have any impact on trade as they would in a limit order market. These types of models of quote- or order-driven markets are much less relevant these days, when most trade takes place in electronic limit order markets.

Bloomfield, O'Hara, and Saar (2005, 2009) examine the behavior of informed and noise traders in an electronic limit order market. The first study addresses the liquidity provision strategies of different types of traders. In this experiment, informed traders and uninformed liquidity traders with specific trading targets trade in a market with many features of actual electronic markets. This enables the authors to determine how both market characteristics (such as the depth of the limit order book) and security characteristics (such as volatility) affect traders' strategies depending on trader type in a way that is impossible in a strictly theoretical framework. Therefore, this setting is much more robust and less restrictive than typical theory work in this field must necessarily be. Results show that order submission strategies are dependent on trader type and evolve over the trading period. While informed traders begin trading with market orders to capitalize on their informational advantages, they switch to limit orders as the period progresses. In this way, informed traders act as a dealer and provide liquidity to the market because they know the security's true value. They benefit from this strategy by profiting from the bid-ask spread.

The latter paper by Bloomfield et al. (2009) examines the behavior of noise traders, who have no exogenous reason to trade, in an electronic limit order market. The markets in these experiments contain informed traders with individually imperfect information but perfect information in the aggregate, liquidity traders with fixed trading targets, and, in some cases, uninformed noise traders. By comparing markets with and without noise traders, their role can be better understood. The authors find that these traders benefit the market by increasing volume and liquidity through their contrarian strategies, but also hinder the market's ability to incorporate new information.

INDIVIDUAL BIAS AND AGGREGATE MARKET BEHAVIOR

A large literature from psychology shows individual errors in judgment. Tversky and Kahneman (1974) outline some of the biases most relevant in the financial setting. These biases include representativeness, the tendency to assume commonality between similar objects; availability, which causes probabilities to be assigned based on how easily similar examples can be brought to mind; and anchoring, the reliance on a single piece of information or starting point when making an estimate.

A key tenet of traditional finance is that markets eliminate these errors. Some suggest that people learn to avoid these mistakes through experience and incentives. As people learn, either directly from investment professionals or indirectly through their own experience, irrational investors will be flushed out of the market. Additionally, even if individual biases are present in the market, they will likely cancel each other out so that, on aggregate, the market will be unbiased. Yet, experimental work has shown that the markets' ability to do so is somewhat limited.

Camerer (1987) conducted the initial experimental work on markets' ability to eliminate individual biases. He reports 15 experiments asking people to predict from which urn a series of three balls are drawn. First, an urn, X or Y, is chosen by picking a random number between 1 and 10 from a third urn. There is a 60 percent

chance of choosing urn X, and a 40 percent chance of urn Y. Subjects know these probabilities but do not know which urn is chosen. Then three balls are chosen with replacement from either X or Y. X contains 1 red and 2 black balls and Y contains 2 red and 1 black balls. Participants are assigned to be either type I or II and then trade an asset that pays a state-dependent dividend in a double-oral auction. Camerer finds that the prices of the assets do tend toward the values predicted by Bayesian theory, but there is also evidence of statistically significant representative bias. This bias decreases as participants gain experience and as incentives are increased. This study may not generalize to real-world financial markets, but is still instrumental in demonstrating some of the potential shortcomings of markets' ability to eliminate individual biases.

Ganguly, Kagel, and Moser (1994) show that information aggregation depends on market structure. They conduct two versions of an experiment to test the persistence of individual biases in the form of the base-rate fallacy; one version is a market in which unbiased traders have the highest expected payoffs, and the other is a market in which biased traders have the highest expected payoffs. The *base-rate fallacy* is the tendency for people to overweight current information rather than the initial base rate. As hypothesized, prices are biased when biased traders have the highest expected payoffs. On the other hand, when unbiased trades have the highest expected payoffs, prices move toward the unbiased level but remain biased. This is because so few traders are actually unbiased; the majority fall victim to the base-rate fallacy. When there are short-sale constraints, as there are in this market, people with unbiased views cannot push prices back to their true values because they cannot sell short. If there is a high probability of traders being biased, even a competitive market cannot remove individual biases if its structure limits certain types of trading.

Gode and Sunder (1993) show that smart institutions can compensate for dumb traders, even if none of the traders in the market are smart. Gode and Sunder create "zero-intelligence" (ZI) programs that submit random orders and report the results of their simulations. These machine-based traders submit random, independent, uniformly distributed orders; they do not try to maximize profits, and they do not remember or learn from past orders. There is obviously a large discrepancy between the behavior of human traders and unconstrained ZI traders. Gode and Sunder attempt to determine how much of this difference is due to learning and profit incentive, and how much can simply be attributed to market discipline. To address this, they run three versions of each market: one with human traders, one with unconstrained ZI traders, and one with ZI traders with budget constraints. The authors find that, while there is no learning with constrained ZI traders, the price series with these traders has much less volatility than that of unconstrained ZI traders and converges to equilibrium within each trading period. In this case, the market is able to eliminate individual irrationality and converge to equilibrium despite the randomness in the traders' strategies. These methods do not work very well in slightly more complex settings.

More complex information structures also interfere with information aggregation in markets with human traders. As discussed above, Plott and Sunder (1988) and Bloomfield (1996) show how the distribution of information can block full revelation. Forsythe and Lundholm (1990) show that information aggregation requires both experienced traders and common knowledge of the dividend structure.

O'Brien and Srivastava (1991) also conduct a series of experiments in which information is not fully aggregated. They argue that the more complex the market is, in terms of the number of securities and the number of trading periods, the more difficult it is for information to be aggregated. In these complex settings, fully arbitraging away these inefficiencies is impossible. Lundholm (1991) shows that information aggregation is less complete when traders would face uncertainty even if they knew all information available in the market.

Aggregation is even more difficult when traders' information comes from their own knowledge, rather than from a fact passed on by the experimenter. Bloomfield, Libby, and Nelson (1996) conduct markets in which the value of a security is based on the answer to an "almanac-style" business-related question. The experiment has two treatments: one in which participants can see the number of traders who traded above, below, and at the posted share price, and one in which they can see the number of shares traded above, below, and at the posted share price. They show that individuals who have higher accuracy in assessing the value of the security trade a larger number of shares. This implicitly allows traders to determine each others' confidence levels. Therefore, when traders see the number of shares rather than just the number of traders, the market price is more accurate. This process is likely to be imperfect in real financial markets due to well-known limits of calibration. This paper does not demonstrate that people are often unaware of their own biases so they will trade aggressively even when they are biased. Therefore, biased judgments will remain prevalent in the market price as well.

Finally, some research examines the possibility that markets can create biases that would not exist at the individual level. Seybert and Bloomfield (2009) examine this issue in the context of wishful thinking. People often trade on their optimistic biases, which may in turn lead others to overestimate these probabilities because people often infer others' beliefs from their actions. In this study, participants traded multiple assets simultaneously and were all endowed with a long position in half of the assets or a short position in the other half. The assets' prices are a function of cumulative demand, so if traders buy shares, the price increases, and vice versa. Each trader also had imperfect information about the value of the asset. Seybert and Bloomfield find that, while traders do not initially engage in wishful thinking (their beliefs are unbiased), they do engage in wishful betting. They are more likely to buy the assets in which they have an initial long endowment. This results in a contagion of wishful thinking because other traders cannot differentiate between wishful betting and actual information about the value of the security. Thus, while other studies show that markets can eliminate some individual biases, Seybert and Bloomfield show that markets can create and magnify biases as well.

INSIGHTS FROM COMPARING EXPERIMENTAL PSYCHOLOGY AND EXPERIMENTAL ECONOMICS

Experimentation has a long tradition in psychology but is relatively new to economics. In fact, Chamberlain performed the first experiment in 1948, and Smith laid out the tenets of experimental economics in 1976. Camerer (1997) describes many of the differences between the styles of those who conduct experiments based

in economics (the E's) and psychology (the P's). Camerer notes a number of key differences in the experiments run by E's and P's. Some of the most important are:

- E's insist that participants receive incentive compensation, while P's rarely do.
- E's typically have experiments with groups of people who interact with one another, while P's often look at individual participants' beliefs and decisions.
- E's typically focus on participant actions that affect aggregate outcomes (e.g., market price) and payoffs, while P's often focus on stated beliefs.
- E's typically remove context from their settings, while P's rarely do. For example, a test of probability assessment by an E would be described in terms of balls drawn randomly from urns with replacement, while a P would more likely present a question such as "How likely is it that the population of Miami is greater than the population of Paris?"
- E's often include extremely complex tables of raw data and econometric estimates of parameters, while P's will usually provide only summary statistics (such as means, variances, F- and t-statistics, and p-values).

Demonstrations vs. Experiments

Understanding the causes of these differences provides an excellent vehicle for understanding how to conduct better experiments in finance. Camerer (1997) argues that some of the differences are driven by the variation in psychological and economic theory. In particular, compensation plays a large role in E studies because the theory assumes there is a payoff to be maximized. Much P research needs only to ensure that participants pay attention to the task and take it seriously, therefore requiring minimal or no payment. Similarly, economic theory is usually devoid of context, so therefore most E's see little benefit to enhancing the numerical settings with irrelevant content and, in fact, many see costs to doing so (because the context might matter for some unknown reason). In contrast, the context in which decisions are made often largely drives psychological models. In general, E's favor precise mathematical formulations of a concise abstraction of reality, while P's prefer verbal descriptions that illustrate the big picture. While the two groups have significant stylistic differences, Camerer argues that, substantively, they are quite similar.

While differences between economic and psychological theory drive some of the differences, a far more important force is likely to be that many experiments in economics are not actually experiments—they are demonstrations. A defining characteristic of an experiment is that the researcher manipulates a single variable, while holding all other aspects of the setting constant. Rarely does an experiment appear in a top psychology journal that does not manipulate a variable. By contrast, many papers published by E's, even in top journals, contain no manipulated variables.

Perhaps the most famous of these is Smith, Suchanek, and Williams (1988), which conducted a series of markets for a security that paid a constant dividend D for each of N periods. Although the value declines from ND to 0 over the periods, Smith et al. conjecture that market prices might form a bubble, with participants buying for more than the fundamental value, in hopes of reselling at a higher price

in the future. Smith et al. (p. 1129) report a "success" as follows: "We observed our first full scale bubble—a boom followed by a market crash. Replication of this experiment (19x) with experienced subjects failed to extinguish a boom-bust pattern of trading."

This paragraph suggests that the study is more a demonstration of a behavior than an experiment. The authors have shown that bubbles arise in the setting they created. Demonstrations have a long tradition in the physical sciences. For example, chemistry researchers will often publish papers in which they describe how they created a molecule that had not been previously synthesized. The authors will do what is necessary to create the molecule, through months or years of trial and error, and then report the method ended up working. Trial and error often takes the form of controlled experiments, but researchers rarely report the results of those experiments. While the success of the demonstration may be consistent with existing theory, and prompt conjecturing refinements to existing theory, the demonstration does not emphasize controlled manipulations used to test a specific theory in a focused way.

In contrast, a true experiment identifies a variable that theory predicts will alter behavior and then manipulates that variable to test the theory. For example, Smith et al. (1988) conjecture that, even if traders are rational and have common initial beliefs about the value of the asset, they may be uncertain about how other traders will react to the same information. Therefore, speculation can arise if traders think they can profit by trading with someone else who interprets the market information differently, and thus bubbles and crashes can occur. A P would likely suggest an experiment in which half of the participants were randomly assigned to a market in which speculation is allowed, while the remainder is assigned to a market in which they are solely a buyer or a seller, thus making speculation impossible. Lei, Noussair, and Plott (2001) conduct such an experiment, which shows that bubbles can arise even when speculation is not allowed. Traders do in fact make judgment errors, and the theory that traders are rational and bubbles are caused strictly by speculation cannot be the whole story. By conducting experiments with controlled manipulation rather than simply demonstrating a market characteristic, true sources of causality for that characteristic can be better identified. The introduction of a controlled manipulation dramatically changes the costs and benefits of various choices in design and analysis. Consider, for example, the role of context. For psychologists, the benefits of context are to provide a natural setting for a decision that is similar to one that participants might make in real life.

Experimental economists often worry about the extra-theoretical implications of context. Yet, recognizing that concerns about such "baggage" are far more serious for a study that has no manipulations is important. Without a manipulation, *any* aspect of the setting could be important in driving bubble formation. Thus, the presence of context makes attributing the presence or absence of bubbles to economic factors very difficult. While concerns about "baggage" are a problem, context is only one relatively obvious noneconomic factor that might drive results. The color and temperature of the room, the background and intelligence of the participants, and details of the trading interface and the noise generated by trading could all affect pricing. Moreover, economic factors not being considered by the research could also matter, such as the length of trading periods, nominal price levels, or the nature of the pricing mechanism (e.g., double auctions vs. clearinghouse

markets). Quite simply, Smith et al. (1988) can only provide conjectures of why they observe bubbles, and any deviation from their setting may change their results.

In contrast, imagine that Smith et al. (1988) had in fact manipulated a variable such as the amount of cash in the market. In fact, Caginalp, Porter, and Smith (2001) conducted a study like this by indicating that large cash endowments do indeed make bubbles more likely. Thus, assume that this alternative to Smith et al. would generate a similar result. In this case, finding such a difference across treatments to be driven by the features of the two settings that are held constant would be very unlikely. As a result, there is little reason to be concerned about the fact that context and meaningful labels would detract from the inferences one can take from the study. After all, the context and labels do not drive bubbles when cash endowments are low. Thus, context and labels by themselves are unlikely to drive bubbles. Also highly unlikely is that the presence of context and labels drives the difference between the two treatments. This would require an interaction between context and cash endowments that, at least at first glance, does not seem plausible.

The power of controlled manipulations also provides experimentalists with defenses against many common criticisms, such as the types of participants in the study and the levels of compensation. While more training and greater incentives might reduce the formation of bubbles, the level of training and incentives in this particular experiment is very unlikely to explain differences across settings in which training and incentives are identical. Thus, those reviewing experiments should be extremely cautious in criticizing experiments in which they believe participants had too little experience or were not paid enough, unless they have a specific reason to believe that experience or incentives will interact with the manipulated variable.

Analyses

The use of controlled manipulation also partly explains why statistical tests differ so much between E and P studies. Analyses of experiments are far simpler than analyses of archival data for the simple reason that the experimental design eliminates many of the problems that econometricians face using data from uncontrolled settings. The alternative Smith et al. (1988) study proposed above could provide strong evidence on the link between cash endowments and bubbles using simple statistics. For example, one could measure a bubble as the time averaged excess of price over fundamental value in each market, and then conduct a t-test of the difference in means across the two settings. Of course, the usual caveats apply regarding the normality of the dependent variable and the similarity of the variances across cells, so using a nonparametric test might be better. However, testing the theory at hand does not require sophisticated econometrics—good experimental designs are usually followed by simple analyses. This is because the researcher designed the entire experiment to make a small set of particular tests possible in a simple and clean way.

Because demonstrations cannot rely on controlled manipulations, they must follow one of two methods of analysis. The first is to assess how similar the behavior in their setting captures the predictions of theory. This leads to extensive focus on

parameter estimation. Theory predicts that price should equal fundamental value in each period, so the mean measure of excess pricing should be zero. Note that this is necessarily a parametric test, so concerns about deviations from normality and outliers are more severe than in a test of the sign of a difference. As a result, such studies traditionally provide tables and figures to permit reviewing the raw data.

The second approach to data analysis in a demonstration is to search for associations within the various dependent variables. For example, Smith et al. (1988) conduct various tests of the adaptive nature of prices, running regressions of the form

$$\bar{P}_t - \bar{P}_{t-1} = \alpha + \beta\left(B_{t-1} - O_{t-1}\right), \quad \beta > 0. \tag{7.4}$$

Here, P_t is the price at time t and $B_{t-1} - O_{t-1}$ is the excess demand at time $t-1$. Such analyses have some advantages over traditional econometric studies of data from naturally occurring markets because they can incorporate dependent and independent variables that would be unobservable outside the laboratory (such as investor beliefs and fundamental value). Still, they face the challenge that they rely on measured (rather than manipulated) independent variables. As a result, such analyses are prone to criticism for correlated omitted variables and self-selection biases.

Experimentalists should not avoid analyses relying on measured independent variables. Such analyses are extremely useful in understanding why people behave as they do in settings with many people engaging in repeated interaction. Researchers should rely on these econometric methods as secondary analyses that serve to support treatment effects, which should be the primary focus of the experiment.

SUMMARY AND CONCLUSIONS

Experiments are an underused method in finance and have natural advantages for behavioral finance. Experiments can provide a useful means to circumvent several common econometric issues such as omitted variables, unobserved variables, and self-selection. Experiments can extend the theoretical models they test by relaxing various assumptions or examining settings that are too complex to be addressed analytically. Whether or not theoretical predictions are clearly known in advance, experiments are most informative when they rely on controlled manipulation, which is the source of their inferential power.

DISCUSSION QUESTIONS

1. How can experimental examinations of extremely simple settings shed light on the behavior of far more complex financial settings?
2. Assume an economic model predicts that, under a given set of assumptions, manipulating independent variable X will increase dependent variable Y. What can possibly be learned from an experiment that imposes the set of assumptions and confirms the predictions of the experiment?

3. Assume there is no tractable economic model that can clearly predict that manipulating independent variable X will increase dependent variable Y. How can one interpret the results of an experiment demonstrating such an effect, as it cannot be said to confirm or refute a prediction?
4. Why do the authors of this chapter argue that experimentalists in economics and finance worry far too much about the influence of features of experimental tasks that are extraneous to economic models, such as the labels used to describe players and actions?

REFERENCES

Benartzi, Shlomo, and Richard H. Thaler. 1999. Risk aversion or myopia? Choices in repeated gambles and retirement investments. *Management Science* 45:3, 364–381.

Berg, Joyce E., Lane A. Daley, John W. Dickhaut, and John R. O'Brien. 1986. Controlling preferences for lotteries on units of experimental exchange. *Quarterly Journal of Economics* 101:2, 281–306.

Bhojraj, Sanjeev, Robert J. Bloomfield, and William B. Tayler. 2009. Margin trading, overpricing, and synchronization risk. *Review of Financial Studies* 22:5, 2059–2085.

Bloomfield, Robert J. 1996. Quotes, prices and estimates in a laboratory market. *Journal of Finance* 51:5, 1791–1808.

Bloomfield, Robert J., and Jeffrey W. Hales. 2006. Should analysts act alone? Johnson School Research Paper No. 39-06. Available at http://ssrn.com/abstract=941494.

Bloomfield, Robert J., Robert Libby, and Mark W. Nelson. 1996. Communication of confidence as a determinant of group judgment accuracy. *Organizational Behavior and Human Decision Processes* 68:3, 287–300.

Bloomfield, Robert J., and Maureen O'Hara. 1999. Market transparency: Who wins and who loses. *Review of Financial Studies* 12:1, 5–35.

Bloomfield, Robert J., and Maureen O'Hara. 2000. Can transparent markets survive? *Journal of Financial Economics* 55:3, 425–459.

Bloomfield, Robert J., Maureen O'Hara, and Gideon Saar. 2005. The "make or take" decision in an electronic market: Evidence on the evolution of liquidity. *Journal of Financial Economics* 75:1, 165–200.

Bloomfield, Robert J., Maureen O'Hara, and Gideon Saar. 2009. How noise trading affects markets: An experimental analysis. *Review of Financial Studies* 22:6, 2275–2302.

Bloomfield, Robert J., William B. Tayler, and Flora H. Zhou. 2009. Momentum, reversal, and uninformed traders in laboratory markets. *Journal of Finance*, forthcoming.

Bossaerts, Peter, and Charles R. Plott. 2004. Basic principles of asset pricing theory: Evidence from large-scale experimental financial markets. *Review of Finance* 8:2, 135–169.

Cadsby, Charles B., Murray Z. Frank, and Vojislav Maksimovic. 1990. Pooling, separating, and semiseparating equilibria in financial markets: Some experimental evidence. *Review of Financial Studies* 3:3, 315–342.

Caginalp, Gunduz, David Porter, and Vernon L. Smith. 2001. Financial bubbles: Excess cash, momentum, and incomplete information. *Journal of Behavioral Finance* 2:2, 80–99.

Camerer, Colin F. 1987. Do biases in probability judgment matter in markets? Experimental evidence. *American Economic Review* 77:5, 981–997.

Camerer, Colin F. 1997. Rules for experimenting in psychology and economics, and why they differ. In *Understanding strategic interaction: Essays in honor of Reinhard Selten*, ed. Wulf Albers, Werner Güth, Peter Hammerstein, Benny Molduvanu, and Eric van Damme, 313–327. Berlin and New York: Springer-Verlag.

Flood, Mark D., Ronald Huisman, Kees G. Koedijk, and Ronald J. Mahieu. 1999. Quote disclosure and price discovery in multiple-dealer financial markets. *Review of Financial Studies* 12:1, 37–59.

Forsythe, Robert, and Russell J. Lundholm. 1990. Information aggregation in an experimental market. *Econometrica* 58:2, 309–347.

Forsythe, Robert, Russell Lundholm, and Thomas Reitz. 1999. Cheap talk, fraud, and adverse selection in financial markets: Some experimental evidence. *Review of Financial Studies* 12:3, 481–518.

Friedman, Daniel. 1984. On the efficiency of experimental double auction markets. *American Economic Review* 74:1, 60–72.

Ganguly, Ananda R., John H. Kagel, and Donald V. Moser. 1994. The effects of biases in probability judgments on market prices. *Accounting, Organizations and Society* 19:8, 675–700.

Gode, Dhananjay K., and Shyam Sunder. 1993. Allocative efficiency of markets with zero-intelligence traders: Market as a partial substitute for individual rationality. *Journal of Political Economy* 101:1, 119–137.

Kachelmeier, Steven J. 1996. Discussion of "Tax advice and reporting under uncertainty: Theory and experimental evidence." *Contemporary Accounting Research* 13:1, 81–89.

Lei, Vivian, Charles N. Noussair, and Charles R. Plott. 2001. Nonspeculative bubbles in experimental asset markets: Lack of common knowledge of rationality vs. actual irrationality. *Econometrica* 69:4, 831–859.

Lundholm, Russell J. 1991. What affects the efficiency of a market? Some answers from the laboratory. *Accounting Review* 66:3, 486–515.

Myers, Stewart C., and Nicholas S. Majluf. 1984. Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics* 13:2, 187–221.

O'Brien, John, and Sanjay Srivastava. 1991. Dynamic stock markets with multiple assets: An experimental analysis. *Journal of Finance* 46:5, 1811–1838.

Plott, Charles R., and Shyam Sunder. 1982. Efficiency of experimental security markets with insider information: An application of rational-expectations models. *Journal of Political Economy* 90:4, 663–698.

Plott, Charles R., and Shyam Sunder. 1988. Rational expectations and the aggregation of diverse information in laboratory security markets. *Econometrica* 56:5, 1085–118.

Seybert, Nicholas, and Robert J. Bloomfield. 2009. Contagion of wishful thinking in markets. *Management Science* 55:5, 738–751.

Smith, Vernon L. 1982. Microeconomic systems as an experimental science. *American Economic Review* 72:5, 923–955.

Smith, Vernon L., Gerry L. Suchanek, and Arlington W. Williams. 1988. Bubbles, crashes, and endogenous expectations in experimental spot asset markets. *Econometrica* 56:5, 1119–1151.

Thaler, Richard H., and Shlomo Benartzi. 2004. Save more tomorrow™: Using behavioral economics to increase employee saving. *Journal of Political Economy* 112:S1, S164–S187.

Tosi, Henry L., Jeffrey P. Katz, and Luis R. Gomez-Mejia. 1997. Disaggregating the agency contract: The effects of monitoring, incentive alignment, and term in office on agent decision making. *Academy of Management Journal* 40:3, 584–602.

Tversky, Amos, and Daniel Kahneman. 1974. Judgment under uncertainty: Heuristics and biases. *Science* 185:4157, 1124–31.

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CHAPTER 8

The Psychology of Risk

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INTRODUCTION

Risk is a subject matter applied jointly and collectively in an assortment of situations. It has different meanings and descriptions among various individuals, institutions, and fields. The purpose of this chapter is to provide the reader with an extensive overview of the subject matter of risk that incorporates the major principles of standard finance and behavioral finance. This forthcoming discussion of both schools of academic thought presents the investment practitioner and financial educator with an improved understanding of the historical, current, and future issues of risk.

The notion of individual and group risk-taking behavior has been examined comprehensively within the social science and business domains (Ricciardi, 2008a, 2008b) and the disciplines of behavioral finance, economics, and accounting (Ricciardi, 2004). The term *risk* is a shared and widespread terminology used in today's world involving personal (e.g., personal finance), business (e.g., corporate governance), governmental (e.g., accounting regulations), and societal (e.g., economic matters) issues. As Ricciardi (2008a) notes, even though this subject matter is highly important, there is no general agreement on the meaning of the term *risk.*

The nature of risk and how it is understood makes risk an important aspect in how individuals make assessments, which influences the courses of action they select in their daily lives. The academic literature discloses that researchers from diverse disciplines reveal a wide range of perspectives in terms of how to define, describe, calculate, and analyze risk. The analysis of risk includes a methodical collection of options and statistical outcomes that consist of losses (downside risk) and gains (upside risk). Charette (1990, p. 456) notes that "one person's risk is often another person's opportunity, and it is often difficult to sort out which is the appropriate perspective to base the analysis on."

Risk is typically defined as the probability of an undesirable outcome (e.g., a decline in the market value of the stock market) occurring and the magnitude of the consequence of that occurrence. In many domains, risk is a characteristic of an ambiguous future and is neither a component of the past or present. According to Pritchard (1997, p. 7), "The traditional view defines risk as a situation in which an outcome is subject to an uncontrollable random event stemming from a known

probability distribution." Nevertheless, most judgments involve a partial component of risk that possess an unknown and unforeseeable consequence or end result that was neither considered nor expected because risk incorporates an element of ambiguity (uncertainty).

From a risk management perspective, risk can be defined in terms of uncertainty. For instance, *pure risk* is the occurrence of some uncertain circumstance or catastrophic event that can only result in a loss such as an earthquake or terrorist attack. On the other hand, *speculative risk* incorporates the potential for a gain (upside risk) or loss (downside risk) such as a stock mutual fund investment, a derivative financial transaction, a gambling experiment, or the outcome of a sporting event. When applying risk management principles, an individual is only focused on minimizing the risk of catastrophic losses (i.e., downside risk). In a financial risk management context, Gray (2000) coined the term "meta-risks" in which individuals must consider subjective inherent risks that are beyond the capacity of precise quantitative risks. In summary, Banks (2008a, p. 71) provides the following overview of the risk management process:

> *Companies and governments operating in the complex economic environment of the twenty-first century must contend with a broad range of risks. Some do so in an* ad hoc *or reactive fashion, responding to risks as they appear, while others are proactive, planning in advance the risks that they wish to assume and how they can best manage them. Since it has become clear over the past few years that risk can be financially damaging when neglected . . . empirical evidence suggests that institutions increasingly opt for formalized processes to manage uncertainties that can lead to losses.*

According to the *Merriam-Webster Online Dictionary*, risk can be defined as (1) the possibility of loss or injury; (2) someone or something that creates or suggests a hazard; and (3) the chance that an investment will lose value. Charette (1990) described risk as possessing three components: (1) a loss connected with it; (2) an aspect of chance or uncertainty; and (3) a selection among different options (choices). In the social sciences, the focus is on examining the approaches people and groups use to assess and react to risk.

The assessment of risk is connected to the uncertainty associated with a circumstance, situation, or event. Gutman (2002) categorizes risk into two diverse groupings: healthy and unhealthy. Healthy risks (i.e., positive behaviors) include involvement in sports activities and volunteer work whereas unhealthy risks (i.e., negative behaviors) focus on drug abuse and criminal activity. Yates and Stone (1992) categorize risk into three aspects: magnitude of losses, potential for losses, and uncertainty of losses. The magnitude (significance) of losses depends on the individual's personal situation. For example, a $5,000 loss may be inconsequential for a billionaire but highly detrimental for a middle class family. The potential for losses is typically measured with a statistical probability (i.e., an objective statistic), normally based on a subjective prediction. The uncertainty of losses incorporates the subjective aspects of risk (i.e., qualitative factors) also known as ambiguity.

Within the judgment and decision-making domain, a difference has been established between risk and uncertainty (Ricciardi, 2008a). Risk can be calculated or at least forecasted based on laws of statistics or probability, whereas uncertainty

is considered the non-quantifiable component that is beyond precise measure. The major difference between risk and uncertainty is that under risk, an individual can apply statistical probabilities that one can evaluate objectively. On the other hand, under uncertainty, the assessment of potential outcomes cannot be determined in numerical probabilities. Instead, a person can project potential outcomes subjectively and with a high degree of unpredictability for the future. A person making a decision under risk is clear about the shape of the distribution curve from which all the final observable outcomes are determined.

Decisions under risk incorporate standard judgments where the alternatives of individual expected consequences are well known (e.g., corporate bonds held within a pension fund). In contrast, an individual making a judgment under uncertainty is uninformed of the exact options of all expected outcomes because this person does not know the exact shape of the distribution from which the results are established. These types of decisions under uncertainty represent a rare circumstance because there is no historical example for comparable judgments. As Ricciardi (2008a, p. 17) notes, "Each decision concerning uncertainty, in some manner is distinctive and therefore, the statistical odds of specific outcomes cannot be determined in an objective nature." In essence, risk is identifiable, forecasted, and well-known whereas uncertainty is unrecognizable, incalculable, and unfamiliar. In the end, risk has different meanings to all types of individuals and across disciplines, since this concept has a wide range of interpretation, description, and assessment (Ricciardi, 2008a).

The remainder of the chapter has the following organization. The next section presents the major theories and tools of the standard (traditional) finance viewpoint of risk. Next, attention turns to a discussion of the main concepts and principles of the behavioral finance perspective of risk. The last section summarizes the chapter and examines the notion of risk-taking behavior during the 1990s through the financial crisis of 2008.

THE STANDARD (TRADITIONAL) FINANCE VIEWPOINT OF RISK

Harrington, Fabozzi, and Fogler (1990, p. 4) note that throughout financial history, the "fair price for risk has been one of the most important, controversial, and difficult problems confronting investors and academics." Within academic finance, the two major schools of thought on the subject matter of risk are the long-established standard or traditional finance and the emerging discipline known as behavioral finance.

A central theme of the standard finance school involves the objective aspects of risk (e.g., standard deviation, beta, and variance). The standard finance perspective incorporates the quantitative measure of risk, and the basis of this approach is the macro-level (cumulative) assessment of risk encompassing all the investors within the markets (Ricciardi, 2008a). Fragnière and Sullivan (2007, p. 21) offer this depiction of the objective nature of standard finance academic models in which "financial risks can be alleviated and addressed using databases and computer programs tailored to the nature of your business . . . risks can also be transferred using insurance or by hedging with financial instruments."

The understanding and application of risk, risk assessment, and risk measurement are all vital aspects in financial decisions because individuals are presented with evaluating whether the return from an investment will offer sufficient compensation (i.e., reward, gain, or profit) for the investment's risk that they accept. The standard finance viewpoint of investment risk is based on the probability of actually earning less than the expected return. Davis and Steil (2001, p. 452) define the standard finance view of risk as the "danger that a certain contingency will occur; often applied to future events that are susceptible to being reduced to objective probabilities." The standard finance academics often measure risk in terms of the standard deviation of returns, its range of returns, and common stock betas.

According to standard finance, the risk associated with an investment is based on the uncertainty of its future returns. For instance, the return an investor will realize (earn) on a common stock is uncertain because its future dividend payments are not guaranteed and its future stock price is uncertain when an individual sells the asset. Culp (2008, p. 54) offers this standpoint on risk:

> *Risk can be defined as any source of randomness that may have an adverse impact on the market value of a corporation's assets net of liabilities, on its earnings, and/or on its raw cash flows. Developing a common understanding of what is meant by the term "risk" at the conceptual level is no trivial task. Simply making a list of the ways a firm can lose money is actually not so hard—but also not so helpful. We need instead to make a list of risks in a way that helps the firm* manage *those risks.*

The standard finance perspective of risk is based on classical decision making (i.e., the normative decision model) and the assumption of rationality (i.e., selecting the optimal choice) in which individuals are *utility maximizers*. (This approach was first developed in areas such as economics, mathematics, and statistics.) As Schindler (2007, p. 22) notes, "In the classical Theory of Finance the concept of rationality has become known as a goal-oriented action" based on specific assumptions and conditions. In effect, Wärneryd (2001, pp. 102–103) states that the "decision maker has options which lead to outcomes whose probabilities are known." A central assumption is that the individual should rank his or her preferences based on the outcomes of various decision choices.

An important aspect of the normative model and the notion of rational decision making under uncertainty is the expected utility approach in which individuals are risk averse and people select the optimal choice over a gamble of an equivalent value. In other words, the assumption is that individual investors will maximize their expected utility. The standard finance model assumes that risk-averse behavior and differences in risk tolerance can be forecasted along the curvature of the utility function. As Ricciardi (2008a, p. 21) observes, this major principle then supports the premise that "higher risk (that is, lower odds of success) will be rewarded with higher reward (return) known as the risk-return tradeoff."

The investment trade-off between risk and return (i.e., a positive relationship between these two variables) is a central issue in which most investors are risk averse and, as a result, they expect a premium for accepting additional risk. An investor presented with two options (alternatives) with the same expected rate of return will select the choice with the lower risk. In a financial market dominated by risk-averse individuals, riskier financial products must provide higher expected

returns than less risky products. If this circumstance does not hold, buying and selling in the market will force it to occur. In most instances, stocks are riskier than bonds and money market securities because stocks have higher standard deviations, which are a measure of volatility that represents the amount of actual returns varied around the long-term historical average. Banks (2008b, p. 40) notes that investors "require returns related to the inherent riskiness of the company: the riskier the company, the greater the return (or risk premium) investors demand. Whether or not a company is risky, however, investors will always seek the maximum possible return."

Ricciardi (2008a) observes that the main foundation of the standard finance school's viewpoint of risk is Modern Portfolio Theory (MPT) and the Capital Asset Pricing Model (CAPM). For example, Cooley and Heck (1981) survey finance professors to evaluate those research papers that have made the most important contributions within the financial academic literature. Two of the three seminal papers identified by this research sample are Markowitz (1952), which is the historical basis of MPT, and Sharpe (1964), which documents the initial development of the CAPM. More than two-thirds of the finance professors in this research sample of 296 responses selected both papers.

MPT not only suggests that rational individuals apply diversification to optimize their investment portfolios but also provides a method for pricing a risky asset within this portfolio. The development of MPT is attributed to the research endeavors of Markowitz's (1952, 1959) theory of portfolio selection. This major contribution occurred because of the integration and application of scientific and statistical techniques to financial research. A central aspect of Markowitz's work was the influence of portfolio diversification in association with the number of securities (e.g., stocks) in a portfolio and the asset's covariances. Markowitz (1999, p. 5) disclosed the historical context of MPT in which before 1952 there was no "adequate *theory* of investment that covered the effects of diversification when risks are correlated, distinguished between efficient and inefficient portfolios, and analyzed risk-return trade-offs on the portfolio as a whole."

The purpose of MPT was to develop a well-diversified portfolio rather than to construct a highly correlated collection of individual securities. The basis of appropriate diversification is the notion of eliminating or reducing the inherent risks on a single investment known as *stock specific risk*. Stock specific risk is information (e.g., a press release of negative company earnings) that can have a detrimental effect on a firm's stock price. However, diversification cannot protect against risk when the overall stock market declines in value defined as *systematic risk*, which is the intrinsic risk associated with the entire market. Ricciardi (2008a, p. 21) states that "MPT suggests that investors form the most favorable portfolios, which have minimum levels of risk (dispersions of returns) for a specified level of expected returns or maximum return of any level of risk." In effect, the assumption espoused is an investor can construct a portfolio that minimizes risk for a given level of expected return based on a normal distribution (Rachev, Menn, and Fabozzi, 2008). Mieg (2001, p. 98) notes that "Markowitz proposed a mean-variance model. The mean in his model is the expected return (of a portfolio) as we find it in the expected-utility model."

Another important aspect is the statistical tool known as variance to assess the degree of variation of a portfolio as the measurement for the divergence of

the expected returns (Ricciardi, 2008a). Interestingly, Haddad and Redman (2005) survey academics within the disciplines of finance, economics, and accounting and find that a strong majority of this research group of educators adhered to the tenets of standard finance in terms of exhibiting risk-averse behavior and owning a diversified asset portfolio.

According to Harrington (1983, p. 12), "The mechanical complexity of the Markowitz portfolio model kept both practitioners and academics from adopting the concept for practical uses." In the 1960s, the CAPM became a fundamental investment tool of MPT in a sample of works by Sharpe (1963, 1964), Lintner (1965), and Mossin (1966). The CAPM is a mathematical model that claims to describe how securities should be priced based on their relative riskiness in association with the return on risk-free assets. The CAPM measures the expected return on an asset as the sum of the return on a risk-free asset and the return appropriate with the asset's market risk. The CAPM assesses the relationship between a particular stock's movements and the volatility of the overall stock market. In other words, as Shirreff (2004, p. 22) notes, the "CAPM sees the risk of an investment portfolio as being dependent on two things: fluctuations in the entire market; and fluctuations in individual stock prices because of individual company news." The model uses a stock's beta, in combination with the average person's level of risk aversion, to calculate the return that people require on that particular stock. Within the financial domain, beta is a measure of market risk in which, the higher the beta, the more sensitive are the returns on the stock to changes in the returns on the market.

The notion of beta as a measure of risk (i.e., stock market volatility) and the CAPM have been subject to substantial criticism. Nonetheless, both are considered important investment instruments of modern portfolio and investment theory (Ricciardi, 2008a). Starting in the 1970s, the significance of beta as a proxy variable for evaluating the risk of a portfolio expanded rapidly throughout the investment community. However, experts soon began to identify substantial divergences between the forecasts of an efficient (competitive) market and the empirical data (Harrington and Korajczyk, 1993). Mangiero (2005, p. 69) describes this basic assessment of beta within the financial community, in which "beta estimates tend to vary over time and across providers, and are extremely sensitive to the choice of market index. Although beta has its share of critics, it is nevertheless used for both investing and risk management purposes." According to Ricciardi (2008a), Fama and French (1992) document the most unfavorable empirical findings against the reliability of beta and the CAPM. They conclude that beta is an inappropriate measure for risk because the CAPM did not explain the average stock returns for the 50-year period of 1941 to 1990. Hawawini and Keim (1998, p. 42) state that Fama and French's study "adds two empirically-determined explanatory factors: size (market capitalization) and financial distress (B/M)." In other words, Fama and French identify the best indicators for future returns as firm size and the book-to-market value (B/M) ratio. Therefore, many financial experts consider these two proxy variables essential fundamental risk measurements. In summary, Blume (1993, p. 8) provides this viewpoint: "The controversy over the CAPM has many ingredients; some may be palatable, and some not. The CAPM is like a menu: You do not have to like everything in order to have a good meal."

Based on a survey of finance professors to evaluate the current state of the discipline, Flanegin and Rudd (2005, p. 28) note, "While as a profession we believe

in and teach the fundamental investment subjects such as CAPM or EMH, we also realize the need to examine ways to explain the 80 percent of the variability of stock returns not explained by the fundamentals." In a research study of finance professors, Doran and Wright (2007) document that even the proponents of standard finance in real-life situations do not always apply the risk and investment concepts they teach in the classroom setting. Based on 642 responses, the authors identify the strategies and tools that finance professors use during their own investment judgment process. Doran and Wright (p. 1) remark:

> *The responses for all investors indicate that the traditional valuation techniques . . . are all unimportant in the decision of whether to buy or sell a specific stock. Instead, finance professors . . . admit they are trying to beat the market with their investment dollars, believe that firm characteristics (especially, a firm's PE ratio and market capitalization), along with momentum related information (a firm's returns over the past six months and year and a firm's 52-week low and high) are most important when considering a stock sale and purchase.*

These two previous research studies by Flanegin and Rudd (2005) and Doran and Wright (2007) challenge the basic application of the approaches and tools of standard finance endorsed by most finance professors. The next section further contests standard finance by discussing the psychological and subjective aspects of risk supported by behavioral finance.

THE BEHAVIORAL FINANCE PERSPECTIVE OF RISK

Montier (2007, p. 445), a behavioral finance expert, comments that "risk is perhaps the most misunderstood concept in finance." When assessing the success of an investment, most individuals have a propensity to focus solely on returns and seldom consider how risk influences their overall financial objective. In fact, most mutual fund trade books written for novice investors during the 1990s failed to even address the topic of risk (Ricciardi and Tomic, 2004). In his overview of risk, Bernstein (2006, p. 215) notes that the investment domain is "unlike many other fields of endeavor because uncertainty is lodged in its heart. When we think we know the future, we are setting ourselves up for trouble." In practical terms, investors should understand the potential price movement of the investment product (e.g., the amount of risk associated with the stock or mutual fund) in developing and implementing an appropriate financial plan.

In terms of the academic literature, risk has distinctive meanings for all types of individuals (e.g., novices vs. experts), and even within the financial literature risk has a variety of definitions (Ricciardi, 2008a). Within academic finance, the typical meaning of risk is the possibility of a negative effect or detrimental outcome to a financial asset or investment service that may occur in the present time period or a future occasion. The standard finance perspective of risk incorporates the objective (quantitative) aspects of risk whereas the behavioral finance viewpoint considers additional subjective (qualitative) factors. In addition, a promising topic of interest and investigation by behavioral finance researchers has been the assessment of an inverse (negative) relationship between perceived risk and expected return (perceived gain). Ricciardi (2008a) provides a comprehensive discussion and collection

of research studies on this topic. In effect, this is an opposite viewpoint of standard finance that is based on the premise of a positive relationship between risk and return.

The forthcoming section provides a sample discussion of the degree to which behavioral finance proponents criticize the standard finance viewpoint of risk. Adams and Finn (2006, p. 45) point out the standard finance viewpoint of risk is based on the notion of expected utility that has been "shown to be riddled with inconsistencies and did not fully explain how humans actually take risks." Plous (1993, p. 95) notes that the assumptions of expected utility are convenient in a setting based on the "*normative* model of decision making (a model about how rational actors would behave if certain assumptions were met)." However, Plous (p. 95) also notes that the normative model is ineffective as a "*descriptive* model (a model of how people actually make decisions)."

Others provide unfavorable observations about risk using the standard finance perspective. For example, Olsen (2008a, p. 3) is critical of the objective nature of risk when he writes "variability of return was not derived from physiological or psychological assumptions of how people perceived or 'felt' uncertainty." Mandelbrot and Hudson (2004, p. 230) offer this unfavorable assessment of standard finance because it "assumes the financial system is a linear, continuous, rational machine. That kind of thinking ties conventional economists into logical knots." Statman (1999, p. 20) offers this criticism of the standard finance standpoint of risk, in which "risk means many things . . . we each have specific ideas about the meaning of risk. So, discussions about risk are all too often discussions among people who are deaf but not mute." In essence, the application of objective measures such as beta and standard deviation are limited because these risk measurements are inaccurate predictors of a stock's future volatility (Ricciardi, 2004, 2008a, 2008b). For instance, a study by McDonald and Stehle (1975) reveals that beta and non-market risk collectively explain 84 percent of the variation in the experts' risk perception based on 225 mailed surveys collected from portfolio managers. However, beta only explains 15 percent whereas non-market risk accounts for 69 percent of the risk perception.

The behavioral finance school applies a broad analysis in which risk is based on an assortment of objective and subjective factors. In other words, quantitative and qualitative issues influence how individuals make decisions pertaining to what financial services or investment products to buy, sell, hold, or reject. In terms of the objective aspects of risk, Ricciardi (2008a) documents from the risk perception academic literature more than 150 accounting and financial indicators as potential risk measurements within the disciplines of behavioral finance, economics, and accounting. The behavioral finance viewpoint also incorporates a subjective component of risk (e.g., the role of cognitive factors and emotional issues), and individual behavior is a central characteristic of defining, assessing, and understanding risk. Ricciardi (2008b) provides an extensive list of behavioral (subjective) risk indicators in research studies within the financial and investment domains. For example, within the behavioral finance literature 111 behavioral (subjective) risk indicators are investigated for 71 endeavors for the period of 1969 to 2002. Olsen (2007, p. 53) provides this behavioral finance viewpoint of subjective risk: "Recent empirical research indicates that perceived risk has both affective and cognitive dimensions because humans are both feeling and thinking beings."

During the 1970s, Slovic (2000) examined risky activities and potential dangers such as environmental hazards, health issues, and emerging technologies. This academic research within the social sciences by Slovic and others documents a large number of cognitive and emotional issues that influence an individual's risk perception for non-financial judgments. Exhibit 8.1 provides a summary of the specific behavioral risk characteristics and findings from the academic literature on risk perception in the social sciences.

The risk perception literature in the social sciences, especially psychology, contains a strong academic and theoretical underpinning for developing new research studies for behavioral finance researchers. Oberlechner (2004, p. 72) points out that "some of the most remarkable answers regarding the question of risk-taking in financial markets have been provided by psychology." Since the late 1990s, the

Exhibit 8.1 Behavioral Factors (Characteristics) Affecting Perceived Risk: The Main Issues and Findings from the Social Sciences for Risky Behaviors and Hazardous Activities

Note: This table provides some major issues and findings on the "psychology of risk" from the social sciences that have wider application concerning how individuals make financial judgments and decisions.

Benefit: The more individuals perceive a benefit from a potential risky activity, the more accepting and less anxiety (fear) they feel toward that risky activity, event, or situation.

Catastrophic potential: Individuals display a tendency to have an increased level of perceived risk for activities that injure or kill a large number immediately and violently. However, there is less anxiety over chronic risks because they occur over a long time horizon and not within one specific occasion (event).

Controllability: People undertake more risk when they perceive they are personally in control because they are more likely to trust their own abilities and skills when engaging in a risky activity.

Dread: Individuals have increased anxiety or dread of risks whose severity they judge to be beyond their control. Examples of these types of risks include catastrophic, lethal, hard to prevent, unfair, threatening to future generations, and involuntary risks.

Familiarity: Individuals are more comfortable and tolerant of risk when they are personally familiar with the specific activity, situation, or event.

Frequency: The perception that the frequency (rate of occurrence) of an activity affects a person's perceived risk. If people do not believe that the risky activity will take place, they are more likely to accept the risk.

Knowledge: The more individuals perceive an activity as difficult to understand (a lower degree of perceived knowledge), the more anxiety (fear) they have toward it.

Media attention: The public has higher levels of anxiety (fear) relating to issues about which they are sensitive and believe are important and credible. Media reporting of certain topics increases the public's recognition of a problem and belief in its credibility.

Personal vs. Societal: Individuals are willing to assume risks that concern only themselves (e.g., personal basis). People apply a much higher benchmark to protect the general public (e.g., societal concerns) from potential risky or hazardous activities.

Trust: The higher the level of trust an individual possesses in the experts informing the public about the risky activity, the less anxiety (dread) the individual has about the specific situation.

Voluntariness: People reveal less anxiety or fear toward risk that they expose themselves to voluntarily than a risk in which they are required to engage (known as involuntary risk).

seminal work of the Decision Research group established by Slovic has started to cross over to a wider spectrum of disciplines such as behavioral finance, accounting, and economics (Ricciardi, 2008b). In particular, the Decision Research organization began to apply a host of behavioral risk characteristics (indicators) and various findings within the realm of financial and investment decision making in a sample of works by Olsen (1997, 1998, 2001, 2004, 2007, 2008a, 2008b, 2009), MacGregor, Slovic, Berry, and Evensky (1999), MacGregor, Slovic, Dreman, and Berry (2000), Slovic (2001), Finucane (2002), and MacGregor (2002). Other risk professionals have also extended the work of Decision Research in various research endeavors in behavioral finance and financial psychology (for an extended sample of academic studies, see Ricciardi, 2008b). Also, Ricciardi (2004) notes that the topic of risk perception has a well-established past and wide application across disciplines such as behavioral accounting, consumer behavior, marketing, engineering, and behavioral economics.

The subject matter of risk perception in behavioral finance is an important issue because the judgment process of how the individual collects information involves the assessment of consequences (outcomes), and this influences the final investment decision. Furthermore, understanding that the analysis and measurement of risk contains a subjective (qualitative) aspect is also important. For example, the risk involved in a finance decision (e.g., the purchase of a mutual fund investment) as perceived by the investor may not include a strong association to what actually exists (i.e., the reality of the situation). The degree of perceived investment risk experienced by a person is dependent on two elements: (1) the amount of unpleasantness of the negative outcome and (2) the potential that this negative result will occur. Brehmer (1987, p. 26) provides the following depiction of the risk perception:

> *The term "perception of risk" is, of course, somewhat of a misnomer. The term perception carries the implication that there is some risk "out there" to be picked up. But the "objective risks" that are supposed to be perceived are of course not real objects, but only numbers that have been computed according to this or that formula. We do not perceive risks, we perceive various features of decision problems and this leads to feelings of risk.*

MacGregor et al. (1999) provide a notable example of a research endeavor within the academic literature on the psychology of risk that has crossed over from the discipline of psychology to behavioral finance. In a survey of financial advisors about expert decision making and investment risk analysis, the authors received responses from 265 participants who provided their assessment of a series of 19 asset classes with 14 specific risk variables. Some of these 14 characteristics are behavioral in nature and examine issues of worry, attention, and knowledge, whereas others are judgment related such as perceived risk, perceived return, and the likelihood of investing. Using multiple regression analysis with perceived risk as the dependent variable, they find that 98 percent of an expert's risk perception is attributable to three indicators: worry, volatility, and knowledge. Finucane (2002, p. 238) provides an additional viewpoint on this study when she writes that "perceived risk was judged as greater to the extent that the advisor would worry about the investments, that the investments had greater variance in market value over time, and how knowledgeable the advisor was about the investment option."

A study by Goszczynska and Guewa-Lesny (2000) extends the earlier work of the Decision Research group with the integration of hazardous activities and the investment decision making. The financial risk perception component of this study examines whether the ratings would be based on qualitative factors similar to those found in a study by Slovic, Fischhoff, and Lichtenstein (1980) involving technological and ecological risk. Goszczynska and Guewa-Lesny examine 11 qualitative risk indicators (based on the earlier work of Slovic and others) in which respondents are asked to judge their perceptions of risk on seven-point Likert scales for 10 types of financial investments (e.g., stocks and bonds) among a sample of three Polish banks (113 experts vs. 108 novices).

Goszczynska and Guewa-Lesny (2000) ask a key question: "Do experts and novices differ significantly regarding their assessment of risk for various categories of financial assets?" The responses between the two groups demonstrate considerable divergence regarding the following risk characteristics: the amount of profit, certainty of profit, judgmental independence, and familiarity for specific categories of investment. Goszczynska and Guewa-Lesny develop three risk dimensions (factors), including certainty of profit, the familiarity of risk, and the deferment of losses. These three risk dimensions account for more than 60 percent of the total variance. The first factor called "certainty of profit" consists of qualitative risk factors including trust, amount of profit, income certainty, and independence of judgment. The second factor labeled "familiarity of risk" incorporates risk indicators such as controllability, knowledge, and accessibility of information. The third factor "fear of immediate loss" deals with loss postponement and anxiety of loss (e.g., this behavior is attributed to loss aversion).

The behavioral finance perspective of the assessment of risk is a multi-factor decision-making process across a wide range of investment classes and financial products. Evensky (1997, p. 24) makes the following comment about the financial psychology of risk: "people, in general, and clients, in particular, have difficulty distinguishing between knowledge-based and foolhardy speculation." Based on the risk perception literature in psychology, Oberlechner (2004, pp. 28–29) points out the following: "how people actually form decisions *contradicted* expected utility theory, both in the controlled and systematic study of decisions in research laboratories and in the observation of real-life decisions." A collection of experimental and theoretical findings in behavioral finance demonstrates that people typically do not behave in a rational manner and use the descriptive approach in psychology concerning how individuals actually make risk judgments and decisions (Ricciardi, 2008b). This descriptive approach recognizes that individuals are affected by their personal experiences, individual values, cognitive issues, emotional factors, the presentation of information, and the accuracy of this information within different domains (Kahneman, Slovic and Tversky, 1982; Slovic, 2000).

According to the descriptive approach, the reason investors act in this manner when evaluating risk is based on the tenets of bounded rationality, loss aversion, and prospect theory. As Ricciardi (2008b, p. 93) notes, "Bounded rationality is the premise that economic rationality has its limitations, especially during the judgment process under conditions of risk and uncertainty." Bounded rationality is the assumption that an individual reduces the number of options to a collection of smaller abbreviated steps, even though this may overly simplify the decision.

Furthermore, bounded rationality suggests that personal attributes and instinctive reactions, skills, and routines influence the decision processes. Under these conditions, according to behavioral decision theory, a person will select the perceived satisfactory choice although this may not be the optimal alternative to select. In effect, bounded rationality implies that individuals exhibit "normal behavior" during the judgment and decision-making process. As Baker, Logue, and Radar (2005, p.257) note, "normal behavior is what people really do as opposed to what they should do according to the economic definition of a rational person."

The assumption of loss aversion is based on the premise that people allocate more weight to losses than they do to gains. According to prospect theory, a person assesses an alternative of losses and gains relative to an acceptable reference point in dollar terms associated with loss-averse behavior. Basu, Raj, and Tchalian (2008, p. 53) describe prospect theory as "how investors actually do behave rather than the normative theory of how they should behave (rational and averse to risk)." Ricciardi (2008a, 2008b) provides a more extensive discussion of these behavioral finance concepts.

Olsen (1997) highlights the important role of bounded rationality, loss aversion, and prospect theory within behavioral finance. He distributed a two-stage questionnaire to a sample of 630 expert investors and 740 sophisticated novice investors. The first survey provided an open-ended definition of investing to obtain specific factors of risk perception while the second survey investigated the specific factors that influence the decision-making process. The results of this study show that both groups of professional and individual investors appear to have a similar perspective of risk. The four main risk characteristics that these investors assign to their perceptions of risk are the concern for a large loss, the feeling of control, the potential for a below-target return, and a perceived degree of knowledge. These four subjective elements of risk perception account for about 77 percent of the variation (high r^2) in security returns for the period 1965 to 1990. However, Olsen reports that only 58 percent use an objective measure of risk, namely, standard deviation. The most substantial factor across 10 different asset classes is the control variable or the ability to sell an asset in a short time horizon without suffering a significant loss for their investment. Finucane (2002, p. 238) offers a further interpretation of Olsen's findings in which "critical dimensions included dread risk (a below-target return, the potential for a large loss, the investor's feeling of control) and unknown risk (the level of ambiguity or knowledge about an investment)."

The behavioral finance literature discloses many different cognitive (mental) and affective (emotional) risk indicators that can be applied to the decision-making process concerning how a person perceives risk for a wide variety of financial services and investment instruments. For example, Ricciardi (2008b) provides an extensive discussion of 12 important factors that influence an individual's perception of risk for different types of financial services and investment products. The factors include overconfidence, loss aversion, prospect theory, heuristics, representativeness, anchoring, familiarity bias, framing, expert knowledge, perceived control, worry, and affect (emotions). Investors assess a potential opportunity based on their beliefs, past experiences, and available information in which they develop different courses of action and then use subjective judgments to determine a final choice. In the end, risk is a situational, multidimensional process that is contingent

on the specific features of the investment service or financial product (Ricciardi, 2008a, 2008b).

SUMMARY AND CONCLUSIONS

This chapter provides a discussion of the subject matter of risk and risk-taking behavior from different viewpoints within the disciplines of psychology, finance, and investments. As Ricciardi (2008a, 2008b) notes, the academic literature discloses that risk experts have diverse beliefs of how to explain, quantify, measure, and assess risk. Starting in the 1970s, researchers have performed many research studies on the psychology of risk within the social sciences. Risk perception is the subjective (qualitative) decision-making process that an individual uses to assess risk. The current research pertaining to the behavioral aspects of the risk perception literature in behavioral finance, accounting, and economics stems from the previous endeavors on risky activities and hazardous behaviors in the field of psychology (Ricciardi, 2008b). A prominent topic area within the risk research literature is how an individual processes information and the diverse behavioral finance concepts and theories that might influence a person's perception of risk for various investment securities (e.g., opening a bank account and investing in a common stock) and financial services (e.g., firing your current tax accountant and selecting an investment advisor).

The analysis of risk has two major perspectives of academic thought known as standard finance and behavioral finance. According to standard finance, the topic of risk is based on objective or quantitative measurements such as standard deviation, variance, and beta. The major principles of standard finance for the measurement of risk are classical decision making, risk aversion, the normative model, rationality, modern portfolio theory, beta, and the CAPM. The behavioral finance viewpoint incorporates a detailed analysis of risk that combines the subjective or qualitative aspects (i.e., cognitive and affective issues) and objective factors (i.e., mathematical and statistical measurements). The main topic areas of behavioral finance for risk assessment are bounded rationality, the descriptive model, behavioral decision theory, prospect theory, and loss aversion.

An important aspect of understanding the notion of risk is from an historical perspective of human behavior. For example, Bernstein (1996, 2007) documents the natural progression and changing perspectives of risk throughout history. Bernstein (1995, p. 10) also notes that as the "mathematics that define these risks grows increasingly complex, the dimensions, contours, and limits of risk are becoming correspondingly obscure." Lo (1999b, p. 13) comments that "risk management practices focus almost exclusively on the *statistical* aspects of risk." Lo (1999a) identifies this approach as statistical risk management. Crouhy, Galai, and Mark (2006, p. 3) provide the criticism that traditional financial risk management has had a poor historical record of preventing market disturbances and revealed "serious concerns that derivative markets make it easier to take on large amounts of risk, and that the 'herd behavior' of risk managers after a crisis . . . actually increases market volatility."

Since the 1990s, the standard finance camp has embraced the complex innovations and exotic instruments of financial risk management (e.g., derivative products), which contributed to the September/October 2008 financial contagion

(i.e., subprime mortgage crisis, frozen credit markets, and stock market meltdown). Although derivative products are highly valuable for protecting profits and hedging (minimizing) against potential losses, financial institutions used these financial instruments for trading and speculative activities that resulted in substantial losses. According to Taleb (2008), the losses incurred by the banking system due to the failures of quantitative risk management seem to exceed the amount that banks ever earned taking risks. Lohr (2008) identifies financial engineering and its reliance on strict mathematical computer models as one of the major causes of the financial crisis. In recent years, the financial risk management literature has started to incorporate a greater emphasis on the individual decision maker (the human element) and the behavioral (subjective) aspects of risk (see, for example, Merton, 2003; Celati, 2004, 2008; Shefrin, 2006, 2009; Goto, 2007; Kloman, 2008; McConnell, 2008; and Power, 2008).

In essence, Leong, Seiler, and Lane (2002, p. 9) contend that the financial "environment is simply too complex for the classical theories to describe fully. In a world that is changing faster than we can understand, risk seems more difficult to understand and control." A research survey in August 2008 of investment managers documents a widespread lack of understanding about derivatives products and risk management issues. In particular, this study reveals that 40 percent of fund managers bought investment products that they had no structure to evaluate risk (Pengelly 2008). Olsen (2008b, p. 72) provides an additional perspective on the current state of financial risk assessment in which "normative processes leading to better investment results cannot be developed and enacted without understanding the psychology and limits of the investing mind."

Both standard finance and behavioral finance provide a valuable contribution to the assessment of risk in which they are complementary rather than mutually exclusive. Standard finance has been the foundation for many innovative risk management products that today have a wide range of applications throughout the financial community. At the same time, behavioral finance incorporates the idea in which the analysis of risk is investor-specific, situational in nature, and a multi-dimensional decision-making process that is contingent on the attributes of the particular financial product or investment service (McDonald and Stehle, 1975; MacGregor et al. 1999; Swisher and Kasten, 2005; Ricciardi, 2006, 2008a, 2008b; Olsen, 2008a, 2009). Nevins (2004, p. 9) notes the significance of both academic schools of finance and suggests an approach that "blends traditional investment theory with the observations of behavioral theorists." Ultimately, individuals should establish their own viewpoint of standard and behavioral finance because these investment concepts will help improve their understanding and ability to make better decisions.

DISCUSSION QUESTIONS

1. What is the difference between risk and uncertainty? Define, describe, and provide examples of each topic.
2. Provide an overview of the standard finance perspective of risk including: objective risk, risk-averse behavior, modern portfolio theory, beta, and the capital asset pricing model.

3. Provide an overview of the behavioral finance viewpoint of risk, including: subjective risk, behavioral decision theory, bounded rationality, prospect theory, and loss aversion.
4. Based on your answers in #2 and #3, do you agree with the standard finance or behavioral finance perspective of risk? Explain your position. In responding to this question, incorporate your own personal experience if you have invested in an individual stock or mutual fund.

REFERENCES

Adams, Brandon, and Brian Finn. 2006. *The story of behavioral finance*. Lincoln, NE: iUniverse.

Baker, August J., Dennis E. Logue, and Jack S. Rader. 2005. *Managing pension and retirement plans: A guide for employers, administrators, and other fiduciaries*. New York: Oxford University Press.

Banks, Erik. 2008a. Catastrophe and risk. In *The handbook of finance, Volume 3: Valuation, financial modeling, and quantitative tools*, ed. Frank J. Fabozzi, 71–79. Hoboken, NJ: John Wiley & Sons.

Banks, Erik. 2008b. Overview of risk management and alternative risk transfer. In *The handbook of finance, Volume 3: Valuation, financial modeling, and quantitative tools*, ed. Frank J. Fabozzi, 39–52. Hoboken, NJ: John Wiley & Sons.

Basu, Somnath, Mahendra Raj, and Hovig Tchalian. 2008. A comprehensive study of behavioral finance." *Journal of Financial Service Professionals* 62:4, 51–62.

Bernstein, Peter L. 1995. Risk as a history of ideas. *Financial Analysts Journal* 51:1, 7–11.

Bernstein, Peter L. 1996. *Against the gods: The remarkable story of risk*. New York: John Wiley & Sons, Inc.

Bernstein, Peter L. 2007. *Capital ideas evolving*. Hoboken, NJ: John Wiley & Sons, Inc.

Blume, Marshall E. 1993. The capital asset pricing model and the CAPM literature. In *The CAPM controversy: Policy and strategy implications for investment management*, ed. Diana R. Harrington and Robert A. Korajczyk, 5–10. Charlottesville, VA: Research Foundation of the Institute of Chartered Financial Analysts (CFA Institute).

Brehmer, Berndt. 1987. The psychology of risk. In *Risk and Decisions*, ed. W. T. Singleton and Jan Howden, 25–39. New York: John Wiley & Sons.

Celati, Luca. 2004. *The dark side of risk management: How people frame decisions in financial markets*. Harlow, U.K.: Prentice Hall.

Celati, Luca. 2008. Back-to-basics on the defensive: Now what for the risk profession? *Journal of Risk Management in Financial Institutions* 1:4, 452–457.

Charette, Robert N. 1990. *Applications strategies for risk analysis*. New York: McGraw-Hill Book Company.

Cooley, Philip L., and Jean L. Heck. 1981. Significant contributions to finance literature. *Financial Management* 10:2, 23–33.

Crouhy, Michel, Dan Galai, and Robert Mark. 2006. *The essentials of risk management*. New York: McGraw-Hill.

Culp, Christopher L. 2008. Risk and risk management. In *The handbook of finance, Volume 3: Valuation, financial modeling, and quantitative tools*, ed. Frank. J. Fabozzi, 53–62. Hoboken, NJ: John Wiley & Sons.

Davis, E. Philip, and Benn Steil. 2001. *Institutional investors*. Cambridge, MA: The MIT Press.

Doran, James S., and Colbrin Wright. 2007. What really matters when buying and selling stocks? *Social Science Research Network (SSRN) Working Paper Series*. Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=980291.

Evensky, Harold R. 1997. *Wealth management: The financial advisor's guide to investing and managing client assets*. New York: McGraw-Hill Companies.

Fama, Eugene F., and Kenneth R. French. 1992. The cross-section of expected stock returns. *Journal of Finance* 47:2, 427–465.

Finucane, Melissa L. 2002. Mad cows, mad corn, & mad money: Applying what we know about the perceived risk of technologies to the perceived risk of securities. *Journal of Behavioral Finance* 3:4, 236–243.

Flanegin, Frank R., and Denis P. Rudd. 2005. Should investments professors join the "crowd"? *Managerial Finance* 31:5, 28–35.

Fragnière, Emmanuel, and George Sullivan. 2007. *Risk management: Safeguarding company assets*. Boston: Thomson Learning.

Goszczynska, Maryla, and Ewa Guewa-Lesny. 2000. General and specific characteristics of risk perception in financial investment. *Polish Psychological Bulletin* 31:4, 301–313.

Goto, Shigeyuki. 2007. The bounds of classical risk management and the importance of a behavioral approach. *Risk Management & Insurance Review* 10:2: 267–282.

Gray, Jack. 2000. Meta-risks: Beyond the scope of explicit financial risks. *Journal of Portfolio Management* 26:3, 18–25.

Gutman, Bill. 2002. *Being extreme: Thrills and dangers in the world of high-risk sports*. New York: Kensington Publishing.

Haddad, Mahmoud M., and Arnold L. Redman. 2005. Ivory tower versus the real world: Do we practice what we teach? *Financial Decisions* 17: 1, 1–19.

Harrington, Diana R. 1983. *Modern portfolio theory and capital asset pricing model: A user's guide*. Englewood Cliffs, NJ: Prentice Hall, Inc.

Harrington, Diana R., Frank J. Fabozzi, and H. Russell Fogler. 1990. *The new stock market*. Chicago: Probus Publishing Company.

Harrington, Diana R., and Robert A. Korajczyk, eds. 1993. *The CAPM controversy: Policy and strategy implications for investment management*. Charlottesville, VA: Research Foundation of the Institute of Chartered Financial Analysts (CFA Institute).

Hawawini, Gabriel, and Donald B. Keim. 1998. Beta, size and price/book: Three risk measures or one? In *The complete finance companion: The latest in financial principles and practices from the world's best finance schools*, ed. Tim Dickson and George Bickerstaff, 36–43. London: Financial Times Pitman Publishing.

Kahneman, Daniel, Paul Slovic, and Amos Tversky, eds. 1982. *Judgment under uncertainty: Heuristics and biases*. New York: Cambridge University Press.

Kloman, Felix. 2008. What are we missing in risk management? *Journal of Risk Management in Financial Institutions* 1:4, 354–359.

Leong, Clint T. C., Michael J. Seiler, and Mark Lane. 2002. Explaining apparent stock market anomalies: Irrational exuberance or archetypal human psychology. *Journal of Wealth Management* 4:4, 8–23.

Lintner, John. 1965. Valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. *Review of Economics and Statistics* 47:1, 13–37.

Lo, Andrew W. 1999a. A behavioral perspective on risk management. *AIMR Conference Proceedings* 3:5, 32–37.

Lo, Andrew W. 1999b. The three P's of total risk management. *Financial Analysts Journal* 55:1, 13–26.

Lohr, Steve. 2008. In modeling risk, the human factor was left out. *New York Times*. November 28, 2008: Available at http://www.nytimes.com/2008/11/05/business/05risk.html.

MacGregor, Donald G. 2002. Imagery and financial judgment. *Journal of Behavioral Finance*, 3:1, 15–22.

MacGregor, Donald G., Paul Slovic, Michael Berry, and Harold R. Evensky. 1999. Perception of financial risk: A survey study of advisors and planners. *Journal of Financial Planning* 12:8, 68–86.

MacGregor, Donald G., Paul Slovic, David Dreman, and Michael Berry. 2000. Imagery, affect, and financial judgment. *Journal of Behavioral Finance* 1:2, 104–110.

Mandelbrot, Benoit, and Richard L. Hudson. 2004. *The (mis) behavior of markets: A fractal view of risk, ruin and reward*. New York: Basic Books.

Mangiero, Susan M. 2005. *Risk management for pensions, endowments, and foundations*. Hoboken, NJ: John Wiley & Sons.

Markowitz, Harry M. 1952. Portfolio selection. *Journal of Finance* 1:7, 77–91.

Markowitz, Harry M. 1959. *Portfolio selection: Efficient diversification of investments*, 2nd edition. Malden, MA: Basil Blackwell, Inc.

Markowitz, Harry M. 1999. The early history of portfolio theory: 1600–1960. *Financial Analysts Journal* 55:4, 5–16.

McConnell, Patrick. 2008. People risk: Where are the boundaries? *Journal of Risk Management in Financial Institutions* 1:4, 370–81.

McDonald, John G., and Richard E. Stehle. 1975. How do institutional investors perceive risk? *Journal of Portfolio Management* 2:1, 11–16.

Merton, Robert C. 2003. Thoughts on the future: Theory and practice in investment management. *Financial Analysts Journal* 59:1, 17–23.

Mieg, Harald A. 2001. *The social psychology of expertise: Case studies in research, professional domains, and expert roles*. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Montier, James. 2007. *Behavioural investing: A practitioner's guide to applying behavioural finance*. Chichester, U.K.: John Wiley & Sons.

Mossin, Jan. 1966. Equilibrium in a capital asset market. *Econometrica* 34:4, 768–783.

Nevins, Dan. 2004. Goals-based investing: Integrating traditional and behavioral finance. *Journal of Wealth Management* 6:4, 8–23.

Oberlechner, Thomas. 2004. *The psychology of the foreign exchange market*. Chichester, U.K.: John Wiley & Sons.

Olsen, Robert A. 1997. Investment risk: The experts' perspective. *Financial Analysts Journal* 53:2, 62–66.

Olsen, Robert A. 1998. Behavioral finance and its implication for stock-price volatility. *Financial Analysts Journal* 54:2, 10–17.

Olsen, Robert A. 2001. Behavioral finance as science: Implications from the research of Paul Slovic. *Journal of Behavioral Finance* 2:3, 157–159.

Olsen, Robert A. 2004. Trust, complexity and the 1990s market bubble [Editorial commentary]. *Journal of Behavioral Finance* 5:4, 186–91.

Olsen, Robert A. 2007. Investors' predisposition for annuities: A psychological perspective. *Journal of Financial Service Professionals* 61:5, 51–57.

Olsen, Robert A. 2008a. Cognitive dissonance: The problem facing behavioral finance. *Journal of Behavioral Finance* 9:1, 1–4.

Olsen, Robert A. 2008b. Perceptions of financial risk: Axioms and affect. *The ICFAI University Journal of Behavioral Finance* 5:4, 58–80.

Olsen, Robert A. 2009. Animal foraging and investors' portfolios: Why the decision similarity? *Journal of Investing* 18:1, 7–14.

Pengelly, Mark. 2008. Survey reveals funds' lack of derivative expertise. *Risk* 21:8, 17.

Plous, Scott. 1993. *The psychology of judgment and decision making*. New York: McGraw-Hill, Inc.

Power, Michael. 2008. *Organized uncertainty: Designing a world of risk management*. New York: Oxford University Press.

Pritchard, Carl. 1997. *Risk management concepts and guidance*. Arlington, VA: ESI International.

Rachev, Svetlozar T., Christian Menn, and Frank J. Fabozzi. 2008. Risk measures and portfolio selection. In *The handbook of finance, Volume 3: Valuation, financial modeling, and quantitative tools*, ed. Frank J. Fabozzi, 101–108. Hoboken, NJ: John Wiley & Sons.

Ricciardi, Victor. 2004. A risk perception primer: A narrative research review of the risk perception literature in behavioral accounting and behavioral finance. *Social Science Research Network (SSRN) Working Paper Series*. Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=566802.

Ricciardi, Victor. 2006. A research starting point for the new scholar: A unique perspective of behavioral finance. *ICFAI Journal of Behavioral Finance* 3:3, 6–23. Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=928251.

Ricciardi, Victor. 2008a. Risk: Traditional finance versus behavioral finance. In *The handbook of finance, Volume 3: Valuation, financial modeling, and quantitative tools*, ed. Frank J. Fabozzi, 11–38. Hoboken, NJ: John Wiley & Sons. Available at http://www.mrw.interscience.wiley.com/emrw/9780470404324/hof/article/hof003002/current/abstract.

Ricciardi, Victor. 2008b. The psychology of risk: The behavioral finance perspective. In *The handbook of finance, Volume 2: Investment management and financial management*, ed. Frank J. Fabozzi, 85–111. Hoboken, NJ: John Wiley & Sons. Available at http://www.mrw.interscience.wiley.com/emrw/9780470404324/hof/article/hof002010/current/abstract.

Ricciardi, Victor, and Igor Tomic. 2004. *An introduction to mutual fund investing: A practical approach for busy people*. Unpublished book.

Schindler, Mark. 2007. *Rumors in financial markets: Insights into behavioral finance*. West Sussex, U.K.: John Wiley & Sons.

Sharpe, William F. 1963. A simplified model for portfolio analysis. *Management Science* 9:2, 277–293.

Sharpe, William F. 1964. Capital asset prices: A theory of market equilibrium under condition of risk. *Journal of Finance* 19:3, 425–442.

Shefrin, Hersh. 2006. The role of behavioral finance in risk management. In *Risk management: A modern perspective*, ed. Michael K. Ong, 653–676. Burlington, MA: Academic Press.

Shefrin, Hersh. 2009. Ending the management illusion: Preventing another financial crisis. *Ivey Business Journal* 73:1, 7.

Shirreff, David. 2004. *Dealing with financial risk*. Princeton, NJ: Bloomberg Press.

Slovic, Paul. 2000. *The perception of risk*. London: Earthscan Publications Ltd.

Slovic, Paul. 2001. Psychological study of human judgment: Implications for investment decision making. *Journal of Behavioral Finance* 2:3, 160–172.

Slovic, Paul, Baruch Fischhoff, and Sarah Lichtenstein. 1980. Facts and fears: Understanding perceived risk. In *Societal risk assessment: How safe is safe enough*?, ed. Richard C. Schwing and Walter A. Albers, 181–214. New York: Plenum Press.

Statman, Meir. 1999. The psychology of risk and taxes. *AIMR Conference Proceedings: Investment counseling for taxable clients*. Charlottesville, VA: Association for Investment Management and Research, 18–27.

Swisher, Pete, and Gregory W. Kasten. 2005. Post-modern portfolio theory. *Journal of Financial Planning* 19:9, 74–85.

Taleb, Nassim N. 2008. The fourth quadrant: A map of the limits of statistics. Edge: The third culture, September 15, 2008. www.edge.org/3rd_culture/taleb08 /taleb08_index.html.

Wärneryd, Karl-Erik. 2001. *Stock market psychology: How people value and trade stocks*. Cheltenham, U.K.: Edward Elgar Publishing.

Yates, J. Frank, and Eric R. Stone. 1992. The risk construct. In *Risk-taking behavior*, ed. J. Frank Yates, 1–25. Chichester, U.K.: John Wiley & Sons.

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CHAPTER 9

Psychological Influences on Financial Regulation and Policy

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INTRODUCTION

This chapter reviews psychological influences on accounting and financial rules and regulation. Behavioral accounting and finance has mainly taken regulatory structures as given, and the applications to regulation have mostly been along normative lines—examining how to protect naive investors (e.g., Hodder, Koonce, and McAnally, 2001; Kachelmeier and King, 2002; Sunstein and Thaler, 2003), often under the implicit assumption of benevolent and rational regulators (Waymire and Basu, 2008). As for positive research on accounting and financial regulation, following the public choice research program in economics, the focus has been primarily on the interactions of *rational* selfish pressure groups and political participants (e.g., Watts and Zimmerman, 1979; Kroszner and Stratmann, 1998; Rajan and Zingales, 2003; Benmelech and Moskowitz, 2007). There is, therefore, little consideration of how psychological bias of policy makers and firm stakeholders affect the development of reporting and disclosure rules.

Economists have, until recently, neglected how irrationality on the part of participants in the *political process* affects financial regulation. For example, the survey of Klapper and Zaidi (2005) does not mention this topic. An extensive survey of the law and economics field barely mentions psychology (Mcnollgast, 2007), and an overview of regulation by a leading behavioral economist does not cover the psychological approach (Shleifer, 2005). Despite a rich body of research by scholars in other fields on the effects of psychological biases on political judgments and decisions (e.g., Baron, 1998, 2009), only recently have economists focused attention on the implications for accounting and financial regulation (e.g., Daniel, Hirshleifer, and Teoh, 2002; McCaffery and Slemrod, 2006; Hirshleifer, 2008; Hirshleifer and Teoh, 2009).

Recent progress is being made on applying psychology to law and politics (e.g., Kuran and Sunstein, 1999; Caplan, 2001; Murphy and Shleifer, 2004; Jolls, Sunstein,

and Thaler, 1998). Caplan (2007) provides evidence of voter irrationality and documents a set of voter political biases. The topic here goes beyond voters because the biases of commentators and regulators also influence regulation and accounting policy. Rather than directly proposing forms of political bias, the chapter discusses how ideas from psychology and other fields can improve understanding of political decision making and regulation.

Such an analysis recognizes that the designers of accounting and financial policy—regulators, politicians, voters, and users—are subject to systematic biases. Hirshleifer (2008) and Hirshleifer and Teoh (2009) call this approach the *psychological attraction approach* to regulation, accounting policy, and more generally political economy because certain beliefs about regulation and accounting are especially good at exploiting psychological biases to attract attention and support.

An early initial step toward incorporating psychology into the study of politics was the notion that voters are rationally ignorant about political matters (Downs, 1957). However, the "rational" part of this theory implies no systematic bias. The theory, therefore, does not explain why voters would make mistaken decisions repeatedly over long periods such as approving protectionism and farm subsidies. Even an ignorant individual, if rational, understands that pressure groups have an incentive to manipulate available information to promote their favored policies.

The chapter further argues that the manner in which issues are presented to the public—emotional catchphrases and positioning—is crucial. Such effects are also precluded in a rational setting. Economists have often been puzzled about why policies they have identified as inefficient persist. Ignorance (lack of information) does not explain why bad policies are adopted just when public discourse focuses sharply on them. The psychological attraction approach suggests studying what kinds of information are salient and alluring to voters and policy makers, and the social contagion of ideas about public policy. The chapter reviews some psychological and social forces that underlie accounting and financial regulation.

The primary focus concerns limited attention, omission bias, in-group bias, fairness and reciprocity norms, overconfidence, mood effects and attention cascades, and cultural evolution of ideology. This list includes both individual biases and social processes that amplify them.

LIMITED ATTENTION

Because people have limited attention, the attractiveness of economic policies depends not just on the costs and benefits they confer on different parties, but also on the salience of these effects. People are more tolerant of hidden taxes than transparent ones (McCaffery and Baron, 2006). Vat or withholding, by reducing the salience of income taxes paid, makes higher tax levels tolerable to citizens. According to McCaffery and Baron, limited attention also creates misperceptions about the progressivity of income taxation. As a result of attention effects, political battles are often waged by framing debates with sound bites to capture public attention and to make positions plausible, understandable, and memorable.

Psychological research has studied what makes stimuli easy to encode and retrieve. Attention is drawn to *salient* stimuli that contrast with other stimuli in the environment, and to *vivid* stimuli, such as stories about personal experiences and emotionally arousing information (Nisbett and Ross, 1980). People

are more willing to expend resources to save the lives of identified individuals than statistical lives, which is called the identifiable victim effect (Small and Loewenstein, 2003). As the famous quote misattributed to Stalin goes, "The death of a single Russian soldier is a tragedy. A million deaths is a statistic," (http://en.wikiquote.org/wiki/Joseph_Stalin).

Regulatory debates are influenced heavily by unusual but heart-rending personal stories. For example, the Enron scandal, together with accounting fraud at WorldCom, helped set the stage for the Sarbanes-Oxley Act of 2002 (SOX), a major change to U.S. reporting regulations. What made the episode so vivid was a narrative of evil perpetrated against innocent employees who had large fractions of their retirement assets invested in Enron stock. Management had promoted Enron stock as a retirement investment to employees while selling its own shares. The motivation for SOX was more general than the protection of employees who invest in own-company stock, but there is some evidence of linkage (Hirshleifer, 2008). The very name Enron became a symbol of outrageous greed. Enron and other accounting frauds caused a tidal wave of pressure for a regulatory response.

Spread widely over many unidentified shareholders, the costs of a financial regulation are often far less salient than the exceptional wrongdoings that incited it. In the Enron scandal, the stories of families losing their life savings were far more vivid than information about possible costs of disclosure regulation that SOX imposed upon general shareholders. Furthermore, management time and attention are intangible, which reduces salience of such costs in the minds of planners. Critics have argued that proponents of SOX underestimated its damage to managerial focus.

Limited attention offers an additional possible explanation for the elemental fact of aggregation in accounting. Aggregation destroys information content and with modern information technology, extensive disaggregation is feasible. However, aggregation makes reports comprehensible and succinct (Hirshleifer and Teoh, 2009).

People dislike losses as measured relative to an arbitrary reference point (Kahneman and Tversky, 1979). A reframing of a decision problem that switches from contemplated gains to losses or vice versa affects choices. A natural extension of this to the social sphere, which is called *loss salience,* suggests that people care more about the financial losses than the financial gains of others. Limited cognitive processing power helps explain the tendency to focus on gains or losses relative to reference points. So, loss aversion and loss salience probably derive from more fundamental sources, such as the tendency to make dichotomous evaluations as a cognitive shortcut (Hirshleifer, 2001). The focus of individuals on losses is amplified at the social level to the extent that conversation or media reporting are biased toward transmitting adverse and emotionally charged news (Heath, Bell, and Sternberg, 2001).

In expected utility theory, there is nothing special about gains or losses relative to an arbitrary benchmark, nor about losses that exceed some arbitrary cutoff. But risk perceptions focus upon the potential for loss among both analysts and investors (Koonce, McAnally, and Mercer, 2005). In practice, financial risk analysis often focuses on bad-case or worst-case scenarios rather than variance or other risk measures that reflect the overall payoff distribution. Loss salience explains the

appeal of the Value-at-Risk (VAR) methodology for risk management, in which risk is measured by maximum possible loss.

The term *mental accounting* (Thaler, 1985) describes a psychological phenomenon, the division of payoffs into separate accounts that are treated differently (despite the fungibility of money). As in prospect theory, gains or losses are measured relative to an arbitrary reference point such as historical purchase price. Mental accounting captures the fact that people view paper gains or losses as less real or important than realized ones. They view such profits as not mattering until the position is closed or some other trigger for reevaluation occurs such as there is limited mental marking-to-market of unrealized profits. The same psychological forces may underlie the revenue recognition principle (Hirshleifer and Teoh, 2009). Recognizing transactions only when they are virtually completed feels natural and is also psychologically attractive.

Loss aversion can help explain the emergence of conservatism as an accounting practice—delaying recognition of profits until they are certain, but anticipating losses. Why do users and regulators find conservatism appealing? Recognition of profits or assets involves a forecast of the future. Users who find the prospect of being disappointed vividly unpleasant may perceive (rightly or wrongly) that conservatism reduces the likelihood of future disappointments (Hirshleifer and Teoh, 2009). Refraining from recognizing a gain is not very painful today but has the advantage of reducing the risk of a painful future loss. Early recognition of losses feels bad but at least is compensated by reducing the risk of future losses.

OMISSION BIAS

Ritov and Baron (1990) refer to the preference for omissions (such as letting someone die) over otherwise equivalent commissions (such as killing someone actively) as omission bias. An example is recommending against vaccination of a child even when the reduction in likelihood of death from disease is much greater than the likelihood of death from vaccination.

Corporate hedging often causes an adverse side effect (losses), which could be avoided by passively not hedging. Observers with omission bias will especially dislike such losses and therefore may perceive even a risk-reducing hedge strategy as risky. Even more simply, observers who do not understand the concept of hedging may hear about derivative losses and directly perceive them as risky.

Similarly, omission bias can deter making purchases to diversify into seemingly risky assets such as the Ghana stock market or real estate. Buying into Ghana is a commission, making any resulting loss especially painful. There are other possible reasons for non-diversification such as familiarity bias (Huberman, 2001; Massa and Simonov, 2006; Cao, Han, Hirshleifer, and Zhang, 2007), and the isolation or focusing effect (or narrow framing; viewed in isolation, volatile assets seem risky; Barberis and Huang, 2008).

Regulation by government or other institutions to protect unsophisticated investors from supposedly dangerous securities or asset classes can block risk-reducing diversification (Del Guercio, 1996). Omission bias also helps explain pension rules in some time periods and countries limiting diversification into major asset classes such as the international sector, rules that limit trading of the stock of

privately held firms, and rules that limit participation in hedge funds to "qualified" investors.

Omission bias provides an alternative explanation for historical cost accounting (Hirshleifer and Teoh, 2009). Updating of the valuation of a previously purchased asset is a commission, whereas sticking with the historical cost is passive. Either approach can fail ex post to provide good estimates of the payoffs the asset ultimately generates. But because marking-to-market is a commission, errors that result from doing so will seem especially blameworthy.

IN-GROUP BIAS

People tend to prefer members of their own group to outsiders, a phenomenon called in-group bias (Brewer, 1979) or parochialism (Schwartz-Shea and Simmons, 1991; Baron, 2001, 2009). The theory of kin selection (Hamilton, 1964) provides an evolutionary basis for in-group bias and xenophobia.

A further source of human conflict is self-serving attribution bias; in interactions with others, people think they are right and others are wrong. This bias extends to group-serving interpretations as well (Taylor and Doria, 1981), which contributes to group antagonisms. Self-censorship in conversation in order to conform to the group can further exacerbate xenophobia (Kuran, 1995). There is evidence that such biases affect financial decisions. For example, citizens of Europe have less trust for countries with different religions and lower genetic similarity, and lower trust is associated with less trade (especially in trust-intensive goods), portfolio investment, and direct investment (Guiso, Sapienza, and Zingales, 2009). In part for patriotic reasons, many countries have government ownership of selected industries. Xenophobia also helps explain restrictions on foreign shareholding and control of domestic companies.

When things go wrong, people eagerly look for someone to blame. Blame is laid upon some visible, disliked, and relatively weak out-group, a phenomenon known as *scapegoating* (Aronson, Wilson, and Akert, 2006). This encourages regulation to prevent misconduct by the despised group.

In the case of Enron, a key forward-looking way to help subsequent investors was to encourage them to diversify out of own-company stock. Requiring greater disclosure from firms was hardly relevant for the aspect of the issue that captured public attention. However, placing the burden for change on future potential scoundrels rather than victims is much more intuitive.

Much of the regulatory structure of U.S. stock markets was imposed following market downturns. For example, this occurred with the passage of the Securities Acts of 1933 and 1934 and the Sarbanes-Oxley legislation that followed the high-tech collapse of 2000.

The explanation suggested by the psychological attraction approach is that people look for someone to blame and then favor regulation to prevent such villains from committing similar acts in the future. Most scholars put more weight on a different kind of explanation—that bubbles develop spontaneously through a positive feedback process, as influenced by investor expectations and biases. Such an account is too abstract and complex to appeal to non-specialists. People are also not especially eager to attribute their own losses to personal incompetence.

A far more satisfying explanation is that the crash was caused by misbehavior, especially by some unpopular group such as the rich, lenders, bureaucrats, capitalists, foreigners, Jews, or speculators. Of course, in any financial market, examples of actual misbehavior can be found, which can add an air of plausibility to the villainy story regardless of whether misconduct played any significant role at the macro level. Another appealing feature of such explanations is that they suggest a simple cure—regulate to prevent the misbehavior.

FAIRNESS AND RECIPROCITY NORMS

Three important norms of behavior are reciprocity, equality, and charity. Reciprocity, or fair exchange, requires no taking without giving. Equality requires equal division of resources. Charity requires acting to relieve hardship of others. Furthermore, hardship is often identified with recent losses, rather than a low level of wealth per se. Therefore, people see outpourings of sympathy for those whose houses are damaged during natural disasters in priority over hungry people who cannot afford a house. These norms have a basis in evolved human psychology but are also culturally spread and enforced.

The charity norm condemns sellers who charge high prices and lenders who charge high interest rates to the poor or recently distressed. This motivates price controls in general and usury laws in particular. In either case mutually beneficial transactions are blocked. For example, usury laws prevent the poor and distressed from obtaining loans, and price gouging regulation creates shortages of essential goods in times of disaster. One of the roles of regulation is to prevent fraud, which is often committed against the poor and distressed. However, regulation based on the charity norm is not designed solely to prevent fraud and is inefficient. Usury rules are not the only way to help the poor and insure against hardship.

The equal division norm is reflected in progressive income taxes and the tendency of individuals to share equally in experiments on resource transfer games (Camerer and Thaler, 1995; Hoffman, McCabe, and Smith, 1996). Envy and the salience of the equality norm are intensified when a group is doing poorly, which helps explain rage against rich CEOs who lay off blue collar workers. Outrage at high executive compensation is expressed regularly. For example, regulation in the United States includes corporate taxation of executive salaries greater than $1 million and the progressive income tax.

Experiments on the "trust game" show that there is much more trust and reciprocation than the rational egoistic model predicts, with reciprocation mediated by the release of the neuroactive hormone oxytocin (Zak, Kurzban, and Matzner, 2004). McAdams and Rasmusen (2007) discuss evidence that reciprocity norms (specifically, promise-keeping norms) are important for market exchange. The norm of reciprocity also requires the punishment of violators. A readiness to succumb to uncontrollable rage has strategic value as a means of commitment (Hirshleifer, 1987; Frank, 1988; Nesse, 2001). But the exercise of outrage can impose heavy social costs, as with "jackpot" litigation awards by U.S. juries against corporate wrongdoers.

Reciprocity norms contribute to hatred of speculators and lenders. People have trouble grasping that intermediating activities add value. For example, when a resource is shifted across locations or over time, it still seems like the "same" product,

which suggests it should have the same price. Middlemen are often viewed as parasites. For example, in the medieval concept of the just price, price should be equal to the cost to the seller (Southern, 1968). In consequence, merchants are often accused of price gouging. This is in part because the costs incurred by middlemen are not salient to buyers.

The notion that middlemen, speculators, and lenders provide little real value goes back at least to the Middle Ages. The norm of equality creates an immediate case against lenders, who are rich enough to lend and therefore ought to help those who are poorer out of generosity. Denigrating lenders also helps preserve a poor borrower's self-esteem if he decides not to repay. When a client is poor or recently distressed, the charity norm also condemns high product prices and interest rates.

Naïve economic analysis together with the reciprocity norm underlies a case against usury. A zero interest rate seems fair to someone who neglects the fact that the same amount of money is worth a different amount at different dates. This confusion influenced medieval Christian views on usury. A dislike of deviations from customary or "reference prices" provides a further possible source of modern usury legislation and opposition to price gouging (Jolls et al., 1998).

The social benefits to speculative activity as identified by economists (Hirshleifer, 1971) are not popularly understood. The public perception is that speculators profit at the expense of others. Some apparent costs to society of speculation are salient. Speculators profit from extreme movements in commodity prices that are associated with hardship for either producers (such as farmers) or consumers. This and the high activity of speculators when securities fluctuate sharply often lead to the conclusion that speculators have manipulated the market for their own ends. This is especially the case for short sellers as bearers of ill tidings about price. Of course, manipulation often occurs and matters, but psychological forces cause great overestimation of its importance.

Security regulations in many countries that are designed to limit speculation include higher taxation of short-term capital gains, securities transaction taxes, and restrictions or bans on short-selling. Hatred of speculators also tarnishes perceptions of derivatives. The perception that derivatives are mainly vehicles for gambling and manipulation makes them attractive targets for regulation.

OVERCONFIDENCE

People have high regard for those who energetically attack the challenges they face. Extending this regard to attackers of society's problems is not always valid because making good decisions on behalf of millions of interacting strangers with diverse preferences and information is difficult. The invisible hand (Smith, 1776) or spontaneous order (Hayek, 1978) achieves functional results that a central planner can never understand in full detail.

Market institutions and technical solutions develop by accumulating creative solutions to problems. These solutions are often carefully designed, but often (as in biological evolution) are random trials that happened to work. However, the human mind is not designed to think about social equilibria in terms of evolutionary processes. Thinking of effects as resulting from the intentional actions of specific individuals within simple models of the world is much easier. People

have engaged in commerce for millennia, yet the concept of the invisible hand was not developed until the eighteenth century. Hence, the perennial appeal of efficiency-reducing market interventions.

Unlike free action at the personal level, market failure is a prerequisite for coercive intervention to be useful. This makes value-increasing interventions scarcer for governments. A failure to grasp the idea of the invisible hand, together with general attentional constraints, makes regulatory solutions to perceived problems immediately alluring. People want government to solve problems even when intervention will create net harm. Political entrepreneurs who propose plausible-sounding solutions have a ready audience.

Overconfidence is the belief that one's personal qualities are better than they really are. Overconfident policy analysts tend to assume that a perceived social problem has not been addressed by the market and fix easily on proposed solutions. Hirshleifer and Teoh (2009) refer to this consequence of overconfidence as *intervention bias*. If over the distribution for potential remedies the mean improvement is, on average, negative, overconfidence leads too often to adoption. Over time this results in too much regulation because there are many potential regulations to consider (Hirshleifer, 2008).

Even economists who understand the general notion of spontaneous order do not always internalize fully, in specific contexts, the full functionality of market institutions. Transactions taxes in asset markets to limit speculation provide a possible illustration. Deliberately suppressing liquidity initially seems counterintuitive. Nevertheless, securities transactions taxes designed to suppress speculation are prevalent internationally. They have also been proposed in the United States both in broad-based forms and targeted at derivative securities (Hakkio, 1994). Proponents have included leading economists such as John Maynard Keynes and James Tobin and after the 1987 stock market crash, luminaries such as Joseph Stiglitz and Lawrence Summers (Stiglitz, 1989; Summers and Summers, 1989).

The chapter now focuses on arguments for transactions taxes based upon the claim that excessive speculation leads to overreactions, excess volatility, and capital misallocation. What is usually absent from the analysis of securities transactions taxes is how markets might be able to address excessive trading (Hirshleifer, 2008). There are many possible mechanisms with such obvious examples as mutual fund loads and the closed-end feature of funds. The policies of security exchanges influence liquidity through numerous means. Firms can choose illiquidity by remaining privately held or by going private. Some public firms, such as Warren Buffett's Berkshire Hathaway, do not split their stocks, resulting in high stock prices, which reduce trading. Firms also influence their liquidity through the choice of which exchange to list and through disclosure policies.

The fact that there are many avenues for internalizing the externalities of excessive trading does not show that such externality problems are largely eliminated. But the neglect of such avenues in academic discussions suggests a lack of awareness of the possibility that the potential social costs of irrational speculative trading could, at least in part, be addressed by market adaptations.

Another possible example of overconfidence is the tendency of public officials or commentators to think they know how to manage market fluctuations helpfully through various policy instruments. An overconfident regulator may think he can assess fundamental value better than the aggregate of thousands or millions of

individuals participating in markets, including professionals who devote their lives to valuation. The illusion of control, an aspect of overconfidence, tempts observers to think that they know how to avert bubbles and crashes. After a crash, commentators condemn existing regulation and regulators as inadequate and call for more active intervention.

Calls by market observers to limit managerial earnings forecasts (guidance) may also result from an overconfident dismissal of market institutions. A possible motivation is evidence of agency problems and inefficiencies associated with earnings forecasts and earnings management (Richardson, Teoh, and Wysocki, 2004). However, corporate transparency offers obvious benefits. Before accusing the market of error, trying to understand why making forecasts has been the market outcome seems important. A simple possible explanation is that investors regard quarterly earnings guidance as highly informative about long-run prospects. Furthermore, contrary to one of the claims of critics, the evidence does not support the view that markets overreact to quarterly earnings news (Bernard and Thomas, 1989).

ATTENTION CASCADES AND MOOD CONTAGION

Psychologists distinguish a fast, intuitive, affect-driven cognitive system from a slow, controlled, and analytical system (Kahneman, 2003). Heuristic decision making has its place, but does not work well in domains that require careful analysis. Contagion of naïve theories and of optimistic or pessimistic moods can lure society into big mistakes in politics and other domains.

Even a society of rational decision makers can converge upon ill-informed decisions owing to information cascades. An individual who observes early support for a regulatory initiative can rationally infer that there may be a good reason for it. This further encourages others to support the initiative and can cause opposing information to be quietly neglected (Bikhchandani, Hirshleifer, and Welch, 1992; Banerjee, 1992). Conformist instincts can further reinforce and stabilize support even for bad measures.

Just as enthusiasm for stocks seems to grow suddenly into intense bubbles, there are episodes of intense fear of physical hazards or of antagonistic actions by other people. People tend to judge the frequency or importance of a phenomenon according to their ability to remember examples of it (Tversky and Kahneman, 1973). This availability heuristic contributes to sudden focus on specific hazards. Kuran and Sunstein (1999) point out that when individuals and news media start discussing a danger, a phenomenon starts to seem more common and important. This self-feeding effect results in what is called attention cascades. Owing to individual biases, attention cascades are idiosyncratic and error prone. For example, hidden dangers such as environmental pollutants receive disproportionate attention relative to, say, car accidents.

A rational observer who knows he is being told only one side of a debate will not generally end up with biased beliefs. Yet, experimental evidence shows that people do not adjust sufficiently for the one-sidedness of evidence (Brenner, Koehler, and Tversky, 1996). In an attention cascade, the presentation of evidence becomes increasingly favorable to one side of an issue. If the issue is a perceived threat, there is self-amplifying pressure for regulation to protect against it.

This helps explain why accounting and financial regulation is so often imposed after severe market downturns.

The psychological attraction approach implies that there will be what Hirshleifer and Teoh (2009) call evaluation-driven overshooting during financial crises. Evidence suggests that people experiencing negatives tend to engage in more critical evaluation and to be more pessimistic. This finding suggests that pressure for precautionary regulation increases after bad news. The obverse of this is a tendency for slackening of informal standards during good times. This leads to a boom-bust pattern in informal regulation. Positive feedback amplifies these forces. During bad times, firms become distressed, and manipulation activities come to light. This focuses public attention on misconduct, creating pressure to litigate and to tighten regulatory and accounting oversight. The benefit to politicians and public prosecutors of aggressively pursuing alleged misconduct increases. As more malfeasance is detected, the public perception that corruption is endemic increases. During good times, a reverse process occurs. Examples of laws created after large bull markets that limit investor rights and allow more risk-taking by banks are the 1927 government agency policy that permit commercial banks to issue securities, 1995 Private Securities Litigation Reform Act, 1998 Securities Litigation Uniform Standards Act, and the 1999 Financial Services Modernization Act.

CULTURAL EVOLUTION OF IDEOLOGY

Two stylized facts about economic regulation are *excess* and *inefficiency*, at least compared to an ideal benchmark. As an example of the latter, economists generally view price controls as inefficient, yet they have been adopted repeatedly. Collectivist movements such as communism, fascism, and Nazism have at times held sway over large populations with disastrous results.

An explanation for these stylized facts is that ideologies, which are broadly construed to include religion and moral beliefs about economic decisions, shape financial regulation. Cultural replicators are ideas or assemblies of ideas that collaborate to grab our attention and our cognitive and emotional susceptibilities to spread through the population, termed *memes* by Richard Dawkins (1989). Ideologies are memes involving some moral view of how society should be organized.

Religious ideology has shaped aspects of financial regulation directly as with prohibitions on usury, and indirectly through emphasis on the equality and charity norms. The equality norm motivates socialist and communist ideologies that reject free trade and private property. Early Christians and influential thinkers such as Plato, Aristotle, Confucius, and Thomas Aquinas shared a suspicion of private property and disdain for trade.

Antimarket ideology remains popular and underlies the pressure for regulation. Envy of the rich motivates and in turn is incited by ideologies of class conflict. An antibusiness meme views profit seeking as evil. For example, Hollywood routinely depicts businessmen as crooks or conspiring killers.

But what makes these views attractive? The idea that trade is mutually beneficial is surprisingly hard to internalize. Viewing commerce as a zero sum game is cognitively simpler (Rubin, 2002). The appeal of socialism comes from overconfidence (as discussed earlier) about the ability to manage an economy from top down—what Hayek (1988) calls "the fatal conceit."

The psychological attraction approach predicts that liberalism thrives during good times and antimarket sentiments during bad times. During an economic downturn, the view that profit is theft is more appealing; people want to blame someone for their hardships, and the capitalist provides a convenient target. Utopian movements, which tend to be antimarket, are attractive during times of dislocation, when people who feel bad about themselves can escape these feelings by identifying with a greater cause (Hoffer, 1963).

Conspiracy theories are another set of ideologies that has shaped regulation. People especially fear hazards whose workings are hidden or complex such as insecticides, genetically modified foods, and nuclear energy, as contrasted with car accidents. Hidden menace is a key ingredient of conspiracy theories, which blame some outsider or despised group for society's problem. Conspiracy theories gain support during bad times. Historically, there have been many conspiracy theories about foreigners, Jews, or speculators controlling the financial system and engineering market crashes (Pipes, 1997; Chancellor, 2001). People have trouble understanding the financial system, which makes them receptive to such theories. Although unintuitive, many believe that a market crash can result from the interaction of many individuals, no single one of whom is powerful. The human mind is inclined to attribute social outcomes to deliberate actions of individuals. Therefore, conspiracy theories provide a more intuitive explanation for bubbles and crashes than impersonal markets.

Hirshleifer (2008) proposes that an ideology of *anti–short-termism* exploits psychological bias to promote its own replication. This ideology claims that markets and publicly traded firms are too focused on short-run results. Such accusations were highly prevalent during the 1980s. Critics of short-termism emphasize the pressures placed on firms by takeovers, leverage, and impatient investors. The alleged bad consequences were underinvestment and lack of innovation. Japan was envied and feared by many Americans for its long-term corporate orientation.

Over the next two decades, the U.S. economy did far better than Japan's. Remarkably, this datum did not lead to a general and explicit critique of the short-termist thesis. Hirshleifer (2008) argues that psychological bias contributes to the evolution and success of the anti–short-termist ideology.

For an ideology to succeed, its propositions (memes) should be emotionally strong and compatible. Logical flaws or lack of supporting evidence matters little unless the defects are glaringly obvious. Hirshleifer (2008) suggests that critics of short-termism typically conflate five distinct propositions: that firms attend too much to short-term stock prices, underinvest, under-innovate, and over-leverage; and that the stock market inefficiently focuses too much on short-term signals such as quarterly earnings news.

Logically, these claims are not entirely compelling or even consistent. The attempt to boost short-term stock price can cause firms to overinvest (because stock prices tend to react positively to investment increases) (Trueman, 1986) and to favor innovative over routine projects (Chordia, Hirshleifer, and Lim, 2001). Empirically, the stock market does not consistently overweight short-term signals. Instead, growth opportunities are overvalued (the value effect). If anything, the market underreacts to short-term earnings-related news (the post-earnings announcement drift anomaly as discussed by Bernard and Thomas, 1989). In addition, whether firms are on the whole overleveraged is unclear.

Evidence suggests that markets overweight certain kinds of quarterly earnings information—accruals (accounting adjustments) and especially their discretionary components (Sloan, 1996; Teoh, Welch, and Wong, 1998a, 1998b). Overall, several data and logical points oppose elements of the anti–short-termist ideology. However, the five propositions above complement each other emotionally to form a stronger and more contagious ideology. The label of "short-termism," as applied to these distinct concepts, exploits the general regard for foresight and discipline. The ideology thereby recruits our preexisting mental equipment for thinking about folly and sin. By joining these disparate concepts together, people are reminded of the ideology more often by external events. That is, its "idea habitat" is expanded (Berger and Heath, 2005).

There is seldom any attempt to reconcile the different pieces of anti–short-termism ideology coherently. Often the same commentators who scathingly criticize firms and investors for being obsessed with short-term earnings are also contemptuous of investors who, during the late 1990s, placed too little weight on the fact that the profits of dot-com firms were negative—a complaint about excessive long-termism.

Moralistic interpretation dominates public discussion of short-termism. This explains the seeming paradox that some of the same commentators who criticized corporate short-termism in the 1980s criticized naïve overexcitement during the tech bubble of the late 1990s.

Corporate leverage is perceived emotionally as analogous to the excessive borrowing of an extravagant spendthrift. Adopters of the ideology can enjoy a narrative in which sin and folly are followed by punishment (firm failure) and a feeling of superiority. In summary, this ideology provides an example of how financial ideas can become popular because of their psychological properties as contrasted with their realism and validity.

A COMPARISON WITH THE RATIONAL PRESSURE GROUP APPROACH

A rational self-interest approach to regulation based upon competition between pressure groups faces two puzzles. First, individuals often take political positions based on principle, not pecuniary self-interest (Sears and Funk, 1991). Indeed, individuals altruistically donate time and funds to their favored pressure groups. Thus, what is commonly interpreted by political economists as rational self-interested lobbying is actually a more interesting combination of selfish and altruistic motives, or identification of own welfare with group welfare. Second, successful pressure groups fool other voters systematically over long periods of time. The psychological attraction approach can analyze explicitly how pressure groups exploit psychological biases.

The psychological attraction approach implies that regulatory responses to perceived problems will often misfire. For example, people expect investor-protection regulation often to hurt the investors. It can also explain why regulatory mistakes persist. A rational pressure group theory does not capture such effects because such an outcome involves political participants being systematically wrong about the true intent and consequences of regulation for long periods of time.

SUMMARY AND CONCLUSIONS

This chapter reviews how psychological bias influences regulation and reporting policy. In the psychological attraction approach, regulation is a consequence of psychological biases on the part of regulators and participants in the political process and of ideologies that evolve because they are tempting to susceptible individuals. The psychological attraction theory also implies that bad regulatory outcomes can result even when all political participants have unselfish intentions and that regulations can reinforce individual level biases. Because the set of possible tempting regulations is unlimited, the theory predicts a general tendency for overregulation and for rules to accumulate as an increasing drag on the economy. The theory also predicts a tendency for increases in regulation in response to market downturns or disruption.

The psychological attraction theory of regulation can inform policy as well. Many often presume that the insights of the behavioral approach support policies and regulation to protect investors from their own psychological biases. This is indeed a strand of behavioral thinking (Thaler and Sunstein, 2008). Still, the behavioral approach in some ways strengthens the case for laissez-faire because it suggests that psychological bias drives regulation. As several authors have argued (Caplan, 2001; Daniel et al., 2002; Hirshleifer, 2008), individuals have a stronger incentive to overcome bias when investing personal resources than when making political choices that tax or regulate others. A behavioral approach suggests that the political process often works even less effectively than markets.

Identifying why psychological bias favors either excessive fondness for or excessive opposition to a given type of regulation is not difficult. Some argue that there are fundamental reasons that overall outcomes tend to be biased toward bad regulation and excessive regulation.

Irrational pressure for a bad regulation is often transient as is the case with attention cascades. Inertia in the political system helps limit the effects of psychological biases on future policies. This implies a benefit to constitutional limitations such as separation of powers, irrevocable rights, supermajority rules, and default sunset provisions. The psychological attraction approach is not unique in suggesting such rules. More generally, an understanding of how psychology affects the political process can provide new insights into what makes pernicious ideologies successful in spreading. Such awareness can potentially help improve the rationality of political and regulatory decisions.

DISCUSSION QUESTIONS

1. What is the "psychological attraction" approach to accounting rules and disclosure and reporting regulation?
2. How does limited processing power offer a possible explanation for aggregation of accounting information?
3. How might rules for risk disclosure of derivative securities reflect psychological bias?
4. What is the role of the media in driving psychological bias in financial regulation?
5. What is the role of scapegoating and overconfidence in the regulatory response to adverse economic events?
6. How do the salience and visibility of the benefits and costs influence financial regulation?

REFERENCES

Aronson, Elliot, Timothy D. Wilson, and Robin M. Akert. 2006. *Social psychology*. Upper Saddle River, NJ: Pearson-Prentice Hall.

Banerjee, Abhijit V. 1992. A simple model of herd behavior. *Quarterly Journal of Economics* 107:3, 797–817.

Barberis, Nicholas, and Ming Huang. 2008. The loss aversion/narrow framing approach to the equity premium puzzle. In *Handbook of the equity risk premium*, ed. Raj Mehra, 201–228. Amsterdam: North Holland.

Baron, Jonathan. 1998. *Judgment misguided: Intuition and error in public decision making*. New York: Oxford University Press.

Baron, Jonathan. 2001. Confusion of group-interest and self-interest in parochial cooperation on behalf of a group. *Journal of Conflict Resolution* 45:3, 283–296.

Baron, Jonathan. 2009. Cognitive biases in moral judgments that affect political behavior. *Synthese*, forthcoming.

Baron, Jonathan, and Edward J. McCaffery. 2006. Unmasking redistribution (and its absence). In *Behavioral Public Finance*, ed. Edward J. McCaffery and Joel Slemrod, 85–112. New York: Russell Sage Foundation.

Benmelech, Efraim, and Tobias Moskowitz. 2007. The political economy of financial regulation: Evidence from U.S. state usury laws in the 19th century. NBER Working Paper 12851.

Berger, Jonah, and Chip Heath. 2005. Idea habitats: How the prevalence of environmental cues influences the success of ideas. *Cognitive Science* 29:2, 195–221.

Bernard, Victor, and Jacob Thomas. 1989. Post-earnings-announcement drift: Delayed price response or risk premium? *Journal of Accounting Research* 27:Supplement, 1–48.

Bikhchandani, Sushil, David Hirshleifer, and Ivo Welch. 1992. A theory of fads, custom, and cultural change as informational cascades. *Journal of Political Economy* 100:5, 992–1026.

Brenner, Lyle, Derek J. Koehler, and Amos Tversky. 1996. On the evaluation of one-sided evidence. *Journal of Behavioral Decision Making* 9:1, 59–70.

Brewer, Marilyn. 1979. In-group bias in the minimal intergroup situation: A cognitive-motivational analysis. *Psychological Bulletin* 86:2, 307–324.

Camerer, Colin, and Richard Thaler. 1995. Anomalies: Ultimatums, dictators and manners. *Journal of Economic Perspectives* 9:2, 209–19.

Cao, Henry, Bing Han, David Hirshleifer, and Harold Zhang. 2007. Fear of the unknown: Familiarity and economic decisions. Working Paper, Merage School of Business, University of California, Irvine.

Caplan, Bryan. 2001. Rational ignorance versus rational irrationality. *Kyklos* 54:1, 3–26.

Caplan, Bryan. 2007. *The myth of the rational voter: Why democracies choose bad policies*. Princeton, NJ: Princeton University Press.

Chancellor, Edward. 2001. A short history of the bear. Available at http://www.prudentbear.com, Guest Commentary, October 29, page 6.

Chordia, Tarun, David Hirshleifer, and Sonya Lim. 2001. Firm and managerial incentives to manipulate the timing of project resolution. Working Paper, Merage School of Business, University of California, Irvine.

Daniel, Kent, David Hirshleifer, and Siew Hong Teoh. 2002. Investor psychology in capital markets: Evidence and policy implications. *Journal of Monetary Economics* 49:1, 139–209.

Dawkins, Richard. 1989. *The selfish gene*. Oxford: Oxford University Press.

Del Guercio, Diane. 1996. The distorting effect of the prudent-man laws on institutional equity investments. *Journal of Financial Economics* 40:1, 31–62.

Downs, Anthony. 1957. *An economic theory of democracy*. New York: Harper.

Frank, Robert H. 1988. *Passions within reason*. New York: Norton.

Guiso, Luigi, Paolo Sapienza, and Luigi Zingales. 2009. Cultural biases in economic exchange. *Quarterly Journal of Economics*, forthcoming.

Hakkio, Craig S. 1994. Should we throw sand in the gears of financial markets? *Federal Reserve Bank of Kansas City—Economic Review*, Second Quarter II, 17–30.

Hamilton, William D. 1964. The genetical evolution of social behaviour I and II. *Journal of Theoretical Biology* 7:1, 1–52.

Hayek, Friedrich A. 1978. *Law, legislation and liberty, Volume 1: Rules and order*. Chicago: University of Chicago Press.

Hayek, Friedrich. 1988. *The fatal conceit: The errors of socialism*. Chicago: University of Chicago Press.

Heath, Chip, Chris Bell, and Emily Sternberg. 2001. Emotional selection in memes: The case of urban legends. *Journal of Personality and Social Psychology* 81:6, 1028–1041.

Hirshleifer, David. 2001. Investor psychology and asset pricing. *Journal of Finance* 56:4, 1533–1597.

Hirshleifer, David. 2008. Psychological bias as a driver of financial regulation. *European Financial Management* 14:5, 856–874.

Hirshleifer, David, and Siew Hong Teoh. 2009. The psychological attraction approach to accounting and disclosure policy. *Contemporary Accounting Research*, forthcoming.

Hirshleifer, Jack. 1971. The private and social value of information and the reward to inventive activity. *American Economic Review* 61:4, 561–574.

Hirshleifer, Jack. 1987. On the emotions as guarantors of threats and promises. In *The latest on the best*. ed. John Dupré, Cambridge, MA: MIT Press.

Hodder, Leslie, Lisa Koonce, and Mary McAnally. 2001. SEC market risk disclosures: Implications for judgment and decision making. *Accounting Horizons* 15:1, 49–70.

Hoffer, Eric. 1963. *The ordeal of change*. New York: Harper and Row.

Hoffman, Elizabeth, Kevin McCabe, and Vernon Smith. 1996. On expectations and the monetary stakes in ultimatum games. *International Journal of Game Theory* 25:3, 289–301.

Huberman, Gur. 2001. Familiarity breeds investment. *Review of Financial Studies* 14:3, 659–680.

Jolls, Christina, Cass R. Sunstein, and Richard Thaler. 1998. A behavioral approach to law and economics. *Stanford Law Review* 50-5, 1471–1550.

Kachelmeier, Steven, and Ron King. 2002. Using laboratory experiments to evaluate accounting policy issues. *Accounting Horizons* 16:3, 219–232.

Kahneman, Daniel. 2003. Maps of bounded rationality: Psychology for behavioral economics. *American Economic Review* 93:5, 1449–1475.

Kahneman, Daniel, and Amos Tversky. 1979. Prospect theory: An analysis of decision under risk. *Econometrica* 47:2, 263–291.

Klapper, Leora, and Rida Zaidi. 2005. A survey of government regulation and intervention in financial markets. In *World development report 2005: A better investment climate for everyone*, ed. Warrick Smith. Washington, D.C.: World Bank.

Koonce, Lisa, Mary McAnally, and Molly Mercer. 2005. How do investors judge the risk of financial and derivative instruments? *Accounting Review* 80:1, 221–241.

Kroszner, Randall S., and Thomas Stratmann. 1998. Interest group competition and the organization of Congress: Theory and evidence from financial services' political action committees. *American Economic Review* 88:5, 1163–1187.

Kuran, Timur. 1995. *Private truths, public lies: The social consequences of preference falsification*. Cambridge: Harvard University Press.

Kuran, Timur, and Cass Sunstein. 1999. Availability cascades and risk regulation. *Stanford Law Review* 51-4, 683–768.

Massa, Massimo, and Andrei Simonov. 2006. Hedging, familiarity and portfolio choice. *Review of Financial Studies* 19:2, 633–685.

McAdams, Richard H., and Eric Rasmusen. 2007. Norms in law and economics. In *Handbook of law and economics* 2:2, ed. A. Mitchell Polinsky and Steven Shavell, 1573–1618. North Holland: Elsevier.

McCaffery, Edward, and Jonathan Baron. 2006. Isolation effects and the neglect of indirect effects of fiscal policies. *Journal of Behavioral Decision Making* 19:4, 289–302.
McCaffery, Edward and Joel Slemrod. 2006. *Behavioral public finance: Toward a new agenda*. New York: Russell Sage Foundation.
Mcnollgast, 2007. The political economy of law. In *Handbook of law and economics* 2:2, ed. A. Mitchell Polinsky and Steven Shavell, 1651–1738. North Holland: Elsevier.
Murphy, Kevin M., and Andrei Shleifer. 2004. Persuasion in politics. *American Economic Review* 94:2, 435–9.
Nesse, Randolph M. 2001. The evolution of subjective commitment. In *Evolution and the capacity for commitment*, ed. Randolph M. Nesse, 1–44. New York: Russell Sage Press.
Nisbett, Richard E., and Lee Ross. 1980. *Human inference: Strategies and shortcomings of social judgment*. Englewood Cliffs, NJ: Prentice-Hall.
Pipes, Daniel. 1997. *Conspiracy: How the paranoid style flourishes and where it comes from*. New York: Free Press.
Rajan, Raghuram G., and Luigi Zingales. 2003. The great reversals: The politics of financial development in the 20th century. *Journal of Financial Economics* 69:1, 5–50.
Richardson, Scott, Siew Hong Teoh, and Peter Wysocki. 2004. The walk-down to beatable analyst forecasts: The role of equity issuance and insider trading incentives. *Contemporary Accounting Research* 21:4, 885–924.
Ritov, Ilana, and Jonathan Baron. 1990. Reluctance to vaccinate: Omission bias and ambiguity. *Journal of Behavioral Decision Making* 3:4, 263–277.
Rubin, Paul H. 2002. *The evolutionary origin of freedom*. New Brunswick, NJ: Rutgers University Press.
Schwartz-Shea, Peregrine, and Randy T. Simmons. 1991. Egoism, parochialism, and universalism. *Rationality and Society* 3:1, 106–132.
Sears, David O., and Carolyn. L. Funk. 1991. The role of self-interest in social and political attitudes. *Advances in Experimental Social Psychology* 24-1, 1–81.
Shleifer, Andrei. 2005. Understanding regulation. *European Financial Management* 11:4, 439–451.
Sloan, Richard. 1996. Do stock prices fully reflect information in accruals and cash flows about future earnings? *Accounting Review* 71:3, 289–315.
Small, Deborah A., and George Loewenstein. 2003. Helping *a* victim or helping *the* victim: Altruism and identifiability. *Journal of Risk and Uncertainty* 26:1, 5–16.
Smith, Adam. 1776. *The wealth of nations*. London: W. Strahan and T. Cadell.
Southern, Richard W. 1968. Aquinas, Thomas. In *The International Encyclopedia of the Social Sciences*, ed. David L. Sills, Volume 1, 374–377. New York: Crowell Collier and Macmillan.
Stiglitz, Joseph E. 1989. Using tax policy to curb speculative short-term trading. *Journal of Financial Services Research* 3:2-3, 101–115.
Summers, Lawrence H., and Victoria P. Summers. 1989. When financial markets work too well: A cautious case for a securities transactions tax. *Journal of Financial Services Research* 3:2-3, 261–296.
Sunstein, Cass R., and Richard H. Thaler. 2003. Libertarian paternalism is not an oxymoron. *University of Chicago Law Review* 70:4, 1159–1202.
Taylor, Daniel M., and Janet R. Doria. 1981. Self-serving bias and group-serving bias in attribution, *Journal of Social Psychology* 113-2, 201–211.
Teoh, Siew Hong, Ivo Welch, and T.J. Wong. 1998a. Earnings management and the post-issue performance of seasoned equity offerings. *Journal of Financial Economics* 50:1, 63–99.
Teoh, Siew Hong, Ivo Welch, and T.J. Wong. 1998b. Earnings management and the long-term market performance of initial public offerings. *Journal of Finance* 53:6, 1935–1974.
Thaler, Richard. 1985. Mental accounting and consumer choice. *Marketing Science* 4:3, 199–214.

Thaler, Richard, and Cass R. Sunstein. 2008. *Nudge: Improving decisions about health, wealth, and happiness*. New Haven, CT: Yale University Press.
Trueman, Brett. 1986. The relationship between the level of capital expenditures and firm value. *Journal of Financial and Quantitative Analysis* 21:2, 115–129.
Tversky, Amos, and Daniel Kahneman. 1973. Availability: A heuristic for judging frequency and probability. *Cognitive Psychology* 5:4, 207–232.
Watts, Ross, and Jerald Zimmerman. 1979. The demand for and supply of accounting theories: The market for excuses. *Accounting Review* 54:2, 273–305.
Waymire, Greg, and Sudipta Basu. 2008. Accounting is an evolved economic institution. *Foundations and Trends in Accounting* 2:1-2, 1–174.
Zak, Paul J., Robert Kurzban, and William T. Matzner. 2004. The neurobiology of trust. *Annals of the New York Academy of Sciences* 1032:1, 224–227.

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PART II

Psychological Concepts and Behavioral Biases

CHAPTER 10

Disposition Effect

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INTRODUCTION

Cut your losses and let your profits run! That is one of the most frequent pieces of advice given in stock market trading guides. Among the personal finance and investment advice books published during 2008 alone, 19 contained this or a similar phrase. Cutting losses turned out to be especially good advice in 2008 with the plummeting stock market, but the advice has been equally prevalent in prior years. The adage has its origins in the early days of the stock market. It makes up two-thirds of the three Golden stock market rules used by the British economist David Ricardo (1772–1823), a successful stock broker and trader.

Many investors seem to have difficulty following this advice. Instead, they tend to quickly sell stocks that have appreciated in price since purchase and hold on to losing stocks. Financial economists use the term *disposition effect* for this tendency. The disposition effect is one of the most robust behavioral regularities documented in studies of trading behavior. It imposes substantial costs on investors. First, disposition investors pay more in capital gains taxes than necessary. Suppose an investor needs cash and must sell some stock, but has no information to suggest which of the stocks will be the worst performer going forward. In this case, the investor should liquidate stock in a way that minimizes taxes. This usually means realizing a loss if possible or realizing a combination of gains and losses. A failure to minimize taxes represents a wealth transfer from investors to the rest of society, so non-investors should be happy about the disposition effect. Second, focusing on the purchase price may interfere with rational forward-looking decision making and may result in inferior performance. The disposition effect may thus be harmful even without capital gains taxes.

Even the market as a whole can be affected if investors behave in a similar way regarding their gains and losses. Systematic disposition behavior by many investors can affect trading volume and drive a wedge between market prices and fundamental values. Understanding the disposition effect and when it is most likely to occur is useful in understanding market behavior. This can provide valuable information for financial advisers educating clients and for asset managers developing trading strategies.

This chapter reviews the empirical evidence related to the disposition effect in trading behavior. Most of the research is done in the stock market, but studies

dealing with other assets exist as well. The next section discusses the empirical findings regarding the disposition effect. The implications of the disposition effect are then considered. The causes of the disposition effect are explored next. The last section summarizes the topic.

EMPIRICAL FINDINGS

This section discusses the empirical findings regarding the disposition effect.

The Discovery

Shefrin and Statman (1985) provide the first formal analysis of the disposition effect. In arguing for the existence of the disposition effect, they appeal to the results from an earlier study by Schlarbaum, Lewellen, and Lease (1978). Using stock transaction data from 2,500 individual brokerage firm customers during the period 1964 to 1970, Schlarbaum et al. analyze the realized returns from round-trip trades for these investors by calculating the returns for stocks bought and subsequently sold. They do not consider the performance of stocks that were bought but not sold during the study period. Judging by these realized returns, the individual investors beat the market by 5 percent per year, and about 60 percent of the trades resulted in a profit. This outperformance is not due to market timing and seems not to be due to higher risk. For comparison, other studies such as Sharpe (1966), Gruber (1996), and Fama and French (2010) show that the average mutual fund manager underperforms the market, and even the very best professional investors struggle to obtain a 60 percent success rate. Based on their evidence, Schlarbaum et al. conclude that individual investors possess respectable stock selection skills.

Shefrin and Statman (1985) question this conclusion. They propose that the realized returns come disproportionately from stock picks that turn out to be the successful ones, while the unsuccessful picks remain in the investor's portfolio. Rational, tax conscious investors would realize more losses and avoid realizing gains at least until they receive a long-term tax status, which at the time required a holding period of six months in the United States. Instead, the data of Schlarbaum et al. (1978) show that a 60-40 split of the positive and negative realized returns holds for all categories of round-trip trade duration. In particular, this result is no different for stocks held less than six months versus more than six months.

Shefrin and Statman (1985) also carry out an analysis of aggregate mutual fund purchases and redemptions. They find that more redemptions occur during good stock market months than poor months. Taken together, these facts are consistent with a disposition effect. The main contribution of Shefrin and Statman, however, is to formally present the disposition hypothesis and to suggest a theoretical framework, which will be discussed later. The available evidence itself is inconclusive. Accordingly, in his discussion of Shefrin and Statman's study, Constantinides (1985, p. 791) notes that "[the evidence] rejects neither the rational model nor the behavioral model in favor of the other."

Curiously, Schlarbaum et al. (1978, p. 323) raise the possibility that their investors' seemingly good performance could be due to a "disposition to sell the winners and ride the losers." They nevertheless quickly dismiss this hypothesis and favor the explanation based on stock picking skills. Since then, many studies

have convincingly shown that individual investors do not have great stock picking skills, but significantly underperform (Odean, 1999; Barber and Odean, 2000; Grinblatt and Keloharju, 2000; Barber, Lee, Liu, and Odean, 2009), and that there indeed is a disposition effect (Odean, 1998 and others, discussed in the next section).

Hard Evidence

In addition to the study discussed above (Schlarbaum et al., 1978), the same authors published several other papers using the brokerage customers' trading data in the 1970s. A relatively quiet period of about 20 years in the use of individual investors' transaction data for research purposes followed. This was partly due to the scarcity of such data, but likely also reflected the values of financial economists in the 1980s and early 1990s. Namely, individual investors' behavior was simply deemed uninteresting. Things changed when Terrance Odean obtained a data set containing the transactions of a discount broker's clients in the mid-1990s. First in a series of highly influential articles by Odean and his co-authors using these data, Odean (1998) conducted a scrupulous test of the disposition effect hypothesis. His data contain the stock market investments of 10,000 accounts in a U.S. discount brokerage from 1987 through 1993.

Odean (1998) develops a method for measuring the disposition effect, which several later studies use. In this method, any time a particular investor sells a stock, the researcher records the number of stock positions (different firms in the portfolio) that are (1) sold for a gain, (2) sold for a loss, (3) not sold and showing a gain, and (4) not sold and showing a loss. Odean calculates gains and losses against the stocks' original purchase price. The realized gains (type 1) and losses (2) are actual trades in which the investor makes a realized profit or loss. Stocks that are not sold are so-called paper gains (3) and paper losses (4), also judged against the purchase price, and using the day's closing price as their hypothetical sale price. All four types of stock positions are determinants of the actual development of investors' wealth.

Summing up the realized gains (1) and paper gains (3) gives a total count of gains available for realization. Summing up (2) and (4) gives the corresponding count for losses. The disposition effect predicts that investors realize more gains relative to the number of gains available for realization, and realize fewer of the losses relative to the number of losses available. Comparing the realized gains and losses to the corresponding gain or loss opportunities eliminates the influence of market conditions. For example, in a booming stock market an investor can potentially have many more gains than losses in his portfolio, so seeing more gains realized would not be surprising.

Odean (1998) calculates these figures individually for each investor and then aggregates over all investors and trading days within each month. He uses the aggregate figures in forming the following proportions:

$$\frac{\text{Realized Gains}}{\text{Realized Gains} + \text{Paper Gains}} = \text{Proportion of Gains Realized (PGR)}$$

$$\frac{\text{Realized Losses}}{\text{Realized Losses} + \text{Paper Losses}} = \text{Proportion of Losses Realized (PLR)} \quad (10.1)$$

Significant differences between PGR and PLR indicate that investors are, on average, more willing to realize either gains or losses. Specifically, the disposition effect is demonstrated when PGR is higher than PLR.

Odean (1998) finds strong evidence in favor of the disposition effect. On average, 14.8 percent of the gains available for realization are actually realized (PGR), while only 9.8 percent of the losses are realized (PLR). Investors are thus more than 50 percent more likely to realize gains than losses. Further evidence in support of Shefrin and Statman's (1985) behavioral theory comes from the investigation of seasonal patterns in the disposition effect. Shefrin and Statman's model predicts that the disposition effect should be weaker at the end of the year due to self-control on behalf of investors. The "rational half" of the investor's decision process recognizes that realizing losses can be advantageous for tax purposes. However, the "irrational half" discards the tax considerations, driven by positive thoughts associated with realizing gains and by the avoidance of negative thoughts associated with realizing losses. Investors should find getting rid of loss-making stocks easier as the deadline for the end of the tax year approaches. Indeed, Odean finds that the disposition effect disappears in December when investors realize more losses and fewer gains compared to the rest of the year.

Another key study on the disposition effect is Grinblatt and Keloharju (2001). They use a regression method for assessing the disposition effect. This allows them to control for investor characteristics and market conditions. Different types of investors tend to react to past returns in different ways. Many institutions follow a momentum style: that is, they are more likely to buy stocks with good prior performance (Grinblatt, Titman, and Wermers, 1995; Badrinath and Wahal, 2002), whereas individual investors appear to follow a contrarian style. That is, they are more likely to buy stocks with below-average past performance (Grinblatt and Keloharju, 2000).

Gains and losses are counted similarly to Odean (1998). That is, whenever an investor sells a stock, the other stocks held by the investor are coded as paper sales for that day. Grinblatt and Keloharju (2001) run logit regressions in which the dependent variable is one for sales and zero for paper sales. Independent variables include control variables relating to the stock (e.g., past returns), investor (e.g., portfolio value), calendar time (dummy variables for each month), and market conditions (e.g., market returns). The disposition effect is picked up by a dummy variable taking the value of one for realized and paper losses, and zero otherwise. The data cover all stock market investors in Finland. The results show a strong disposition effect while controlling for many other factors in the analysis.

Weber and Camerer (1998) conduct a laboratory experiment of the disposition effect that involves buying and selling 6 hypothetical stocks in the course of 14 trading rounds. They find that subjects are about 50 percent more likely to realize gains compared to losses. This confirms the results obtained with field data in a controlled environment.

Professional Investors

The study by Grinblatt and Keloharju (2001) finds the disposition effect for all types of investors studied: households, nonfinancial corporations, government institutions, not–for-profit institutions, and financial institutions. Financial institutions

are arguably the most sophisticated of the investor types in their study. The differences in the economic magnitudes of the effect between the investor types are surprisingly small. For all investor types, the odds of selling a stock are roughly half for stocks with moderate losses (less than 30 percent) compared to those with gains. Compared to other investor types, financial institutions appear somewhat more willing to liquidate larger losses (in excess of 30 percent).

Several studies document behavior consistent with the disposition effect among professional futures traders. Heisler (1994) studies a group of small speculators in the Treasury bond futures market and finds that they hold on to losses significantly longer than gains. Locke and Mann (2005) find similar results for 300 professional futures traders at the Chicago Mercantile Exchange. In a study of 426 proprietary Treasury bond futures traders at the Chicago Board of Trade, Coval and Shumway (2005) analyze how the traders' tendency to take risks in the afternoon trading session is related to their performance in the morning and whether this influences market prices. They also conduct a test of trade duration and find that traders who carry a losing position into the afternoon take longer to close the position than those with a winning position. Choe and Eom (2009) use Korean data covering stock index futures transactions of all market participants. They find the disposition effect for all investor types studied, which includes individuals, institutions, and foreign investors.

Barber, Lee, Liu, and Odean (2007) study all trading activity on the Taiwan Stock Exchange (TSE) for the years between 1994 and 1999. In aggregate, investors are about twice as likely to realize a gain rather than a loss. The authors find the disposition effect for individuals, corporations, and dealers, but not for mutual funds and foreign investors. Frazzini (2006) constructs a data set of all U.S. mutual funds' stock holdings for each quarter between 1980 and 2003. The average fund is about 20 percent more likely to realize gains than losses. Sorting the funds based on past returns shows that about a third of the funds (those with lower returns) are 50 percent more likely to realize gains and losses, comparable to the figures obtained with individual investors. Scherbina and Jin (2010) analyze the equity trades by mutual funds following changes in fund management. They find that the new managers tend to sell off the loser stocks in the fund's portfolio. This tendency is strong even after controlling for the trades of other mutual funds without manager changes that hold the same stocks. The funds' performance also improves under the new managers. O'Connell and Teo (2009) do not find any evidence of the disposition effect among large institutions in the foreign exchange markets. On the contrary, these investors are more likely to sell a currency after experiencing losses.

Are Mutual Fund Shares Different?

Calvet, Campbell, and Sodini (2009) use data from households in Sweden, where about 30 percent of all households have both individual stocks and equity mutual funds. They find that people are significantly more likely to exit from the stock market (sell all their stocks) after experiencing gains on their stock portfolio, which is consistent with the disposition effect. The probability of exiting from the mutual fund market is also positively related to the gain on the investor's mutual fund portfolio. The magnitude of the effect is about two-thirds of the corresponding effect for stocks, but the relation is not statistically significant. On the other hand,

the probability of selling mutual funds significantly increases after experiencing losses. Apparently, there is no disposition effect for mutual fund shares.

The results of Ivković and Weisbenner (2009) are also consistent with this conclusion. They find that people are reluctant to sell mutual funds that have appreciated in value and are more willing to sell losing funds, which is consistent with tax motivations. This finding comes from the same brokerage firm data set analyzed by Barber and Odean (2004), who find the disposition effect in the common stock trades of these investors. The sample of households used in the two studies is not entirely identical, however. The data set covers 78,000 households, of which 66,500 hold common stocks (Barber and Odean, 2000). Ivković and Weisbenner report that 32,400 households make at least one mutual fund purchase during the sample period. Based on these figures, most mutual fund investors also appear to hold some common stock, but the converse is not necessarily true. Further, the results of Ivković and Weisbenner are limited to mutual fund purchases in the month of January. Still, the time period and the investor segment analyzed are the same in these two studies, which prompts the following questions: Controlling for investor characteristics, does the disposition effect exist for mutual fund shares? If not, why?

Using the same data set, Bailey, Kumar, and Ng (2009) calculate several measures of behavioral biases for each investor and relate these to behavior regarding mutual fund shares. They find that investors suffering from the disposition effect in their common stock trades are less likely to invest in equity mutual funds. Conditional on investing in mutual funds, disposition investors select funds with higher expenses and time their purchases and sales poorly. These results indicate that mutual fund investors may be, on average, more sophisticated than those who hold only common stocks. Investor heterogeneity may thus explain some of the observed difference in behavior regarding stocks versus mutual fund shares, but it is unlikely to be the whole explanation.

Investor Heterogeneity and Learning

Shapira and Venezia (2001) find disposition effects for both independent stock market investors and those advised by brokers in Israel. The effect is weaker for the advised group. Dhar and Zhu (2006) find that not all investors are prone to the disposition effect. About 20 percent show a reverse disposition effect. In other words, they tend to realize more losses than gains. Among measurable investor characteristics, income, wealth, professional occupation, and investor's age correlate with a diminished tendency for the disposition effect. They also find that investors who trade more frequently are more willing to realize their losses.

Feng and Seasholes (2005) find the disposition effect among Chinese investors. The disposition effect is significantly weaker for investors using multiple channels for placing trades (e.g., Internet and telephone orders), investors who begin their trading career with more than one stock, younger investors, and males. The authors argue that these qualities positively correlate with investor sophistication. Feng and Seasholes also find that trading experience attenuates the disposition effect. In addition, combining the aforementioned investor characteristics with trading experience eliminated the disposition effect. Chen, Kim, Nofsinger, and Rui (2007) also document the disposition effect with Chinese investors and find that it is weaker for institutional investors and individuals with more trading experience. In their study

covering all stock index futures transactions in Korea, Choe and Eom (2009) report that higher trading activity and higher value of trade are associated with a weaker disposition effect, controlling for investor type (institution versus individual).

The studies cited above show that investors clearly differ with regard to the disposition effect and demonstrate its relation to investor characteristics that plausibly correlate with investor sophistication. However, based on this evidence, judging whether investors are learning to avoid the disposition effect is impossible. The results could be due to self-selection; more biased investors may learn that to stop trading altogether is better. This would result in a negative correlation between trading experience and the disposition effect in the data even if the disposition tendency remained constant for each investor. Seru, Shumway, and Stoffman (2010) present evidence showing that such self-selection is an important feature of household trading behavior. Most of the correlation between sophistication and performance is due to self-selection. Some "learning by trading" nevertheless remains, but it is rather slow. For example, 10 years of trading experience reduces the likelihood ratio of realizing gains versus losses by 30 percentage points, after which the median investor would still remain almost twice as likely to realize gains versus losses.

Further Stylized Facts

Ivković, Poterba, and Weisbenner (2005) find the disposition effect for individuals' stock purchases that are initially worth at least $10,000. However, the disposition effect disappears and a capital gains tax lock-in effect starts to dominate when a stock's holding period exceeds a year.

Kumar (2009) investigates stock level determinants of the disposition effect. Individual investors' trading exhibits the disposition effect in most stocks, but for about 20 percent of the stocks it does not exist or is reversed. The disposition effect is stronger for stocks with higher idiosyncratic volatility, lower market capitalization, higher turnover, weaker price momentum, lower institutional ownership, lower prices, and higher bid-ask spreads. Kumar argues that this is consistent with the disposition effect being stronger among stocks that are more difficult to value. Behavioral biases in general should be stronger for such stocks.

Kumar and Lim (2008) find that investors who tend to execute several trades during the same day suffer less from the disposition effect. This result is obtained while controlling for overall trading activity and portfolio size. The authors argue that such investors are more likely to consider what is good for the overall performance of their stock portfolio instead of focusing on each stock separately.

IMPLICATIONS

This section discusses the implications of the disposition effect on financial markets as well as housing markets, and the associated welfare costs.

Trading Volume

Lakonishok and Smidt (1986) compare the turnover of stocks whose prices have increased (winners) with that of stocks whose prices have decreased (losers).

They find that winners generally have higher turnover. However, the volume for losers increases in December. Ferris, Haugen, and Makhija (1988) find some evidence that the historical volume in a particular price range predicts future volume on that price level. However, this result is based on a small sample of stocks with very low market capitalization. Statman, Thorley, and Vorkink (2006) find that the trading volume in a stock has a strong positive relation to past returns on the stock. The findings of these studies are consistent with the disposition effect having an impact on overall trading volume.

Kaustia (2004) conducts a more specific test. He notes that in initial public offerings (IPOs) all investors initially share a common purchase price, namely the offering price for new shares sold at the listing. He tracks the aftermarket price development and trading volume of a group of U.S. IPO stocks with a special feature—the stocks opened trading below their offer price and stayed below the offer price at least for a month. Controlling for various factors that affect trading volume, these stocks generate significantly more trading volume whenever they trade above versus below the offer price. The boost in trading volume is especially strong when the stock price first exceeds the offer price. These findings are difficult to reconcile with anything except a disposition effect in aggregate volume.

Historical maximum and minimum stock prices can also be relevant for the disposition effect. Until this point, the purchase price has been considered to be the relevant metric against which investors judge gains and losses. Investors can also have other benchmarks. Suppose an investor is considering a sale of a stock at a profit, but decides against it. If the price then goes down, the investor might be counting his losses against that hypothetical sale price. Several studies find evidence consistent with this idea. Heath, Huddart, and Lang (1999) discover that employee stock options are exercised substantially more often when new highs in stock prices are attained. Poteshman and Serbin (2003) find similar results for standardized exchange traded stock options. Grinblatt and Keloharju (2001) observe that monthly new stock price highs and lows increase investors' likelihood of selling. Kaustia (2004) finds that IPO stocks experience substantially higher trading volume as they attain new maximum or minimum price levels. Huddart, Lang, and Yetman (2009) find the same result for stocks in general.

Asset Pricing

First documented by Jegadeesh and Titman (1993), return momentum, or the tendency of the prior 3- to 12-month stock returns to continue, is one of the strongest asset pricing anomalies. Grinblatt and Han (2005) show that this momentum effect may be connected to the disposition effect. They present a model with two types of investors: disposition investors and rational traders. Momentum arises from underreaction to new information in the model. Specifically, when many investors have gains on a particular stock, some of them are more eager to sell due to the disposition effect. As positive news hits the market, the price goes up, but the advance is stalled by the selling pressure from the disposition investors. Analogously, consider a stock in which many investors have losses. As negative news hits the market, disposition investors will not sell at a loss and the rate of decrease in the price slows down. Over the longer term, the market price will equal the underlying fundamental value. In the short term, there will be momentum in the direction of

the initial market reaction to the new information. Conversely, there will be no underreaction in a stock if most investors have losses and the new information is positive or when most investors have gains and the new information is negative. In these cases the disposition investors do not have a motive to react against the information. Grinblatt and Han find empirical support for their model, showing that stocks with large aggregate unrealized capital gains have higher returns than stocks with large aggregate unrealized capital losses. Their measure of unrealized gains and losses appears to be the key driver of momentum profits: The classic momentum predictor (past 12-month return) becomes insignificant when unrealized gains and losses are used in forecasting returns.

Frazzini (2006) conducts a specific test of whether there really is underreaction to new information due to the disposition effect. He uses data on mutual funds' stock holding to measure the extent of unrealized gains and losses across stocks. He finds that the markets take longer to incorporate positive earnings news in prices for stocks with unrealized capital gains. More generally, the post–earnings-announcement drift is greater when earnings surprises and unrealized returns have the same sign: that is, both are either positive or both negative. The magnitude of the drift is directly related to the amount of unrealized gains or losses. The market responses are asymmetric, as predicted by the disposition effect. Specifically, stocks with large unrealized gains underreact to positive earnings surprises, but react normally to negative surprises. Similarly, stocks with large unrealized losses underreact to negative earnings news, but react normally to positive surprises.

Goetzmann and Massa (2008) derive additional implications from the Grinblatt and Han (2005) model. They find that a stronger disposition effect is associated with lower returns, smaller trading volume, and less volatility at the stock level. Their evidence is also consistent with the existence of a common disposition effect–related factor. The exposure of a stock to this factor is associated with lower returns.

Clustering of purchase prices could give rise to what technical analysts call resistance and support levels. Technical analysis proposes that the market price should not easily cross these levels, but once it does, a trend would continue in the short term. For example, Brock, Lakonishok, and LeBaron (1992) find some predictability for the Dow Jones Index based on the index reaching new record high or low levels. Osler (2000) identifies resistance and support levels in the foreign exchange market, and Osler (2003) documents clustering in currency stop-loss and take-profit orders. Whether investors can profitably exploit these trading rules is still debatable, as Ready (2002) and other authors show.

The disposition effect can also be a factor in a classical seasonal stock market anomaly called the January effect. Evidence shows that stock returns are, on average, higher in January than in other months. This applies particularly to stocks with negative returns during the previous year. Tax-loss selling rather than window dressing by institutions appears to be driving this phenomenon (Poterba and Weisbenner, 2001; Grinblatt and Moskowitz, 2004). If investors have an inherent aversion to realizing losses, but nevertheless recognize the tax benefits available, this would cause tax-loss harvesting activities to cluster at the year end, rather than occurring throughout the year. Such behavior would be consistent with the asset pricing patterns.

Welfare Costs

The disposition effect increases investors' capital gains taxes. Poterba (1987) documents that about two-thirds of investors realized only gains in their tax returns during the years 1982 and 1983. Based on this information, calculating exactly how much extra taxes these investors paid is impossible. The amount depends on the availability of losses that they could have used to offset some of the gains and whether they could have postponed the sales. In any case, many of these investors probably failed to minimize their taxes.

Barber and Odean (2004) analyze equity trading in normal taxable accounts as well as tax-deferred accounts for clients of a discount broker and a large retail broker, for a total of almost half a million households. The gain and loss realization patterns show a strong disposition effect similar to the one documented in Odean (1998) for both brokerage firms' customers. The results for taxable and tax-deferred accounts are remarkably close throughout the year, except toward the year's end. For taxable accounts the pattern reverses in December when clients of both firms realize more losses than gains. The behavior in tax-deferred accounts does not change in December.

In addition to increasing taxes, the disposition effect may also hurt investors' returns in other ways. There is some degree of momentum in stock returns, and by selling too early the disposition investors would miss these profits. Odean (1998) finds that the losing stocks that investors hold subsequently underperform the winning stocks that they sell by 3.4 percent per year. Seru et al. (2010) find that this adverse effect is greater for investors who are especially prone to the disposition effect. Investors who are free from the disposition bias do not suffer this penalty. Stocks sold for a gain by these investors actually underperform those that could have been sold at a loss.

Heisler (1994) finds that more successful futures traders, as defined by the realized profit per contract traded, are less prone to the disposition effect. Locke and Mann (2005) show that an important success factor for a professional futures trader is the ability to promptly close the open positions. Holding on to a losing position can thus hurt performance. However, Locke and Mann find that holding winning positions open for too long also negatively affects future performance. The tendency of new mutual fund managers to dispose of losing stocks "inherited" from the old manager improves the fund's future performance (Scherbina and Jin, 2008 and 2010). This is consistent with the disposition effect imposing a cost on professional investment management, perhaps through its detrimental effect on the quality of trading decisions.

Seru et al. (2010) find that the disposition effect is a relatively stable individual trait. This observation, combined with investors' slow learning, implies that the disposition effect can have negative long-term consequences. Disposition investors must first become aware of their tendency. Of course, investors could eliminate the disposition effect by selling all marketable assets and investing everything in a bank account. This is hardly the optimal solution, but it is nevertheless a genuine risk for bitter investors who have experienced losses. Investors tend to overweight personal experience (Kaustia and Knüpfer, 2008). The challenge is therefore to correct a behavioral bias without leaving investors with too bad a taste about investing in general.

Real Estate Market

Evidence also shows the presence of the disposition effect in the housing market. This can have important welfare effects. First, housing is an integral component of household wealth, far more significant than stocks for many people. Second, the functioning of the housing market has important spillover effects for the rest of the economy. Third, financial economists generally view the housing market as considerably less efficient than the stock market.

Genesove and Mayer (2001) are the first to document the disposition effect among individual home owners. They find that sellers facing a loss set higher asking prices relative to comparable property, have longer selling times, and are less likely to close a deal. Einiö, Kaustia, and Puttonen (2008) provide further evidence from a larger sample and analyze 79,483 repeat sales in the Finnish (greater Helsinki area) apartment market from 1987 to 2003. Controlling for general real estate market trends as well as area-specific trends, Einiö et al. show that sellers are more than twice as likely to sell an apartment for a gain compared to a loss. A home value that is too low relative to the mortgage balance may prevent selling even if the optimal (unconstrained) decision is to move (Stein, 1995). Genesove and Mayer nevertheless find the aversion to realize losses to be strong even after taking these equity constraints into account. In addition, Einiö et al. find this aversion when the constraint is unlikely to be binding.

The real estate markets exhibit a strong correlation between trading volume and price levels. The disposition effect is probably responsible for much of that correlation. The disposition effect can lead to suboptimal decisions in the housing market and consequently in the labor market. Liquidity in the housing market could dry up in an economic downturn. This could hinder labor mobility when the economy most needs it. In a severe recession such as occurred in the 2007 to 2009 real estate market, a mortgage balance exceeding home equity can have a much stronger lock-in effect, but the disposition effect may be of first-order importance in a milder downturn.

WHAT CAUSES THE DISPOSITION EFFECT?

This section considers the potential causes of the disposition effect.

Shefrin and Statman's Framework

Shefrin and Statman (1985) compose a theoretical framework with four ingredients that underlie the disposition effect. The first ingredient is prospect theory (see Chapters 11 and 12 in this volume for an overview). An investor with preferences given by prospect theory would become more risk-averse after experiencing gains and more risk-seeking after experiencing losses. This means that holding on to the investment becomes more attractive than selling if the value of the investment goes down because the investor is willing to tolerate more risk.

The second ingredient is mental accounting, a concept developed by Thaler (1980, 1985) and Tversky and Kahneman (1981). It describes people's tendency to organize some sources and uses of money in different psychological accounts in their mind. For example, people may treat differently money received as salary

versus money saved on a purchase. This is often harmless. However, as people tend to consider these mental accounts separately, they may occasionally lose sight of what is best for their overall financial well-being. Shefrin and Statman (1985) argue that when investors buy a stock, they create a new mental account for that stock. Investors would then consider the value of each stock separately and compare it to the purchase price.

The third ingredient that Shefrin and Statman (1985) propose is regret aversion. Closing a stock position at a loss and thus having to admit a mistake may cause regret over the initial decision to buy the stock. This idea is also related to a motive based on self-justification, which will be discussed later.

The fourth ingredient is self-control. Self-control explains why the disposition effect is weaker at the end of the year. Investors may find getting rid of loss-making stocks easier when faced with explicit self-control mechanisms, such as the end of the tax year.

Rational Explanations

Could there be any rational reason for selling winning stocks and holding on to losing stocks? As previously discussed, the disposition effect not only causes many investors to pay more taxes but also may degrade investment performance even without considering taxes. The disposition effect could be justified if it brought some benefit or if avoiding it entailed some costs.

Given the fixed nature of some trading costs, proportional costs decrease as the value of the investment grows. More valuable stock positions are likely those that have appreciated since purchase. Transaction cost considerations could thus prompt investors to trade appreciated stocks. However, Odean (1998) does not find evidence in support of this hypothesis. Transaction costs should be particularly high for stocks with low nominal prices, but the disposition effect is not consistently stronger for these stocks.

Portfolio rebalancing is another rationale to trade that could explain a tendency to realize gains (Lakonishok and Smidt, 1986). An investor who is committed to maintaining portfolio weights of individual securities within some limits must sell some of the stock if its weight exceeds those limits. Correspondingly, the investor may buy more of the stock that has depreciated. Odean (1998) argues that partial sales (i.e., not selling the entire position in a stock) should be more likely motivated by rebalancing. Excluding partial sales, Odean still finds essentially the same results; investors realize gains much more than losses. To carry out portfolio rebalancing one must also purchase stocks, so sales that are not followed by any purchases are less likely to be due to rebalancing. Odean eliminates sales from investors who do not purchase anything in the following three weeks and still finds the disposition effect. These findings do not support the rebalancing hypothesis.

This discussion on rebalancing also ignores taxes. In the presence of capital gains taxes, rebalancing and minimizing taxes are conflicting objectives. Assuming both zero transaction and short selling costs, Constantinides (1983) shows that the optimal strategy is to realize all losses as they occur and defer all capital gains. When there are short-selling restrictions, Dammon, Spatt, and Zhang (2001) show that the optimal decision is to realize some gains and still realize all losses. This means

that explaining the disposition effect is difficult using the portfolio rebalancing argument when considering taxes.

To reap the full benefits of loss realization, one must be able to repurchase sold assets. The tax code may put limits on this activity. For example, in the United States the so-called wash-sale rule prohibits investors from repurchasing substantially identical securities for 30 days after the sale. With a wash-sale rule, the rational response is no longer to realize losses immediately because there is a tradeoff between receiving a tax rebate and not decreasing the equity exposure too much (Jensen and Marekwica, 2009). While having a wash-sale rule provides a motive to hold on to some losses, it generally does not lead to realizing gains.

Certain types of stock return expectations could also give rise to the disposition effect. People may believe in mean-reverting returns and hence judge the expected return to be better for investments that have fallen (Andreassen 1988; Odean 1998). An investor who is acting on mean-reversion would tend to sell stocks with paper losses if the stocks have been performing well. Correspondingly, the mean-reversion investor would hold on to stocks with paper gains if they have been performing poorly. This would produce a reversed disposition effect for these stocks. However, Kaustia (2010) finds that this is not the case. He shows that in contrast to the mean-reversion hypothesis, recent appreciation actually decreases selling for loss-making positions.

Finally, investors could buy stocks based on private information and sell them once the market incorporates this information into prices (Lakonishok and Smidt, 1986). This strategy would result in trading patterns similar to the disposition effect. However, this hypothesis is not consistent with the fact that the disposition effect is prevalent among individual investors who do not possess valuable private information, and is stronger for the least sophisticated investors. Kaustia (2010) also reports further evidence inconsistent with this hypothesis. In sum, the disposition effect remains difficult to explain rationally, at least with standard assumptions about investors' preferences.

Prospect Theory

Studies on the disposition effect typically refer to Kahneman and Tversky's (1979) prospect theory (see Chapters 11 and 12 in this volume for an overview) as the underlying cause of the disposition effect. Prospect theory implies the use of a reference point against which investors would code their gains and losses. The converse is not true. Reference points can also be relevant outside the context of prospect theory. An investor with prospect theory preferences becomes more risk averse after experiencing gains and risk seeking after experiencing losses. This change in risk perception may cause the disposition effect.

Barberis and Xiong (2009) and Kaustia (2010) investigate this argument more thoroughly and find that it does not so easily lend itself to the disposition effect. According to Kaustia, prospect theory can predict holding on to losses but it also predicts holding on to gains. So the likelihood of a sale occurring should actually decrease as the stock moves away from the purchase price in either direction. Kaustia's empirical results, on the other hand, show that the propensity to sell a stock does not decline as gains or losses increase. Rather, the propensity to

sell a stock is increased or constant in the domain of gains and quite insensitive to return over wide segments of losses. There is a jump in the propensity to sell exactly at zero profit. This pattern is not predicted by reasonable parameterizations of prospect theory. Barberis and Xiong show in a multi-period model that prospect theory faces great difficulty in predicting the ratios of realized gains and losses found in empirical studies. They propose a new theory in which investors derive prospect theory utility only from realized gains and losses and ignore paper gains and losses. Barberis and Xiong find that this specification more readily predicts the disposition effect.

Self-Justification

Selling a stock at a loss may be unpleasant for investors due to admitting an error. A psychological theory of cognitive dissonance says that a discrepancy between one's actions and attitudes creates discomfort, and changing an attitude involves psychological costs (Festinger, 1957). Applied to the disposition effect, investors would want to hold on to a positive attitude about their ability to make investment decisions and fit their actions to be consistent with those attitudes. This is easier to do when allowing a little self-deception—judging the value of past investment positions based on realized returns. This mechanism of coping with cognitive dissonance is called self-justification. Some authors have expressed these ideas using slightly different terminology (Shefrin and Statman, 1985; Hirshleifer, 2001). Barber et al. (2007, p. 425) remark: "For some investors, the tendency to hold losers may be driven on a more basic level than probabilities of gains and losses. We live in a world in which most decisions are judged ex post and most people find it psychologically painful to acknowledge their mistakes." The new model proposed by Barberis and Xiong (2009) assumes that investors derive utility only from realized profits, which also fits the idea of self-justification.

The findings in the existing literature are consistent with self-justification and some facts are hard to reconcile with other hypotheses. For example, consider Weber and Camerer's (1998) laboratory experiment. This experiment allowed one group of subjects to trade freely at all times, but required the second group of subjects to automatically sell all stocks at the end of each trading round. The subjects in this automatic selling condition were then freely allowed to buy back all the shares they wanted. Because transaction costs were zero, standard economic theory predicts no difference in the behavior of the two groups. Weber and Camerer nevertheless found a significant difference. The subjects without automatic selling executed 69 percent of their sale orders after the share price had just increased. For the subjects with automatic selling, only 54 percent of net sales occurred after a price increase. With automatic selling, the subjects would have had to actively repurchase the losing stocks to make their portfolio holdings similar to the free trading group. They did some of that, but far less than the amounts required to bring their portfolios in line with the free trading group. Weber and Camerer (p. 177) conclude: "It appears that while subjects are reluctant to have their hopes of getting their money back extinguished, they are especially reluctant to blow out the flame of hope with their own breath."

The results on mutual fund shares permit an interesting interpretation in terms of self-justification. The available evidence for mutual fund shares, though limited

in scope compared to that for common stocks, does not show a disposition effect. Self-justification involves escaping the personal responsibility of a poor investment outcome. In the case of mutual funds, this may be more easily accomplished by blaming the mutual fund manager for the losses. This would allow liquidating the shares without suffering a blow to self-image.

SUMMARY AND CONCLUSIONS

The disposition effect, which is a tendency to realize gains and defer the realization of losses, increases the capital gains taxes that investors pay and reduces returns even before taxes. This effect underlies patterns in market trading volume, contributing to, for example, the positive correlation between housing market liquidity and price levels. The disposition effect plays a part in stock market underreactions, leading to price momentum.

Researchers have documented many stylized facts about the disposition effect, of which the following four seem most robust. First, individual investors have a consistent tendency to realize about 50 percent more gains compared to losses in January through November. Second, this pattern disappears or reverses for the month of December (near the end of the tax year). Third, there is a substantial increase in the tendency to realize even very small gains compared to small losses. Fourth, heterogeneity exists among investors, and the disposition effect is weaker for more sophisticated investors. A successful theoretical model for the disposition effect should account for these key patterns.

Focusing on realized returns instead of total portfolio returns can give a false impression of investment performance. The disposition effect may help explain why investors are overly optimistic about their future performance (Barber and Odean, 2001), but do not appear to know their actual historical performance (Goetzmann and Peles, 1997; Glaser and Weber, 2007). Investors may be judging their performance based on realized profits. The causality, however, is complex. The realized returns may be better than portfolio returns precisely because investors want to have an overly optimistic picture of their investment performance and realizing more gains allows them to achieve this self-justification.

What are the implications for financial advice? People sometimes need comforting when their investments have gone bad. They can try to comfort themselves by projecting the actual loss in the values of their holdings as "only a paper loss." Should they do this? Some argue that acknowledging the facts is the first step in the process of making rational decisions. In most situations a paper loss is as real as a realized loss in economic terms. On the other hand, holding onto losses could be likened to perseverance, which is considered to be a virtue in investing. As discussed at the beginning of this chapter, the advice "cut your losses and let your profits run" is meant to help people engage in disciplined investment management. But what if investors have not cut their losses in time? "It's only a paper loss—it'll come back" could perhaps then be the appropriate advice? However, even if losing investments sometimes do come back, that reliance represents buying comfort at the cost of interfering with realistic expectations and a neutral forward-looking approach to investing. That will increase the chances of making bad decisions.

DISCUSSION QUESTIONS

1. Why is the disposition effect harmful to investors?
2. Explain how the disposition effect can lead to momentum in stock prices.
3. Should investors' performance be judged based on the returns realized on their asset sales? Why or why not?

REFERENCES

Andreassen, Paul. 1988. Explaining the price-volume relationship: The difference between price changes and changing prices. *Organizational Behavior and Human Decision Processes* 41:3, 371–389.

Badrinath, Swaminathan G., and Sunil Wahal. 2002. Momentum trading by institutions. *Journal of Finance* 57:6, 2449–2478.

Bailey, Warren, Alok Kumar, and David Ng. 2009. Behavioral biases and mutual fund clienteles. Working paper, Cornell University.

Barber, Brad M., and Terrance Odean. 2000. Trading is hazardous to your wealth: The common stock investment performance of individual investors. *Journal of Finance* 55:2, 773–806.

Barber, Brad M., and Terrance Odean. 2001. Boys will be boys: Gender, overconfidence, and common stock investment. *Quarterly Journal of Economics* 141:1, 261–292.

Barber, Brad M., and Terrance Odean. 2004. Are individual investors tax savvy? Evidence from retail and discount brokerage accounts. *Journal of Public Economics* 88:1-2, 419–442.

Barber, Brad M., Yi-Tsung Lee, Yu-Jane Liu, and Terrance Odean. 2007. Is the aggregate investor reluctant to realise losses? Evidence from Taiwan. *European Financial Management* 13:3, 423–447.

Barber, Brad M., Yi-Tsung Lee, Yu-Jane Liu, and Terrance Odean. 2009. Just how much do individual investors lose by trading? *Review of Financial Studies* 22:2, 609–632.

Barberis, Nicholas, and Wei Xiong. 2009. What drives the disposition effect? An analysis of a long-standing preference-based explanation. *Journal of Finance* 64:2, 751–784.

Brock, William, Josef Lakonishok, and Blake LeBaron. 1992. Simple technical trading rules and the stochastic properties of stock returns. *Journal of Finance* 47:5, 1731–1764.

Calvet, Laurent E., John Y. Campbell, and Paolo Sodini. 2009. Fight or flight? Portfolio rebalancing by individual investors. *Quarterly Journal of Economics* 124:1, 301–348.

Chen, Gongmeng, Kenneth A. Kim, John R. Nofsinger, and Oliver M. Rui. 2007. Trading performance, disposition effect, overconfidence, representativeness bias, and experience of emerging market investors. *Journal of Behavioral Decision Making* 20:4, 425–451.

Choe, Hyuk, and Yunsung Eom. 2009. The disposition effect and investment performance in the futures market. *Journal of Futures Markets* 29:6, 496–522.

Constantinides, George. 1983. Capital market equilibrium with personal taxes. *Econometrica.* 51:3, 611–636.

Constantinides, George. 1985. Discussion of Shefrin and Statman. *Journal of Finance* 40:3, 791–792.

Coval, Joshua D., and Tyler Shumway. 2005. Do behavioral biases affect prices? *Journal of Finance* 60:1, 1–34.

Dammon, Robert M., Chester S. Spatt, and Harold H. Zhang. 2001. Optimal consumption and investment with capital gains taxes. *Review of Financial Studies* 14:3, 583–616.

Dhar, Ravi, and Ning Zhu. 2006. Up close and personal? An individual level analysis of the disposition effect. *Management Science* 52:5, 726–740.

Einiö, Mikko, Markku Kaustia, and Vesa Puttonen. 2008. Price setting and the reluctance to realize losses in apartment markets. *Journal of Economic Psychology* 29:1, 19–34.

Fama, Eugene F., and Kenneth R. French. 2010. Luck versus skill in the cross section of mutual fund returns. *Journal of Finance*, forthcoming.

Feng, Lei, and Mark Seasholes. 2005. Do investor sophistication and trading experience eliminate behavioral biases in financial markets? *Review of Finance* 9:3, 305–351.

Ferris, Stephen, Robert A. Haugen, and Anil K. Makhija. 1988. Predicting contemporary volume with historic volume at differential price levels: Evidence supporting the disposition effect. *Journal of Finance* 43:3, 677–697.

Festinger, Leon. 1957. *A theory of cognitive dissonance*. Stanford, CA: Stanford University Press.

Frazzini, Andrea. 2006. The disposition effect and under-reaction to news. *Journal of Finance* 61:4, 2017–2046.

Genesove, David, and Christopher Mayer. 2001. Loss aversion and seller behavior: Evidence from the housing market. *Quarterly Journal of Economics* 116:4, 1233–1260.

Glaser, Markus, and Martin Weber. 2007. Why inexperienced investors do not learn: They do not know their past portfolio performance. *Finance Research Letters* 4:4, 203–216.

Goetzmann, William N., and Massimo Massa. 2008. Disposition matters: Volume, volatility and price impact of a behavioral bias. *Journal of Portfolio Management* 34:2, 103–125.

Goetzmann, William N., and Nadav Peles. 1997. Cognitive dissonance and mutual fund investors. *Journal of Financial Research* 20:2, 145–158.

Grinblatt, Mark, and Bing Han. 2005. Prospect theory, mental accounting, and momentum. *Journal of Financial Economics* 78:2, 311–339.

Grinblatt, Mark, and Matti Keloharju. 2000. The investment behavior and performance of various investor types: A study of Finland's unique data set. *Journal of Financial Economics* 55:1, 43–67.

Grinblatt, Mark, and Matti Keloharju. 2001. What makes investors trade? *Journal of Finance* 56:2, 589–616.

Grinblatt, Mark, and Tobias J. Moskowitz. 2004. Predicting stock price movements from past returns: The role of consistency and tax-loss selling. *Journal of Financial Economics* 71:3, 541–579.

Grinblatt, Mark, Sheridan Titman, and Russ Wermers. 1995. Momentum investment strategies, portfolio performance and herding. *American Economic Review* 85:5, 1088–1105.

Gruber, Martin J. 1996. Another puzzle: The growth in actively managed mutual funds. *Journal of Finance* 51:3, 783–810.

Heath, Chip, Steven Huddart, and Mark Lang. 1999. Psychological factors and stock option exercise. *Quarterly Journal of Economics* 114:2, 601–627.

Heisler, Jeffrey. 1994. Loss aversion in a futures market: An empirical test. *Review of Futures Markets* 13:3, 793–822.

Hirshleifer, David. 2001. Investor psychology and asset pricing. *Journal of Finance* 56:4, 1533–1597.

Huddart, Steven, Mark Lang, and Michelle Yetman. 2009. Volume and price patterns around a stock's 52-week highs and lows: Theory and evidence. *Management Science* 55:1, 16–31.

Ivković, Zoran, and Scott Weisbenner. 2009. Individual investor mutual fund flows. *Journal of Financial Economics* 92:2, 223–237.

Ivković, Zoran, James Poterba, and Scott Weisbenner. 2005. Tax-motivated trading by individual investors. *American Economic Review* 95:5, 1605–1630.

Jegadeesh, Narasimhan, and Sheridan Titman. 1993. Returns to buying winners and selling losers: Implications for stock market efficiency. *Journal of Finance* 48:1, 65–91.

Jensen, Bjarne Astrup, and Marcel Marekwica. 2009. Optimal portfolio choice with wash sale constraints. Working Paper, Copenhagen Business School, Department of Finance.

Kahneman, Daniel, and Amos Tversky. 1979. Prospect theory: An analysis of decision under risk. *Econometrica* 47:2, 263–291.

Kaustia, Markku. 2004. Market-wide impact of the disposition effect: Evidence from IPO trading volume. *Journal of Financial Markets* 7:2, 207–235.
Kaustia, Markku. 2010. Prospect theory and the disposition effect. *Journal of Financial and Quantitative Analysis*, forthcoming (June issue).
Kaustia, Markku, and Samuli Knüpfer. 2008. Do investors overweight personal experience? Evidence from IPO subscriptions. *Journal of Finance* 63:6, 2679–2702.
Kumar, Alok. 2009. Hard-to-value stocks, behavioral biases, and informed trading. *Journal of Financial and Quantitative Analysis*, 44:6, 1375–1401.
Kumar, Alok, and Sonya S. Lim. 2008. How do decision frames influence the stock investment decisions of individual investors? *Management Science* 54:6, 1052–1064.
Lakonishok, Josef, and Seymour Smidt. 1986. Volume for winners and losers: Taxation and other motives for stock trading. *Journal of Finance* 41:4, 951–974.
Locke, Peter R., and Steven C. Mann. 2005. Professional trader discipline and trade disposition. *Journal of Financial Economics* 76:2, 401–444.
O'Connell, Paul G. J., and Melvyn Teo. 2009. Institutional investors, past performance, and dynamic loss aversion. *Journal of Financial and Quantitative Analysis* 44:1, 155–188.
Odean, Terrance. 1998. Are investors reluctant to realize their losses? *Journal of Finance* 53:5, 1775–1798.
Odean, Terrance. 1999. Do investors trade too much? *American Economic Review* 89:5, 1279–1298.
Osler, Carol. 2000. Support for resistance: Technical analysis and intraday exchange rates. *Federal Reserve Bank of New York Economic Policy Review*, July, 53–68.
Osler, Carol. 2003. Currency orders and exchange-rate dynamics: Explaining the success of technical analysis. *Journal of Finance* 58:5, 1791–1819.
Poterba, James M. 1987. How burdensome are capital gains taxes? Evidence from the United States. *Journal of Public Economics* 33:2, 157–172.
Poterba, James M., and Scott Weisbenner. 2001. Capital gains tax rules, tax-loss trading, and turn-of-the-year returns. *Journal of Finance* 56:1, 353–368.
Poteshman, Allen M., and Vitaly Serbin. 2003. Clearly irrational financial market behavior: Evidence from the early exercise of exchange traded stock options. *Journal of Finance* 58:1, 37–70.
Ready, Mark J. 2002. Profits from technical trading rules. *Financial Management* 31:3, 43–61.
Scherbina, Anna, and Li Jin. 2010. Inheriting losers. *Review of Financial Studies*, forthcoming.
Scherbina, Anna, and Li Jin. 2008. Inheriting Losers. Working Paper, Harvard Business School and University of California, Davis.
Schlarbaum, Gary G., Wilber G. Lewellen, and Ronald C. Lease. 1978. Realized returns on common stock investments: The experience of individual investors. *Journal of Business* 51:2, 299–325.
Seru, Amit, Tyler Shumway, and Noah Stoffman. 2010. Learning by trading. *Review of Financial Studies* 23:2, 705–739.
Shapira, Zur, and Itzhak Venezia. 2001. Patterns of behavior of professionally managed and independent investors. *Journal of Banking and Finance* 25:8, 1573–1587.
Sharpe, William F. 1966. Mutual fund performance. *Journal of Business* 39:1(Part 2), 119–138.
Shefrin, Hersh, and Meir Statman. 1985. The disposition to sell winners too early and ride losers too long. *Journal of Finance* 40:3, 777–790.
Statman, Meir, Steven Thorley, and Keith Vorkink. 2006. Investor overconfidence and trading volume. *Review of Financial Studies*, 19:4, 1531–1565.
Stein, Jeremy C. 1995. Prices and trading volume in the housing market: A model with down-payment effects. *Quarterly Journal of Economics* 110:2, 379–406.
Thaler, Richard H. 1980. Toward a positive theory of consumer choice. *Journal of Economic Behavior and Organization* 1:1, 39–60.

Thaler, Richard H. 1985. Mental accounting and consumer choice. *Marketing Science* 4:3, 199–214.

Tversky, Amos, and Daniel Kahneman. 1981. The framing of decisions and the psychology of choice. *Science* 211:4481, 453–458.

Weber, Martin, and Colin F. Camerer. 1998. The disposition effect in securities trading: An experimental analysis. *Journal of Economic Behavior and Organization* 33:2, 167–184.

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CHAPTER 11

Prospect Theory and Behavioral Finance

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INTRODUCTION

Behavioral finance has become increasingly important to the discourse on corporate finance, investments, the stock market, and the efficiency of financial markets. Prospect theory, developed by Kahneman and Tversky (1979) and Tversky and Kahneman (1974, 1981) was proposed as a best practice alternative to conventional wisdom. Prospect theory is a theory of average behavior. It theorizes how an individual or group of individuals behaves, on average, in a world of uncertainty. A basic premise of behavioral finance is that individual choice behavior systematically deviates from the predictions of conventional wisdom (Fama, 1970, 1991; Shleifer, 2000; Malkiel, 2003). The conventional wisdom is exemplified by the efficient market hypothesis (EMH) and subjective expected utility (SEU) theory. Conventional finance theory assumes that individuals behave in accordance with the stipulation of these theories and, in so doing, act as rational agents. Even if some individuals prefer not to behave in accordance with standard theory, market forces will compel them to do so. At a minimum, on average, market behavior will map onto the predictions of the conventional wisdom. Thus, the conventional theory should not be simply read as a theory of individual behavior (Malkiel, 2003). Like prospect theory, an important subset of the conventional theory focuses on average, not individual, behavior.

A critical underlying assumption of the conventional wisdom is that economic agents are rational as defined by the normative strictures of the EMH and SEU theory. Other irrational behaviors are ruled out by definition or are assumed to be of trivial analytical importance because they will, in short shrift, be taken care of by market forces. The conventional model is thought to provide the most accurate analytical predictions, thereby validating the model's simplifying assumptions. An important constituency in behavioral finance, of which prospect theory is a critical component, accepts the conventional wisdom's perspective that behavior is irrational or at least suboptimal if it deviates from the ideal behavioral norms specified in the EMH and SEU theory. But behavioral finance scholars argue that

irrational choice behavior is typical and therefore needs to be better described and modeled. When such behavior is modeled appropriately, it yields more accurate analytical predictions (Schwartz, 1998; Shiller, 1999, 2000; Barberis and Thaler, 2003; Kahneman, 2003; Altman, 2004, 2008). Moreover, based upon considerable empirical evidence, behavioral economics maintains that a model's behavioral and institutional assumptions are critical to causal analyses and to the accuracy of its analytical predictions.

At the forefront of behavioral finance, Thaler provides the following definition (Barberis and Thaler, 2003, pp. 1053–1054):

> *. . . a new approach to financial markets . . . has emerged, at least in part, in response to the difficulties faced by the traditional paradigm. In broad terms, it argues that some financial phenomena can be better understood using models in which some agents are* not *fully rational. More specifically, it analyzes what happens when we relax one, or both, of the two tenets that underlie individual rationality. In some behavioral finance models, agents fail to update their beliefs correctly. In other models, agents apply Bayes' law properly but make choices that are normatively questionable, in that they are incompatible with SEU. . . . To make sharp predictions, behavioral models often need to specify the form of agents' irrationality. How exactly do people misapply Bayes law or deviate from SEU? For guidance on this, behavioral economists typically turn to the extensive experimental evidence compiled by cognitive psychologists on the biases that arise when people form* beliefs, *and on people's* preferences, *or on how they make decisions, given their beliefs.*

Thaler elaborates on the still-dominant EMH (Barberis and Thaler, 2003, p. 1054) as follows:

> *In an efficient market, there is "no free lunch": no investment strategy can earn excess risk-adjusted average returns, or average returns greater than are warranted for its risk. Behavioral finance argues that some features of asset prices are most plausibly interpreted as deviations from fundamental value, and that these deviations are brought about by the presence of traders who are not fully rational.*

Of critical importance for Thaler is the pre-eminence of economic behaviors that are not fully rational (not consistent with the prescribed behavioral norms of the conventional wisdom), which generate outcomes in financial markets that deviate substantively from fundamental values.

Prospect theory touches on only a subset of the issues raised in the behavioral finance literature. But its point of focus is a critical one: how individuals evaluate risky gambles or prospects and engage in risky choice behavior. Risky choice behavior is core to participation in financial markets. Some scholars argue that the value of prospect theory is its capacity to better explain the puzzles of human behavior in a world of uncertainty. These puzzles include the preference for certain outcomes (the Allias paradox); the unexpected (from a conventional theoretical perspective) high average rates of returns of stocks relative to bonds, referred to as the equity premium puzzle; overpaying for insurance and engaging in low expected value lotteries; individuals tending to weigh losses more than gains (referred to as loss aversion); the apparent overweighting of small errors (related

to regret theory), which can result in individuals holding on to low-return assets for too long in the hope of a better tomorrow so as to avoid the regret of taking a loss; and the importance of reference points to decision making. The importance of reference points suggests and helps explain herding and cascades in investment behavior (Shiller, 1999; Fromlet, 2001; Zaleskiewicz, 2006).

Prospect theory raises the question of whether individuals in financial markets are irrational as posited by mainstream behavioralists. If so, this irrationality suggests the need to develop policies to induce individuals to behave in a fashion consistent with the conventional wisdom's specification of rational behavior. Such policies often involve tricking people to behave in the desired manner or changing the attitude and preferences of the individual.

Prospect theory points to the possibility that individuals' nonconventional behavior is intelligent and thus rational given the constraints facing the individual. Rational nonconventional behavior might be related to imperfect and asymmetric information and the rules of the game in financial markets. Such unconventional behavior might be consistent with economic efficiency. To such an extent, this suggests changing the constraints that decision makers face to correct the problem, as opposed to changing the behavior of individuals. This direction of behavioral economics is one not yet well traveled by behavioral finance scholars, but might lead to greater payoffs in terms of analysis and public policy than the irrationality perspective. Altering these constraints might be the most reasonable avenue both analytically and empirically. Behavioral finance conveniently allows for significant revisions of finance theory while maintaining important elements of the conventional core, which includes the assumptions that decision makers are intelligent in choice behavior.

Smith (2005) makes a salient point with regard to the relationship between revealed choice behavior and the conventional wisdom. He finds that individuals tend not to behave in a manner consistent with conventional wisdom. Smith maintains that this is not a sign of irrationality in individual choice behavior or in suboptimal behavior. Nonconventional behavior can even result in superior economic results. Smith (pp. 149–150; see also Smith, 2003) writes:

> *It is shown that the investor who chooses to maximize expected profit (discounted total withdrawals) fails in finite time. Moreover, there exist a variety of non-profit-maximizing behaviors that have a positive probability of never failing. In fact it is shown that firms that maximize profits are the least likely to be the market survivors. My point is simple: when experimental results are contrary to standard concepts of rationality, assume not just that people are irrational, but that you may not have the right model of rational behavior. Listen to what your subjects may be trying to tell you. Think of it this way. If you could choose your ancestors, would you want them to be survivalists or to be expected wealth maximizers?*

The rest of this chapter examines the behavioral and institutional assumptions underlying behavioral finance that are specific to prospect theory and that contrast those of traditional finance theory. Particular emphasis is placed on the contrast between prospect theory and SEU theory. Of particular importance to prospect theory is that its simplifying modeling assumptions build upon an understanding of

actual human behavior, providing cogent analytical prediction of choice behavior in financial markets. In addition, the specifics of prospect theory as a substitute for SEU theory are discussed, and positive and normative attributes of prospect theory are detailed. Moreover, prospect theory's capacity to provide answers to key puzzles or anomalies of conventional financial economics choice theory is examined. Finally, the possible implications of prospect theory for public policy are explored.

BEHAVIORAL FINANCE AND BEHAVIORAL ASSUMPTIONS

Prospect theory falls directly within the methodological domain of behavioral economics. Simon's (1959, 1978, 1987a, 1987b) oeuvres contributed fundamentally to the development of behavioral economics. Simon makes the key point that the empirical validity of one's modeling assumptions matters for both the quality of the causal analysis and the predictive power of the hypothesis or model. This does not imply that assumptions should not represent simplification of socio-economic reality. Rather, he argues, the nature of the simplifications is of critical importance. Simon (1987a, p. 221) states:

> *Behavioural economics is concerned with the empirical validity of these neoclassical assumptions about human behaviour and, where they prove invalid, with discovering the empirical laws that describe behaviour correctly and as accurately as possible. As a second item on its agenda, behavioural economics is concerned with drawing out the implications for the operation of the economic system and its institutions and for the public policy, of departures of actual behaviour from the neoclassical assumptions. A third item on its agenda is to supply empirical evidence about the shape and content of the utility function (or of whatever construct will replace it in an empirically valid behavioural theory) so as to strengthen the predictions that can be made about human economic behaviour.*

Also consistent with behavioral economics in general and with Simon in particular is that behavioral finance and prospect theory identify particular assumptions in the conventional wisdom that are found empirically and analytically deficient. Contemporary behavioral finance scholars, exemplified by Barberis and Thaler (2003), echo these views. This critical literature focuses on the form of the utility function, the preference for utility maximization, and the manner in which choices are made among alternatives. The literature also examines not only the extent of knowledge available to decision makers with regard to all relevant available alternatives and the consequences of choices, but also the extent to which such consequences are known with certainty and the extent to which one can attach probability weights to uncertain events. More often than not, risk cannot be measured. As Simon (1987a) points out, the conventional reasoning assumes perfect knowledge, zero cost to the decision-making process, and the ability of individuals to know with certainty or to attach probability weights to the consequence of alternative choices and choice outcomes.

With regard to decision making under uncertainty and measurable risk, the focal point of prospect theory, Simon (1987a) argues that individuals do not have

the physiological capabilities (cognitive limitations) to function in the optimizing, utility-maximizing manner prescribed by the conventional wisdom even if they wanted to. For this reason, smart people adopt alternative decision-making heuristics to engage in choice behavior. Simon writes (1987b):

> *The term "bounded rationality" has been proposed to denote the whole range of limitations on human knowledge and human computation that prevent economic actors in the real world from behaving in ways that approximate the predictions of classical and neoclassical theory: including the absence of a complete and consistent utility function for ordering all possible choices, inability to generate more than a small fraction of the potentially relevant alternatives, and inability to foresee the consequences of choosing alternatives, including inability to assign consistent and realistic probabilities to uncertain future events.*

Finally, the conventional wisdom assumes that institutions provide individuals with accurate, reliable information in a transparent and symmetrical fashion. Thus, individuals can make rational decisions that are utility maximizing (as defined by the conventional wisdom). An assumption of the conventional wisdom is that institutions are in some very substantive sense rational and facilitate both individually and socially rational choice behavior. Prospect theory does not challenge this often implicit conventional wisdom assumption. North (1994, p. 360), a key proponent of the New Institutional Economics, points to a fundamental defect of conventional theory by stating that it assumes that "... not only [are] institutions designed to achieve efficient outcomes, but that they can be ignored in economic analysis because they play no independent role in economic performance." The conventional wisdom naively assumes that institutions facilitating and promoting efficiency will develop by force of circumstance. According to North, economic history clearly demonstrates that institutions that induce economic inefficiency consistent with individual utility-maximizing behavior can persist over time. Institutions that reward utility-maximizing inefficient behavior can be stable. Therefore, institutions make a substantive difference to economic outcomes, even assuming narrowly self-interested utility-maximizing agents. With regard to behavioral economics, Simon (1978) makes the case that one has to model the institutional reality that sets the constraints within which choice behavior takes place and which plays a decisive role in incentivizing choice behavior.

With regard to prospect theory specifically and more generally to behavioral finance, conventional finance theory may fail not because of specific faults with SEU theory per se, but because of the institutional parameters. These parameters can include false and asymmetric information as well as perverse individual incentives (such as moral hazard–related principal-agent problems) that induce inefficient, suboptimal behavior. For example, in a world of asymmetric information, if fund managers bear little or no risk of losing their economic gains from engaging in high-risk investments and can hide such actions from the scrutiny of investors, moral hazard sets in and potentially yields economically inefficient outcomes. All agents can be assumed to be rational given the constraints (including the incentive environment) that they face. Therefore, introducing institutional parameters into the discourse of prospect theory is important.

THE NATURE OF PROSPECT THEORY

Prospect theory is proposed as an alternative to SEU theory as the most appropriate predictive and descriptive theory of choice behavior under risk and uncertainty, with important implications for choice under uncertainty. Kahneman and Tversky (1979) make the point that their theory, as compared to SEU theory, is not normative and does not prescribe behavior at any level. SEU remains the norm for rational choice behavior. Thus, prospect theory does not replace SEU theory as a normative theory. With regard to SEU, Tversky and Kahneman (1974, p. 1130) write:

> *Modern decision theory regards subjective probability as the quantified opinion of an idealized person. Specifically, the subjective probability of a given event is defined by the set of bets about this event that such a person is willing to accept. An internally consistent, or coherent, subjective probability measure can be derived for an individual if his choices among bets satisfy certain principles, that is, the axioms of the theory. The derived probability is subjective in the sense that different individuals are allowed to have different probabilities for the same event. The major contribution of this approach is that it provides a rigorous subjective interpretation of probability that is applicable to unique events and is embedded in a general theory of rational decision.*

Ultimately, individuals make choices that systematically deviate from how the idealized agent would behave. Such behavior is a product of the application of judgmental heuristics that produce cognitive errors. These errors are neither a product of poor incentives nor wishful thinking, and they cannot be overcome by learning. Actual choice behavior persistently deviates from the conventional norm established by SEU theory.

Prospect theory is a representation of the statistical average of individual behaviors. Thus, there will be deviations from the mean. The analytical predictive value of the theory relates only to group behavior, where the group is defined as the statistical average of the outcomes of individual choice behaviors. This statistical group does not imply coordinated behavior among agents. Individual choice behavior can be contrary to prospect theory, but is important to understand as the group (more accurately, the sample) average. This raises the question of the importance of deviant behavior (variations from the mean) for understanding aspects of choice behavior and economic outcomes. For example, a subsample of individuals behaving in a consistently deviant fashion can help explain important aspects of choice behavior, whether or not such behavior is consistent with the conventional wisdom or prospect theory. Nevertheless, the underlying empirics of prospect theory with regard to average choice behavior have been well documented. As Tversky and Kahneman (1981, p. 454) write:

> *Prospect theory and the scales [used in this theory] should be viewed as an approximate, incomplete, and simplified description of the evaluation of risky prospects. Although the properties of v and n summarize a common pattern of choice, they are not universal: the preferences of some individuals are not well described by an S-shaped value function and a consistent set of decision weights.*

SEU theory, predicated on narrow behavioral assumptions, still dominates the literature in spite of the proven failure of its predictive power. Yet, Kahneman and

Tversky's (1979) paper on prospect theory is the second-most-cited paper in the journal *Econometrica*, often serving as the bête noire of mainstream theorists.

Shiller (1999, p. 3), a leading behavioral finance scholar, points out the following:

> *Prospect theory has probably had more impact than any other behavioral theory on economic research. Prospect theory is very influential despite the fact that it is still viewed by much of the economics profession at large as of far less importance than expected utility theory. Among economists, prospect theory has a distinct, though still prominent, second place to expected utility theory for most research. . . . Expected utility theory still retains the position of highest honor in the pantheon of economic tools. It has dominated much economic theory so long because the theory offers a parsimonious representation of truly rational behavior under uncertainty.*

An important outcome of prospect theory is its description of choice behavior where this behavior is often shown to be inconsistent with SEU theory, especially in experimental environments. Thus, individuals are shown to deviate from the ideal normative choice behavior. Prospect theory is therefore said to describe biases and cognitive illusions in human choice behavior where biases are a function of the type of heuristics used. These nonconventional choice behaviors are biased and therefore suboptimal. Prospect theory is the foundation for a variety of descriptive propositions pertaining to so-called persistent biased decision making under risk and uncertainty.

Kahneman and Tversky's (1979) biases and cognitive illusions approach to choice behavior is now the conventional wisdom among a preponderance of behavioral economists. Conventional economists perceive this iteration of behavioral economists to be the essence of their field. Still, the Kahneman and Tversky assumption that the nonconventional behavior mapped out by prospect theory is biased and suboptimal has been challenged, most pre-eminently by Smith (2003, 2005), Todd and Gigerenzer (2003), and Gigerenzer (2007), as well as March (1978) and Altman (2004, 2008). These scholars agree with Kahneman and Tversky's view that typical choice behavior is not what is prescribed by the conventional wisdom.

Apart from being a proposed alternative to SEU theory, Tversky and Kahneman (1979) also regard prospect theory as an alternative to the bounded rationality approach to human decision making put forth by Simon (1978). They consider prospect theory to be more rigorous than either SEU theory or bounded rationality. As discussed above, Simon views a key shortfall of SEU theory and more generally neoclassical theory to be the assumption that human agents have the physiological capacity and the knowledge to behave as the conventional wisdom recommends and predicts. In the absence of such capacity, individuals adopt alternative heuristics (which Simon argues are rational) when engaging in decision making. Simon refers to such decision making as bounded rationality, where the latter is the foundation of behavioral economics. Simon (1987b, p. 226) writes:

> *Theories of bounded rationality can be generated by relaxing one or more of the assumptions of SEU theory. Instead of assuming a fixed set of alternatives among which the decision-maker chooses, we may postulate a process for generating alternatives. Instead of assuming known probability distributions of outcomes, we may introduce estimating procedures*

> *for them, or we may look for strategies for dealing with uncertainty that do not assume knowledge of probabilities. Instead of assuming the maximization of a utility function, we may postulate a satisfying strategy. The particular deviations from the SEU assumptions of global maximization introduced by behaviourally oriented economists are derived from what is known, empirically, about human thought and choice processes, and especially what is known about the limits of human cognitive capacity for discovering alternatives, computing their consequences under certainty or uncertainty, and making comparisons among them.*

Tversky and Kahneman (1981) employ prospect theory to better describe human decision making and to gauge what they consider to be the extent of errors in judgment. In contrast, Simon (1987b) does not equate bounded rationality–type choice behavior with errors in judgment and, therefore, with suboptimal choice behavior. Choice is determined by various constraints, both physiological and environmental. Therefore, choice behavior can be intelligent while not adhering to neoclassical norms. Prospect theory's analytical predictions and analyses are not contingent upon the notion of bounded rationality. Indeed, the latter paradigm does not easily allow for the notion of biases and errors in decision making or, related to this, cognitive illusions. Tversky and Kahneman (1981, p. 458) maintain:

> *Like other intellectual limitations discussed by Simon under the heading of "bounded rationality," the practice of acting on the most readily available frame can sometimes be justified by reference to the mental effort required to explore alternative frames and avoid potential inconsistencies. However, we propose that the details of the phenomena described in this article are better explained by prospect theory and by an analysis of framing than by ad hoc appeals to the notion of cost of thinking.*

Simon (1959, 1978, 1987b) also considers the availability of knowledge and the quality of knowledge to be critical determinants to the decision-making process. Kahneman and Tversky (1979) as well as Tversky and Kahneman (1974, 1981) argue that the emotive and cognitive illusions infrastructure of the human brain is of overriding importance in building a descriptive model of human decision making. This suggests that even if one possessed neoclassical cognitive capacities, choice behavior would be substantively different from what is prescribed and predicted by SEU theory.

Kahneman (2003) argues that a critical component of prospect theory is the introduction of emotive short-term factors as determinants of choice behavior. Also of key importance are short-term states of wealth and standing as well as changes to these variables. Kahneman argues that in SEU theory, emotional factors are screened out of the decision-making process and only long-term outcomes matter, which are based on final states of wealth or standing. This approach to individual rationality follows directly from traditional (conventional) economic perspectives on rationality. According to Kahneman (p. 1457):

> *The cultural norm of reasonable decision-making favors the long-term view over a concern with transient emotions. Indeed, the adoption of a broad perspective and a long-term view is an aspect of the meaning of rationality in everyday language. The final states interpretation of the utility of outcomes is therefore a good fit for a rational-agent model. These considerations support the normative and prescriptive status of the Bernoullian definition of outcomes.*

On the other hand, Kahneman and Tversky (1979) contend that prospect theory builds upon a view of decision making as an actual, if flawed, process, as opposed to an ideal (as specified in SEU theory). This actual process of decision making relates to utility maximization. Moreover, in prospect theory, decision making is not fundamentally related to Simon's bounded rationality and therefore to limitations to physiologically determined computational capacities and limitations to information and knowledge. Even if one assumes rationality to be unbounded, decision making would still be inconsistent with SEU theory. Ultimately, decision making is most markedly affected by emotive, intuitive factors and an individual's relative state of wealth or position. This yields a better description of choice behavior. Prospect theory represents a better descriptive theory than SEU theory, but unlike SEU theory it is not prescriptive or normative. Kahneman (2003, p. 1457) argues that the long-term worldview embedded in SEU theory:

> *. . . may be prescriptively sterile, because the long term is not where life is lived. Utility cannot be divorced from emotion, and emotions are triggered by changes. A theory of choice that completely ignores feelings such as the pain of losses and the regret of mistakes is not only descriptively unrealistic, it also leads to prescriptions that do not maximize the utility of outcomes as they are actually experienced—that is, utility as Bentham conceived it.*

PROSPECT THEORY AND THE CHOICE BEHAVIOR

Although prospect theory captures the importance of psychological variables in choice behavior, as well as the dominance of short-term concerns in choice behavior, Kahneman and Tversky (1979) typically assign the prescriptive face of choice theory to SEU theory. They maintain that a key distinguishing feature between the two theories—both as a description and predictor of choice behavior—is that in SEU theory choices are assumed to be reference-independent, whereas in prospect theory choices are reference-dependent. In prospect theory, utility is determined by individuals' attitudes (related to preference functions) toward gains and losses, which are established relative to a reference point. In other words, utility is affected by changes in a person's state of wealth relative to some reference point. In SEU theory there is no reference point. An individual's state of wealth and subjective valuation of this state of wealth affect utility. In prospect theory, changes in wealth, not the level of wealth at any given point in time, are critical to an individual's utility. Individuals are not modeled as wealth maximizers per se. Other variables become critically important to an individual's decision set such as emotive-psychological variables.

Kahneman (2003, p. 1455) summarizes these points as follows:

> *From the vantage point of a student of perception, it is quite surprising that in standard economic analyses the utility of decision outcomes is assumed to be determined entirely by the final state of endowment, and is therefore reference-independent. In the context of risky choice, this assumption can be traced to the brilliant essay that first defined a theory of expected utility (Daniel Bernoulli, 1738). Bernoulli assumed that states of wealth have a specified utility, and proposed that the decision rule for choice under risk is to maximize the expected utility of wealth (the moral expectation). The language of Bernoulli's essay is prescriptive—it speaks of what is sensible or reasonable to do—but the theory was also intended as a description of the choices of reasonable men. As in most modern treatments of*

> *decision-making, Bernoulli's essay does not acknowledge any tension between prescription and description. The proposition that decision makers evaluate outcomes by the utility of final asset positions has been retained in economic analyses for almost 300 years. This is rather remarkable, because the idea is easily shown to be wrong; I call it Bernoulli's error.*

In an interview with *Forbes* magazine (Ackman, 2002), Kahneman elaborates on his interpretation of Bernoulli's (1738) error and its relationship to choice behavior. He points out that Bernoulli, in his essay on decision making based on the Amsterdam spice trade, examined the outcome of a gamble and the utility of the outcome—introducing expected utility theory. The gamble consisted of investing in a ship and cargo that may or may not be lost at sea. There were substantial profits to be made if the ship succeeded in its venture and substantial losses if it failed. But Bernoulli looked at the utility of the state of wealth that followed from the outcome of the gamble which, Kahneman argues, is not how people think. Rather, individuals think in terms of gains and losses, irrespective of a person's state of wealth. Bernoulli's error consists of analyzing choice theory in terms of final states of wealth. According to Ackman (2002, p. 1), Kahneman provides a contemporary example of this perspective:

> *You have two people, both of whom get their quarterly returns on their stock portfolios. One of them learns his wealth has gone from $1 million to $1.2 million, and the other one learns his wealth has gone down from $4 million to $3.5 million. I can ask you two questions. I can ask you who is happier. There is no question the first one is happier than the second. Then I can ask you who is better off financially. The second one is better off. Bernoulli's analysis was in terms of who is better off financially—basically in terms of wealth. But when people think of the outcomes of their decisions, they think much more short term than that. They think in terms of gains and losses. That was the basic insight [of prospect theory].*

As Ackman notes (2002, p. 1), Kahneman elaborates on this point: "When you think in terms of wealth—the final state—you tend to be much closer to risk-neutral than when you think of gains and losses. That's the fundamental way prospect theory departs from utility theory." Moreover, Kahneman argues that thinking in terms of final states—the Bernoulli way—is more rational. It is more rational than behaving in terms of deviations from a reference point, which is how Kahneman finds individuals typically behave with regard to choice behavior.

The distinctive analytical predictions of prospect theory follow from the shape of what Kahneman and Tversky (1979) refer to as a value function, which is illustrated in Exhibit 11.1. In prospect theory there is a value function characterized by both positive and negative domains. The value function is drawn to reflect changes in states of wealth from some exogenously given (subjective) reference point. In contrast, in SEU theory there is a utility function in only one, the positive domain, where gains and losses are assumed equal with regard to utility. Moreover, individuals are assumed to estimate their utility in terms of states of wealth (additive utility functions), where marginal increases in wealth are subject to diminishing returns. The reference point in SEU theory is given "objectively" at the origin where the state of wealth is zero. As opposed to SEU theory, a kink exists in the value function and, moreover, the slope of the value function is steeper for losses than for gains by a factor of about 2 to 2.5 times. Thus, in prospect theory losses are

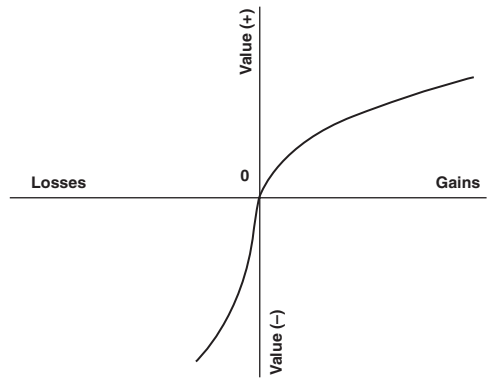

Exhibit 11.1 Kahneman-Tversky Value Function
Note: This figure presents a visual representation of prospect theory and shows an S-shaped value function.

weighed more than gains. Adding a $1 lost and a $1 gain yields a negative value or utility, whereas in SEU theory one would get a value of 0.

Reference points serve to frame the decision parameters. Thus, gains and losses are evaluated both separately (in separate mental accounts) and relatively, as opposed to simultaneously and in terms of absolute values or states of wealth, as in SEU theory. Also in prospect theory, the probability weights of SEU theory attached to prospects are replaced by decision weights that filter, and thus recalibrate, the probabilities of SEU theory. Extremely low probability events are given a weight of 0 whereas extremely high probability events receive a weight of 1. Therefore, individuals use a heuristic that treats extreme events symmetrically such that the very low probability events are assumed to be impossible and the extremely high probability events are assumed to be certain. On the other hand, individuals overweigh low-probability events (individuals exaggerate the extent to which such an event will take place) but underweigh moderate- and high-probability events. When prospects are uncertain, individuals underestimate the extent to which a prospect will occur. Overall, in SEU theory, rational agents should choose prospects that maximize expected utility as opposed to expected value.

In SEU theory, utility is given by an individual's subjective valuation of his or her final state of wealth where the wealth is assumed to be subject to diminishing returns, which in turn reflects the assumption of risk aversion. Prospect theory's value function is concave in the positive domain (as it is in SEU theory) and convex in the negative domain, yielding an S-shaped value function. Thus, the value function retains the SEU theory assumption of diminishing returns to wealth and risk aversion at least in the positive domain. Individuals, however, are assumed to be risk seeking with respect to losses (loss aversion). The slopes of the two components of the value function are also drawn to reflect the assumption (based on experimental evidence) that, on average, the disutility from losing a given value (income or wealth) is always greater than the utility from gaining an identical value. In this modeling scenario, a monetary gain exceeding a monetary loss might still yield a net loss in utility, leading an individual to reject such a prospect where it would not be rejected in SEU theory. Hence, under particular circumstances,

individuals are predicted not to behave rationally, where rationality is defined as wealth maximization.

Kahneman (2003, p. 1457) argues that the core idea of prospect theory is:

> *. . . that the value function is kinked at the reference point and loss averse [and this] became useful to economics when Thaler used it to explain riskless choices. In particular, loss aversion explained a violation of consumer theory that Thaler identified and labeled the "endowment effect": the selling price for consumption goods is much higher than the buying price, often by a factor of 2 or more. The value of a good to an individual appears to be higher when the good is viewed as something that could be lost or given up than when the same good is evaluated as a potential gain.*

The endowment effect and loss aversion are closely related (Thaler, 1980, 2000). Both concepts are tightly linked to psychological considerations that override the materialist imperative that drives the understanding of choice behavior in SEU theory. Individuals' subjective psychological valuation of prospects determines choice behavior inclusive of behavior on the financial markets.

IMPLICATIONS OF PROSPECT THEORY FOR CHOICE BEHAVIOR

In prospect theory, individuals might reject prospects of net positive material worth because of the emotional pain suffered from a prospective loss. Therefore, individuals do not behave as simple wealth maximizers. This rather accurate prediction of average behavior across individuals is contrary to the analytical prediction of SEU theory and is one of prospect theory's key contributions. Although Kahneman and Tversky's (1979) worldview (and that of conventional wisdom) suggests that choices that are not geared toward maximizing wealth are irrational, one can argue that this need not be the case if the individual is attempting to maximize her or his utility (or to satisfice). In the real world, increasing wealth need not be the primary motivational objective of the rational individual when a probability of loss exists, especially in a world of uncertainty where risks cannot be calculated.

Closely related to the reality-based assumption of prospect theory that wealth maximization is not the type of behavior in which individuals tend to engage in a world of uncertainty, Kahneman and Tversky discuss the certainty effect where a certain outcome (particular state of wealth) is preferred over a gamble (uncertain outcome) with an equal or greater monetary expected value. For example, if the sure thing is \$700 (option one) and the expected value of the gamble is $0.90 \times \$1{,}000 + 0.10 \times \$0$, or \$900 (option two), the risk-averse individual chooses the sure thing even though it yields a lower monetary value. The utility of the sure thing (no gamble) exceeds the utility of the uncertain but higher monetary value. To accept a gamble requires an even higher return to offset the disutility of engaging in the risky prospect. Also, if one reduces the probability of gain equally across both prospects, the choices shift from option one to option two. Moving marginally from certainty to uncertainty has a big effect given the high level of utility that individuals have for certainty. In contrast, risk-seeking behavior refers to a situation where a certain outcome is rejected in favor of a gamble yielding an equal or lower monetary expected value. Thus, if a choice exists between a sure loss of \$700 and a gamble of

$0.90 \times (-\$1{,}000) + 0.10 \times \$0$, or negative \$900, the individual might choose the latter option because there is a possibility that the result will be no loss. Once again this behavior is considered to be irrational, but it need not be from the perspective of the utility maximizing or satisficing individual, or if the emotional cost of incurring potential (probable) losses is taken into consideration.

Kahneman and Tversky (1979) also argue that a preference for certainty allows individuals to be manipulated by frames (framing effects) that create the illusion of certainty, thereby generating choices that cannot be justified on grounds of SEU rationality. Both Smith (1985) and Altman (2004) contend that individuals can be fooled, but primarily in the short term. However, given brain construction, imperfect information, and uncertainty, one would expect (and experimental evidence suggests this to be the case) individuals to learn (adaptive expectations) what is and is not a cognitive illusion produced by a particular frame. Thereafter, individuals make choices based on their preferences that may include SEU rational preferences for certain events.

Individuals also use positive or negative frames in their decision-making process. Kahneman and Tversky (1979) find that when events are framed positively, individuals tend to choose the certain event over the gamble even if the gamble yields an equal or greater expected value. They will also choose a positively framed gamble over a negatively framed one, even when both yield the same expected value. This should not happen because the different frames have no substantive effect on events. Thus, individuals are subject to a perceptual or cognitive illusion. A lack of consensus exists around whether differential framing affects choice when prospects are substantively different. Gigerenzer (2007) argues that in a world of bounded rationality (the real world), rational individuals cannot be expected to use non-neoclassical heuristics to make their choices. Frames can signal information about the event, which is important in a world of imperfect information and uncertainty. When an event is positively or negatively framed, individuals read between the lines and attempt to extract surplus information from the frames. They read a positive frame as suggesting a better choice than the negatively framed event. This is a judgment call that might prove to be incorrect, but it is rational in a world of bounded rationality. Given these particular caveats, framing can affect the investment and disinvestment of financial assets. Different frames can yield different behaviors on the financial market. To the extent that frames distort the economic reality of financial assets, investment behavior can be inefficient.

Related to the notion of the certainty effect and prospect theory, Kahneman and Tversky (1979) introduce the notion of loss aversion and aversion to a sure loss. Because individuals are more sensitive to losses than to equivalent gains, they are more likely to engage in risky behavior to avoid sure or highly probable losses. This causes individuals to pay attention to sunk costs and, therefore, to throw good money after bad with regard to holding on to failing corporations and depreciating financial paper for longer than would be predicted by the conventional wisdom. Such behavior contravenes the conventional norm that rational agents will ignore sunk costs. But the conventional wisdom assumes a world of unbounded rationality. An important question that needs addressing is: In a world of bounded rationality, when should an intelligent individual take sunk costs into consideration?

SOME IMPLICATIONS FOR BEHAVIORAL FINANCIAL RELEVANCE

The potential capacity of prospect theory to explain particular aspects of financial markets or behavior in financial markets more clearly than the conventional wisdom is predicated largely upon three unique features of prospect theory:

1. Prospect theory assumes that choice decisions are based upon a subjectively determined reference point independent of the decision maker's state of wealth.
2. Subjective reference points introduce a frame to a prospect, which affects choice behavior.
3. A kink exists at the reference point of prospect theory's value function, assuming individuals weight losses at above twice that of gains.

The next two important areas to be discussed relate specifically to stock market behavior. These areas should be placed in the context of one of the key challenges of behavioral economics to financial economics: Valuations of financial assets (current asset prices) do not reflect the fundamental values of these same financial assets. Individuals do not behave in accordance with neoclassical norms where such behavior should force the rapid convergence between market prices and the fundamental values of the assets in question.

Behavioral economists argue that prospect theory helps explain the tendency of investors to hold on to losing stocks for too long and sell winning stocks too soon. This is referred to as the disposition effect (Shefrin and Statman, 1985; Shiller, 1999). This effect follows from the assumption that, on average, individuals tend to be risk seeking in losses and risk averse in gains. Given that choices are made in a world of uncertainty, many people will hold on to losing stocks hoping that the value of these stocks will bounce back toward the purchase price value (risk seeking). Many people will sell relatively high-valued financial assets too quickly for fear that these assets will fall in price. From the conventional perspective, in a world without capital gains taxes, the more rational decision would be for individuals to hold on to winning stocks to achieve further gains and to sell losing stocks to prevent mounting losses. However, in a world where prospective risks cannot be measured easily (Knightian uncertainty), determining when to sell or retain stock is not always clear because of the difficulty of predicting future prices of financial assets or the timing of the movements in these prices. Thus, in this scenario, behaving in accordance with prospect theory might actually be rational behavior (utility maximizing). Moreover, given such uncertainty and the existence of asymmetric information, many individuals will make investment decisions based on herding, which would reinforce the disposition effect. Individuals would be expected to sell, buy, or hold financial assets following crowd behavior or the market trend. Such behavior would generate large and deep swings in the price of financial assets and produce financial bubbles and busts. A rational explanation for such behavior hinges upon the assumption that in a world of imperfect and asymmetric information, individuals follow the market trend as a fast and frugal heuristic—given what little an

individual knows, the crowd or market might be better informed than a single individual.

Generating considerable attention is the capacity of prospect theory, as refined by De Bondt and Thaler (1985, 1987) and Benartzi and Thaler (1995), to explain the "equity premium puzzle." This puzzle, which is perplexing to contemporary theorists, refers to high historical average returns of stocks relative to bonds (Shiller, 1999). The equity premium represents the difference between the historical average return in the stock market and that for bonds or treasury bills. According to one estimate, the equity premium for U.S. stocks over short-term government bonds averaged more than 6 percent per annum from 1926 to 1992. Moreover, in the United States from 1871 to 1993, returns to stocks easily dominate returns to bonds or Treasury bills (Barberis and Thaler, 2003).

The economic opportunity costs of such investments are considerable. For example, if the 30-year average annual rate of returns is 2 percent on bonds and 8 percent on stocks, the equity premium favoring stock is 6 percentage points. In this scenario, an investment of $100 in bonds would yield an income in 30 years of $181, whereas the same investment in stocks would yield an income of $1,006. Given this evidence, why would rational decision makers invest in bonds and treasury bills in the considerable amounts that these financial instruments have traditionally attracted? Why are individuals apparently willing to pay such a high price for a less risky investment? Are many individuals so risk averse? Shiller (1999) argues that risk aversion is an unlikely candidate for explaining the equity premium assuming investors maximize utility over the long term. The relative risk differential between these two types of financial assets is not large enough to explain the prevailing and historical equity premium.

Benartzi and Thaler (1995) employ prospect theory's value function and the assumption of myopic loss aversion to explain the high (by conventional standards) equity premium. Individuals attempt to maximize utility by evaluating the prospective gains and losses in relation to deviations from their reference points, wherein individuals are assumed to weight losses much more heavily than gains. If individuals are loss averse to the extent estimated by Kahneman and Tversky (1979), then they would demand a relatively high equity premium to invest in stocks if stocks are characterized by a much higher risk of loss than bonds.

Benartzi and Thaler (1995) also argue that over the long term, the objective risk of loss from stocks is relatively low, and therefore loss aversion could not explain the significant extent of the equity premium. If individuals evaluate their investment every 10 years, for example, there is only a small risk of losing money, contingent upon not selling one's stock portfolio. So Benartzi and Thaler ask how often individuals would have to evaluate their investment portfolios to make sense of the historically high equity premium. If individuals do their evaluation frequently and over short intervals such as one-year time frames, stock prices are highly volatile. In any given year, if the expected value of loss is of some importance, individuals stand to lose money on their investment if they sell. Even if there is a 50 percent chance of losing $50 and a 50 percent chance of gaining $300, yielding an expected value of $125 (= –$25 + $150), there is still a 50 percent change of losing $25. To complicate matters, even if an individual does not sell, those who suffer from loss aversion might experience regret from prior investment decisions that have fallen in value during any given evaluative time frame.

What Benartzi and Thaler (1995) find is that if individuals are sufficiently loss averse and if they evaluate their investments each year, their behavior is consistent with the extant and historical equity premiums. Prospect theory helps explain what appeared to be odd "equilibrium" differences in rates of return between different financial assets. Moreover, given the institutional reality of annual reports and tax laws, an annual review of investments makes economic sense. One implication of this analysis is that, given loss aversion, how relative returns are framed with respect to evaluation periods substantially affects the required "equilibrium" equity premium. Differently framing returns for a long period of time, such as 30 one-year returns as opposed to one 30-year return, yields different allocations of income between stocks and bonds, with the latter frame yielding a much larger percentage allocation to stocks. The former facilitates myopic loss aversion. This raises the question of whether myopic loss aversion–type behavior is irrational and suboptimal and if frames can or should be changed.

A key contribution of prospect theory in this instance is that it can better describe and predict average choice behavior in financial markets. Although some behavioral economists regard myopic loss aversion–type behavior as irrational, this view may be incorrect. Evaluating the returns on an annual basis makes sense for individuals who expect that they might have to sell a portion of their financial assets at short notice. That is, they attach a positive probability that they judge to be high, even if it is objectively low. These individuals may never actually sell over a 10-, 20-, or 30-year period. But just the possibility that such sales might transpire justifies using an annual time frame to evaluate financial returns. There is a substantive and practical difference between whether the frame is annual or only at the end of a multi-year period. Assuming that loss aversion and annual frames are irrational, choice parameters might be highly misleading.

These two examples of the implications of prospect theory for behavioral finance demonstrate the importance of framing a prospect for the decision-making process and for the ultimate outcome of the process. The benchmark for the decision makers is critical. Also important is whether the decision maker frames a prospect as a loss or a gain. Further, when emotive variables enter into the decision-making process, they critically affect decision outcomes. These outcomes need not be wealth maximizing, but they are consistent with decision makers maximizing their utility.

SUMMARY AND CONCLUSIONS

Prospect theory addresses an important subset of issues in behavioral finance, bringing to the forefront the importance of choice behavior that deviates from the conventional norm. In particular, prospect theory is built upon stylized facts, which are based on evidence derived from economic and psychology-type experiments. These stylized facts are that the average individual: (1) weights losses more heavily than gains; (2) evaluates losses and gains relative to a subjectively determined benchmark; (3) is interested in changes at the margin as opposed to level affects; and (4) is affected by the framing of prospects even if the frames do not appear to have a substantive or real effect on the expected value of the prospects. These results are of particular importance in a world of uncertainty. For many contemporary

behavioral economists, such behaviors signify irrationality and/or biases in behavior, where the norm for rationality and unbiased behavior is predicated upon neoclassical behavior derived from SEU theory. Consistent with the worldview presented by Simon (1978, 1987a, 1987b) and more recently by Smith (2003, 2005), Todd and Gigerenzer (2003), and Gigerenzer (2007), prospect theory–type behavior can be rational even if inconsistent with SEU norms and therefore with wealth maximization when loss aversion and rationally based short-term time preferences are introduced to individuals' preference functions.

In terms of providing possible "rational" explanations for prospect theory–like behavior, an important avenue of research is the role that imperfect and asymmetric information and institutionally given frames play in determining the extent of loss aversion and the time frame for decision making (or the rate of time preference). Improved information sets and trust in the quality of these can, for example, affect how long one holds financial assets and the extent of loss aversion. In the rationality approach to behavioral finance, modifying the individual's information and incentive environment can change choice behavior. Also, SEU norms are not necessarily the benchmark for rational or optimal individual behavior.

DISCUSSION QUESTIONS

1. What distinguishes prospect theory from subjective expected utility (SEU) theory?
2. Why do Kahneman and Tversky regard prospect theory (1979) as fundamentally different and superior to the bounded rationality approach of Simon (1987b)?
3. Discuss how prospect theory explains the equity premium puzzle.
4. Explain how differential weights to losses and gains affect investment decisions.
5. Why might prospect theory–like behavior be rational? Why do many behavioral economists argue that such behavior is irrational?

REFERENCES

Ackman, Dan. 2002. Nobel laureate debunks economic theory. Forbes.com. Available at http://www.forbes.com/2002/11/06/cx_da_1106nobel1.html.

Altman, Morris. 2004. The Nobel Prize in behavioral and experimental economics: A contextual and critical appraisal of the contributions of Daniel Kahneman and Vernon Smith. *Review of Political Economy* 16:1, 3–41.

Altman, Morris. 2008. Behavioral economics. In *International Encyclopedia of the Social Sciences*, ed. William A. Darity, 499–502. 2d ed. Detroit: Macmillan Reference.

Barberis, Nicholas C., and Richard H. Thaler. 2003. A survey of behavioral finance. In *Handbook of the economics of finance*, ed. George Constantinides, Milton Harris, and René Stulz, 1052–1121. Amsterdam: North-Holland.

Benartzi, Shlomo, and Richard H. Thaler. 1995. Myopic loss aversion and the equity premium puzzle. *Quarterly Journal of Economics* 110:1, 75−92.

Bernoulli, Daniel. 1954 [1738]. Exposition of a new theory on the measurement of risk. *Econometrica* 22: 1, 23–36.

De Bondt, Werner, and Richard H. Thaler. 1985. Does the stock market overreact? *Journal of Finance* 40: 3, 793−808.

De Bondt, Werner, and Richard H. Thaler. 1987. Further evidence on investor overreaction and stock market seasonality. *Journal of Finance* 42:3, 557−581.

Fama, Eugene F. 1970. Efficient capital markets: A review of theory and empirical work. *Journal of Finance* 25:2, 383–417.

Fama, Eugene F. 1991. Efficient capital markets II. *Journal of Finance* 46:7, 1575–1618.

Fromlet, Hubert. 2001. Behavioral finance—Theory and practical application—Statistical data included. Available at http://findarticles.com/p/articles/mi_m1094/is_3_36/ai_78177931/.

Gigerenzer, Gerd. 2007. *Gut feelings: The intelligence of the unconscious*. New York: Viking Press.

Kahneman, Daniel. 2003. Maps of bounded rationality: Psychology for behavioral economics. *American Economic Review* 93:5, 1449–1475.

Kahneman, Daniel, and Amos Tversky. 1979. Prospect theory: An analysis of decision under risk. *Econometrica* 47:2, 263–291.

Malkiel, Burton G. 2003. The efficient market hypothesis and its critics. CEPS Working Paper No. 91.

March, James G. 1978. Bounded rationality, ambiguity, and the engineering of choice. *Bell Journal of Economics* 9:2, 587–608.

North, Douglas C. 1994. Economic performance through time. *American Economic Review* 84:3, 359–368.

Schwartz, Hugh. 1998. *Rationality gone awry? Decision making inconsistent with economic and financial theory*. Westport, CT: Praeger Publishers.

Shefrin, Hersh, and Meir Statman. 1985. The disposition to sell winners too early and ride losers too long. *Journal of Finance* 40:3, 777–792.

Shiller, Robert J. 1999. Human behavior and the efficiency of the financial system. In *Handbook of macroeconomics*, vol. 1 c, ed. John B. Taylor and Michael Woodford, 1305–1334. Amsterdam: Elsevier.

Shiller, Robert. 2000. *Irrational exuberance*. Princeton: Princeton University Press.

Shleifer, Andrei. 2000. *Inefficient markets: An introduction to behavioral finance*. New York/Oxford: Oxford University Press.

Simon, Herbert A. 1959. Theories of decision making in economics and behavioral science. *American Economic Review* 49:3, 252–283.

Simon, Herbert A. 1978. Rationality as a process and as a product of thought. *American Economic Review* 70:1, 1–16.

Simon, Herbert A. 1987a. Behavioral economics. In *The new Palgrave: A dictionary of economics*, ed. John Eatwell, Murray Millgate, and Peter Newman, 221–225. London: Macmillan.

Simon, Herbert A. 1987b. Bounded rationality. In *The new Palgrave: A dictionary of economics*, ed. John Eatwell, Murray Millgate, and Peter Newman, 267–268. London: Macmillan.

Smith, Vernon. 1985. Experimental economics reply. *American Economic Review* 71:1, 264–272.

Smith, Vernon L. 2003. Constructivist and ecological rationality in economics. *American Economic Review* 93:3, 465–508.

Smith, Vernon L. 2005. Behavioral economics research and the foundations of economics. *Journal of Socio-Economics* 34:2, 135–150.

Thaler, Richard H. 1980. Towards a positive theory of consumer choice. *Journal of Economic Behavior and Organization* 1:1, 39–60.

Thaler, Richard H. 2000. Mental accounting matters. In *Choice, values, and frames*, ed. Daniel Kahneman and Amos Tversky, 241–268. Cambridge, U.K.: Cambridge University Press.

Todd, Peter M., and Gerd Gigerenzer. 2003. Bounding rationality to the world. *Journal of Economic Psychology* 24:2, 143–165.

Tversky, Amos, and Daniel Kahneman. 1974. Judgment under uncertainty: Heuristics and biases. *Science*, New Series 185:4157, 1124–1131.

Tversky, Amos, and Daniel Kahneman. 1981. The framing of decisions and the psychology of choice. *Science* 211:4481, 453–458.

Zaleskiewicz, Tomasz. 2006. Behavioral finance. In *Handbook of contemporary behavioral economics: Foundations and developments*, ed. Morris Altman, 706–728. Armonk, NY: M. E. Sharpe.

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CHAPTER 12

Cumulative Prospect Theory: Tests Using the Stochastic Dominance Approach

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INTRODUCTION

With a few well-known exceptions (Friedman and Savage, 1948; Markowitz, 1952b), most economic models assume, implicitly or explicitly, expected utility maximization with risk aversion in the whole range of outcomes (von Neuman and Morgenstern, 1944; Markowitz, 1952a, 1959, 1987; Tobin, 1958; Pratt, 1964; Sharpe, 1964; Arrow, 1965; Lintner, 1965; Roll, 1977). The prospect theory (PT) (Kahneman and Tversky, 1979) and its modified version, cumulative prospect theory (CPT) (Tversky and Kahneman, 1992), cast doubt on the validity of all these theoretical models that are based on expected utility, as well as on the empirical studies that test them.

CPT advocates an S-shape utility (or value) function with risk seeking for losses where decision weights replace objective probabilities. Though risk seeking in the negative domain is an important feature of CPT, several studies reveal only slight risk seeking in the negative domain and some cases even reveal linear preference in this domain (Fennema and van Assen, 1998; Abdellaoui, 2000; Booij and van de Kuilen, 2009). Thus, this finding and assertion that there is no risk seeking in the negative domain is not in sharp contradiction even to the experimental studies supporting CPT.

In CPT, decision weights rather than objective probabilities should be employed in all cases, hence decision weights should be employed also in the uniform probability case, for example, in the case where each observation (rate of return) corresponding to the risky asset has an equal probability. Because most empirical studies in economics and finance assign an equal probability to each empirically observed outcome, testing CPT in the uniform probability case is of particular interest. As by CPT, an unequal decision weight should be assigned to each observation even in this case. If it has supportive evidence, it would cast doubt on the validity of most empirical studies in economics and finance.

To illustrate the importance of testing the relevancy of decision weights to the equal probability case, consider the case when one uses historical rates of return to estimate the risk premium on equity. Using the 20 years of historical rates of return on the S&P index (the period 1989 to 2008) and assigning equal probability to each observation (i.e., no decision weights are employed), the estimate of the annual risk premium is 7.9 percent. Using CPT's decision weights, the estimate of the risk premium is only 4.9 percent, with no normalization of the weights (recall that the sum of the decision weights is generally different from 1). The estimate of the risk premium is 5.7 percent with normalization (such that the sum of the decision weights is 1). Thus, the issue whether investors employ decision weights in the equal probability case is of crucial importance when making economic and financial decisions.

CPT challenges the expected utility paradigm, which includes the economic models that rely on the assumption of decreasing marginal utility of money as well as the empirical studies that assign an equal probability to each observation. Therefore, testing the validity of CPT with a correct methodology, the uniform probability case, and with relevant prospects each with more than two outcomes is of critical importance. Rabin (2000) offers criticism on the expected utility paradigm from a different angle. This chapter addresses this issue.

The chapter provides a test of the CPT experimentally with stochastic dominance (SD) criteria. A situation is constructed experimentally where one prospect, say, F, stochastically dominates another prospect, say, G, according to CPT. In both options, F and G, there are more than two outcomes and an equal probability is assigned to each outcome. Therefore, all individuals with any possible S-shape value function and CPT's reverse S-shape probability weighting function (with a wide range of parameters) should prefer F over G. If the majority of the choices are G, then the S-shape preference with the CPT decision weights are rejected.

However, even with these results, CPT cannot be rejected in the non-uniform case and in particular when small probabilities are involved. This is probably because in these cases decision weights play more crucial roles than in the uniform probability case. Indeed, when previous experimental studies are repeated with non-equal probabilities and with prospects with only two outcomes, the results are almost identical to the previously published evidence, strongly supporting prospect theory. This indicates that CPT is valid in some situations, but not in situations characterized by a uniform probability, which are typical to finance and economics. Alternatively, the interpretation may be that in some cases decision weights play an important role but in other cases they play no role or only a negligible role.

Note that in this study, the focus is only on some properties of CPT in the uniform probability case. Nevertheless, there are also studies showing violations of other properties of CPT (Brinbaum, Johnson, and Longbottom, 2008). On the other hand, there is strong support for the well-known loss-aversion property of CPT. This support is theoretical (Markowitz, 1952b; Rabin, 2000) as well as empirical and experimental (Benartzi and Thaler, 1995; Abdellaoui, Bleichrodt, and Paraschiv, 2007).

CPT is a rich paradigm with several important elements. Those focused on here include the following three main components of CPT:

a. The preference is S-shaped.
b. Decision weights rather than probabilities are employed. The decision-weighting function is a reverse S-shape.
c. Subjects make decisions based on *change* of wealth rather than on *total* wealth.

Factors *b* and *c* contradict expected utility theory (EUT). Factor *a* does not contradict EUT but contradicts most economic models, which assume risk aversion.

This study does not test mental accounting (Thaler, 1999) and loss aversion. Loss aversion does not contradict expected utility, but mental accounting contradicts expected utility in general and portfolio selection models in particular. Thus, when S-shape preferences are allowed in this study, preferences revealing loss aversion of the type of Kahneman and Tversky (1979) and Tversky and Kahneman (1992), of Markowitz (1952b), as well as of Benartzi and Thaler (1995) are also allowed. In other words, when the S-shape value function is rejected, loss aversion is not rejected, which may exist even with a piece-wise linear utility function.

Employing the certainty equivalent (CE) approach, Tversky and Kahneman (1992) and several other researchers who follow their pioneering studies provide estimates of the functions given in *a* and *b* above. There are two extreme approaches for testing CPT:

1. Testing for *all* S-shaped utility functions and *all* reverse S-shaped weighting functions, which is a complex if not an impossible task.
2. Alternatively, testing only for the *specific* S-shape function and the *specific* reverse S-shape weighting function as estimated by Tversky and Kahneman (1992) or by other studies that followed.

Here, the CPT test is conducted in a framework that is a compromise between these two extremes. The S-shaped preference and the reverse S-shaped weighting function are jointly tested, where *all* possible S-shaped preferences are considered, as well as several reverse S-shaped weighting functions with various parameters as estimated by Tversky and Kahneman (1992) and other researchers. Thus, the approach is close to the very general approach 1 above, albeit not identical to it, as several reverse S-shaped weighting functions and not all possible reverse S-shaped weighting functions are considered. Finally, stochastic dominance (SD) rules are employed, which are invariant to the initial wealth, hence element *c* of CPT mentioned above is also taken into account.

Most experimental studies that support CPT employ the certainty equivalent (CE) approach, that is, one prospect is certain and the other uncertain with two outcomes (see Exhibit 12.3, Tasks I and II shown later). More recent experimental studies employ the utility midpoints approach (Abdellaoui et al., 2007). Moreover, in both of these two approaches, the uncertain option is composed of only two outcomes—generally, one outcome occurs with a relatively small probability and the other with a relatively large probability. Within this framework, most studies reject risk aversion for $x < 0$ and there is experimental evidence against EUT. Specifically, subjects choose inconsistently and employ decision weights $w(p)$, which contradicts EUT.

The CE approach is mathematically convenient, yet it is exposed to the well known "certainty effect," which does not exist when the two prospects under consideration are both uncertain. This strong evidence in favor of CPT and against EUT as obtained in the CE framework is not questioned. However, tests are conducted of CPT in another and maybe more relevant scenario for economics and finance, at least for a wide range of cases, where investors face two or more uncertain options and none of the probabilities are extremely low. The uncertain options may have more than two outcomes per case where CPT can be tested with SD criteria but cannot be tested with the CE approach, which is limited to only two uncertain outcomes. Finally, note that the certainty equivalent method can also be used with more than two outcomes, but this does not allow a conclusion to be drawn regarding the curvature of preference.

CPT's decision weights have strong implications to theoretical models in finance and economics. For example, the Sharpe-Lintner CAPM, which assumes a given distribution of returns (e.g., normal distributions) may yield completely different results and may be even theoretically invalid when decision weights, $w(p)$, are employed rather than the objective probability, p. Moreover, accepting CPT has strong implications to virtually all empirical studies. In empirical studies aiming to measure risk (e.g., beta), portfolio performance and optimal portfolio composition, as well as in most econometric studies (e.g., tests of the CAPM), the *ex-ante* distribution is typically estimated by taking n historical observations and assigning a probability of $1/n$ to each observation (Fama and French, 1992, 1993; Fama and MacBeth, 1973). Thus, a discrete distribution is assumed with an equal probability assigned to each observation.

However, if investors assign decision weights $w(1/n) \neq 1/n$ to each observation as CPT advocates, then market prices are determined by these decision weights, and therefore, to explain a given phenomenon, for example, risk-return relationship, virtually all these empirical tests should be repeated with $w(p)$ rather than p. For example, a historical beta measured with $w(p) \neq 1/n$ is generally much different from beta measured with $p = 1/n$. Thus, testing the validity of CPT in the case where there are n observations with a probability $p = 1/n$ assigned to each observation has important implications to the design of empirical studies in economics and finance.

Tests in this chapter show that in the most important scenario to economics and finance where $p = 1/n$, CPT has no support; hence, there is no reason to doubt the results of all these empirical studies. Thus, in extreme cases, with two-outcome prospects and where a very low probability is assigned to one outcome and, in particular, with one certain prospect, there are strong deviations from EUT and strong support of CPT as documented in numerous CPT experiments. However, these cases are not typical to empirical studies in economics and finance when an equal probability is assigned to each observation. Thus, though CPT's criticism of expected utility is generally valid, it is not valid with regard to virtually all empirical studies in economics and finance as well as to equilibrium price models like the CAPM.

This is not the first study on this topic that uses stochastic dominance. Levy and Levy (2002b), using SD, reject the S-shaped value function by assuming that probability in the case of $p = 1/n$ with n observations is not replaced by decision weights. Once this assumption is relaxed and decision weights are employed, based on the results of Levy and Levy, one cannot reject CPT. Indeed, Levy and

Levy were criticized for not taking into account decision weights (Wakker, 2003), because CPT advocates that decision weights should be employed also in the uniform probability case. Baltussen, Post, and van Vliet (2006) provide an analysis of the dispute between Levy and Levy and Wakker.

Considering this criticism, this study relaxes Levy and Levy's (2002b) assumption and designs an experiment where the above three components of CPT can be tested simultaneously. In particular, in accordance with CPT's claim, the assumption is that w(p) is employed rather than p, *even in the case where* $p_i = 1/n$. For brevity's sake, in the rest of the study, the case where an equal probability is assigned to each observation is called the "uniform probability case."

As is seen below in the uniform probability case, there is no support to CPT. The joint hypothesis asserting that the value function is S-shaped and that CPT's decision weights are employed is rejected. However, whether the S-shape function is invalid, the weighting function is invalid, or both are invalid cannot be disentangled. Yet, CPT has strong support in the non-uniform probability case. Moreover, CPT has other important characteristics relevant to decision making not tested here (e.g., mental accounting and loss aversion).

The subjects in these experiments are graduate and undergraduate business school students and financial practitioners. Altogether there are 216 subjects. Some of the experiments are conducted with an actual financial payoff to the subjects, which depends on the subject's choices. The experimental results are very similar across subject populations and experimental designs. The findings show clear evidence rejecting the above CPT joint hypothesis in the uniform probability case, both for prospects with positive outcomes and for prospects with negative outcomes.

This study is organized as follow: First, there is a brief review of PT, CPT, and the SD criteria. Second, the three experiments employed in this study and their results are presented. The last section includes a summary and concluding remarks.

PT, CPT, AND THE STOCHASTIC DOMINANCE (SD) APPROACH

This section compares the three dominant theories: prospect theory, cumulative prospect theory, and stochastic dominance.

PT and CPT Decision Weights

Decision weights are determined differently in PT and in CPT. In PT, the probabilities are directly weighted, that is, $p^* = w(p)$, where p^* is the decision weight (Edwards, 1962; Quiggin, 1982; Prelec, 1998). Employing decision weights as suggested by PT may lead to a violation of first degree stochastic dominance (FSD), an unaccepted property (Fishburn, 1978; Machina, 1982). This severe drawback of PT led to a few alternate suggestions for probability weighting. Quiggin was the first to suggest that in order to avoid FSD violations, the probability weighting should depend on the cumulative probability function rather than on the individual probabilities. Namely, given a cumulative distribution F, one employs a transformation $F^* \equiv T(F)$, where T is a monotone transformation

$$T'(\cdot) \geq 0 \quad \text{with} \quad T(0) = 0,\ T(1) = 1$$

Note that F^*, by definition, is always a proper cumulative probability function (Machina, 1982, 1994).

Using a different kind of transformation, which is based on the cumulative probability, separately for negative outcomes and separately for positive outcomes, Tversky and Kahneman (1992) suggest Cumulative Prospect Theory (CPT), which basically is very similar to PT with the exception that decision weights are determined in the spirit of Quiggin (1982) such that FSD is not violated. Yet, the CPT's decision weights do not generally have the characteristics of a cumulative probability function and may even not sum up to 1. However, this study employs either prospects with only negative outcomes or prospects with only positive outcomes. In these two cases, CPT's decision weights sum up to 1 and therefore can be employed as (subjective) cumulative probability functions (see below).

The "Certainty Effect"

In order to find whether risk aversion or risk seeking prevails between any two points on the utility function, it is common, as originally done by Kahneman and Tversky (1979), to employ the certainty equivalent (CE) approach. Ever since the Allais (1953) paradox was published, evidence suggests that in some cases when one option is certain, investors may violate the expected utility paradigm, or make contradictory decisions when a series of choices is presented to them. Thus, with one certain prospect and one uncertain prospect where a relatively small probability is assigned to one of the outcomes, the role of the decision weights might become important, hence the name, the "certainty effect." Indeed, in their experiments Kahneman and Tversky (1979) and Tversky and Kahneman (1992) rely on the comparison of two options, one certain and one uncertain; hence decision weights play an important role and may explain their results. Wu and Gonzalez (1996), who find experimental evidence supporting Tversky and Kahneman's decision-weighting function, also use the CE approach. More recent studies (Abdellaoui et al., 2007) use the utility midpoints approach where prospects with two outcomes are considered in the non-uniform probability case.

Both the CE approach and the midpoints approach find support for CPT. The following experiment shows that this is not the case when considering more than two outcomes and when each observation has an equal probability.

Stochastic Dominance Approach

The SD Criteria

Realizing the well-known drawback of the CE approach, Levy and Levy (2001, 2002a) were the first to suggest employing stochastic dominance (SD) criteria to analyze subjects' choices and the implied preferences in experimental studies. The advantages of the SD approach over the CE approach are that it can compare two uncertain options, with as many outcomes as one wants (hence also overcome the constraint of the two outcomes imposed by the utility midpoints approach), and the outcomes can be all positive, all negative, or mixed. Yet, this study uses non-mixed prospects to be able to compare to the results corresponding to the CE method. With the CE method nothing can be concluded regarding the curvature

of the preference with mixed prospects (Levy and Levy, 2002b). Thus, the SD rules are not exposed to the "certainty effect" and are not limited to two outcomes of the risky options as in the case of the CE approach or as in the case of the midpoints approach.

Finally, recall that though a uniform probability prospects is employed here, the SD rule given below can generally be used without any constraint on probabilities. However, uniform probability prospects are used here because such prospects are very important to economics and finance models and also because of the suspicion that in such a case, decisions weights play a minor or no role, in contrast to what CPT advocates. Regardless of whether employing decision weights in the uniform probability case is appropriate, the results of this study both with and without decision weights are analyzed.

A brief review of the various investment criteria employed in the study will facilitate the understanding of the results of this study. First discussed are the types of preference that are relevant to the study and correspond to the various SD criteria. Exhibit 12.1a−12.1d shows the four possible general shapes of preference.

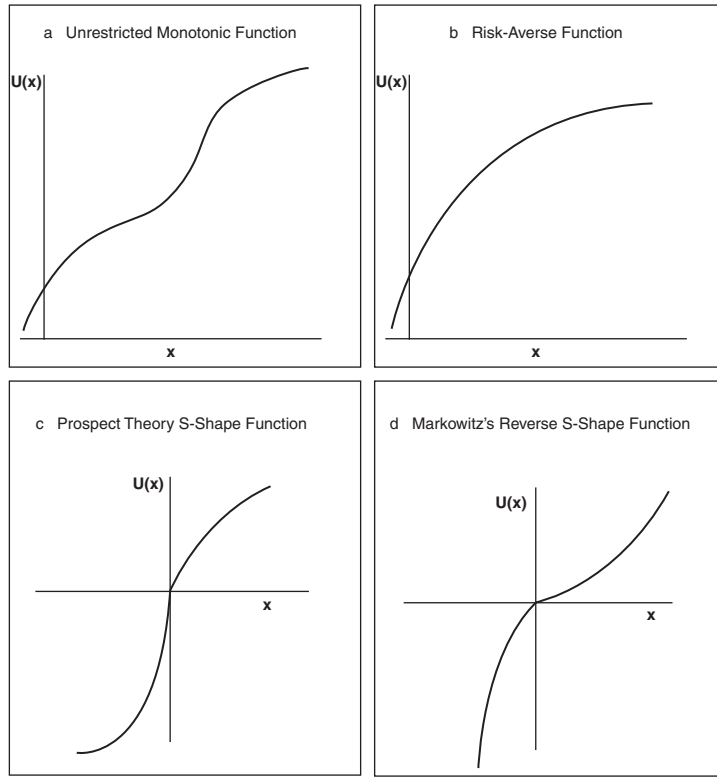

Exhibit 12.1 The Alternative Utility Functions

Note: Graph a illustrates unconstrained preference u(x) as long as monotonicity is kept, i.e., $u'(x) > 0$. Graph b reveals the most commonly employed risk-averse preference u(x) in economics and finance with $u'(x)\ 0$, $u''(x) \leq 0$. Graph c describes the PT and CPT S-shape function with an inflection point at $x = 0$, $u'(x)\ 0$, and $u''(x) > 0$ for $x < 0$ (risk seeking) and $u''(x) \leq 0$ for $x > 0$ (risk aversion). Graph d illustrates a reverse S-shaped function with risk-aversion for $x < 0$ and risk seeking for $x > 0$.

Exhibit 12.1a illustrates unconstrained preference u(x) as long as monotonicity is kept, that is, u′(x) > 0. Exhibit 12.1b reveals the most commonly employed risk-averse preference u(x) in economics and finance with

$$u'(x) \geq 0,\ u''(x) \leq 0$$

Exhibit 12.1c describes the PT and CPT S-shape function with an inflection point at

$$x = 0,\ u'(x) \geq 0 \quad \text{and} \quad u''(x) > 0 \text{ for } x < 0 \qquad \text{[risk seeking]}$$

and

$$u''(x) \leq 0 \quad \text{for } x > 0 \qquad \text{[risk aversion]}$$

In an extension of Friedman and Savage's (1948) analysis, Markowitz suggested as early as in 1952 a reverse S-shaped function (see Exhibit 12.1d) with risk aversion for $x < 0$ and risk seeking for $x > 0$.

While experimental evidence with the CE approach supports the S-shape preference, empirical evidence (which ignores decision weights) tends to support the reverse S-shaped utility function (see Exhibit 12.1d). In most empirical studies, evidence suggests only the first three moments of the distribution of rates of return are important in asset pricing. Specifically, the skewness plays an important role in asset pricing and cannot be ignored (Arditti, 1967; Kraus and Litzenberger, 1976; Friend and Westerfield, 1980; Harvey and Siddique, 2000). Skewness preference can coexist with risk aversion, for example, the logarithmic utility function. However, if choices depend on the first three moments of the distribution, and only on these first three moments, then the utility must be cubic. The cubic preference is a reverse S-shaped preference. If a value function that depends on change of wealth is assumed, then once again, a reverse S-shape value function is obtained.

The cubic utility function predicts a linear relationship between mean return covariance and co-skewness with the market portfolio. Indeed, co-skewness explains a relatively large proportion of cross-sectional variation of mean returns which is not detected by beta. The empirical evidence reveals a positive premium for covariance and a negative premium for co-skewness. Thus, in contrast to the experimental finding with the CE approach, the empirical findings tend to support the hypothesis that preference is *reverse* S-shaped.

Nevertheless, investment decision criteria corresponding to each type of preference illustrated in Exhibit 12.1 is described and then later tested experimentally for validity of each type of the competing preference, with the incorporation of decision weights.

Attention now turns to the SD criteria that will be employed in the study.

- **FSD** (First degree SD): Let F and G be the cumulative distributions of two options under consideration. Then F dominates G for all utility functions u $\in \mathbf{U}_1$ (when u $\in \mathbf{U}_1$ if u′ 0, see Exhibit 12.1a), if and only if

$$F(x) \leq G(x) \text{ for all values } x, \text{ with at least one strict inequality.} \qquad (12.1)$$

- **SSD** (Second degree SD): Let F and G be as before. Then F dominates G for all u $\in \mathbf{U}_2$ (when u $\in \mathbf{U}_2$ if u′ 0, u″ $\leq$ 0, see Exhibit 12.1b), if and only if

$$\int_{-\infty}^{x} [G(t) - F(t)]dt \geq 0 \tag{12.2}$$

for all values x, with at least one strict inequality.

- **PSD** (Prospect SD): Let F and G be defined as before. Then F dominates G for all u $\in \mathbf{U}_s$ (where $\mathbf{U}_s$ represents the class of all S-shaped functions: u $\in \mathbf{U}_s$, if u′$>$ 0, u″ $>$ 0 for $x < 0$, and u″ $<$ 0 for $x > 0$, see Exhibit 12.1c), if and only if

$$\text{and} \quad \left.\begin{array}{ll} \displaystyle\int_{y}^{0} [G(t) - F(t)]\, dt \geq 0 & \textit{for all} \quad y \leq 0 \\ \displaystyle\int_{0}^{x} [G(t) - F(t)]\, dt \geq 0 & \textit{for all} \quad x \geq 0 \end{array}\right\} \tag{12.3}$$

with at least one strict inequality.

- **MSD** (Markowitz's SD): Let F and G be defined as before. Then F dominates G for all u$\in \mathbf{U}_M$ (where $\mathbf{U}_M$ represents the class of all S-shaped functions: u$\in$ $\mathbf{U}_M$ if u′ 0, u″$\leq$ 0 for $x < 0$, and u″ 0 for $x > 0$, see Exhibit 12.1d), if and only if

$$\text{and} \quad \left.\begin{array}{ll} \displaystyle\int_{-\infty}^{y} [G(t) - F(t)]dt \geq 0 & \text{for all} \quad y \leq 0 \\ \displaystyle\int_{x}^{\infty} [G(t) - F(t)]dt \geq 0 & \text{for all} \quad x \geq 0 \end{array}\right\} \tag{12.4}$$

with at least one strict inequality.

Note that PSD seems to be a mirror image of MSD. However, despite the similarity of PSD and MSD criteria, if F dominates G by PSD, it does not generally imply that G dominates F by MSD, and vice versa. Hadar and Russell (1969) and Hanoch and Levy (1969) give a proof of FSD. Fishburn (1964), Hadar and Russell (1969), Hanoch and Levy (1969), and Rothschild and Stiglitz (1970) provide a proof of SSD. Levy and Levy (2002a) present a proof of PSD and MSD. Levy (2006) offers a comprehensive analysis of the SD approach.

Stochastic Dominance with Decision Weights

SD criteria are defined in terms of the cumulative distributions F and G with objective probabilities. Using decision weights according to PT or according to CPT may impose a restriction on the employment of SD criteria, as the sum of the weights may be greater or smaller than

$$1 \left(\sum w_i \gtreqless 1 \right)$$

hence the subjective distribution $(w(x), x)$ is not necessarily a probability measure. However, one can safely employ the SD investment criteria with decision weights in the following four distinct cases:

1. In the case of a Rank Dependent Expected Utility transformation: $F^* = T(F)$ with $T'(\cdot) > 0$, $T(0) = 0$ and $T(1) = 1$; hence, the transformed distribution is also a cumulative probability function.
2. In the case of prospects with the same number of equally likely outcomes and PT's probability weighting (but not with CPT weighting). Levy and Levy (2002b) show that in this case the dominance relationship is not affected by PT's decision weights. Therefore, in this specific case decision weights can be ignored in the SD analysis, despite the fact that decision weights cannot be considered as probabilities.
3. In the case of CPT decision weights when either all outcomes are positive or all outcomes are negative (in which case $\Sigma\, w_i = 1$, see Equation 12.5.
4. In the case where $\sum_F w_i = \sum_G w_i$, even if these sums are not equal to 1.

As CPT is the modified version of PT, this study focuses on CPT's decision weights. Moreover, as the CPT results rely mainly on the CE approach that analyzes preferences separately for negative outcomes and separately for positive outcomes, SD tests corresponding to these two domains are employed. In this case, $\Sigma\, w_i = 1$ (see case *c* above), and it can safely employ the SD approach, where the cumulative distributions with decision weights may be considered as subjective cumulative distributions. However, an extension of the analysis to mixed prospects is possible (Levy and Levy, 2002b).

CPT Probability Weighting and the Uniform Probability Case

Based on their experimental results, Tversky and Kahneman (1992) suggest the following CPT transformed cumulative probability formula

$$\left.\begin{aligned} w^{*-}(p) &= \frac{p^{\delta}}{[p^{\delta} + (1-p)^{\delta}]^{1/\delta}} \\ w^{*+}(p) &= \frac{p^{\gamma}}{[p^{\gamma} + (1-p)^{\gamma}]^{1/\gamma}} \end{aligned}\right\} \tag{12.5}$$

where the experimental parameter estimates are: $\gamma = 0.61$, $\delta = 0.69$, p is the cumulative (objective) probability, and $w^*(p)$ is the cumulative decision weight, $w^{*-}(p)$ relates to the negative outcomes, and $w^{*+}(p)$ relates to the positive outcomes.

In some situations, especially in the case of "long shots," intuition and experiments support using subjectively weighted probabilities. Indeed, Equation 12.5 was estimated mainly with bets with small probabilities, for example, 0.1. One of the basic questions that arises is whether one can apply this probability weighting formula indistinguishably to other prospects, for example, prospects with relatively large probabilities, for instance, $p \geq 0.25$, and particularly to prospects with equally likely outcomes for example, $p_i = 1/n$ when $n = 2,3,4\ldots$ This case is crucial

Exhibit 12.2 Some Hypothetical Bets with Probabilities p_i and Decision Weights $w(p_i)$ as Derived from CPT Equation (12.5)*

Note: This table shows the probability weighting as implied by Tversky and Kahneman's CPT transformed cumulative probability formula in the uniform case. The term $w(p)$ is calculated by using equation (12.5), solving for the distorted cumulative distribution from which one can derive the individual decision weights. Note that $\Sigma w(p)$ is equal to 1. This is not the case with mixed outcome bets.

Case 1			Case 2		
Outcome ($)	Probability(p)	CPT Decision Weights $w(p)$	Outcome ($)	Probability(p)	CPT Decision Weights $w(p)$
–4,000	1/4	0.2935	1,000	1/4	0.4317
–3,000	1/4	0.1605	2,000	1/4	0.1476
–2,000	1/4	0.1724	3,000	1/4	0.1299
–1,000	1/4	0.3736	4,000	1/4	0.2908

to empirical studies in economics and finance. Note that in the case of equally likely outcomes, Equation 12.5 implies a very different decision weight for each of the outcomes. Some researchers cast doubt on generality of the above probability weighting formula and suggest that it should not be employed in all cases. For example, Quiggin (1982, p. 328) asserts, "The claim that the probabilities of 50-50 bets will not be subjectively distorted seems reasonable, and, as stated above, has proved a satisfactory basis for practical work."

Although Quiggin (1982) does not extend his argument to the general equal probability case with $n > 2$, in Viscusi's (1989) prospective reference theory there is *no* probability weighting in the general symmetric uniform probability case. To illustrate the probability weighting as implied by Equation 12.5 in the uniform case and to grasp the drawback of its indiscriminate employment to all cases, consider the uniform probability bets in Exhibit 12.2. In case 1, the decision weight corresponding to the outcome of −$1,000 is more than double the decision weight corresponding to the outcome of −$2,000. Things are even more extreme in case 2 of all-positive outcomes, where the outcome of $1,000 is assigned a decision weight that is 3.3 times larger than the decision weight assigned to the outcome of $3,000!

Obviously, one cannot reject Equation 12.5 based just on the counterintuitive decision weights. Therefore, this study tests the *joint* hypothesis of CPT probability weighting function and the S-shaped value function regardless of whether such decision weights are intuitively accepted or not.

Other Estimates of the Decision-Weighting Function

This study focuses on the CPT decision weights as given in Equation 12.5. Yet, a spectrum of decision-weighting functions is also tested as suggested and estimated by Camerer and Ho (1994), Wu and Gonzalez (1996), and Prelec (1998). Thus, all preferences $u \in \mathbf{U}_s$ and a wide range of decision-weight functions are covered in the experimental test, as suggested in the literature.

THE EXPERIMENTS AND THE RESULTS

The null hypothesis, which is tested in the experiments given below, is that CPT is valid. The underlying idea is as follows: Suppose the subject has to choose between two uncertain prospects, *F* and *G*, where *F* dominates *G* by PSD with CPT's decision weights. Thus, if CPT is valid, the subjects should select *F*, because *G* is inferior. Namely,

$$\sum_{F} w(x)u_s(x) \geq \sum_{G} w(x)u_s(x)$$

for all $u_s \in \mathbf{U}_s$, where $w(x)$ are the decision weights as derived from CPT's Equation 12.5 (later on the test is expanded to other decision weights, too). If the above inequality holds, then *F* dominates *G* by PSD, that is, there is dominance for all CPT investors (see Equation 12.3). If indeed F dominates G by PSD but most subjects select G, CPT is rejected. However, as it is a *joint test*, it is generally possible that the probability weighting function is rejected, that the S-shape preference is rejected, or that both are rejected.

Now suppose that a certain percentage, $\alpha\%$, of the choices is *G*. Then at least $\alpha\%$ of the subjects are said to reject CPT. The term "at least" is used because those who select F do not necessarily have CPT preferences: They may have a particular utility function $u \notin \mathbf{U}_s$, with $E_F\, u(x) > E_G\, u(x)$. While it is true that the $(1 - \alpha)\%$ that selected *F* conform with CPT, the selection of F may also conform with EUT with many possible utility functions, for example, a concave function. Thus, it is a strong case against CPT if a high proportion of subjects select G. However, if a high proportion of the choices is F, our test conforms but does not prove CPT. In all the experiments reported below, one prospect dominates the other in the CPT framework; hence, a case where the CPT null hypothesis can be tested is created.

Experiment 1

Experiment 1 involves four tasks. Exhibit 12.3 provides the tasks of experiment 1, and Exhibit 12.4 reports the results. The subjects in this experiment were 26 second-year MBA students at the Hebrew University of Jerusalem. All took the basic courses in finance, economics, and statistics but were not exposed to PT and were unaware (at this stage of their studies) of SD criteria, let alone the relatively new PSD and MSD investment criteria.

To pinpoint the difference between the CE approach and SD approach and to find out whether the standard test of PT provides similar results with our subjects, one of Kahneman and Tversky's (1979) famous experiments is replicated. Tasks I and II simply repeat two of Kahneman and Tversky's tasks based on the CE approach. Very similar results to those of Kahneman and Tversky are obtained: In Task I, 77 percent of the choices were F, and in Task II, 81 percent of the choices were G. The interpretation of Kahneman and Tversky of such results is that subjects are risk-seeking in the domain of losses ($x < 0$), and are risk-averse in the domain of gains ($x > 0$), hence the S-shape preference advocated by them (Kahneman and Tversky, 1979).

Thus, having one certain prospect and one risky prospect, findings with the CE approach show that the results of Kahneman and Tversky regarding the S-shape

Exhibit 12.3 The Tasks in Experiment 1

Note: Four tasks are presented. Task I and Task II repeat two of Kahneman and Tversky's (1979) tasks that are based on the CE approach. Task III and Task IV test the findings of Task I and Task II when the certainty effect is neutralized.

Task I. If you *have* to choose between investments F and G, which investment would you prefer when it is given that the dollar loss one month from now will be as follows?

F		G	
Loss	**Probability**	**Loss**	**Probability**
$–4,000	0.80	$–3,000	1
$ 0	0.20		

Task II. Which would you prefer, F or G, if the dollar gain one month from now will be as follows?

F		G	
Gain	**Probability**	**Gain**	**Probability**
$4,000	0.80	$3,000	1
$ 0	0.20		

Task III. If you *have* to choose between investments F and G, which investment would you prefer when it is given that the dollar loss one month from now will be as follows?

F		G	
Loss	**Probability**	**Loss**	**Probability**
$–4,000	1/2	$–5,000	1/2
$–2,000	1/2	$–1,000	1/2

Task IV. Which would you prefer, F or G, if the dollar gain one month from now will be as follows?

F		G	
Gain	**Probability**	**Gain**	**Probability**
$4,000	1/2	$5,000	1/2
$8,000	1/2	$7,000	1/2

Exhibit 12.4 The Choices in Experiment 1

Note: This table presents the choices for Experiment 1. The number of participants $n = 26$. Numbers in the table are in percentages rounded off to the nearest integer. In Task III, G dominates F by PSD with and without probability weighting. In Task IV, G dominates F by PSD with and without probability weighting.

	F %	G %	Indifferent %	Total %
Task I	77	23	—	100
Task II	19	81	—	100
Task III	73	23	4	100
Task IV	42	50	8	100

function are robust and do not change much across various populations of subjects. However, as argued earlier, these results may be due to the "certainty effect," that is, due to the possible effect of decision weights, which is not incorporated by Kahneman and Tversky in their 1979 study. Namely, it is possible that in both tasks $w(0.2) > 0.2$, which may explain the observed choices even with risk aversion everywhere. The purpose of Tasks III and IV is to test the findings of Tasks I and II when the certainty effect is neutralized, that is, when the two prospects under consideration are uncertain.

In Tasks III and IV, $p = {}^1/_2$ for all outcomes, hence the focus first is on the SD rules with *no* probability weighting, as done by Kahneman and Tversky (1979). Later on, decision weights are incorporated as suggested by CPT (Tversky and Kahneman, 1992) and by other experimental studies. Using SD dominance rules discussed in the previous section, Task III shows that G dominates F by PSD, yet F dominates G by SSD and MSD (see Exhibit 12.5a). Exhibit 12.5 reveals that in

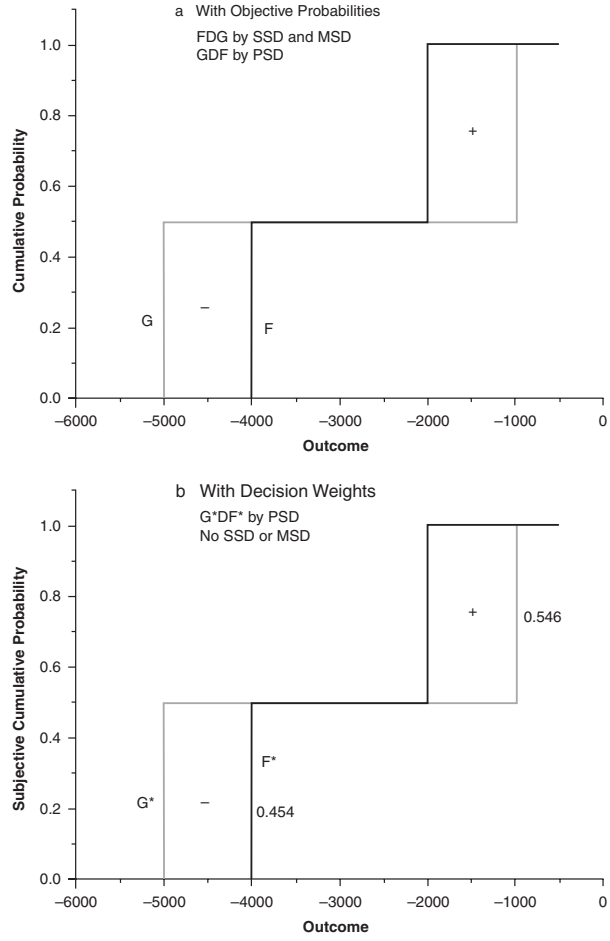

Exhibit 12.5 The Cumulative Distributions in Task III of Experiment 1

Note: Using SD dominance rules, Task III shows that G dominates F by PSD, yet F dominates G by SSD and MSD.

Task III, 73 percent of the choices are F, and only 23 percent of the choices are G (4 percent are indifferent). Recall that if G dominates F by PSD, *every* investor with an S-shape value function should prefer G (regardless of the precise slopes of this preference, see Equation 12.3). The fact that 73 percent of the subjects selected option F implies that *at least* 73 percent of the subjects are *not* characterized by an S-shape value function. As explained above, the term *at least* is used because also among the 23 percent of students who selected G, the evidence suggests that these choices conform with an S-shape function, but one can establish many other utility functions that are not S-shaped yet still reveal a higher expected utility corresponding to G relative to F.

Thus, Task I reveals that 77 percent of the subjects are risk-seekers in the negative domain, and Task III reveals that at least 73 percent of the *same subjects* are not risk-seekers in this domain—a clear contradiction. The most plausible explanation for this contradiction is that in Task I there is the certainty effect, with $w(0.2) > 0.2$. Indeed, apparently most subjects are risk averters, and due to the employment of a decision weight in Task I (certainty effect), 77 percent of the subjects selected F. Thus, the interpretation of the above results is that the choices in Task I reflect the employment of decision weights rather than by risk-seeking preference.

Although Kahneman and Tversky (1979) in their 1979 experiment mentioned above did not incorporate decision weights, one may object to the above conclusion on the basis that the above PSD dominance of G over F was only shown for the objective probabilities, and if the subjects employ CPT probability weighting, perhaps there is no PSD dominance. The question of whether it is plausible to expect a CPT probability weighting in the symmetric 50-50 case is not discussed here (Quiggin, 1982). Rather, as shown below in Task III, G dominates F by PSD even with CPT's probability weighting. Namely, not only does G dominate F by PSD, but also G^* dominates F^* by PSD, where F and G are the objective distributions, and G^* and F^* are the cumulative distribution corresponding to the CPT's decision weights as implied by Equation 12.5.

Exhibit 12.5a and 12.5b show the cumulative distributions of F and G. As can be seen from Exhibit 12.5a, G dominates F by PSD as

$$\int_y^0 [F(t) - G(t)]dt \geq 0 \text{ for all } y < 0 \text{ and } \int_0^x [F(t) - G(t)]\,dt = 0 \text{ for all } x > 0.$$

By Tversky and Kahneman's formula (see Equation 12.5), the results (where both outcomes are negative) are:

$$w_F(-4000) = w_G(-5000) = 0.454$$
$$w_F(-2000) = w_G(-1000) = 0.546$$

(See the figures corresponding to CPT's decision weights in Exhibit 12.9, which is reported later in this chapter.)

The weighted cumulative probability functions are given by F^* and G^* in Exhibit 12.5b. The PSD dominance of G^* over F^* is even enhanced with decision weights as the positive area becomes even larger relative to the negative area that

precedes it. Thus, the PSD integral condition holds confirming the dominance of G* over F*. Despite the dominance of G* (with decision weights) over F* by PSD, 73 percent of the choices were F, hence the S-shape value function hypothesis is rejected even when probability weighting is taken into account. Therefore, regardless of whether decision weights are employed or not in the case $p = {}^1/_2$, that is, in this specific uniform probability case, CPT is rejected. A possible interpretation for the strong experimental preferences of prospect F is that probability weighting does not take place in the case $p = {}^1/_2$ (unlike what is advocated by CPT), and that these choices reflect the dominance of F over G, by SSD (and MSD) with the objective probabilities.

Tversky and Kahneman (1992) estimate the parameters of the S-shape value function and the parameters of the weighting function (see Equation 12.5). The above experiment, in the uniform probability case, rejects not only the specific S-shaped preference estimated by Tversky and Kahneman but also *all* possible S-shape functions—quite a strong result. However, regarding the weighting function, the parameters estimated by Tversky and Kahneman were adhered to, hence the rejection of their formulation of CPT. To extend this analysis, the validity of the S-shape preference accompanied by other weighting functions is also tested.

Looking at the decision weights reported later in Exhibit 12.9 corresponding to Experiment 1, Task III, see that G* dominates F* by PSD also with the decision weights as estimated by Camerer and Ho (1994), Wu and Gonzalez (1996), and Prelec (1998). Moreover, the dominance is valid for any reverse S-shaped weighting function as long as $w({}^1/_2) < {}^1/_2$ and $w(1) = 1$ (see Exhibit 12.9, figures corresponding to Task III). Thus, the results of Task III are quite robust as they cover all $u \in \mathbf{U}_s$ and a wide spectrum of suggested decision-weight functions, including the CPT decision-weighting function.

To sum up, in the negative domain of outcomes, the SD results of Task III, contradict the classical PT results of Task I, which were obtained with the CE methodology. The risk-seeking hypothesis for $x < 0$ is rejected by at least 73 percent of the choices, regardless of whether CPT probability weighting is employed or not. Moreover, the same results are intact for all other decision weights as estimated and published in the literature, which are reported later in Exhibit 12.9. This contradiction in the results reflects the drawback of the CE approach, which has been mistakenly interpreted as risk-seeking preference for $x < 0$, rather than as the employment of decision weights w(0.2) when one of the prospects is certain.

Now turn to the positive domain of outcomes, that is, contrasting Tasks II and IV with the CE and SD approaches, respectively. The two distributions F and G with and without probability weighting are drawn in Exhibit 12.6. With the objective probabilities, note that

$$\text{(a)} \quad \int_0^x [F(t) - G(t)]dt \geq 0 \quad \text{for all x} \quad (\text{x} \geq 0)$$

$$\text{(b)} \quad \int_x^\infty [G(t) - F(t)]dt \geq 0 \quad \text{for all x} \quad (\text{x} \geq 0)$$

(and the two integrals are equal to zero in the negative domain, see Exhibit 12.6). Hence, G dominates F by PSD (and by SSD), but F dominates G by MSD (see

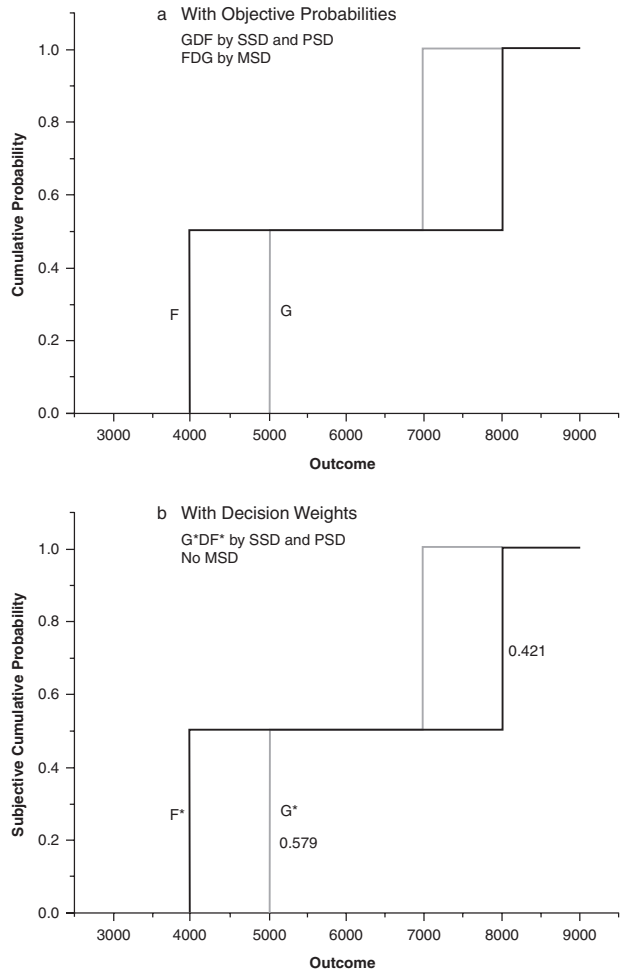

Exhibit 12.6 The Cumulative Distributions in Task IV of Experiment 1

Note: The two distributions F and G are drawn in Graph a with object probabilities. Here, G dominates F by PSD (and by SSD), but F dominates G by MSD. In Graph b, with CPT probability weighting, the PSD dominance of G over F is intact (G*DF*), but there is *no MSD* dominance of F* over G*.

previous section for these SD criteria). Incorporating CPT probability weighting results in (see later in Exhibit 12.9, the right column corresponding to Task IV):

$$w_F(4000) = w_G(5000) \cong 0.579$$
$$w_F(8000) = w_G(7000) \cong 0.421$$

With these probability weights, we obtain F* and G* as shown in Exhibit 12.6. With these two distributions, the following can be observed:

$$\int_0^x [F^*(t) - G^*(t)]dt \geq 0 \quad \text{for all } x \geq 0$$

but

$$\int_{x}^{\infty} [G^*(t) - F^*(t)]dt < 0 \qquad \text{for some value } x \text{ (e.g., for } x = 4000)$$

Hence, with CPT probability weighting, the PSD dominance of G over F is intact (G^*DF^*), but there is *no MSD* dominance of F^* over G^*. Therefore, incorporating decision weights once again enhances the PSD dominance but violates the MSD dominance, which prevails with no probability weighting.

Looking at the choices in Task IV, 42 percent of the choices were F (and 8 percent were indifferent), that is, at least 42 percent of the choices reject CPT (and also reject risk aversion as the choices are confined to the range $x > 0$ where PSD and SSD coincide). Fifty percent of the choices were G, which conforms to CPT, but does not prove it because any risk-averse utility function would show a preference for G, as G dominates F also by SSD. Therefore, the 50 percent of the G choices conform with CPT as well as to the EU paradigm with risk aversion. Using the decision weights as estimated and suggested by Camerer and Ho (1994), Wu and Gonzalez (1996), and Prelec (1998) (see Exhibit 12.9, Task IV) does not change the results, as G^* dominates F^* by PSD also with all these decision weights.

To sum up Experiment 1, Tasks I and II replicated from Kahneman and Tversky (1979) strongly support the S-shape value function hypothesis, while Tasks III and IV reject it by at least 42 percent to 73 percent of the subjects (regardless of whether CPT's probability weighting and the other suggested decision-weighting functions are employed). The suggested explanation for these contradictory results is as follows: In Tasks I and II the probabilities are not uniform and one of the prospects is certain. Therefore, there is a strong case for incorporating probability weighting in these two tasks. Hence, the choices in these two tasks may reflect mainly the certainty effect (that is, the probability 1 corresponding to the certain income is not distorted but the other probabilities may be distorted), rather than the S-shape preferences.

Indeed, incorporating decision weights, for example, those as suggested by Equation 12.5 in Tasks I and II, can easily show that the choices as obtained by Kahneman Tversky (1979) conform not only with S-shape preference but also with risk-averse, linear, and even reverse-S-shape preference, as suggested by Markowitz. Levy and Levy (2002b) provide an analysis of Kahneman and Tversky (1979) results with probability distortion. Thus with CPT probability weighting, Kahneman and Tversky cannot conclude the S-shape preferences from the choices in Tasks I and II in their 1979 study.

However, in Tasks III and IV the certainty effect is neutralized, and thus they test the S-shape preference hypothesis (with and without probability weighting), and reject this hypothesis. Therefore, the conclusion is that there is no contradiction between the results of the various tasks of this experiment in CPT framework: From Tasks I and II with decision weights one cannot reject the S-shape hypothesis but also cannot prove it because one also cannot reject many other non-S-shape preferences, while the choices in Tasks III and IV reject CPT by at least 42 percent to 73 percent of the subjects.

Finally, note that the rejection of CPT in Task IV is weaker relative to the rejection of CPT in Task III. The reason is that the 50 percent of the choices in Task IV that conform to PSD also conform with SSD in the EU framework, as they are confined to the positive domain. Such identity between the SSD and PSD optimal choice does not exist in Task III. Therefore, one possible interpretation of the results of Task IV is that at least 42 percent of the subjects are clearly not risk averters in the domain $x > 0$, (8 percent are indifferent), and 50 percent are risk averters. This result is in line with Levy and Levy (2001) who find in a completely different setting that only about 50 percent of the choices conform to risk aversion. Attention now turns to Experiments 2 and 3, which reveal even a stronger rejection of CPT.

Experiment 2

In Tasks III and IV of Experiment 1, there is a PSD relationship both with and without probability weighting with all four suggested decision-weighting functions. Thus, in the case $p = 1/2$, the S-shape hypothesis is rejected regardless of the issue of whether probabilities are weighted. Experiments 2 and 3 constitute comprehensive tests of CPT. The tests in these experiments include tasks with more than two outcomes for each prospect, in which one option dominates the other by CPT, namely by PSD when CPT probability weighting is employed. In most cases, there is PSD also with the other decision-weighting functions suggested in the literature. Hence, in this experiment as well as in Experiment 3, all S-shape functions and the CPT probability weighting function (and other weighting functions) are jointly tested for prospects with more than two outcomes.

There were 25 subjects in Experiment 2, all MBA students. Exhibit 12.7 presents the two tasks and Exhibit 12.8 reports the results. Exhibit 12.9 provides the corresponding decision weights as derived from Equation 12.5 (i.e., CPT's decision weights), as well as the other three weighting functions suggested in the literature. The results of the experiment reveal a strong rejection of the S-shape and decision weights as suggested by CPT, and also, in most cases, a rejection of the S-shape function with other decision-weighting functions.

In Task I, G* dominates F* by PSD with decision weights—see Exhibit 12.10. The various box areas are calculated with CPT's decision weights given in Exhibit 12.9. Hence, all subjects with any possible S-shape preference and with decision weights given by Equation 12.5 should prefer G, because G dominates F by CPT. Yet, 100 percent of the choices were F, a strong rejection of the above-mentioned two fundamental elements of CPT (see Exhibit 12.8).

Drawing figures similar to Exhibit 12.10 with the other decision weights reported in Exhibit 12.9 reveals that G* dominates F by PSD also by all three other decision-weight schemes (see Exhibit 12.9). Therefore, the result revealing 100 percent choices of F is a very strong result, as it shows a rejection of the S-shape and decision weights of CPT, as well as all other decision-weighting functions, when they are tested jointly with *all* possible S-shape preferences.

Similar results, albeit not as strong as in Task I, are obtained in Task II. Here F* dominates G* by CPT (see Exhibit 12.11), yet 76 percent of the choices were G*, implying that the S-shape and the decision weights of CPT are not valid with regard to at least 76 percent of the subjects. In Task II, F* dominates G* by CPT, and F* also dominates G* with the decision weights suggested by Camerer and

Exhibit 12.7 The Tasks in Experiment 2

Note: Two tasks are employed for testing S-shape functions and the CPT probability weighting function (and other weighting functions) for prospects with more than two outcomes, in the uniform case. Task I considers the negative domain and Task II considers the positive domain.

Task I. If you *have* to choose between investments **F** and **G**, which investment would you prefer when it is given that the dollar loss one month from now will be as follows:

F		**G**	
Loss	**Probability**	**Loss**	**Probability**
–5,000	1/4	–5,800	1/4
–4,000	1/4	–4,200	1/4
–3,000	1/4	–3,500	1/4
–2,000	1/4	–1,000	1/4

Task II. Which would you prefer, **F** or **G**, if the dollar gain one month from now will be:

F		**G**	
Gain	**Probability**	**Gain**	**Probability**
1,800	1/4	1,000	1/4
1,900	1/4	2,000	1/4
2,500	1/4	3,000	1/4
3,100	1/4	4,000	1/4

Ho (1994) (see Exhibit 12.9), but such dominance does not exist with the decision weights suggested by Prelec (1998) and by Wu and Gonzalez (1996) (see Exhibit 12.9). Therefore, while one can safely conclude that *all* possible S-shape preferences with CPT's and Camerer and Ho's decision-weighting function are rejected, S-shape value function with the other two decision-weighting functions given in Exhibit 12.9 cannot be rejected.

Experiment 3

The two tasks given in Exhibit 12.7 are also employed in Experiment 3. However, in Experiment 3, there are several heterogeneous groups of subjects, with and

Exhibit 12.8 The Choices in Experiment 2

Note: This table shows the results of Task I and Task II in Experiment 2. The number of participants $n = 25$. The numbers in the table are in percentages rounded off to the nearest integer.

	F %	**G %**	**Total %**
Task I. G^* dominates F^* by PSD (No SSD, No MSD)	100	0	100
Task II. F^* dominates G^* by PSD and SSD (No MSD)	24	76	100

Exhibit 12.9 Various Decision Weighting Functions

Note: This table shows various decision weights as derived from Tversky and Kahneman's CPT transformed cumulative probability formula [(see equation 12.5)] and from three other weighting functions suggested in the literature.

	F	G	Prelec's DW	Wu and Gonzalez's DW	Camerer and Ho's DW	CPT's DW
Outcomes in Experiment 1						
Task III	−4,000	−5,000	0.4547	0.4606	0.3935	0.4540
	−2,000	−1,000	0.5453	0.5394	0.6065	0.5460
Task IV	4,000	5,000	0.5453	0.5394	0.6065	0.5794
	8,000	7,000	0.4547	0.4606	0.3935	0.4206
Outcomes in Experiment 2						
Task I	−5,000	−5,800	0.2904	0.2929	0.2836	0.2935
	−4,000	−4,200	0.1643	0.1677	0.1099	0.1605
	−3,000	−3,500	0.1862	0.1783	0.1311	0.1724
	−2,000	−1,000	0.3591	0.3611	0.4754	0.3736
Task II	1,800	1,000	0.3591	0.3611	0.4754	0.4317
	1,900	2,000	0.1862	0.1783	0.1311	0.1476
	2,500	3,000	0.1643	0.1677	0.1099	0.1299
	3,100	4,000	0.2904	0.2929	0.2836	0.2908

without monetary payoff. The corresponding figures of the cumulative distribution functions are exactly as in Exhibits 12.10 and 12.11 corresponding to Experiment 2. Experiment 3 has the following characteristics:

- In three out of the five groups who participated in Experiment 3, subjects received monetary payoff that is directly linked to their choices. This allows for a test and comparison of the results with and without financial payoff, and an analysis of the importance of the monetary payoff in the experiments.
- Experiment 3 has four groups of business school students. Two of these four groups were exposed to the mean-variance decision rule, but did not study expected utility and SD criteria. The other two groups studied all the sophisticated investment criteria and also were exposed to the limitations of the mean-variance criterion. Moreover, one group was composed of advanced MBA students, some of whom are PhD candidates in economics and finance. In addition, there is a fifth group of practitioners who are mutual fund managers and financial analysts.

The Payoff

Each subject received an initial sum of 75 Israeli Shekels (IS) (about $17 dollars). Then subjects were given the questionnaire and were told that after the questionnaires were completed and collected, a lottery would be performed in front of

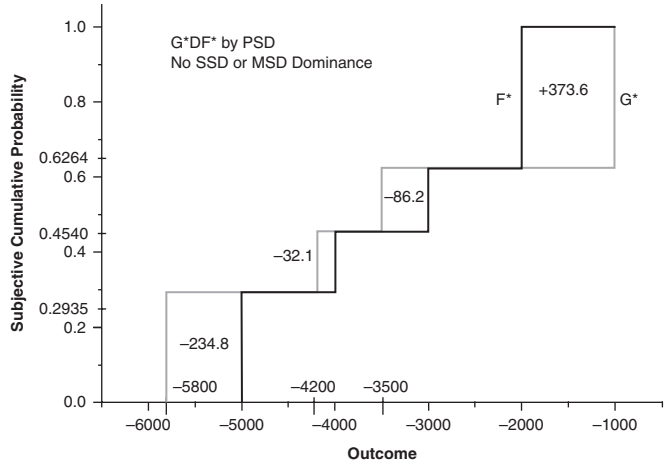

Exhibit 12.10 The Subjective Cumulative Distributions in Task I of Experiment 2
Note: The various box areas are calculated with CPT's decision weights given in Exhibit 12.9.

the subjects to determine the realized outcome of each prospect in each task. The lottery is drawn independently for each task and each prospect. If an outcome X is realized with the prospect the subject chose, the subject would receive a (positive or negative) cash flow of X/100 IS. The subjects received the payoff immediately after they made their choices and the outcome was realized. Note that in the worst-case scenario from the subject's point of view, the subject will not lose out-of-pocket money. At most all of the initial sum given to the subject may be lost. At best, the subject may end up with a gain of about 150 IS, that is, about $33. Most of the subjects won $20 to $30 in the 10- to-15-minute experiment.

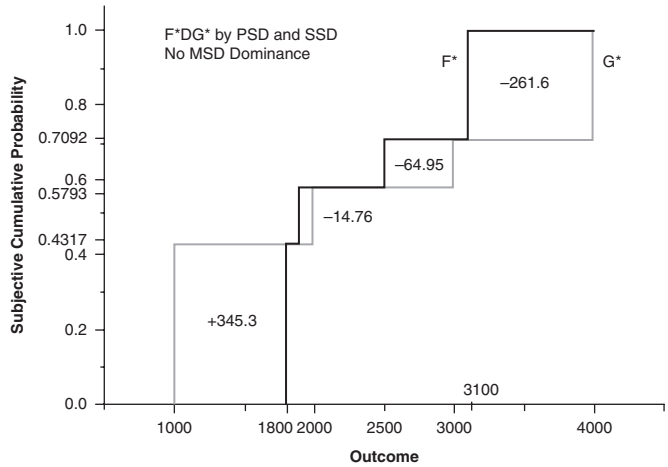

Exhibit 12.11 The Subjective Cumulative Distributions in Task II of Experiment 2
Note: F* dominates G* by CPT, yet 76 percent of the choices were G*, implying that the S-shape and the decision weights of CPT are not valid with regard to at least 76 percent of the subjects.

The Results

Exhibit 12.12 presents the results. The main findings follow.

As in Experiment 2, in Task I most subjects prefer F and in Task II most subjects selected G. The existence of monetary payoff does not change these strong results, which as in Experiment 2 and in Tasks III and IV of Experiment 1, strongly

Exhibit 12.12 The Choices in Experiment 3 (in percent)

Note: This table presents the results of Task I and Task II in Exhibit 12.7 for heterogeneous groups of subjects, with and without monetary payoffs.

Group 1. $n = 58$ undergraduate business students; no monetary payoff

	F	**G**	**Total**
Task I	94.8	5.2	100
Task I	12.1	87.9	100

Group 2. $n = 42$ mutual funds managers and financial analysts; no monetary payoff

	F	**G**	**Total**
Task I	92.8	7.2	100
Task I	9.5	91.5	100

Group 3. $n = 23$ second-year M.B.A. students; no exposure to SD criteria with monetary payoff

	F	**G**	**Total**
Task I	95.6	4.4	100
Task I	8.7	91.3	100

Group 4. $n = 27$ second-year M.B.A. students; studied SD criteria and expected utility with monetary payoff

	F	**G**	**Total**
Task I	77.8	22.2	100
Task I	7.4	92.6	100

Group 5. $n = 15$ advanced M.B.A. students (some Ph.D. candidates); studied SD criteria, expected utility and prospect theory

	F	**G**	**Total**
Task I	80.0	20.0	100
Task I	13.3	86.7	100

Aggregate across all five groups, $n = 165$

	F	**G**	**Total**
Task I	87.9	12.1	100
Task I	10.4	89.6	100

PSD (or CPT) Dominance: Task I G dominates F; Task II F dominates G.

reject the joint hypothesis of CPT. Moreover, based on the results of Task I, as in Experiment 2, the evidence rejects all possible S-shape value functions jointly with each of the other decision-weighting functions given in Exhibit 12.9. However, based on Task II, as in Experiment 2, the decision weighting of Prelec (1998) and Wu and Gonzalez (1996) (see discussion of the results of Experiment 2) cannot be rejected.

The choices are very similar across all five groups. The difference in choice between the group of mutual fund managers and financial analysts, and the students' groups is very minor. Also, at least in this specific case where leverage is not allowed, the choices with and without monetary payoff are very similar. Therefore, the results can be aggregated and focused on the lower part of Exhibit 12.12, which corresponds to all 165 subjects. From these results, the conclusion is that all CPT possible S-shape preference and CPT's decision-weighting function (as well as some other decision-weighting functions) are jointly rejected by 87.9 percent to 89.6 percent of the choices.

SUMMARY AND CONCLUSIONS

Since the appearance of their breakthrough articles, Kahneman and Tversky's prospect theory (PT) study (Kahneman and Tversky, 1979) and its modified version, cumulative prospect theory (CPT) (Tversky and Kahneman, 1992), expected utility theory (EUT) has been under severe attack as experimental studies revealed that subjects make choices in accordance with PT and CPT, which contradict EUT. As most models in finance and economics rely on EUT, CPT implies that these models are questionable.

To be more specific, CPT describes that subjects make choices based on change of wealth rather than *total* wealth (this does not affect portfolio efficient set analysis suggested by Markowitz and the Sharpe-Lintner CAPM). Subjects would employ decision weights, which contradict EUT in general and the CAPM in particular, and are characterized by an *S-shape value function*, which contradicts all models that assume risk aversion but does not contradict expected utility. Moreover, if probabilities are weighted also in the uniform probability case, as CPT advocates, then the results of virtually all empirical studies in economics and finance that estimate the *ex-ante* distribution by assigning a probability of $1/n$ to each of the n *ex-post* observation are questionable.

In this study, the validity of CPT is tested with stochastic dominance (SD) criteria. While CPT has many more important elements (e.g., loss aversion and mental accounting), the focus here is on decision weights, change of wealth, and the S-shape value function, which are important characteristics of CPT. Yet, loss aversion, which has much supporting evidence, does not contradict expected utility models and does not contradict the mean-variance model and the CAPM.

The existing experimental studies that test the PT and CPT use mainly the certainty equivalent approach and the utility midpoints approach. Experimental studies relying on the certainty equivalent (CE) approach compare one option with two outcomes (generally one outcome with a very low probability) to another

option with a certain outcome. Hence, the "certainty effect" prevails, implying that decision weights strongly affect choices. The utility midpoints approach relies on a comparison of two options, each of which contains at most two outcomes with an unequal probability. These two methods of testing CPT do not reflect most actual choice situations where the investors have to choose between two risky prospects, for example, two mutual funds or two positions and levered or unlevered portfolios.

To circumvent the "certainty effect" and the two-outcomes constraint, Levy and Levy (2001, 2002a) develop stochastic dominance (SD) criteria, which can be used in testing CPT and other alternative hypotheses, and then they employ these criteria experimentally. The advantages of SD criteria over the CE approach is that one can compare two risky options, with as many outcomes as one wishes, hence the compared prospects are more similar to what one observes in practice and also the "certainty effect" is avoided. Researchers did not employ these SD criteria in CPT experiments before, because the SD criteria corresponding to all S-shape preferences and all reverse-S-shape preferences were developed only in the last few years.

The null hypothesis of this study is that the subjects make decisions based on a change of wealth, with any possible S-shape preference, and with decision weights as suggested by CPT (see Equation 12.5). Also tested are any possible S-shape preferences jointly with other decision-weighting functions suggested in the literature. The focus here is on the equally likely outcome probability case, which is a canonical case and has strong implications to empirical studies in economics and finance. Therefore, these results and conclusions are confined only to the uniform probability case. This case, however, is important to economic models and in particular to empirical testing of these models.

Altogether, there are 216 subjects, each of whom makes several choices. Some of the subjects were students (second-year MBA students, advanced finance students as well as undergraduate students), and some were financial analysts and mutual fund managers. Some of the experiments involve an actual financial payoff, which was directly linked with the subjects' choices. The main results are as follows:

Kahneman and Tversky's 1979 experiment with the "certainty equivalent" approach is first repeated. The results are very similar to those of Kahneman and Tversky supporting the S-shape value function with risk seeking in the negative domain. However, in additional tasks using SD investment criteria and a choice from two uncertain prospects (with no "certainty effect"), at least 42 percent to 73 percent of the same subjects reject any possible S-shape preference with no decision weights as well as with CPT's decision weights.

Thus, with the CE approach, about 75 percent of the subjects are found to be risk seekers in the negative domain and with the SD approach about 75 percent of the same subjects are not risk-seekers in the negative domain—a contradictory result (the same contradiction is obtained in the positive domain; see Exhibit 12.4). This seeming contradiction in the choices is explained by the fact that Kahneman and Tversky in their 1979 paper did not incorporate probability weighting. Therefore, with probability weighting, their results, as well as results in the task replicating their original experiment, conform not only with S-shape function but also to possible risk-averse, linear, and even reverse S-shape preference functions. In other

words, in Tasks I and II the certainty effect with $w(0.2) > 0.2$ is present, hence the choices reflect this decision weight rather than the deduced risk-seeking preference by Kahneman and Tversky (1979).

In Experiments 2 and 3, a more general case is tested as prospects with more than two outcomes are considered. In these tasks, the convexity of preference in the negative domain and concavity of preference in the positive domain are tested, respectively. In the two experiments, the results with *CPT* probability weighting are as follows: Risk seeking in the negative domain is rejected by 88 percent to 100 percent of the subjects' choices. Risk aversion in the positive domain is rejected by 76 percent to 90 percent of the subjects' choices.

In summary, in the uniform probability case, the S-shape preference and the decision-weights function suggested by CPT are rejected. However, disentangling whether the CPT probability weighting is not intact, the S-shape preference is not intact, or both are not intact is impossible. The other weighting functions suggested in the literature jointly with the S-shape preference are also rejected with the exception of a few cases. The results are very similar regardless of the characteristics of the group of subjects and regardless of whether monetary payoff was involved in the experiment.

This study does not conclude that CPT is invalid for several reasons. First, CPT contains several important features not tested in this study. Second, in extreme cases with one certain prospect and one uncertain prospect with two outcomes, one with a relatively low probability and one with a relatively high probability, CPT explains choices.

However, for most situations one faces in economics and finance, that is, uncertain prospects with n observations with a probability $1/n$ assigned to each observation, all S-shape preferences combined with a wide range of reverse S-shape weighting functions are rejected. Thus, the validity of CPT and the strong evidence in its favor in explaining human decision making in some situations has limited implications to virtually all empirical tests commonly employed in finance and economics, as well as to the theoretical equilibrium models such as the CAPM. Hence, CPT has an excellent explanatory power in many situations but does not in the special and important equal probability case.

The results presented here may seem surprising. After all, CPT has been tested and verified by dozens of studies. However, most of these studies employ the CE or the midpoints methodologies and not the more general SD methodology, which can be employed in experiments with prospects that investors face in the real world. All the data needed to replicate this study are available in this chapter. The experiments are easy to replicate, and the skeptical reader is encouraged to conduct similar experiments to verify these results.

DISCUSSION QUESTIONS

1. Suppose Kahneman and Tversky's decision-weights function is acceptable and the task is to estimate beta for a given stock. Describe how to measure beta in such a case.
2. Suppose that F dominates G by PSD and $10,000 is added to the two random variables. Does PSD still hold?

3. Explain why one cannot use the certainty equivalent approach with a risky prospect with more than two outcomes to draw a conclusion about the curvature of the utility function.
4. This study shows that for equal probability weights, CPT is violated. Suggest a study to test CPT with unequal and small probabilities.

REFERENCES

Abdellaoui, Mohammed. 2000. Parameter-free elicitation of utilities and probability weighting functions. *Management Science* 46:11, 1497–1512.

Abdellaoui, Mohammed, Han Bleichrodt, and Corina Paraschiv. 2007. Loss aversion under prospect theory: A parameter-free measurement. *Management Science* 53:10, 1536–1674.

Allais, Maurice. 1953. Le comportement de l'homme rationnel devant le risque: Critique des postulats et axiomes de l'école américaine. *Econometrica* 21:4, 503–546.

Arditti, Fred D. 1967. Risk and the required return on equity. *Journal of Finance* 22:1, 19–36.

Arrow, Kenneth. 1965. *Aspects of the theory of risk bearing*. Helsinki: Yrjö Hahnsson Foundation.

Baltussen, Guido, Thierry Post, and Pim van Vliet. 2006. Violations of cumulative prospect theory in mixed gambles with moderate probabilities. *Management Science* 52:8, 1288–1290.

Benartzi, Shlomo, and Richard H. Thaler. 1995. Myopic loss aversion and the equity premium puzzle. *Quarterly Journal of Economics* 110:1, 73–92.

Booij, Adam S., and Gijs van de Kuilen. 2009. A parameter-free analysis of the utility of money for the general population under prospect theory. *Journal of Economic Psychology*, forthcoming.

Brinbaum, Michael, H. Kathleen Johnson, and Jay-Lee Longbottom. 2008. Tests of cumulative prospect theory with graphical displays of probability. *Judgment and Decision Making* 3:7, 528–546.

Camerer, Colin F., and Teck-Hua Ho. 1994. Violations of the betweenness axiom and nonlinearity in probability. *Journal of Risk and Uncertainty* 8:2, 167–196.

Edwards, Ward. 1962. Subjective probabilities inferred from decisions. *Psychology Review* 69:2, 109–135.

Fama, Eugene F., and Kenneth R. French. 1992. The cross-section of expected stock returns. *Journal of Finance* 47:2, 427–465.

Fama, Eugene F., and Kenneth R. French. 1993. Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics* 33:1, 3–56.

Fama, Eugene F., and James D. Macbeth. 1973. Risk, return and equilibrium: Empirical tests. *Journal of Political Economy* 81:3, 607–636.

Fennema, Hein, and Marcel van Assen. 1998. Measuring the utility of losses by means of the tradeoff method. *Journal of Risk and Uncertainty* 17:3, 277–295.

Fishburn, Peter C. 1964. *Decisions and value theory*. New York: John Wiley & Sons, Inc.

Fishburn, Peter C. 1978. On Handa's "new theory of cardinal utility" and the maximization of expected return. *Journal of Political Economy* 86:2, 321–324.

Friedman, Milton, and Leonard J. Savage. 1948. The utility analysis of choices involving risk. *Journal of Political Economy* 56:4, 279–304.

Friend, Irwin, and Randolph Westerfield. 1980. Co-skewness and capital asset pricing. *Journal of Finance* 35:4, 897–913.

Hadar, Joseph, and William R. Russell. 1969. Rules for ordering uncertain prospects. *American Economic Review* 59:1, 25–34.

Hanoch, Giora, and Haim Levy. 1969. The efficiency analysis of choices involving risk. *Review of Economic Studies* 36:3, 335–346.

Harvey, Campbell, and Akhtar Siddique. 2000. Conditional skewness in asset pricing tests. *Journal of Finance* 55:3, 1263–1295.
Kahneman, Daniel, and Amos Tversky. 1979. Prospect theory: An analysis of decision under risk. *Econometrica* 47:2, 263–291.
Kraus, Alan, and Robert H. Litzenberger. 1976. Skewness preference and the valuation of risk assets. *Journal of Finance* 31:4, 1085–1100.
Levy, Haim. 2006. *Stochastic dominance: Investment decision making under uncertainty.* Boston: Kluwer Academic Press.
Levy, Moshe, and Haim Levy. 2001. Testing for risk-aversion: A stochastic dominance approach. *Economics Letters* 71:2, 233–240.
Levy, Moshe, and Haim Levy. 2002a. Prospect theory: Much ado about nothing. *Management Science* 48:10, 1334–1349.
Levy, Haim, and Moshe Levy. 2002b. Experimental test of the prospect theory value function. *Organizational Behavior and Human Decision Processes* 89:2, 1058–1081.
Lintner, John. 1965. Security prices, risk, and the maximal gains from diversification. *Journal of Finance* 20:4, 587–615.
Machina, Mark J. 1982. Expected utility analysis without the independence axiom. *Econometrica* 50:2, 277−323.
Machina, Mark J. 1994. Review of generalized expected utility theory: The rank-dependent model. *Journal of Economic Literature* 32:3, 1237–1238.
Markowitz, Harry M. 1952a. Portfolio selection. *Journal of Finance* 7:1, 77–91.
Markowitz, Harry M. 1952b. The utility of wealth. *Journal of Political Economy* 60:2, 151–156.
Markowitz, Harry M. 1959. *Portfolio selection*. New York: John Wiley and Sons.
Markowitz, Harry M. 1987. *Mean variance analysis, portfolio choice and capital markets*. New York: Basil Blackwell.
Pratt, John W. 1964. Risk aversion in the small and in the large. *Econometrica* 32:1/2, 122–136.
Prelec, Drazen. 1998. The probability weighting function. *Econometrica* 66:3, 497–527.
Quiggin, John C. 1982. A theory of anticipated utility. *Journal of Economic Behavior and Organization* 3:4, 323–343.
Rabin, Matthew. 2000. Risk aversion and expected-utility: A calibration theorem. *Econometrica* 68:5, 1281–1292.
Roll, Richard. 1977. A critique of asset pricing theory's test: Part I: On past and potential testability of the theory. *Journal of Financial Economics* 4:2, 129–176.
Rothschild, Michael, and Joseph Stiglitz. 1970. Increasing risk: I. A definition. *Journal of Economic Theory* 2:3, 225–243.
Sharpe, William F. 1964. Capital asset prices: A theory of market equilibrium. *Journal of Finance* 19:3, 425–442.
Thaler, Richard H. 1999. Mental accounting matters. *Journal of Behavioral Decision Making* 12:3, 183–206.
Tobin, James. 1958. Liquidity preferences as behavior toward risk. *Review of Economic Studies* 25:2, 65–86.
Tversky, Amos, and Daniel Kahneman. 1992. Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk and Uncertainty* 5:4, 297–323.
Viscusi, Kip W. 1989. Prospective reference theory: Toward an explanation of the paradoxes. *Journal of Risk and Uncertainty* 2:3, 235–264.
von Neuman, John, and Oskar Morgenstern. 1944. *Theory of games and economic behavior*. Princeton, NJ: Princeton University Press.
Wakker, Peter P. 2003. The data of Levy and Levy (2002) "Prospect theory: Much ado about nothing?" actually support prospect theory. *Management Science* 49:7, 979–981.
Wu, George, and Richard Gonzalez. 1996. Curvature of the probability weighting function. *Management Science* 42:12, 1676–1690.

ABOUT THE AUTHOR

Haim Levy received his PhD in 1969 from the Hebrew University of Jerusalem and was appointed Professor of Business Administration in 1976. For the last 50 years, Professor Levy has published several books and hundreds of articles in top financial journals, among them papers co-authored with two Nobel prize winners, Harry Markowitz and Paul Samuelson. Professor Levy's novel work won him numerous scholarly honors and awards. In 1988 and in 2005 he was ranked as the most prolific researcher in finance in the world for the years 1945 to 1986 and 1952 to 2002, respectively. In 2006, Professor Levy won the EMET Prize for the role his studies played in the formation of modern finance theory and its development. Two of his major contributions to the field of finance and to other fields as well include the development of stochastic dominance, which are rules used in decision making under conditions of uncertainty, and the development of economic models for risk management.

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CHAPTER 13

Overconfidence

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INTRODUCTION

Overconfidence is a pervasive phenomenon and can have severe consequences. Researchers have offered overconfidence as an explanation for wars, strikes, litigations, entrepreneurial failures, and stock market bubbles (Glaser, Nöth, and Weber, 2004; Moore and Healy, 2008). According to Plous (1993, p. 217), "no problem in judgment and decision making is more prevalent and more potentially catastrophic than overconfidence."

Furthermore, overconfidence is an active field of research, as demonstrated by two literature database search requests for the word "overconfidence" (performed in mid-2009):

- Business Source Premier (EBSCO Host) shows 144 peer-reviewed journal articles published in 2008 and 1,189 articles since 2000.
- ScienceDirect indicates 250 peer-reviewed journal articles published in 2008 and 1,556 articles since 2000.

Given the voluminous amount of material on overconfidence, a main goal of this chapter is to explain the basic facets of overconfidence, not to provide a comprehensive overview of the entire field. Different phenomena are often summarized as overconfidence, which gives rise to some confusion about what researchers actually mean in a specific context. This chapter will discuss the facet that is most important in finance: miscalibration in judgmental intervals. The chapter places special focus on the recent literature from psychology and decision analysis in order to identify some applications in finance.

This chapter has the following structure: the first section describes the basic facets of overconfidence and presents questions that elicit the degree of overconfidence in survey participants. The next section discusses how overconfidence is modeled in finance. The third section discusses factors influencing the degree of overconfidence, including the stability of overconfidence over time and potential

explanations of overconfidence. The fourth section reviews recent research that analyzes the effects of overconfidence in finance. Specifically described are phenomena that can be explained by behavioral finance models incorporating overconfidence in the areas of investor behavior, asset pricing, and corporate finance. Empirical evidence and experimental studies document that overconfidence explains phenomena such as excessive trading of investors, stock market anomalies, or overinvestment of firms. A short summary concludes the chapter and provides suggestions for future research.

THE BASIC FACETS OF OVERCONFIDENCE

The two main facets of overconfidence are miscalibration and the better-than-average effect. Miscalibration can manifest itself in estimates of quantities that could potentially be discovered (such as the length of the river Nile) and in estimates of not yet known quantities (such as the future price of a stock or the value of a stock index). The following fractile method may be used to measure the degree of miscalibration in interval estimates:

Please give the following estimates for your prediction. The true answer to the questions (e.g., a question about the length of the river Nile; or a question on the value of the Dow Jones Euro Stoxx 50 in one week) should . . .

- Lower bound: with a high probability (95 percent) not falling short of the lower bound.
- Upper bound: with a high probability (95 percent) not exceeding the upper bound.

Studies that analyze such assessments of uncertain quantities using this fractile method usually find that people's probability distributions are too tight (Lichtenstein, Fischhoff, and Phillips, 1982; Keren, 1991). For example, studies that ask people to state a 90 percent confidence interval for several uncertain quantities (such as the above interval for the length of the river Nile) find that the percentage of surprises (i.e., the percentage of true values that fall outside the confidence interval) are higher than 10 percent, which is the percentage of surprises of an unbiased person in this context of estimating 95 percent upper and lower bounds.

Such estimates of the quantiles of probability distributions are often elicited for uncertain continuous quantities, usually general knowledge questions (Juslin, Wennerholm, and Olsson, 1999; Klayman, Soll, González-Vallejo, and Barlas, 1999; Soll and Klayman, 2004; Cesarini, Sandewall, and Johannesson, 2006; Juslin, Winman, and Hansson, 2007). Hit rates in many studies using 90 percent confidence intervals are less than 50 percent, leading to surprise rates of 50 percent or higher instead of the 10 percent expected from well-calibrated judges (see, for example, Hilton, 2001; Klayman et al., 1999; Russo and Schoemaker, 1992).

Such confidence intervals are also used to elicit predictions of time series such as stock price charts (Budescu and Du, 2007; Glaser and Weber, 2007). Questionnaire studies that obtain a volatility estimate of investors by asking for confidence intervals regarding the return/value of an index or return/price of a stock in the future (such as the above interval for the value of the Dow Jones Euro

Stoxx 50 in one week) usually find that the intervals provided are too tight. Thus, historical volatilities are underestimated (Hilton, 2001; Glaser et al., 2004). One example is the study of Graham and Harvey (2001). They study expectations of the stock market risk premium as well as associated volatility estimates in a panel survey. On a quarterly basis, chief financial officers (CFOs) of U.S. corporations are asked to provide their estimates of the market risk premium as well as upper and lower bounds of 90 percent confidence intervals of this premium. Graham and Harvey find that compared to historical standard deviations of one-year stock returns, CFOs underestimate the variance of stock returns and are thus very confident in their assessments. DeBondt (1998) presents results from a study of 46 individual investors. One important finding is that the confidence intervals are too narrow compared to the actual variability of prices. Glaser, Langer, and Weber (2009) obtain similar results for students and professional stock traders. In Hilton's review of questionnaire studies analyzing exchange rate and stock price predictions, he reports that these studies also find too narrow confidence intervals.

In the above studies, hit rates are also often calculated as in Budescu and Du (2007). When real financial time series are forecasted within a particular time window, such hit rates are problematic because the development of stock prices of different firms is not independent (Glaser, Langer, and Weber, 2007). Consider an investor who predicted in July 2001 that a set of stocks will increase slightly until the end of the year, with error bounds around a median forecast that correspond to historical stock price volatility. After September 11, 2001, such an investor would have been classified as extremely overconfident, although the *ex ante* prediction looked quite reasonable. This is why several studies compare the volatility expectation implied by the width of the stated confidence interval with a reasonable benchmark such as the historical volatility or the volatility implied by the option market (Graham and Harvey, 2001; Glaser and Weber, 2007). When forecasting financial time series, financial econometricians never agree on a single "correct" volatility estimate to judge the appropriateness of confidence intervals stated by subjects. The "optimal" volatility forecast scarcely exists (Poon and Granger, 2004). However, different volatility benchmarks only affect the amount of overconfidence measured by a researcher, but not the ranking of people with respect to their degree of overconfidence.

Other studies ask subjects to answer questions with two choices to measure the degree of miscalibration. Subjects are then asked to state the probability that their answer is correct, as the following example shows (direct probability judgment):

- Who was born first, Charles Darwin or Charles Dickens?
- How sure are you (please state a value between 50 percent and 100 percent)?

The usual finding is that the proportion of correct answers is lower than the assigned probability (Lichtenstein et al., 1982).

Another facet of overconfidence is the better-than-average effect. A typical question designed to elicit this effect is:

- Consider your driving skills. Do you think that you have above-average skills compared to the other people in this room?

The main finding is that people think their skills are above average. Taylor and Brown (1988) document that people have unrealistically positive views of themselves. One important manifestation of this evidence is that people judge themselves to be better than others with regard to skills or positive personality attributes. One commonly cited example is that 82 percent of a group of students rank themselves among the 30 percent of drivers with the highest driving safety (Svenson, 1981). A recent debate in the literature focuses on whether the better-than-average effect can be explained rationally (Merkle and Weber, 2009).

So far, both miscalibration and the better-than-average effect have been discussed in this chapter. However, there are alternative terms for this behavior. Moore and Healy (2008) suggest the following expressions:

- "excessive precision in one's belief," also called miscalibration
- "overplacement of one's performance relative to others," also called the better-than-average effect

The next section explains how to incorporate overconfidence into finance models.

OVERCONFIDENCE IN FINANCE MODELS

Overconfidence is usually modeled as overestimation of the precision of private information (Glaser et al., 2004). In investor trading models, the uncertain liquidation value of a risky asset is modeled as a realization of a random variable. Assume the liquidation value v is a realization of a normal distribution with mean 0 and variance $\sigma_{\tilde{v}}^2$, i.e., $\tilde{v} \sim N(0, \sigma_{\tilde{v}}^2)$. Investors receive private information signals s which are noisy; that is, they contain a random error ε. Assuming that random variables (the distribution of the liquidation value, $\tilde{v}$, and the distribution of the error term, $\tilde{\varepsilon} \sim N(o, \sigma_{\tilde{\varepsilon}}^2)$) are independent, the signal s is usually written as a realization of the random variable $\tilde{s}$, which is the sum of the random variables $\tilde{v}$ and $\tilde{\varepsilon}$, that is, $\tilde{s}(= \tilde{v} + k \cdot \tilde{\varepsilon}) \sim N(0, \sigma_{\tilde{v}}^2 + k^2 \cdot \sigma_{\tilde{\varepsilon}}^2)$. The parameter k captures the finding of overconfidence. If the parameter k is in the interval (0, 1), an investor underestimates the variance of the signal, s. In other words, the investor underestimates the variance of the error term. If $k = 0$, an investor believes that he knows the value of the risky asset with certainty. Thus, this way of modeling overconfidence captures the idea that investors underestimate the variance of signals or the uncertain liquidation value of an asset. As a consequence, their confidence intervals are too tight. This way of modeling overconfidence is closely related to miscalibration as defined above. Thus, the focus of this illustration will be on miscalibration in interval estimates. Moore and Healy (2008) provide evidence on other facets of overconfidence.

Some models assume that the degree of overconfidence, that is, the degree of the underestimation of the variance of signals, is a stable individual trait that is constant over time. However, other models assume that overconfidence dynamically changes over time. This assumption is motivated by psychological studies that find biased self-attribution (Wolosin, Sherman, and Till, 1973; Langer and Roth, 1975; Miller and Ross, 1975; Schneider, Hastorf, and Ellsworth, 1979). People overestimate the degree to which they are responsible for their own success. In the finance literature, overconfidence and biased self-attribution are sometimes regarded as

static and dynamic counterparts (Hirshleifer, 2001). In overconfidence models with biased self-attribution, the degree of overconfidence, that is, the degree of overestimation of the precision of private information, is a function of past investment success.

At this point, it is important to stress the following explicit and implicit assumptions of the way overconfidence is modeled in theoretical finance. Static models or models with constant overconfidence over time assume stable individual differences in the degree of overconfidence, that is, miscalibration. Some papers such as Benos (1998) even refer to investors' different degrees of overconfidence as different investor "types."

In contrast to these explicit and implicit assumptions, a large debate in the psychological literature exists about whether miscalibration is domain or task dependent. Some even consider miscalibration a statistical illusion (Gigerenzer, Hoffrage, and Kleinbölting, 1991; Erev, Wallsten, and Budescu, 1994; Klayman et al., 1999; Juslin, Winman, and Olson, 2000). Others question whether there are stable individual differences in reasoning or decision-making competence (Stanovich and West, 1998, 2000; Parker and Fischhoff, 2005). The following subsections in this chapter further discuss these issues.

FACTORS INFLUENCING THE DEGREE OF OVERCONFIDENCE, INDIVIDUAL DIFFERENCES, AND EXPLANATIONS

In this part of the chapter, we discuss factors that explain the variance in the degree of overconfidence within and across subjects. We especially present studies analyzing the influence of the specific elicitation mode, the level of difficulty of questions, gender, culture, the amount of information available to subjects, monetary incentives, and expertise. Furthermore, we discuss evidence on the stability over time of the degree of overconfidence and attempts to argue that the finding of overconfidence is in line with rationality.

Elicitation Method

Direct probability judgments induce only a modest bias as compared to the fractile method. Some studies using direct probability judgments even find modest underconfidence (Erev et al., 1994). Juslin et al. (1999) refer to the pattern of extreme overconfidence obtained by fractile estimates and the better calibration with probability estimates as "format dependence of overconfidence."

When eliciting interval estimates, the experimenter has the choice between several variations of the basic question described above:

- Please give the following estimates. The true answer to the questions (e.g., in the first question, the length of the river Nile; in the second question, the value of the Dow Jones Euro Stoxx 50 in one week) should. . .

Soll and Klayman (2004) distinguish between the range method, the two-point method, and the three-point method. When using the range method, judges are

asked for something like a 90 percent interval, which is not specified in greater detail. An example of the two-point method, which breaks the task into two separate questions, is given above (upper and lower bound). In the three-point method, subjects are also asked to provide the median estimate together with the upper and lower bound range of an interval. Measuring miscalibration with the help of the fractile method can therefore be done in three ways: (1) Ask for a range for which the test person is 90 percent sure that the right answer will be contained therein; (2) ask separately for a point with a 5 percent chance of being too low and another with a 5 percent chance of being too high; or (3) ask for those two estimates plus a median estimate. Soll and Klayman document another case of format dependence of overconfidence. They find that the format by which subjective intervals are elicited has a large effect on the level of overconfidence found and show that the 90 percent range produces the most overconfidence while asking for a median and upper and lower bound produces the least.

Budescu and Du (2007) ask subjects to provide lower and upper bounds of stock price forecasts. More specifically, they ask subjects to provide median values as well as 50, 70, and 90 percent confidence intervals of future prices. Using a within-subject experiment, Budescu and Du find that 70 percent intervals are well calibrated. They observe overconfidence when asking subjects to state 90 percent confidence intervals and underconfidence when asking subjects to state 50 percent confidence intervals.

For stock market predictions, Glaser et al. (2009) show that overconfidence is stronger as the forecast horizon increases. They observe slight underconfidence for short forecast horizons of one week. As Glaser, Langer, Reynders, and Weber (2008) show, the strength of the overconfidence effect in stock market forecasts significantly depends on whether subjects provide price or return forecasts. Volatility estimates are lower (and thus the overconfidence bias is stronger) when subjects are asked for returns compared to price forecasts. To summarize, the format by which miscalibration is measured heavily affects the degree of miscalibration obtained.

Hard Versus Easy Questions

Overconfidence is not omnipresent. It is often reduced or reversed for very easy questions, a phenomenon generally known as the hard-easy effect. The hard-easy effect occurs when people exhibit higher overconfidence for more difficult questions and less overconfidence, or even underconfidence, for easy questions (Lichtenstein and Fischhoff, 1977).

Several studies document this hard-easy effect (Lichtenstein and Fischhoff, 1977; Soll, 1996; Brenner, Koehler, Liberman, and Tversky, 1996; Juslin et al., 2000; Stone and Opel, 2000; Brenner, 2003) and find that this effect exists in a broad range of different categories of questions (Brenner, 2003). Moreover, evidence shows that the overconfidence bias is most prevalent for particularly difficult questions (Erev et al., 1994; Dawes and Mulford, 1996; Soll, 1996).

In experimental studies, the difficulty of tasks is measured by the proportion of people identifying the correct answer or by subjective assessments of difficulty made by the subjects (Soll, 1996; Klayman et al., 1999; Brenner, 2003). For example, in binary choice general knowledge studies, those questions that are answered correctly less than 70 to 80 percent of the time can be regarded as "difficult"

(Lichtenstein and Fischhoff, 1977; Suantak, Bolger, and Ferrell, 1996; Stone and Opel, 2000).

Researchers offer numerous explanations for these results. For example, some argue that the hard-easy effect may arise because subjects make errors when estimating the difficulty level of questions. Therefore, subjects are likely to believe that the hard questions are easier than they seem, resulting in more overconfidence when confronted with hard questions (Pulford and Colman, 1997). However, Erev et al. (1994) contend that observation of both overconfidence and underconfidence may arise from the regression effects of different models. Moreover, other authors stress the importance of unrepresentative questions chosen by the experimenter, and that asking for frequencies reduces or eliminates overconfidence in direct probability estimates (Gigerenzer et al., 1991; Juslin, 1994).

Gender

Several studies analyze the influence of gender on the degree of overconfidence as documented in Wu, Johnson, and Sung (2008) and Barber and Odean (2001). For example, Lundeberg, Fox, and Puncochar (1994) find that while both men and women exhibit overconfidence, men are generally more overconfident than women. Gender differences in overconfidence are highly task dependent. Lundeberg et al. show that differences in calibration are strongest for topics in the culturally masculine dominated tasks. Pulford and Colman (1997) also find that males are significantly more overconfident than females. In summary, gender seems to affect overconfidence where males are generally more overconfident than females. Pulford and Colman suggest that greater social pressure on females to exhibit underconfidence may be a reason for the observed gender differences.

Culture

Although most of the studies discussed in this chapter involve Western societies especially subjects in North America (Wu et al., 2008), several studies examine whether cross-national variation may exist in the levels of overconfidence. Culture may influence an individual's cognitive processes, which may affect an individual's confidence judgments and the manner in which a person processes information or knowledge. Yates, Lee, and Bush (1997) and Yates, Lee, Shinotsuka, Patalano, and Sieck (1998) conduct several cross-country studies. Their results indicate that Chinese subjects are more overconfident than American subjects, while Americans are more overconfident than Japanese people in general knowledge studies. Weber and Hsee (2000, p. 38) argue that Americans are less overconfident than Chinese because "[Americans] are encouraged to challenge others' and their own opinions" and that "this critical thinking style reduces their tendency to be overconfident." In a more recent study, Acker and Duck (2008) show that Asians are consistently more overconfident than the British.

Amount of Information and Monetary Incentives

This subsection addresses factors that, according to economic reasoning, should affect the degree of overconfidence. Tsai, Klayman, and Hastie (2008) report three

studies showing that when judges receive more information, their confidence increases more than their accuracy, resulting in substantial confidence-accuracy discrepancies. Their results suggest that judges do not adjust for the cognitive limitations that reduce their ability to effectively use additional information. Cesarini et al. (2006) investigate the robustness of results from confidence interval estimation tasks with respect to monetary incentives. Using monetary incentives, the measured overconfidence in the confidence interval method is reduced by about 65 percent.

The Effect of Expertise on Judgment

The analysis of the effects of expertise on judgmental forecasting and behavior in financial markets has attracted much attention. For example, Keren (1991), Koehler, Brenner, and Griffin (2002), Andersson, Edman, and Ekman (2005), and Lawrence, Goodwin, O'Connor, and Önkal (2006) provide extensive literature reviews.

An overwhelming body of research shows that miscalibration tends to occur among experts in most domains (Koehler et al., 2002). Some exceptions exist, however, such as the calibration of weather forecasters (Murphy and Brown, 1984; Murphy and Winkler, 1984). Experts' prediction intervals are also too tight, indicating overconfidence (Russo and Schoemaker, 1992; Graham and Harvey, 2001; Deaves, Lüders, and Schröder, 2005). Glaser et al. (2007, 2009) find that professional traders provide tighter intervals compared to a student comparison group. McKenzie, Liersch, and Yaniv (2008) examine interval estimates of information technology (IT) professionals and University of California at San Diego (UCSD) students about topics regarding both the IT industry and the UCSD. This within-subjects experiment shows that experts and novices are about equally overconfident. Experts report intervals with midpoints closer to the true value, which increases the hit rate, and that are narrower (i.e., more informative), which decreases the hit rate. The net effect is no change in the hit rate and overconfidence.

To sum up, the question of how the strength of professionals' biases compare to that of nonprofessionals is difficult to answer. The results presented so far suggest the following interpretation. Financial education and financial knowledge (also called "financial literacy") acquired by trading experience or other means of learning might be advantageous to improve behavior and reduce biases in tasks in which such knowledge should actually be helpful. Agnew and Szykman (2005) as well as Elliott, Hodge, and Jackson (2008) provide further support for this conjecture.

Individual Differences and Stability over Time

A main test of the modeling assumption of behavioral finance models analyzes whether there are stable individual differences in the degree of miscalibration. More generally, recent research investigates whether different judgment biases are related and whether stable individual differences exist in reasoning or decision-making competence (Stanovich and West, 1998, 2000; Parker and Fischhoff, 2005; Schunk and Betsch, 2006), or miscalibration (Klayman et al., 1999; Jonsson and Allwood, 2003; Budescu and Du, 2007; Glaser and Weber, 2007; Glaser et al., 2009).

Various studies document individual differences in the degree of miscalibration (Klayman et al., 1999; Soll, 1996; Stanovich and West, 1998; Alba and Hutchinson, 2000; Pallier, Wilkinson, Danthiir, Kleitman, Knezevic, Stankov, and Roberts, 2002; Soll and Klayman, 2004; Glaser et al., 2009). This empirical evidence is consistent with the common modeling assumption in finance that investors with different degrees of overconfidence can be regarded as different investor "types" (Benos, 1998). Usually, individual differences are especially strong when subjects are asked to state subjective confidence intervals when compared to binary choice tasks (Klayman et al., 1999).

Furthermore, people often show different levels of overconfidence depending on the task or domain, but reveal the same rank-order over tasks or domains (Jonsson and Allwood, 2003; Glaser et al., 2009). These authors also present evidence that overconfidence and the rank order across people are stable over time.

Bias, Rationality, or Statistical Artifact?

In recent years, several studies have called the overconfidence phenomenon into question. The arguments against overconfidence generally fall in one of two groups (Merkle, Sieck, and van Zandt, 2008): ecological validity or statistical artifact. The ecological validity arguments (Gigerenzer et al., 1991; Juslin, 1994) typically stress that experimenters (consciously or unconsciously) select questions that are not representative of all possible questions in a given category or domain. They argue that if a test has a large number of trick questions, judges will be overconfident because their prior experience in the test domain conflicts with the selected questions (Merkle et al.). Others suggest that overconfidence should be at least partly regarded as a statistical artifact (Erev et al., 1994; Pfeifer, 1994). These researchers show that empirical findings may be influenced by the method of analysis or that random error can produce similar findings. Taken together, the ecological and statistical validity arguments imply that no systematic cognitive biases are at work in the confidence elicitation process and that only random error or biased test items are to blame for observed overconfidence.

Merkle et al. (2008), however, show that random error is unlikely to completely explain overconfidence. They find that random error can account for the degree of overconfidence found in calibration studies even when overconfidence is actually caused by other factors. Thus, according to the authors, the error models say little about whether cognitive biases are present in the confidence elicitation process.

Glaser et al. (2009) contribute the following solution to this debate. They extensively analyze interval estimates for knowledge questions, for real financial time series, and for artificially generated charts. Furthermore, they suggest a new method to measure overconfidence in interval estimates that is based on the implied probability mass behind a stated prediction interval. More specifically, when objective benchmarks for stock market forecasts are available (e.g., realized volatility and implied volatility), superior knowledge of subjects is unlikely. For their forecasts of artificial charts, objective benchmarks are also available, and superior knowledge of subjects is impossible. They document overconfidence that is difficult to reconcile with rationality of agents and cannot be explained by knowledge plus random error. Furthermore, Glaser et al. show a significantly positive correlation of the above measures with standard miscalibration scores based on interval

estimates for knowledge questions to assess comparability of tasks (i.e., interval estimates in different domains). They do this in two field experiments for different levels of expertise of subjects (a group of students and more than 100 professional traders and investment bankers) over time, and for ecologically valid tasks.

APPLICATION IN FINANCE: THE EFFECTS OF OVERCONFIDENCE ON BEHAVIOR AND MARKET OUTCOMES

In this part of the chapter, we summarize behavioral finance models of financial markets that incorporate overconfident investors. These models make predictions concerning the behavior of traders in markets and concerning market outcomes. After discussing the theoretical literature, we turn to the empirical and experimental literature that tests these predictions. Finally, we briefly sketch how overconfidence might be used to explain stylized facts in corporate finance.

Models of Financial Markets

Overconfident investors underestimate the variance of the risky asset or overestimate its precision. Stated equivalently, their confidence intervals for the value of the risky asset are too tight. Benos (1998), Kyle and Wang (1997), Odean (1998), Wang (1998), and Caballé and Sákovics (2003) incorporate this way of modeling overconfidence in different types of trading models originally proposed by Hellwig (1980), Grossman and Stiglitz (1980), Diamond and Verrecchia (1981), and Kyle (1985, 1989). Most of the overconfidence models predict high trading volume in the market when there are overconfident traders. Moreover, at the individual level, overconfident investors trade more aggressively: The higher the degree of investor overconfidence, the higher the investor's trading volume. Odean (p. 1888) calls this finding "the most robust effect of overconfidence." DeBondt and Thaler (1995, pp. 392–393) note that the high trading volume observed in financial markets "is perhaps the single most embarrassing fact to the standard finance paradigm" and that "the key behavioral factor needed to understand the trading puzzle is overconfidence."

Apart from the ability to explain high levels of trading volume, the models of Benos (1998), Kyle and Wang (1997), Odean (1998), Wang (1998), and Caballé and Sákovics (2003) make further predictions. Odean finds that overconfident traders have lower expected utility than rational traders and hold underdiversified portfolios. In contrast, Kyle and Wang find that overconfident traders might earn higher expected profits or have higher expected utility than rational traders as overconfidence works like a commitment device to aggressive trading. Benos finds similar results. However, higher profits of overconfident investors are a result of a first mover advantage in his model. Benos, Caballé, and Sákovics as well as Odean all show that the presence of overconfident traders helps explain excess volatility of asset prices: that is, the fluctuation of asset prices is higher than the fluctuation of the fundamental value. In summary, some predictions are common results of all models (the effect of overconfidence on trading volume), whereas other predictions depend on further assumptions (e.g., the effect of overconfidence on expected utility).

Kyle and Wang (1997), Hirshleifer and Luo (2001), and Wang (2001) show that overconfident traders may survive in security markets. Daniel, Hirshleifer, and Subrahmanyam (1998) show that overconfidence might present an explanation for the momentum effect, that is, the empirical fact that winning stocks in the past 3 to 12 months remain winners in the subsequent period, and that those that were losers in the past 3 to 12 months remain losers. Gervais and Odean (2001) analyze how overconfidence dynamically changes over time as a function of past investment success due to a self-attribution bias. Scheinkman and Xiong (2003) provide evidence that overconfidence can explain bubbles in financial markets.

Empirical and Experimental Tests of Model Predictions Concerning Investor Behavior

The purest test of overconfidence models of investor behavior is to measure the degree of overconfidence of subjects and to try to explain behavior with these measures of biases (Glaser et al., 2004). Obviously, measuring the degree of overconfidence using the questions described above outside the laboratory and correlating these measures with behavior is difficult.

In the Barber and Odean (2001) study, the proxy for overconfidence is gender. They summarize psychological studies that find a higher degree of overconfidence among men than among women. Consequently, they divide their data set of 35,000 households from a large discount brokerage house by gender and find that men trade more than women, which is consistent with overconfidence models.

Glaser and Weber (2007) directly test this hypothesis by correlating individual overconfidence scores with several measures of trading volume of individual investors. They ask roughly 3,000 online broker investors to answer an Internet questionnaire designed to measure various facets of overconfidence (miscalibration, volatility estimates, and the better-than-average effect). The authors calculate measures of trading volume by the trades of 215 individual investors who answered the questionnaire. Glaser and Weber find that investors who think that they are above average in terms of investment skills or past performance (but who did not have above average performance in the past) trade more. Furthermore, they find that investors who underestimate the volatility of stock returns have higher stock portfolio turnover values. However, the effect of the better-than-average effect on trading activity of individual investors is stronger.

Biais, Hilton, Mazurier, and Pouget (2005) experimentally analyze whether psychological traits and cognitive biases affect trading. Based on the answers of 184 subjects (students) to a psychological questionnaire, the authors measure, among other psychological traits, the degree of overconfidence via calibration tasks. The subjects also participate in an experimental asset market afterward. Biais et al. find that overconfident subjects have a greater tendency to place unprofitable orders.

Empirical Tests of Model Predictions Concerning Market Outcomes

Several of the above-mentioned overconfidence models make predictions concerning financial market outcomes that deviate from those of rational models. These predictions can be tested with aggregate market data. For example, in Daniel et al.'s

(1998) model, the momentum effect is a result of the trading activity of overconfident traders. One implication of their model is that momentum is strongest among stocks that are difficult to value by investors. One example of such stocks is growth stocks with hard-to-value growth options in the future. Daniel and Titman (1999) confirm this implication and find that momentum is stronger for growth stocks. If disagreement among investors about future performance is stronger for hard-to-value stocks and if trading volume is a measure of this disagreement, then a further implication of Daniel et al.'s model is a stronger momentum effect among high-volume stocks. Lee and Swaminathan (2000) and Glaser and Weber (2003) confirm this model using turnover, defined as the number of shares traded divided by the number of shares outstanding, as a measure of trading volume. These authors find that momentum is stronger among high-turnover stocks.

Behavioral Corporate Finance

Recently, theoretical progress has been made in understanding the effects of managerial overconfidence in the field of corporate finance. This field of research is extensively covered in other chapters of this book.

One clear test of such behavioral corporate finance models is suggested by Ben-David, Graham, and Harvey (2007), who test whether top corporate executives are miscalibrated and whether their miscalibration affects corporate investment and financing decisions. Over six years, the authors collect a panel of nearly 7,000 observations of probability distributions provided by top financial executives regarding the future development of the stock market by using the questions described above to measure overconfidence. The first observation is that financial executives are miscalibrated—realized market returns are within the executives' 80 percent confidence intervals only 38 percent of the time. Then, Ben-David et al. show that companies with overconfident CFOs use lower discount rates to value cash flows, invest more, use more debt, are less likely to pay dividends, are more likely to repurchase shares, and use proportionally more long-term as opposed to short-term debt.

SUMMARY AND CONCLUSIONS

Many regard overconfidence as the most prevalent judgment bias. Several studies show that overconfidence can lead to suboptimal decisions on the part of investors, managers, and politicians. Theoretical economics and finance papers model overconfidence as the degree of underestimation in the variance of signals. Agents with different degrees of overconfidence are regarded as different "types" of agents. The implicit assumption behind this modeling choice is that stable individual differences exist in the degree of overconfidence. Recent research, however, questions whether overconfidence should be considered as a bias. Some studies stress that the way researchers measure overconfidence drives results to document overconfidence when there is none. These studies show that different degrees of agents' knowledge plus a random error in predictions can easily explain "overconfidence."

This chapter shows that a balanced reading of the psychological and decision-theoretic literature suggests that the amount of overconfidence varies among

elicitation methods. Still, the ranking of people remains constant. Whether too tight intervals can be completely explained by rationality is unlikely.

Another message of this chapter is that using the term "overconfidence" requires care. Several different concepts, such as the better-than-average effect or miscalibration, are often subsumed as overconfidence. The chapter also shows that miscalibration is the facet of overconfidence most closely related to the way finance models characterize overconfidence. The above-mentioned studies indicate that a reasonable modeling assumption is that investors are miscalibrated by underestimating stock variances or equivalently by overestimating the precision of their knowledge.

Several aspects of overconfidence are still not yet well understood. Analyzing the dynamics of overconfidence seems to be a fruitful area of future research. So far, there is mixed evidence on the influence of outcome feedback on miscalibration (Lichtenstein and Fischhoff, 1980; Subbotin, 1996; Stankov and Crawford, 1997; Stone and Opel, 2000). Currently, the question of how feedback interacts with personal experience or the effects of past success remains unanswered. Such findings are important to understand how "debiasing" through behavioral finance training for financial markets professionals, or attempts to increase financial literacy, might work to mitigate the detrimental effects of overconfidence. What can firms do to eliminate the effects of managerial overconfidence on corporate decisions? How can managers be debiased? Future research should also analyze the effects of properly designed management accounting systems, compensation contracts, and corporate governance to eliminate these biases and their effects on corporate decisions.

DISCUSSION QUESTIONS

1. Explain how a researcher can measure the degree of miscalibration of a group of people.
2. What aspects of overconfidence are often modeled in finance?
3. Describe how predictions of overconfidence models can be empirically tested.
4. What market phenomena can be explained by overconfidence in the areas of individual investor behavior, asset pricing, and corporate finance?

REFERENCES

Acker, Daniella, and Nigel W. Duck. 2008. Cross-cultural overconfidence and biased self-attribution. *Journal of Socio-Economics* 37:5, 1815–1824.

Agnew, Julie R., and Lisa R. Szykman. 2005. Asset allocation and information overload: The influence of information display, asset choice, and investor experience. *Journal of Behavioral Finance* 6:2, 57–70.

Alba, Joseph W., and J. Wesley Hutchinson. 2000. Knowledge calibration: What consumers know and what they think they know. *Journal of Consumer Research* 27:2, 123–156.

Andersson, Patric, Jan Edman, and Mattias Ekman. 2005. Predicting the World Cup 2002 in soccer: Performance and confidence of experts and non-experts. *International Journal of Forecasting* 21:3, 565–576.

Barber, Brad M., and Terrance Odean. 2001. Boys will be boys: Gender, overconfidence, and common stock investment. *Quarterly Journal of Economics* 116:1, 261–292.

Ben-David, Itzhak, John R. Graham, and Campbell R. Harvey. 2007. Managerial overconfidence and corporate policies. NBER Working Paper No. 13711.

Benos, Alexandros V. 1998. Aggressiveness and survival of overconfident traders. *Journal of Financial Markets* 1:3-4, 353–383.

Biais, Bruno, Denis Hilton, Karine Mazurier, and Sébastien Pouget. 2005. Judgemental overconfidence, self-monitoring, and trading performance in an experimental financial market. *Review of Economic Studies* 72:2, 287–312.

Brenner, Lyle A. 2003. A random support model of the calibration of subjective probabilities. *Organizational Behavior and Human Decision Processes* 90:1, 87–110.

Brenner, Lyle A., Derek J. Koehler, Varda Liberman, and Amos Tversky. 1996. Overconfidence in probability and frequency judgments: A critical examination. *Organizational Behavior and Human Decision Processes* 65:3, 212–219.

Budescu, David V., and Ning Du. 2007. Coherence and consistency of investors' probability judgments. *Management Science* 53:11, 1731–1744.

Caballé, Jordi, and József Sákovics. 2003. Speculating against an overconfident market. *Journal of Financial Markets* 6:2, 199–225.

Cesarini, David, Örjan Sandewall, and Magnus Johannesson. 2006. Confidence interval estimation tasks and the economics of overconfidence. *Journal of Economic Behavior & Organization* 61:3, 453–470.

Daniel, Kent, David Hirshleifer, and Avanidhar Subrahmanyam. 1998. Investor psychology and security market under- and overreactions. *Journal of Finance* 53:6, 1839–1885.

Daniel, Kent, and Sheridan Titman. 1999. Market efficiency in an irrational world. *Financial Analysts Journal* 55:6, 28–40.

Dawes, Robyn M., and Matthew Mulford 1996. The false consensus effect and overconfidence: Flaws in judgment or flaws in how we study judgment? *Organizational Behavior and Human Decision Processes* 65:3, 201–211.

Deaves, Richard, Erik Lüders, and Michael Schröder. 2005. The dynamics of overconfidence: Evidence from stock market forecasters. Discussion Paper, Centre for European Economic Research No. 05-83.

DeBondt, Werner F. M. 1998. A portrait of the individual investor. *European Economic Review* 42:3-5, 831–844.

DeBondt, Werner F. M., and Richard H. Thaler. 1995. Financial decision making in markets and firms: A behavioral perspective. In *Handbooks in operations research and management science*, ed. Robert A. Jarrow, Vojislav Maksimovic, and William T. Ziemba. Vol. 9, 385–410. Amsterdam: Elsevier.

Diamond, Douglas W., and Robert E. Verrecchia. 1981. Information aggregation in a noisy rational expectations economy. *Journal of Financial Economics* 9: 3, 221–235.

Elliott, W. Brooke, Frank D. Hodge, and Kevin E. Jackson. 2008. The association between nonprofessional investors' information choices and their portfolio returns: The importance of investing experience. *Contemporary Accounting Research* 25:2, 473–498.

Erev, Ido, Thomas S. Wallsten, and David V. Budescu. 1994. Simultaneous over- and underconfidence: The role of error in judgment processes. *Psychological Review* 101:33, 519–528.

Gervais, Simon, and Terrance Odean. 2001. Learning to be overconfident. *Review of Financial Studies* 14:1, 1–27.

Gigerenzer, Gerd, Ulrich Hoffrage, and Heinz Kleinbölting. 1991. Probabilistic mental models: A Brunswikian theory of confidence. *Psychological Review* 98:4, 506–528.

Glaser, Markus, Thomas Langer, Jens Reynders, and Martin Weber. 2008. Scale dependence of overconfidence in stock market volatility forecasts. Working Paper, University of Mannheim.

Glaser, Markus, Thomas Langer, and Martin Weber. 2007. On the trend recognition and forecasting ability of professional traders. *Decision Analysis* 4:4, 176–193.

Glaser, Markus, Thomas Langer, and Martin Weber. 2009. Overconfidence of professionals and laymen: Individual differences within and between tasks? Working Paper, University of Mannheim.

Glaser, Markus, Markus Nöth, and Martin Weber. 2004. Behavioral finance. In *Blackwell handbook of judgment and decision making*, ed. Derek J. Koehler and Nigel Harvey, 527–546, Oxford, U.K.: Blackwell Publishing.

Glaser, Markus, and Martin Weber. 2003. Momentum and turnover: Evidence from the German stock market. *Schmalenbach Business Review* 55:2, 108–135.

Glaser, Markus, and Martin Weber. 2007. Overconfidence and trading volume. *Geneva Risk and Insurance Review* 32:1, 1–36.

Graham, John R., and Campbell R. Harvey. 2001. Expectations of equity risk premia, volatility, and asymmetry. NBER Working Paper No. 8678.

Grossman, Sanford J., and Joseph E. Stiglitz. 1980. On the impossibility of informationally efficient markets. *American Economic Review* 70:3, 393–408.

Hellwig, Martin F. 1980. On the aggregation of information in competitive markets. *Journal of Economic Theory* 22:3, 477–498.

Hilton, Denis J. 2001. The psychology of financial decision-making: Applications to trading, dealing, and investment analysis. *Journal of Psychology and Financial Markets* 2:1, 37–53.

Hirshleifer, David. 2001. Investor psychology and asset pricing. *Journal of Finance* 56:4, 1533–1597.

Hirshleifer, David, and Guo Y. Luo. 2001. On the survival of overconfident traders in a competitive securities market. *Journal of Financial Markets* 4:1, 73–84.

Jonsson, Anna-Carin, and Carl M. Allwood. 2003. Stability and variability in the realism of confidence judgments over time, content domain, and gender. *Personality and Individual Differences* 34:4, 559–574.

Juslin, Peter. 1994. The overconfidence phenomenon as a consequence of informal experimenter-guided selection of almanac items. *Organizational Behavior and Human Decision Processes* 57:2, 226–246.

Juslin, Peter, Pia Wennerholm, and Henrik Olsson. 1999. Format dependence in subjective probability calibration. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 25:4, 1038–1052.

Juslin, Peter, Anders Winman, and Henrik Olson. 2000. Naive empiricism and dogmatism in confidence research: A critical examination of the hard-easy effect. *Psychological Review* 107:2, 384–396.

Juslin, Peter, Anders Winman, and Patrik Hansson. 2007. The naïve intuitive statistician: A naïve sampling model of intuitive confidence intervals. *Psychological Review* 114:3, 678–703.

Keren, Gideon. 1991. Calibration and probability judgements: Conceptual and methodological issues. *Acta Psychologica* 77:3, 217–273.

Klayman, Joshua, Jack B. Soll, Claudia González-Vallejo, and Sema Barlas. 1999. Overconfidence: It depends on how, what, and whom you ask. *Organizational Behavior and Human Decision Processes* 79:3, 216–247.

Koehler, Derek J., Lyle Brenner, and Dale Griffin. 2002. The calibration of expert judgment: Heuristics and biases beyond the laboratory. In *Heuristics and biases: The psychology of intuitive judgment*, ed. Thomas Gilovich, Dale Griffin, and Daniel Kahneman, 686–715. Cambridge, U.K.: Cambridge University Press.

Kyle, Albert S. 1985. Continuous auctions and insider trading. *Econometrica* 53:6, 1315–1336.

Kyle, Albert S. 1989. Informed speculation with imperfect competition. *Review of Economic Studies* 56:3, 317–356.

Kyle, Albert S., and F. Albert Wang. 1997. Speculation duopoly with agreement to disagree: Can overconfidence survive the market test? *Journal of Finance* 52:5, 2073–2090.

Langer, Ellen J., and Jane Roth. 1975. Heads I win, tails it's chance: The illusion of control as a function of the sequence of outcomes in a purely chance task. *Journal of Personality and Social Psychology* 32:6, 951–955.

Lawrence, Michael, Paul Goodwin, Marcus O'Connor, and Dilek Önkal. 2006. Judgmental forecasting: A review of progress over the last 25 years. *International Journal of Forecasting* 22:3, 493–518.

Lee, Charles M. C., and Bhaskaran Swaminathan. 2000. Price momentum and trading volume. *Journal of Finance* 55:5, 2017–2069.

Lichtenstein, Sarah, and Baruch Fischhoff 1977. Do those who know more also know more about how much they know? *Organizational Behavior and Human Performance* 20:2, 159–183.

Lichtenstein, Sarah, and Baruch Fischhoff. 1980. Training for calibration. *Organizational Behavior and Human Performance* 26:2, 149–171.

Lichtenstein, Sarah, Baruch Fischhoff, and Lawrence D. Phillips. 1982. Calibration of probabilities: The state of the art to 1980. In *Judgment under uncertainty: Heuristics and biases*, ed. Daniel Kahneman, Paul Slovic, and Amos Tversky, 306–334. Cambridge, U.K.: Cambridge University Press.

Lundeberg, Mary A., Paul W. Fox, and Judith Puncochar. 1994. Highly confident but wrong: Gender differences and similarities in confidence judgments. *Journal of Educational Psychology* 86:1, 114–121.

McKenzie, Craig R. M., Michael J. Liersch, and Ilan Yaniv. 2008. Overconfidence in interval estimates: What does expertise buy you? *Organizational Behavior and Human Decision Processes* 107:2, 179–191.

Merkle, Christoph, and Martin Weber. 2009. True overconfidence: The inability of rational information processing to account for apparent overconfidence. Working Paper, University of Mannheim.

Merkle, Edgar C., Winston R. Sieck, and Trisha van Zandt. 2008. Response error and processing biases in confidence judgment. *Journal of Behavioral Decision Making* 21:4, 428–448.

Miller, Dale T., and Michael Ross. 1975. Self-serving biases in attribution of causality: Fact or fiction? *Psychological Bulletin* 82:2, 213–25.

Moore, Don A., and Paul J. Healy. 2008. The trouble with overconfidence. *Psychological Review* 115:2, 502–17.

Murphy, Allan H., and Barbara G. Brown. 1984. A comparative evaluation of objective and subjective weather forecasts in the United States. *Journal of Forecasting* 3:4, 369–393.

Murphy, Allan H., and Robert L. Winkler. 1984. Probability forecasting in meteorology. *Journal of the American Statistical Association* 79:387, 489–500.

Odean, Terrance. 1998. Volume, volatility, price, and profit when all traders are above average. *Journal of Finance* 53:6, 1887–1934.

Pallier, Gerry, Rebecca Wilkinson, Vanessa Danthiir, Sabina Kleitman, Goran Knezevic, Lazar Stankov, and Richard D. Roberts. 2002. The role of individual differences in the accuracy of confidence judgments. *Journal of General Psychology* 129:3, 257–299.

Parker, Andrew M., and Baruch Fischhoff. 2005. Decision-making competence: External validation through an individual-differences approach. *Journal of Behavioral Decision Making* 18:1, 1–27.

Pfeifer, Phillip E. 1994. Are we overconfident in the belief that probability forecasters are overconfident? *Organizational Behavior and Human Decision Processes* 58:2, 203–213.

Plous, Scott. 1993. *The psychology of judgment and decision making*. New York: McGraw-Hill.

Poon, Ser-Huang, and Clive Granger. 2004. Practical issues in forecasting volatility. *Financial Analysts Journal* 61:1, 45–56.

Pulford, Briony D., and Andrew M. Colman. 1997. Overconfidence: Feedback and item difficulty effects. *Personality and Individual Differences* 23:1, 125–133.

Russo, J. Edward, and Paul J. H. Schoemaker. 1992. Managing overconfidence. *Sloan Management Review* 33:2, 7–17.

Scheinkman, Jose A., and Wei Xiong. 2003. Overconfidence and speculative bubbles. *Journal of Political Economy* 111:6, 1183–1219.

Schneider, David J., Albert H. Hastorf, and Phoebe C. Ellsworth. 1979. *Person perception*. Reading, MA: Addison-Wesley.

Schunk, Daniel, and Cornelia Betsch. 2006. Explaining heterogeneity in utility functions by individual differences in decision modes. *Journal of Economic Psychology* 27:3, 386–401.

Soll, Jack B. 1996. Determinants of overconfidence and miscalibration: The roles of random error and ecological structure. *Organizational Behavior and Human Decision Processes* 65:2, 117–137.

Soll, Jack B., and Joshua Klayman. 2004. Overconfidence in interval estimates. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 30:2, 299–314.

Stankov, Lazar, and John D. Crawford. 1997. Self-confidence and performance on tests of cognitive abilities. *Intelligence* 25:2, 93–109.

Stanovich, Keith E., and Richard F. West. 1998. Individual differences in rational thought. *Journal of Experimental Psychology: General* 127:2, 161–188.

Stanovich, Keith E., and Richard F. West. 2000. Individual differences in reasoning: Implications for the rationality debate. *Behavioral and Brain Sciences* 23:5, 645–726.

Stone, Eric R., and Ryan B. Opel. 2000. Training to improve calibration and discrimination: The effects of performance and environmental feedback. *Organizational Behavior and Human Decision Processes* 83:2, 282–309.

Suantak, Liana, Fergus Bolger, and William R. Ferrell. 1996. The hard-easy effect in subjective probability calibration. *Organizational Behavior and Human Decision Processes* 67:2, 201–221.

Subbotin, Vadim. 1996. Outcome feedback effects on under- and overconfident judgments (general knowledge tasks). *Organizational Behavior and Human Decision Processes* 66:3, 268–76.

Svenson, Ola. 1981. Are we all less risky and more skillful than our fellow drivers? *Acta Psychologica* 47:2, 143–148.

Taylor, Shelley E., and Jonathon D. Brown. 1988. Illusion and well-being: A social psychology perspective on mental health. *Psychological Bulletin* 103:2, 193–210.

Tsai, Claire I., Joshua Klayman, and Reid Hastie. 2008. Effects of amount of information on judgment accuracy and confidence. *Organizational Behavior and Human Decision Processes* 107:2, 97–105.

Wang, F. Albert. 1998. Strategic trading, asymmetric information and heterogeneous prior beliefs. *Journal of Financial Markets* 1:3-4, 321–352.

Wang, F. Albert. 2001. Overconfidence, investor sentiment, and evolution. *Journal of Financial Intermediation* 10:2, 138–170.

Weber, Elke, and Christopher K. Hsee. 2000. Culture and individual judgment and decision making. *Applied Psychology: An International Review* 49:1, 32–61.

Wolosin, Robert J., Steven J. Sherman, and Amnon Till. 1973. Effects of cooperation and competition on responsibility attribution after success and failure. *Journal of Experimental Social Psychology* 9:3, 220–235.

Wu, Shih-Wie, Johnnie E. V. Johnson, and Ming-Chien Sung. 2008. Overconfidence in judgements: The evidence, the implications and the limitations. *Journal of Prediction Markets* 2:1, 73–90.

Yates, J. Frank, Ju-Wei Lee, and Julie G. G. Bush. 1997. General knowledge overconfidence: Cross national variations, response style, and "Reality." *Organizational Behavior and Human Decision Processes* 70:2, 87–94.

Yates, J. Frank, Ju-Wei Lee, Hiromi Shinotsuka, Andrea L. Patalano, and Winston R. Sieck. 1998. Cross-cultural variations in probability judgment accuracy: Beyond general knowledge overconfidence? *Organizational Behavior and Human Decision Processes* 74:2, 89–117.

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CHAPTER 14

The Representativeness Heuristic

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INTRODUCTION

What do investors ask of the fund manager? Naturally investors want him or her to make them money. Yet, how can they infer from the fund manager's track record the chances of this occurring in the future? Consider Bill Miller, the legendary lead manager of the Legg Mason Value Trust mutual fund, which was the only fund to beat the S&P 500 each calendar year from 1991 to 2005. A string of accolades for Miller's investment performance culminated in 2006 with him winning the *Standard & Poor's/Business Week* Excellence in Fund Management award for the fourth year in a row, and also with *Fortune* magazine anointing him "the greatest money manager of our time" (Serwer, 2006). According to Serwer, Miller was also frequently compared to the Yankees slugger Joe DiMaggio, who had at least one hit in 56 successive Yankees games, for having a "hot hand" or being a "streak shooter." To what extent can the remarkable performance of the Legg Mason Value Trust be attributed to its lead manager's skill? Was there a large component of luck? Does this situation deal with the general misconception of chance and randomness known as the "law of small numbers," an aspect of the representativeness heuristic, or is Miller the exceptional fund manager his unique track record suggests?

Representativeness refers to the way people make subjective probability judgments based on similarity to stereotypes. However, recognizing the representativeness heuristic is easier than defining it. Gilovich (1991, p. 18) describes the nature of the heuristic in more detail: "Representativeness is a tendency to assess the similarity of outcomes, instances and categories on relatively salient and even superficial features, and then to use these assessments and similarity as a basis of judgment. People assume like goes with like." Because representativeness is not influenced by several factors that should affect probability judgments, the implication is that errors in judgment sometimes result.

This chapter first describes the representativeness heuristic and the associated research evidence, much of which is based on simple abstract experiments of a laboratory nature conducted by cognitive psychologists. The chapter then explores the extent to which the results of these experiments are also relevant in complex real-world financial environments. The concluding section provides a critique of how

representativeness is treated in behavioral finance and discusses some alternative views on the underlying psychological processes at work.

THE REPRESENTATIVENSS HEURISTIC

Representativeness deals with the subjective assessment of probabilities. Tversky and Kahneman (1974, p. 1124) define the representativeness heuristic as the way in which probabilities are evaluated "... by the degree to which A is representative of B, that is, the degree to which A resembles B." What A and B represent depends on the judgment that is being made. The brain assumes that things that have similar qualities are quite alike.

Some Illustrations

Consider the following five questions:

1. (Nofsinger, 2008, p. 63) "Mary is quiet, studious and concerned with social issues. While an undergraduate at Berkeley she majored in English literature and environmental studies." Given this information, indicate which of the following three cases is most probable:
   (a) Mary is a librarian.
   (b) Mary is a librarian and a member of the Sierra Club (America's largest and most influential environmental organization with 1.3 million members).
   (c) Mary works in the banking industry.
2. Peter is an ambitious, streetwise New Yorker who talks quickly and dresses smartly. Although young, bright, and dynamic, he is considered quite brash by his friends. He works for a large investment bank. What is the probability Peter is a derivatives trader?
3. Two mutual funds with the same beta, A and B, have both managed to outperform the S&P 500 by the same amount over the past five years. If performance was monitored on a monthly basis, which fund do you think had more months during this period when it beat the S&P 500 in that month by a minimum of 1 percent if mutual fund A held an average of 100 stocks, and mutual fund B an average of 25 stocks?
   (a) Fund A.
   (b) Fund B.
   (c) About the same.
4. Demand for a beer manufacturer is largely influenced by chance factors such as the weather and number of people watching sporting events. In the first week of July, the manufacturer achieved exceptional sales of 1.2 million cans. In the absence of other information, are the sales during the following week likely to be?
   (a) Higher.
   (b) About the same.
   (c) Lower than 1.2 million cans.
5. A consultant is advising the trustees of a pension plan on which fund manager to hire. One particular fund manager has been in the top quartile

of his sector for each of the past three years. What would you estimate his likelihood of being in the top quartile again in the following year to be?

Each of the above examples illustrates a different aspect of the representativeness heuristic.

Tversky and Kahneman (1974) describe different aspects of the way in which people act in violation of the laws of statistics, at least in theoretical or abstract tasks, when making probability judgments relying on the representativeness heuristic:

- *Insensitivity to prior information* or *base rate neglect:* Ignoring prior probabilities or base rate frequencies, and relying on the representativeness of the event alone.
- *Insensitivity to sample size:* Making inferences, or probability assessments, on the basis of the representativeness of the sample statistic derived independent of the size of the sample.
- *Misconceptions of chance and randomness:* Involving the way people view sequences of events such as fund manager performance each year or, more simplistically, a series of coin tosses, and read patterns into what is essentially a series of random outcomes. A related aspect of this behavior is the "law of small numbers," which describes the situation when too much faith is placed in the representativeness of a small number of observations. This is associated with the "gambler's fallacy," where chance is expected to be a self-correcting process, for example, expecting a run of bad firm results to be followed by a good year, or a series of reds on a roulette wheel in a casino to be followed by a black.
- *Insensitivity to predictability:* Making judgments based on the representativeness of the information presented, with the reliability of the evidence and expected accuracy of the prediction ignored.
- *Misconceptions of regression:* Misunderstanding the "regression toward the mean" phenomenon and inventing spurious explanations for what is a normal process. Exceptional performance is expected to be followed by further extreme outcomes, rather than more normal ones.

The illusion of validity: Viewing confidence as a function of the representativeness of the situation, not the underlying characteristics of the decision task. As Kahneman and Tversky (1973, p. 249) point out:

> *People are prone to experience much confidence in highly fallible judgments, a phenomenon that might be termed the* illusion of validity. *Like other perceptual and judgmental errors, the illusion of validity often persists even when its illusory character is recognized. When interviewing a candidate for example, many of us have experienced great confidence in our prediction of his future performance, despite our knowledge that interviews are notoriously fallible.*

Kahneman and Tversky similarly demonstrate how confidence is a function of the number of correlated inputs leading to redundancy, even though predictions of outcomes are no better as a result.

Comments

Question 1: Mary illustrates the basic principles of the representativeness heuristic. Clearly, answer (a) Mary is a librarian dominates answer (b), as only a sub-set of librarians are likely to be directly concerned with environmental issues. However, Mary is far more likely to be working in the banking industry, answer (c), because there are many more bankers than librarians. Based on responses from undergraduate investment students, MBA graduate students, and financial advisers, Nofsinger (2008) reports that more than half his subjects typically answer (b), a quarter to a third choose (a), and the remainder select (c). Mary's personality sketch is consistent with, or representative of, what one would expect from a member of the Sierra Club, and this similarity pattern seems to dominate other information. This leads both to the *conjunction fallacy*, that is, working as a librarian and being a member of the Sierra Club is more likely than simply being a librarian, and to neglecting the fact that many more jobs are in banking than as librarians (*base rate neglect*). The saliency and power of such "stories" in driving judgment relate to the confidence that the decision maker feels in his or her judgment. Face value degree of fit is key, not the underlying information (the *illusion of validity*). Confidence in people's decisions = f (the degree of representativeness) with little or no regard paid to the factors that might limit predictive accuracy.

Question 2. The probability of Peter being a derivatives trader similarly addresses *insensitivity to prior information.* With audiences of investors and MBA students specializing in finance, responses typically range from 5 percent to 15 percent, whereas the true probability is likely to be a fraction of 1 percent given the very small number of investment bankers actually trading derivatives. Again, base rate evidence is ignored as the description of Peter fits the stereotype of what people would expect a typical derivatives trader to be. In fact, the thumbnail sketch of Peter is largely uninformative (Kahneman and Tversky, 1973). Responses to this example also demonstrate the *illusion of validity*, with respondents being convinced Peter is a derivatives trader because of the apparent face value validity of the character sketch.

Question 3. The portfolio performance example usually results in more than 50 percent of respondents believing the number of months when the two portfolios outperform the S&P 500 by a minimum of 1 percent is about the same—answer (c). The lack of correct responses, answer (b), can be explained by respondents suffering from *insensitivity to sample size.* Sampling theory indicates the return of fund B containing 25 stocks will be more volatile from month to month, and therefore have a higher standard deviation, than portfolio A with 100 stocks. As such, fund B is likely to have experienced more months when it beats the market index than fund A, but also more months when it earns a below–the-market return.

Question 4. In the beer example, more than half of respondents typically believe the following week's sales are likely to be the same at 1.2 million cans, which is answer (b). This response ignores the fact that an extreme outcome is less likely to be repeated through the process of regression toward the mean. The correct answer is (c) below 1.2 million cans. Interestingly, when particularly good or bad outcomes are followed by those nearer to some central tendency, people typically invent rationalizations or spurious cause and effect explanations to explain the results. Such *misconceptions of regression* also apply in the case of investment analysts

expecting exceptionally good earnings numbers to be followed by similarly good earnings, and if subsequent figures are below the prior year results, interpreting this as a deficiency on the part of a firm's management. Kahneman and Tversky (1973) describe a (nonfinancial) illustration of how instructors in a flight school conclude that praising trainee pilots for a well-executed landing led to a poorer landing on the next try. Does this mean that teachers should stop reinforcing success? Not at all: Simply on the basis of regression, outstanding performances are likely to be followed by performances that are closer to the average, and poor performances will improve regardless of whether admonishment is genuinely effective.

Question 5. The final question, involving the evaluation of fund manager performance, demonstrates the operation of the "law of small numbers," which suggests that people place too much confidence in results based on small samples. On average, fund managers underperform their benchmarks each year, and there is little consistency in their performance from year to year (Dash and Pane, 2009). Therefore, if there is evidence that a particular fund manager has outperformed his or her benchmark over a three-year period, this appears inconsistent with a random return-generating process, and thus must be due to, or representative of, fund manager skill. However, given such a short sequence of superior top quartile performance, the return pattern is most likely due to chance. The correct answer is thus around 25 percent, as performance over the past three years tells little about likely performance in the following year regardless of what investors believe. Typical responses to this question, on the other hand, frequently range between 40 percent and 60 percent.

An entertaining demonstration of the law of small numbers outside the psychological laboratory is the belief that the performance of an athlete temporarily improves following a string of successes despite the lack of any scientific support for this pattern in practice. Obvious parallels apply in the way fund manager performance is viewed, as responses to question 5 often demonstrate. As with basketball, a tendency exists to interpret chance occurrences as the result of good or bad skill rather than luck. Gilovich, Vallone, and Tversky (1985) discuss the hot hand phenomenon in basketball, which is the belief that a player has a better chance of making a basket after one or more successful shots than after having missed a shot. The authors demonstrate that the chances of making the next basket in fact do not differ significantly from the player's overall probability of making a basket independent of previous success. Hot hands, also known as "streak shooting," or the athlete being "on a roll" is simply an illusion due to the operation of the law of small numbers.

THE REPRESENTATIVENESS HEURISTIC IN THE REAL WORLD OF FINANCE

The field of behavioral finance has developed in response to the increasing number of stock market anomalies that cannot be explained by traditional asset pricing models (Shiller, 2003). As Chan, Frankel, and Kothari (2004, p. 3) point out, however, the "potentially boundless set of psychological biases underlying the behavioral explanations for security price behavior [that] can lead to overfitting of theories to data." Importantly, the original heuristics and biases research

literature was developed using abstract laboratory-type cognitive experiments. Such experiments often involved statistically naïve high school and undergraduate student subjects and focused on problems of a hypothetical and context-free nature (e.g., Kahneman, Slovic, and Tversky, 1982; Gilovich, Griffin, and Kahneman, 2002). These experiments are far removed from real-world situations, and the participants cannot be considered highly skilled or experienced decision makers. Additionally, participants make judgments solely on an individual level. In contrast, finance is usually more concerned with (anomalous) patterns in market price behavior. Why should markets behave in the same way as unskilled individuals making intuitive, stylized, subjective probability assessments in hypothetical judgmental tasks unrelated to real-world financial contexts?

In fact, few studies attempt to test the validity of many behavioral finance propositions in real-world financial markets. Chan et al. (2004), in the case of the representativeness heuristic, is an exception. The authors (p. 4) set out "to test the predictions of market inefficiency theories (known as behavioral finance) based on investors' biased processing of patterns in firms' financial information." Specifically, Chan et al. test the market consequences of two related psychological biases—representativeness and conservatism—using measures of trends and consistency in financial performance. Conservatism here relates to the slow updating of investors' beliefs in the face of new evidence, and is the notional opposite of representativeness. The paper also constitutes an explicit empirical test of the validity of the well-known Barberis, Shleifer, and Vishny (1998) theoretical behavioral finance model.

However, Chan et al. (2004) find that neither representativeness nor conservatism bias in the interpretation of earnings information by investors appears to affect common stock prices and future returns, as Barberis et al. (1998) predict it should. Similarly, Chan et al.'s evidence is inconsistent with markets behaving in the same way as individual investors whose judgments are biased in line with the representativeness theory. Such out-of-sample empirical tests are clearly important when comparing the predictive ability of behavioral hypotheses and rational asset pricing theories (Barberis and Thaler, 2005).

Shiller (2003) draws a distinction between "natural experiments" and "lab experiments." According to Shiller (p. 94), natural experiments "occur in real time, with real money, with real social networks, and associated inter-personal support and emotions, with real and visceral envy of friends' investments, successes, and with communication media presence" and are far more convincing. Markets consist of many highly skilled and experienced traders competing in a very rich and complex information environment making decisions in very different ways. Expecting simple mis-specified subjective probability judgments manifested in highly abstract laboratory situations to apply equally in real-world situations is inappropriate. There is the need in finance to be able to distinguish between stories told *ex post* in an attempt to explain market anomalies, even if these have some superficial face-value plausibility because of their representativeness, and how investors actually make decisions.

Nonetheless, the cognitive psychological literature, which describes how individuals in narrowly framed situations may mis-specify probabilities using "automated" or "intuitive" judgmental processes, may also be useful when thinking about what may be happening in financial markets and the nature of

decisions taken by market participants. The next section describes a range of natural experiments relating to the application of the representativeness heuristic in practice.

REPRESENTATIVENESS IN FINANCE: SOME NATURAL EXPERIMENTS

Conducting natural experiments to test the validity of the representativeness heuristic in real-world financial markets and to demonstrate directly whether such biased investor behavior actually drives market prices is very difficult. The enormous complexity of financial markets and the myriad of factors that affect firm valuations are likely to confound any such formal tests. Nonetheless, several research studies provide evidence at least consistent with market prices reflecting representativeness-type behavior. This section summarizes various studies that explore factors such as the pricing of Internet stocks, investor choice of mutual funds, whether good stocks are the stocks of good companies, how the growth/value stock market anomaly might be explained, analyst stock recommendation bias, fund manager selection processes, the lack of value of Wall Street analyst and CEO superstar rankings, and the way in which an understanding of representativeness may help explain the popularity of technical analysis or "chartism" despite its lack of empirical value.

Representativeness and the Pricing of Dot-com Stocks

Studies by Cooper, Dimitrov, and Rau (2001) and Cooper, Khorana, Osobov, Patel, and Rau (2005) clearly demonstrate the potential impact of representativeness bias on how investors valued Internet-related firms during and after the dot-com bubble. Cooper et al. (2001) document average abnormal returns of 53 percent associated with adding a dot-com suffix to firm names during the Internet bubble between June 1998 and July 1999. Interestingly, this effect was independent of the extent to which the firm was actually involved with the Internet. Investors seemed to be simply reacting to the firm name change announcements, viewing all such firms as representative of dot-com stocks and repricing them accordingly. An apparent association with the Internet of this nature with no obvious direct cash flow implications led to a large and permanent increase in firm value. Investors eager to be associated with Internet companies seemed to be responding to a cosmetic name change alone. Such stock re-rating is clearly consistent with investment decisions being made in line with the representativeness heuristic.

Cooper et al. (2005) explore the parallel price impact of reverse name changes after the dot-com bubble burst. As might be expected, investors now reacted equally positively to firms that removed dot-com from their name. In fact, these companies experienced average cumulative abnormal returns of 64 percent over the 60-day period surrounding the name change announcement date after February 2000. Further, non-Internet firms previously having dot-com-related names experienced abnormal returns of 98 percent, compared with 42 percent for Internet firms. In the latter case, investors might have been deceived by such firms attempting to look like non-Internet companies, consistent once again with the operation of

the representativeness heuristic. However, the dot-com stocks in both studies were predominantly small and traded over-the-counter and thus mainly of interest to unsophisticated investors and day traders. Additionally, the dot-com bubble was an exceptional event. As such, drawing any conclusions of a more general nature from these studies about how investors can be irrationally influenced by cosmetic firm behaviors must be done with caution.

Representativeness and Mutual Fund Investors

Cooper, Gulen, and Rau (2005) demonstrate related behavior in the responses of mutual fund investors to fund style name changes such as from "value" to "growth" and "small" to "large." Changes tend to be to the current "hot" (high return) style or away from the current "cold" (low return) style. These name change funds also typically suffer from prior negative fund flows and underperformance relative to other funds. If mutual fund investors are prone to representativeness bias, then they are likely to confuse the apparent style change with real change in investment strategy, and judge the likelihood of future returns on the basis of the particular style's past returns.

These authors report how, relative to a control group of non–name change funds, the name change funds experienced a 20 percent increase in fund inflows over the following year, concentrated in funds with name changes to the current "hot" style. Investors seemed to be "tricked" by the name change, particularly as the name change funds subsequently performed no better than matched funds. In fact, funds changing their name to the current "hot" style performed significantly more negatively than before the name change. As average fund switching costs were 3.75 percent, the implications of the use of the representativeness heuristic by mutual fund investors in this context are substantial.

Jain and Wu (2000) study the impact of mutual fund advertising on investor behavior. The authors examine whether mutual funds advertised in *Barron's* or *Money* magazine subsequently performed better. Is advertising used to signal superior investment skills, or simply to increase fund flows into the advertised funds with fund investors suffering from representativeness bias? In fact, although Jain and Wu's average advertised fund outperformed in the pre-advertisement year by 6 percent compared with similar funds, in the post-advertising year the average return was 0.8 percent below equivalent funds, consistent with regression toward the mean. On the other hand, subsequent fund flows into the advertised funds were 20 percent higher than for similar non-advertised funds. Although past performance was not associated with future returns, investors seemed to believe it was. More generally, as Sirri and Tufano (1998) show, investors seem to extrapolate past price trends. There is a disproportionate flow into the top quintile performing mutual funds over the previous three years despite the lack of evidence of persistence in subsequent performance. This is an illustration of *extrapolation bias*, that is, forecasts based on unwarranted extrapolation of past trends, and is an aspect of the representativeness heuristic consistent with the misperception of chance processes. In a similar way, Bange (2000) shows how individual investors increase their equity holdings after market run-ups and decrease their holdings after market downturns believing recent market movements to be predictive of future market direction. Likewise, Benartzi (2001) finds employees allocate their discretionary

contributions to their 401(k) retirement savings accounts to their own firm's stock based on how well the stock has done historically over the previous 10 years.

Are Good Stocks from Good Companies?

Picking good stocks—those that will perform well in the future—is difficult, if not impossible. So how do investors deal with this conundrum? One way is to use a proxy, such as the "good company (good management), good stock" bias, which is an aspect of the representativeness heuristic. The belief is that if a stock performs well, the firm must be well run. As a result, apparently well-managed companies are taken to be those whose stocks will subsequently outperform, rather than investors recognizing that if good management is price-relevant, the attribute will already be reflected in the market price. On this basis, poorly managed firms are just as likely to do well or badly in the future as well-run firms.

Shefrin and Statman (1995) report that executives polled for *Fortune* magazine's *America's Most Admired Survey of Corporate Reputations* believe quality of management is highly correlated with value of the associated stock as a long-term investment ($R^2 = 0.86$). Belief about future investment performance is clearly associated with perceptions of how well-managed the firm is (as described above). Shefrin (2007) reports parallel high correlations between quality of management and financial soundness ratings: that is, good companies are judged to be safe companies; and between long-term investment value and financial soundness: that is, executives also judge good stocks to be those of financially sound companies. That good stocks are viewed as being the stocks of good companies and good companies as being safe companies is again consistent with the operation of the representativeness heuristic. However, this belief among executives is clearly contrary to traditional finance theory, which teaches that risk and return are positively correlated. As such, safe (i.e., low-risk) stocks should earn low returns, not high returns. Not surprisingly, the evidence is that good management and subsequent stock performance are unrelated (Shefrin and Statman, 2003; Agarwal, Taffler, and Brown, 2008). Agarwal et al. point out that although good reputation may still be value-relevant in that firms with good management have lower cost of equity than those with poor management, nonetheless, good management cannot predict stock returns.

Value Stocks and Growth Stocks

Lakonishok, Shleifer, and Vishny (1994) and Chan and Lakonishok (2004) show how value stocks, defined as those with low market price/book assets, outperform growth or "glamour" stocks. How might this apparent "book/market anomaly" be explained? Lakonishok et al. suggest the anomaly may be partly due to investors being excessively optimistic about glamour stocks and excessively pessimistic about value stocks because they extrapolate future growth rates from past growth rates: that is, they ignore regression toward the mean. Consistent with this belief, Lakonishok et al. find that the earnings, cash flows, and turnover of their growth stock firms grew significantly faster over the previous five years than in the case of their value firms. Reflecting this, prior three-year cumulative stock returns for the top decile (glamour stock) portfolio were 145 percent, compared with

–12 percent for the bottom decile (value stock) portfolio. Nonetheless, over the following five-year period, earnings growth rates reversed dramatically with value stock firm earnings now growing rapidly but growth stock firm earnings almost static. As Lakonishok et al. (p. 1575) point out, "Putting excessive weight on recent past history, as opposed to a rational prior is a common error . . . in the stock market." Lakonishok et al. also suggest a parallel "good company, good stock" explanation for the investor preference for glamour stocks.

Representativeness Bias and Analyst Stock Recommendations

Analysts seem similarly prone to extrapolation bias or belief in hot hands (Shefrin, 2007). Jegadeesh, Kim, Krische, and Lee (2004) show how sell-side analysts also generally prefer glamour stocks to value stocks. Stocks that receive stronger analyst buy recommendations, as well as more favorable recommendation upgrades, tend to have more positive price and earnings momentum, higher market/book ratios and trading volume, greater past sales growth, and are expected to grow their earnings faster in the future. However, following such stock recommendations can be costly as high-growth glamour stocks tend to be overvalued by the market. According to Jegadeesh et al., (p. 1119), that analysts appear "over enamored with growth and glamour stocks" is again consistent with the operation of the representativeness heuristic.

Mokoaleli-Mokoteli, Taffler, and Agarwal (2009) explicitly test whether sell-side analysts are prone to a range of behavioral errors when making stock recommendations. The authors examine the stock returns earned over the year subsequent to new buy and sell recommendations issued by investment analysts at the 10 top rated U.S. brokerage firms. Mokoaleli-Mokoteli et al. conclude analysts are prone to various cognitive biases, including representativeness, as well as conflicts of interest in their new buy but not new sell stock recommendations. They suggest that this helps explain why more than half of their analysts' new buy recommendations have negative buy-and-hold abnormal returns over the following 12 months, and less than one in three could be viewed as "successful," that is, with industry-adjusted returns greater than 10 percent. In contrast three in five new sell recommendations were successful on the same basis. The new buy stock recommendations that analysts got wrong were for firms that were significantly larger than those they got right, had growth rather than value characteristics, and had recently experienced high prior stock returns (as well as being more likely to have strong corporate links with the analyst's investment bank). Analysts appear to prefer stocks with "best" characteristics in line with the good company, good stock bias of the representativeness heuristic, even though this appears to lead to poor stock recommendations.

Breton and Taffler (2001) find similar results when they analyze brokerage house analyst reports to identify the factors distinguishing buy from sell recommendations. The authors find the key information cues associated with buy compared with sell recommendations are predominantly of a non-financial qualitative nature. Particularly, analyst judgment focuses on the quality of the firm's management and strategy. Analysts recommend the stocks of firms they consider to be well managed. Breton and Taffler (p. 99) conclude: "Consideration of a firm's management and strategy, although occupying a small part of the analyst's report, is a key

determinant (of a buy recommendation)." Once again, analysts appear to be suffering directly from representativeness bias in the form of the good management, good stock syndrome.

Fund Manager Selection and the Law of Small Numbers

Retail investors, as described above, appear prone to investment behavior consistent with the operation of the representativeness heuristic in their mutual fund selection task, as are apparently investment analysts in their stock recommendation decisions. However, are professional investors equally affected, or does their training and skill ameliorate such information-processing biases? Goyal and Wahal (2008) explore the hiring practices of investment management firms by investment plan sponsors. They find that fund managers are hired after large positive excess returns over the previous three years, but this return-chasing behavior does not subsequently deliver similar superior returns. In fact, post-hiring abnormal returns do not differ significantly from zero. In contrast, in the case of fund manager terminations that follow poor investment performance, three-year post-firing excess returns are significantly positive and above those of the firms that replace them. As switching managers can cost between 2 and 5 percent of the portfolio value, such decisions can have a major impact on fund returns. Plan sponsors apparently hire investment managers after superior performance consistent with extrapolation bias, but, on average, post-hiring excess returns are zero, reflecting regression toward the mean. Conversely, when fund managers are terminated following poor performance, post-firing excess returns are positive and statistically significant. If plan sponsors had stayed with the fired investment managers, their overall returns would at worst be no different from those actually delivered by their newly hired managers but without incurring high manager switching costs. Based on this natural experiment, there is evidence consistent with the operation of the representativeness heuristic in the judgments of professional investors.

The process by which fund managers are often hired is also prone to representativeness bias. Typically, the investment consultant provides a short list of firms for the plan sponsor to meet with selected, among other factors, on the basis of prior performance. In many cases the process of selection from this short list consists of a "beauty pageant" and an unstructured interview to identify the fund manager most likely to outperform in the future. Such situations are inherently prone to cognitive bias. In particular, plan sponsors may be making intuitive judgments about whether they "like" the applicant fund manager, confusing "liking" with future returns similar to the "good management, good stock" syndrome. Posthuma, Morgeson, and Campion (2002) and Macan (2009) summarize the recent research into the lack of validity of the parallel employment interview and demonstrate the range of representativeness-type biases to which it is prone. For example, there is extensive evidence of the key role played by applicant attractiveness and appearance, as well as personality, in determining interview success. Yet, whether these factors are necessarily related to subsequent job performance is unclear. This is particularly true in the fund management arena. On this basis, plan sponsors would appear to be at risk of selecting fund managers based on misconception of chance processes, insensitivity to predictability, and illusion of validity. Such issues may help to explain the Goyal and Wahal (2008) results.

A parallel natural experiment relates to whether highly publicized Wall Street analyst rankings have any validity. Emery and Li (2009) explore the factors that determine *Institutional Investor (II)* and *Wall Street Journal (WSJ)* analyst superstar rankings. The authors conclude that the two rankings are essentially popularity contests prone to high levels of bias. This is particularly so in the case of the *II* ranking, which appears to reflect an analyst's subjective reputation rather than the performance of his or her investment recommendations.

Analyst investment performance subsequent to being anointed with star status is also of interest. In the year following being awarded star status, the stock recommendations of *II* superstars perform no differently on average than those of non-stars, although 70 percent of them nonetheless retain their star status. *WSJ* stars actually perform significantly worse than non-stars with only one in five being awarded a similar accolade in the following year. Emery and Li's (2009) results are exactly what would be predicted from the operation of the representativeness heuristic. In the case of the *II* ranking, where recognition is the prime determinant of superstar status, illusion of validity seems to drive the rating. Regarding the *WSJ* ranking, where prior stock recommendation performance determines superstar status, deterioration in subsequent star performance reflects regression toward the mean. The attention paid by the investment industry to the results of such analyst rating systems belies their clear lack of investment value.

The representativeness heuristic similarly seems to be at work in the case of chief executive officers (CEOs) who achieve superstar status as measured by the award of such titles as Best Manager *(Business Week)*, CEO of the Year (*Financial World)*, and Best Performing CEO *(Forbes)*. Malmendier and Tate (2009) show how CEOs of large growth firms with strong recent stock market performance, and who have been in the job longer, are more likely to win such accolades. However, such awards are associated with subsequent firm underperformance of around 20 percent over the following three years compared with predicted winners who did not win such awards, despite a 44 percent gain in their CEOs' compensation. Once again, this demonstrates the misconception of chance and illusion of validity seemingly associated with such awards.

Chartism and the Representativeness Heuristic

The final natural experiment discussed in this chapter relates to technical analysis or "chartism," the forecasting of future price movements using past prices and volumes. This approach is extensively used by participants in a wide range of speculative markets (Park and Irwin, 2007). The theory is that prices move in trends determined by economic, monetary, political, and investor psychological factors. In contrast to the views of many practitioners, academics are highly skeptical about whether technical analysis works as it violates the efficient market hypothesis in its weak form. Park and Irwin provide an extensive review of the empirical evidence on the profitability of technical analysis. Although they report 60 percent of recently published studies claim positive results for technical trading strategies, most of these studies are subject to a range of methodological issues including data snooping bias, *ex-post* selection of trading rules or search strategies, and difficulties in estimating risk and transaction costs. As such, whether these investment strategies have any real value is still an open question. The highly complex

technologies being applied and large number of rules being tested may only serve to hide the underlying lack of predictability of the data. Perhaps technical analysts and chartists have a tendency to capitalize on chance, read patterns into random events, and suffer from the illusion of validity. The operation of the representativeness heuristic could well explain the popularity of chartism better than its actual investment value in practice.

SUMMARY AND CONCLUSIONS

As Nisbett, Krantz, Jepson, and Kunda (2002, p. 511) note, "The representativeness heuristic is the best studied and probably the most important of judgmental heuristics." Representativeness describes a process whereby people make judgments based on the degree of perceived similarity between events or classes. It assesses the degree of "fit" between objects and events and organizes them along the lines of "like goes with like." Nevertheless, the representativeness heuristic is only a heuristic, and judgments based on it can lead people astray. Gilovich and Savitsky (2002) even suggest that it may lead to superstition as with the craps shooter who rolls the dice gently to coax a low number and more vigorously to encourage a high one.

Lieberman, Gaunt, Gilbert, and Trope (2002) describe how the brain performs neural parallel-processing and similarity-based pattern-matching operations on incoming data, which may well underpin the way the representativeness heuristic operates. Lieberman et al. (p. 218) term this the *reflexive* or X-system, "which is the part of the brain that automatically provides a stream of consciousness experience that we take (or mistake!) for reality." The C-system, in contrast, is a symbolic-processing system and *reflective* in nature. It is typically invoked when the X-system encounters problems that it cannot solve intuitively. Kahneman and Frederick (2002) similarly partition cognitive processes into two main families that they term System 1 (*intuitive*), and System 2 (*reflective*). The former is characterized by automatic, effortless, associative, and affective processes, while the latter is typified by controlled, effortful, deductive, and statistical ones. Pattern matching is again a key characteristic of the System 1 processes. Nonetheless, as pointed out in this chapter, most of the psychological research into the representativeness heuristic has been of a highly abstract and context-free nature. Thus, important questions need to be raised about the relevancy of the results of simple laboratory studies to the complex real-world of financial markets and to skilled decision makers such as professional fund managers.

Kahneman and Frederick (2002) describe how the original program of research known as the heuristics and biases approach began with a survey of 84 participants at the 1969 meetings of the Mathematical Psychological Society and the American Psychological Association. Results are reported in Tversky and Kahneman (1971). The survey posed a range of questions about the statistical significance of samples drawn from populations, the robustness of statistical estimates, and the replicability of research results. Although the respondents included several authors of statistical texts, there was a general tendency to make incorrect probability and other statistical judgments such as placing too much confidence on the results of small samples. Kahneman and Frederick argue that not only should these scientists have known better, but also they did know better as they could have readily

computed the correct answers on the back of an envelope. Nonetheless, when using experiments of this nature, even with seemingly realistic questions and highly sophisticated subjects who make "irrational answers," arguing that these are tests of the validity of the representativeness heuristic is not possible. Had Kahneman and Frederick's experts been engaged in actual research studies requiring them to make *real* statistical judgments, they would have relied on their reflective cognitive system rather than their intuitive one and made statistically correct decisions.

In a related way, Gigerenzer (2008a) describes how the classic Tversky and Kahneman (1983) "Linda" question, on which the Mary example (question 1) at the beginning of this chapter is closely based, cannot be used to argue that human beings are fundamentally illogical. Typical answers to the question lead to the *conjunction* fallacy (Mary is a librarian and a member of the Sierra Club), that is, that a subset can never be larger than the set itself. Gigerenzer points out how this apparent paradox arises because of the underlying problems with the way the question is framed. He argues that the "content blind" nature of such logical norms as the conjunction fallacy overlooks the fact that human intelligence has to operate in an uncertain world, not the artificial certainty of a logical system, and needs to go beyond the information given. A major source of uncertainty in this case lies in the ambiguous use of the terms *probable* and *and*, which have several meanings. For example, in the case of the term *probable*, one of the interpretations is the conversational *maxim of relevance*—the subject may unconsciously interpret the question in terms of what the experimenter expects of him or her. This is very different from mathematical probability. Therefore, the relevance rule will suggest that *probable* must mean something that makes the description relevant, such as whether it is plausible. In fact, supportive of this argument, when Gigerenzer reframed the Linda question in terms of frequency virtually all respondents now gave the correct answer. The question is not whether people's intuitions follow the law of logic, but rather what unconscious rules of thumb underlie intuitions about meaning.

Gigerenzer (2008b, p. 24) stresses, "Models of heuristics need to be distinguished from mere labels. For instance, terms such as *representativeness* and *availability* are commonsense labels without specification of a process and the conditions under which a heuristic succeeds or fails. These need to be developed into testable models; otherwise they can account for everything post hoc." In particular, behavioral finance needs to guard against the anthropomorphic view that the market behaves like an individual, and therefore any potential individual cognitive bias is reflected in market pricing. Clearly this is an invalid proposition. Nonetheless, if investors are more aware of the potential for cognitive bias in their judgments, they may be able to make investment decisions on a less automatic or reflexive basis, thus reducing the likelihood of error.

Some evidence exists to suggest that financial market participants are prone to similarity type judgments consistent with representativeness theory, as demonstrated in such natural experiments in finance as those described in this chapter. This may be because of the enormous complexity of the market environment in which investors have to operate and their need to make sense of what is taking place. Because the reflective cognitive systems of financial decision makers may be overwhelmed, they may fall back on their reflexive ones. Notwithstanding

this, demonstrating causality in terms of market impact is difficult. Most of the illustrations discussed above apply the label of representativeness *ex post* to describe certain market behaviors of an anomalous nature that cannot otherwise be explained in a plausible way.

Finally, how can investors improve their judgment and decision-making skills and avoid the operation of the representativeness heuristic? Plous (1993, pp. 119–120) makes the following recommendations:

- *Do not be misled by highly detailed scenarios.* In general, the more specific a scenario is, the lower its chances of occurring—even when the scenario seems perfectly representative of the most probable outcome.
- *Whenever possible, pay attention to base rates.* Base rates are particularly important when an event is very rare or very common.
- *Remember that chance is not self-correcting*. A run of bad luck is just that: a run of bad luck.
- *Do not misinterpret regression toward the mean.* Even though a run of bad luck is not necessarily balanced by a run of good luck (or vice versa), extreme performances tend to be followed by more average performances.

Keeping these suggestions in mind may allow investors to avoid many of the biases that result from a reliance on the representativeness heuristic.

What about Joe DiMaggio? Not the Yankees slugger, but his four-year-old son, Joe Jr. Mlodinow (2009) reports how, after returning to civilian life in the summer of 1945, DiMaggio took his young son to Yankee Stadium. A fan noticed the baseball star, then another, and throughout the stadium people began chanting "Joe, Joe, Joe DiMaggio!" "See, Daddy?" said little DiMaggio. "Everybody knows me!" Apparently even four-year-olds are subject to representativeness bias.

DISCUSSION QUESTIONS

1. An actively traded stock is selected at random and its daily price movement relative to the market index examined. Which of the following three sequences is most likely to have occurred over the past six trading days where a plus sign denotes stock price change greater than the market, and a negative sign, price change less than the market?

Sequence	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
(a)	−	+	−	+	−	+
(b)	−	−	−	+	+	+
(c)	+	+	−	+	−	−

2. Describe the representativeness heuristic and some of its main characteristics.
3. How relevant are the results of laboratory experiments conducted by cognitive psychologists to test the validity of the representativeness heuristic for investors and financial markets?

4. Briefly describe some real-world examples in finance consistent with the operation of the representativeness heuristic in practice. Do such "natural experiments" prove financial markets are prone to representativeness bias?
5. How can an understanding of the representativeness heuristic help investors make less biased decisions?

REFERENCES

Agarwal, Vineet, Richard J. Taffler, and Michael Brown. 2008. Is management quality value relevant? Working Paper, University of Edinburgh Business School. Available at: http://ssrn.com/abstract=1102584.

Bange, Mary. 2000. Do the portfolios of small investors reflect positive feedback trading? *Journal of Financial and Quantitative Analysis* 35:2, 239–255.

Barberis, Nicholas, Andrei Shleifer, and Robert W. Vishny. 1998. A model of investor sentiment. *Journal of Financial Economics* 49:3, 307–343.

Barberis, Nicholas, and Richard H. Thaler. 2005. A survey of behavioral finance. In *Advances in behavioral finance*, ed. Richard H. Thaler, Volume II, 1–78. Princeton, NJ: Princeton University Press.

Benartzi, Shlomo. 2001. Excessive extrapolation and the allocation of 401(k) accounts to company stock. *Journal of Finance* 55:5, 1747–1764.

Breton, Gaetan, and Richard J. Taffler. 2001. Accounting information and analyst stock recommendation decisions: A content analysis approach. *Accounting and Business Research* 31:2, 91–101.

Chan, Louis K. C., and Josef Lakonishok. 2004. Value and growth investing: Review and update. *Financial Analysts Journal* 60:1, 71–86.

Chan, Wesley S., Richard Frankel, and S. P. Kothari. 2004. Testing behavioral finance theories using trends and consistency in financial performance. *Journal of Accounting and Economics* 38: December, 3–50.

Cooper, Michael J., Orlin Dimitrov, and P. Raghavendra Rau. 2001. A rose. com by any other name. *Journal of Finance* 56:6, 2371–2388.

Cooper, Michael J., Huseyin Gulen, and P. Raghavendra Rau. 2005. Changing names with style: Mutual fund name changes and their effects on fund flows. *Journal of Finance* 60:6, 2825–2858.

Cooper, Michael J., Ajay Khorana, Igor Osobov, Ajay Patel, and P. Raghavendra Rau. 2005. Managerial actions in response to a market downturn: Valuation effects of name changes in the dot. com decline. *Journal of Corporate Finance* 11:1-2, 319–335.

Dash, Srikent, and Rosanne Pane. 2009. *Standard and Poor's indices versus active funds scorecard. Year end 2008.* Available at www.standardpoors.com.

Emery, Douglas R., and Xi Li. 2009. Are the Wall Street analyst rankings popularity contests? *Journal of Financial and Qualitative Analysis* 44:2, 411–437.

Gigerenzer, Gerd. 2008a. *Gut feelings, short cuts to better decision making*. London: Penguin Books.

Gigerenzer, Gerd. 2008b. *Rationality for mortals.* New York: Oxford University Press.

Gilovich, Thomas. 1991. *How we know what isn't so.* New York: The Free Press.

Gilovich, Thomas, and Kenneth Savitsky. 2002. Like goes with like: The role of representativeness in erroneous and pseudo-scientific beliefs. In *Heuristics and biases: The psychology of intuitive judgment*, ed. Thomas Gilovich, Dale Griffin, and Daniel Kahneman, 617–624. New York: Cambridge University Press.

Gilovich, Thomas, Dale Griffin, and Daniel Kahneman (eds.). 2002. *Heuristics and biases: The psychology of intuitive judgment.* New York: Cambridge University Press.

Gilovich, Thomas, Robert Vallone, and Amos Tversky. 1985. The hot hand in basketball: On the misspecification of random sequences. *Cognitive Psychology* 17:3, 295–314.

Goyal, Amit, and Sunil Wahal. 2008. The selection and termination of investment management firms by plan sponsors. *Journal of Finance* 63:4, 1805–1847.

Jain, Prem C., and Joanna Shuang Wu. 2000. Truth in mutual fund advertising: Evidence on future performance and fund flows. *Journal of Finance* 55:2, 937–958.

Jegadeesh, Narasimhan, Joonghyuk Kim, Susan D. Krische, and Charles M. C. Lee. 2004. Analyzing the analysts: When do recommendations add value? *Journal of Finance* 59:3, 1083–1124.

Kahneman, Daniel, and Shane Frederick. 2002. Representativeness revisited: Attitude substitution in intuitive judgment. In *Heuristics and biases: The psychology of intuitive judgment*, ed. Thomas Gilovich, Dale Griffin, and Daniel Kahneman, 49–81. New York: Cambridge University Press.

Kahneman, Daniel, and Amos Tversky. 1973. On the psychology of prediction. *Psychological Review* 80:4, 237–251.

Kahneman, Daniel, Paul Slovic, and Amos Tversky (eds.). 1982. *Judgment under uncertainty: Heuristics and biases.* New York: Cambridge University Press.

Lakonishok, Josef, Andrei Shleifer, and Robert W. Vishny. 1994. Contrarian investment, extrapolation, and risk. *Journal of Finance* 49:5, 1541–1578.

Lieberman, Matthew D., Ruth Gaunt, Daniel T. Gilbert, and Yaacov Trope. 2002. Reflexion and reflection: A social cognitive neuroscience approach to attributional inference. *Advances in Experimental Social Psychology* 34, 199–249.

Macan, Therese. 2009. The employment interview: A review of current studies and direction for future research. *Human Resource Management Review* 19:3, 203–218.

Malmendier, Ulrike, and Geoffrey Tate. 2009. Superstar CEOs. *Quarterly Journal of Economics* 124:4, 1593–1638.

Mokoaleli-Mokoteli, Thabang, Richard Taffler, and Vineet Agarwal. 2009. Behavioral bias and conflicts of interest in analyst stock recommendations. *Journal of Business Finance and Accounting* 36:3-4, 384–418.

Mlodinow, Leonard. 2009. The triumph of the random. *Wall Street Journal*, July 16, W10.

Nisbett, Richard E., David H. Krantz, Christopher Jepson, and Ziva Kunda. 2002. The use of statistical heuristics in everyday inductive reasoning. In *Heuristics and biases: The psychology of intuitive judgment*, ed. Thomas Gilovich, Dale Griffin, and Daniel Kahneman, 510–533. New York: Cambridge University Press.

Nofsinger, John R. 2008. *The psychology of investing*. 3rd ed. Upper Saddle River, NJ: Pearson Education.

Park, Cheol-Ho, and Scott H. Irwin. 2007. What do we know about technical analysis? *Journal of Economic Surveys* 21:4, 786–826.

Plous, Scott. 1993. *The psychology of judgment and decision making.* New York: McGraw-Hill Inc.

Posthuma, Richard A., Frederick P. Morgeson, and Michael A. Campion. 2002. Beyond employment interview validity: A comprehensive narrative review of recent research and trends over time. *Personnel Psychology* 55:1, 1–81.

Serwer, Andy. 2006. The greatest money manager of our time. *Fortune* November 28.

Shefrin, Hersh. 2007. *Behavioral corporate finance.* New York: McGraw-Hill Irwin.

Shefrin, Hersh, and Meir Statman. 1995. Making sense of beta, size and book-to-market. *Journal of Portfolio Management* 21:2, 26–34.

Shefrin, Hersh, and Meir Statman. 2003. The style of investor expectations. In *The handbook of equity style management*, ed. T. Daniel Coggin, Frank J. Fabozzi, and Robert Arnott. 3rd ed., 195–218. Hoboken, NJ: John Wiley & Sons.

Shiller, Robert J. 2003. From efficient markets theory to behavioral finance. *Journal of Economic Perspectives* 17:1, 83–104.

Sirri, Erik R., and Peter Tufano. 1998. Costly search and mutual fund flows. *Journal of Finance* 53:5, 1589–1622.

Tversky, Amos, and Daniel Kahneman. 1971. Belief in the law of small numbers. *Psychological Bulletin* 76:2, 105–110.

Tversky, Amos, and Daniel Kahneman. 1974. Judgment under uncertainty: Heuristics and biases. *Science* 185:4157, 1124–1131.

Tversky, Amos, and Daniel Kahneman. 1983. Extensional versus intuitive reasoning: The conjunction fallacy in probability judgment. *Psychological Review* 90:4, 293–315.

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CHAPTER 15

Familiarity Bias

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INTRODUCTION

A popular Wall Street adage is to "invest in what you know." But what if investing in "what you know," means passing up higher returns and lower risks available in assets that "you do not know?" This revealed preference for familiar assets in the presence of higher returns and lower risks from less familiar assets is known as familiarity bias.

Displaying a bias toward the familiar suggests a lack of diversification. This was perhaps no more evident than with the Enron bankruptcy in 2001. More than 60 percent of the assets in the Enron 401(k) program consisted of Enron stock. When the company collapsed, not only did employees suffer a loss of income, but many also saw their retirement savings wiped out. Diversifying their investments into less familiar assets could have better insulated their consumption from labor income risk.

Why do investors continue to hold portfolios heavily weighted in familiar assets despite the seemingly obvious gains from diversification? This chapter reviews the existing theoretical and empirical literature aimed at answering this question. The remainder of this chapter consists of five sections. The first section seeks to define familiarity bias, showing that investors can achieve gains from greater diversification into unfamiliar assets.

The rest of the chapter reviews possible explanations for familiarity bias. The second section focuses on measuring familiarity bias. Explanations for the bias fall into three major categories. Several studies argue that familiarity biases are related to measurement issues. One way to measure home bias is to compare observed portfolio weights to those derived from the international capital asset pricing model (ICAPM). However, the ICAPM has not performed well in practice. Thus, the difference between optimal and observed portfolio weights may simply reflect specification error in the underlying model. Another method of measuring familiarity bias is to compute optimal portfolio weights from past asset returns. A criticism of this approach is that past returns are a poor proxy for expected future returns. The second section takes a closer look at these measurement issues.

The third section focuses on institutional frictions. Investors may be biased toward local assets because these assets do a better job of hedging against local

risks such as inflation and income. On the international side, currency risk and transaction costs may prohibit investors from international diversification. Furthermore, investors may be able to achieve international diversification by investing in domestically headquartered multinationals. Finally, investors may face asymmetric information when dealing with unfamiliar assets. These information asymmetries are especially relevant when considering foreign assets given language barriers or differences in accounting and reporting standards.

Institutional frictions can only explain part of the bias. Thus, the fourth section examines behavioral finance explanations for familiarity bias. For example, employees tend to overinvest in own-company stock, consistently underestimating the risk of concentrating wealth in a single equity. Perhaps explaining this observation, investors tend to display overconfidence in forecasting returns on familiar assets, even in the absence of superior information about these assets. Other behavioral explanations to be explored include risk avoidance, patriotism, and social identification. The fifth section concludes the chapter and discusses costs of familiarity bias to both individual investors and social welfare.

DEFINING FAMILIARITY BIAS

Researchers have studied familiarity bias in both the domestic (local bias) and international (home bias) settings. In both cases, familiarity bias occurs when investors hold a portfolio biased toward "familiar" assets compared to an unbiased portfolio derived from a theoretical model or empirical data.

Local Bias

With local bias, investors display a preference for local assets with which they are more familiar, despite the gains from diversification into the "unknown." That investors prefer local assets within their own country suggests that international market frictions such as currency risk and transaction costs on foreign equity are not solely responsible for familiarity bias. Coval and Moskowitz (1999) survey mutual fund managers and find that these managers display a preference for locally headquartered firms. In another example of locally biased portfolios, Huberman (2001) finds that customers of a Regional Bell Operating Company (RBOC) hold more stock shares in their own RBOC than in other RBOCs. Employees of a firm often invest in their company's stock at the expense of diversifying labor income risk. For example, Benartzi (2001) finds that at Coca-Cola, employees allocate as much as three-quarters of their discretionary contributions to their own-company shares. As a downturn in Coca-Cola's profits is likely to lead to both a drop in stock returns and labor income for Coca-Cola employees, these employees may be better served by investing elsewhere.

If investors are biased toward local firms, then these investors should place a premium on these firms' stock prices. As long as the geographic distribution of firms does not match the geographic distribution of investment dollars, then local bias should have an effect on stock price. Hong, Kubik, and Stein (2008) find that holding all other factors constant, firms located in the deep South, where there is a relatively low ratio of publicly traded firms to investment dollars, have stock

prices nearly 8 percent higher than those located in the mid-Atlantic, where there is a relatively high ratio of firms to investment dollars.

Several studies have argued that local bias may be a rational response to better information about familiar assets. Ivković and Weisbenner (2005) find that individual investors earned an excess return of 3.5 percent on local assets relative to non-local holdings, suggesting that these investors are taking advantage of local knowledge. Massa and Simonov (2006) find that familiarity bias has less of an effect on portfolios following a "familiarity shock" such as a change of profession or relocation, which would support the local knowledge hypothesis. Further evidence of investors taking their local bias along with them when they move is provided by Bodnaruk (2009), who finds that investors who move tend to sell shares of the firms they used to live near and buy shares of firms near their new homes.

Home Bias

Familiarity bias is even more evident at the international level with most portfolios heavily biased toward domestic equity despite the large gains to be made through international diversification. For example, French and Poterba (1991) derive optimal portfolio shares from an ICAPM and find that observed domestic equity shares can only be justified by implausible rates of risk aversion or transaction costs higher than any reasonable estimates.

One way to measure familiarity bias is to compare the share of "local" assets held in an investor's portfolio to the share of these assets in an unbiased portfolio. At the international level, one approach is to compare the share of domestic equity held within a country to that country's share of world market capitalization (i.e., comparing a country's holdings of its own domestic equity compared to that held in the "global" portfolio). Exhibit 15.1 lists domestic equity and world market capitalization shares for 28 countries representing 90 percent of world market capitalization, using a survey of international equity holdings published by the International Monetary Fund. In nearly every case, the share of domestic equity held within a country far exceeds that country's share of world market capitalization. For example, the typical investor in the United States holds a portfolio consisting of 87.2 percent domestic equity, despite the fact that American equity represents only 43.1 percent of world market capitalization. For other countries, this discrepancy is even larger.

Are the observed domestic equity shares rational? The observed shares only represent a bias if investors can improve welfare through greater diversification. Exhibit 15.2 displays a mean-variance analysis for a range of portfolios consisting of 100 percent U.S. equity to a portfolio consisting entirely of foreign equity. The horizontal axis shows the average monthly standard deviation of returns across these portfolios while the vertical axis shows the average annualized returns. If investors only care about risk and return, then welfare improves as they move left (less risk) and up (higher returns) along the diagram. As Exhibit 15.2 portrays, the poorest performing portfolio consists of 100 percent U.S. equity. The global portfolio yields the highest return but also the highest risk.

Determining the optimal portfolio requires knowing the investor's relative preferences for risk and return. For example, an investor with preferences represented by the indifference curve U_0 would maximize his or her utility by holding a

Exhibit 15.1 Domestic Equity and World Market Capitalization Shares.

Note: This table shows domestic equity shares and world market cap shares as a percent. Domestic equity shares are computed from the International Monetary Fund's Coordinated Portfolio Investment Survey for 2005. The domestic equity share is defined as the share of domestic equity in a country's equity portfolio. The world market capitalization share is the share of a country's domestically issued equity in world market capitalization. The value for Ireland is not an error, but rather the result of an inordinately high share of foreign ownership of Irish equity.

	Domestic Equity Share (%)	World Market Cap Share (%)
Australia	86.5	2.0
Austria	59.5	0.2
Belgium	88.4	2.0
Canada	76.3	3.1
Czech Republic	91.1	0.1
Denmark	66.1	0.4
Finland	68.8	0.5
France	79.1	4.9
Germany	72.3	3.2
Greece	96.5	0.3
Hungary	95.9	0.1
Ireland	−27.7	0.3
Italy	78.0	2.1
Japan	90.5	9.7
Korea	98.8	1.1
Mexico	98.2	0.5
Netherlands	42.4	1.6
New Zealand	68.6	0.1
Norway	55.1	0.4
Poland	99.4	0.2
Portugal	85.0	0.2
Slovak Republic	85.9	0.0
Spain	91.2	2.5
Sweden	67.1	1.0
Switzerland	78.7	2.2
Turkey	99.9	0.3
United Kingdom	72.0	7.4
United States	87.2	43.1

portfolio consisting of 40 percent U.S. equity, roughly the U.S. share of world market capitalization. A more risk-averse investor would choose a portfolio weighted more toward U.S. equity, while a more risk-seeking investor would prefer greater international diversification. Regardless, the observed 87.1 percent domestic equity share is clearly dominated by portfolios with a greater degree of foreign equity. Exhibit 15.3 displays an even starker bias for the United Kingdom, where the global portfolio strictly dominates all others, reflecting the relatively lower returns and higher risk generated by British equities over this period. Despite these seemingly obvious gains, investors continue to display a bias toward familiar assets. The rest of the chapter focuses on explaining why this is the case.

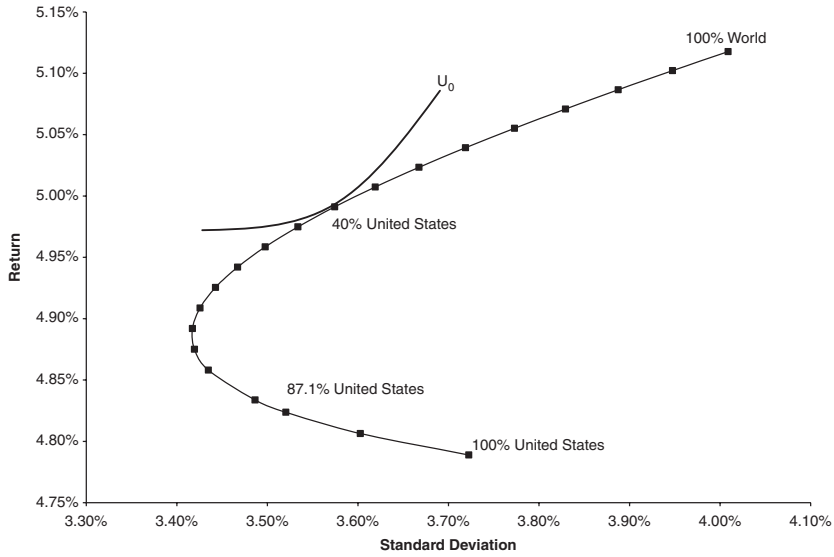

Exhibit 15.2 Mean Variance Diagram for the United States

Note: Portfolio returns and standard deviations are calculated from the MSCI USA and World (excluding the United States) indices. The return is computed as the average annualized return over the period January 1970 through July 2009, while the standard deviation is the average annual standard deviation of monthly returns over this same period. Portfolios range from 100 percent U.S. equity to 100 percent global (non-U.S.) equity in increments of 5 percent. The observed 87.1 percent domestic equity portfolio for the United States is also included below.

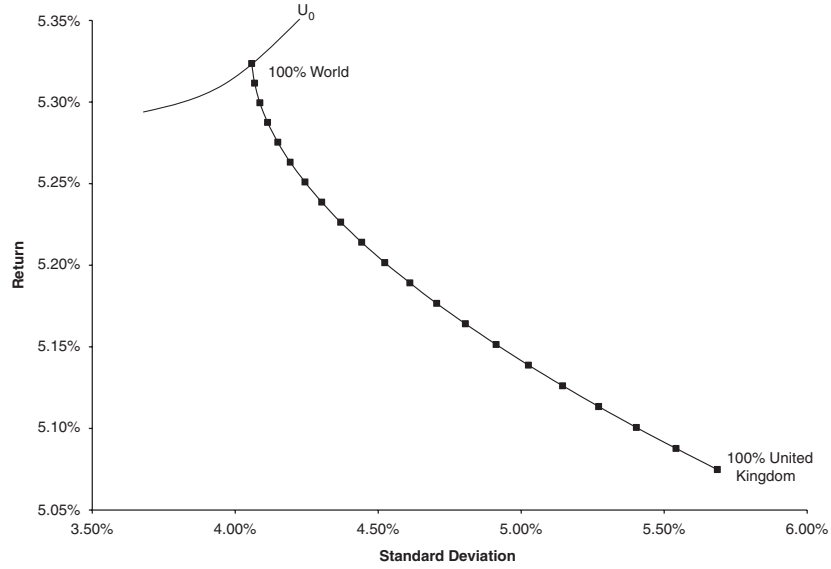

Exhibit 15.3 Mean Variance Diagram for the United Kingdom

Note: Portfolio returns and standard deviations are calculated from the MSCI United Kingdom and World (excluding the United Kingdom) indices. The return is computed as the average annualized return over the period January 1970 through May 2009, while the standard deviation is the average annual standard deviation of monthly returns over this same period. Portfolios range from 100 percent United Kingdom equity to 100 percent global equity in increments of 5 percent.

MEASURING FAMILIARITY BIAS

How can familiarity bias be measured? The existing literature describes two major approaches: (1) a model-based approach based on a version of the ICAPM and (2) a data-based approach in which optimal portfolio weights are derived from a mean-variance optimization procedure. While both approaches have their merits and flaws, they reach the same conclusion: Namely, there are gains to greater diversification out of local assets.

The Model-Based Approach

The model-based approach uses the ICAPM that assumes complete information, no barriers to capital flows such as transaction costs or taxes, and identical beliefs and preferences about returns for all investors. This model yields the following relationship:

$$E(r_j) - r = \beta_j * [E(r_w) - r] \tag{15.1}$$

where $E(r_j)$ and $E(r_w)$ are the expected returns on any asset j and the world portfolio respectively, r is the risk-free rate (identical across locations), and $\beta = cov(r_j,r_w)/var(r_w)$. Under the assumptions given above, this equation holds when all investors maintain the world market portfolio in which the weight of each asset is relative to its share in world market capitalization. Thus, if a French asset represents 5 percent of world market capitalization and French investors hold 79 percent French assets, then these investors are displaying a bias.

Sercu (1980) modifies Equation 15.1 above by taking exchange rates into account. The expression above now becomes:

$$E(r_j) - r = \beta_j * [E(r_w) - r] + \sum_{i=1}^{N-1} \delta_{j,i}[E(s_i + r_i) - r] \tag{15.2}$$

where N is the number of countries in the world, s_i is the change in the nominal exchange rate, r_i is the risk-free rate in country i, and r is the world risk-free rate. Assuming that investors can hedge against currency risk with their own risk-free asset, this model yields the same conclusion as before: Namely, each investor should hold assets in proportion to their share of world market capitalization.

While familiarity bias is easy to observe using the model-based approach (simply compare observed portfolio weights to market capitalization shares), the model has not performed well in practice. One way to test the validity of the ICAPM is to estimate the following equation:

$$r_j - r = \alpha_j + \beta_j * (r_w - r) + \sum_{i=1}^{N-1} \delta_{j,i} * (s_i + r_i - r) + \varepsilon_j \tag{15.3}$$

where r_j and r_w are the observed returns on portfolio j and the world portfolio. The empirical validity of the ICAPM depends on estimates of α_j being not significantly

different from zero. Otherwise, there exists some risk factor other than the relative return between asset *j* and the world portfolio. In practice, the empirical validity of the CAPM is very weak, suggesting that capital markets are not perfectly integrated and the optimal portfolio for all investors need not be the world portfolio.

Another argument against the model-based approach is that even if it were empirically valid, the global portfolio may be difficult to replicate for all investors. This world portfolio contains assets that are not freely tradable due to capital restrictions or shareholders who are reluctant to sell. As the share of unavailable assets varies by location, using the world portfolio of all shares (available or not) as a benchmark amplifies any observed familiarity bias. Dahlquist, Pinkowitz, Stulz, and Williamson (2003) suggest that the correct benchmark should be the world "float" portfolio of freely floated shares. Using this benchmark, familiarity bias is reduced but not eliminated.

The Data-Based Approach

Given the shortcomings of the ICAPM, other researchers advocate deriving optimal portfolio weights using a data-based approach. This approach assumes mean-variance investors, as in Markowitz (1952) and Sharpe (1963), who choose portfolio weights to maximize utility that is increasing in mean returns and decreasing in risk (variance). Let γ represent a typical investor's coefficient of relative risk aversion, μ be the $(N \times 1)$ vector of expected returns in excess of a risk-free rate on N risky assets, and Ω be the $(N \times N)$ covariance matrix for the N risky assets. Assuming that the investor faces no capital restraints and perfectly integrated financial markets, the optimal portfolio weights are given by:

$$w^* = \frac{1}{\gamma}\Omega^{-1}\mu \tag{15.4}$$

where w^* represents the $(N \times 1)$ vector of optimal portfolio weights. Assuming that risk aversion is constant, the optimal weights will change only in response to altered expectations over an asset's excess return (μ) or its contribution to overall portfolio risk (Ω). As the expected excess return on an asset increases or its contribution to overall risk decreases, the optimal weight on that asset increases.

Thus, measuring familiarity bias involves comparing the optimal portfolio weights derived from Equation 15.4 to the observed weights on local assets. However, estimating optimal portfolio weights from Equation 15.4 requires a measure of expected excess returns and the covariance matrix. Merton (1980) shows that while the covariance matrix may be estimated with high precision, expected returns are very difficult to forecast using historical data. For example, the average monthly return on the Morgan Stanley Capitalization Index (MSCI) for the U.K.between 1970 and 2009 was 0.43 percent, while the standard deviation of returns over this same period was 6.3 percent. Furthermore, high correlation across market returns yields a nearly singular covariance matrix. As a result, even small changes in μ can lead to large changes in optimal weights. Given that μ is estimated with great imprecision, any estimates of optimal portfolio weights from this data-based approach must be viewed skeptically.

In response to this, studies using the data-based approach have taken the observed portfolio weights as given and estimated the expected returns needed to rationalize these weights. These estimates show implausible investor optimism about local assets, suggesting a bias. For example, Jeske (2001) estimates that for the observed domestic equity share among Italian investors, these investors would have to believe that Italian assets would beat the risk-free rate by 11.83 percent and that foreign assets would underperform the risk-free rate by −2.83 percent. Given that Italian asset returns came nowhere near these expectations, something else must be driving the observed portfolio shares.

A third approach to estimating familiarity bias involves a compromise between the model and data-based approaches. Pástor (2000) develops a Bayesian model in which an investor is forced neither to accept unconditionally the ICAPM weights nor to discard them completely in favor of the data. Rather, investors can update their "skepticism" about the ICAPM using past information. As skepticism grows, weights move closer to those implied by the data. Garlappi, Uppal, and Wang (2007) refine this approach by allowing for multiple prior beliefs. This methodology yields more realistic optimal portfolio weights but does not disprove the existence of familiarity bias.

INSTITUTIONAL EXPLANATIONS

Both the model- and data-based approaches to measuring familiarity bias make certain assumptions that may not hold in practice. In reality, markets are not perfectly integrated due to transaction costs, currency risk, asymmetric information, and differences in corporate governance and standards. Numerous studies attempt to explain familiarity bias by challenging the assumptions of integrated capital markets to varying degrees of success. This section takes an in-depth look at these explanations and their ability to explain the familiarity bias puzzle.

Hedging against Local Risks

Investors may choose to hold more local assets than would otherwise be predicted if local assets provide a better hedge against risks such as inflation or reduced income. For example, an investor may prefer to invest in his or her own country's assets if they are highly correlated with domestic inflation. By doing so, this investor is shielding wealth from an erosion of purchasing power caused by inflation. While theoretically appealing, this explanation only holds if local returns and inflation are highly correlated. Adler and Dumas (1983) and Cooper and Kaplanis (1994) find evidence to the contrary.

Local assets may do a better job of hedging against labor income risk. Suppose that local assets are negatively correlated with local income. Thus, holding local assets so that consumption is insulated from fluctuations in labor income would make sense. Engel and Matsumoto (2006) argue that this negative correlation could hold if there is price stickiness in the goods market. As a result, reductions in labor income may temporarily lead to higher firm profits (and thus returns) as firm costs fall. Yet, the empirical evidence suggests that local asset returns and local income may be positively related. For example, Baxter and Jermann (1997) show that human and physical capital (i.e., labor income and asset returns) tend to

be positively correlated in the presence of productivity shocks. A productivity shock that reduces the demand for labor may also erode firm profits, leading to a reduction in both income and returns. In fact, localized shocks present one of the key arguments for greater diversification.

Currency Risk

Familiarity bias is perhaps most evident when comparing domestic to international asset holdings. As the effective return on a foreign asset is a function of both local currency return and the appreciation of the foreign currency, foreign assets carry with them an additional element of exchange rate risk. While investors may hedge currency risk using forward contracts, this hedging is not costless and may deter smaller volume investors from greater diversification. De Santis (2006) and Foad (2008a), who find that familiarity bias has declined across the euro-zone since the adoption of the euro, give support for the currency risk explanation. However, currency risk alone cannot explain all familiarity bias because a significant preference still exists for domestic equity even within the euro-zone. In a related study, Fidora, Fratzscher, and Thimann (2007) find that currency risk can explain only 20 to 30 percent of the variation in home bias across countries. Thus, currency risk is only one of several important factors.

Transaction Costs

Another institutional explanation for familiarity bias is that local assets have lower transaction costs. Both the model and data-based approaches to measuring the bias assume no barriers to capital mobility. In reality, there are explicit barriers such as different tax rates, laws limiting asset liquidity, and currency conversion fees, as well as implicit barriers such as appropriation risk in distant markets. Given the near singularity of the covariance matrix across returns, even small transaction costs can rationally tilt optimal portfolios toward local assets, as shown by Martin and Rey (2004).

Using the data-based approach described above, Glassman and Riddick (2001) compute the transaction costs needed to rationalize the observed domestic equity shares. They find that for France, Germany, Japan, and the United Kingdom, the implied foreign investment costs were 14 percent to 19 percent per year over the period 1985 through 1990. These costs are well above any reasonable estimates and exceed the actual asset returns. Using a more conservative risk-aversion measure, Jeske (2001) estimates more modest transaction costs of 1.5 percent for the United States, 4.5 percent for Germany, 7.6 percent for Spain, and 14.7 percent for Italy. These costs are still well above any reasonable estimates of transaction costs on foreign equity.

Further evidence against the transaction costs explanation is given by Tesar and Werner (1995), who find that turnover rates on foreign assets are actually higher than those on domestic assets. If transaction costs limited international diversification, foreign assets should be traded at lower, not higher, volumes (all else being equal). Amadi and Bergin (2006) point out that this ignores the potentially high fixed costs of entry into foreign financial markets. Transaction costs may be low for investors who have already "taken the plunge" into foreign markets,

but fixed costs of entry may prevent a subset of investors from ever investing abroad.

Implicit costs such as appropriation risk may also limit diversification. Stulz (2005) argues that twin agency problems may cause familiarity bias. On one hand, there is corporate-insider discretion in which inside investors extract private benefits from outsiders. Thus, the less familiar an asset, the more likely there will be an outsider investor. On the other hand, governments can appropriate returns from foreign investors through regulations and taxes through the use of state-ruler discretion. Thus, the seemingly implausible transaction costs on foreign assets needed to justify the observed domestic equity shares may be accurate. In support of this theory, Stulz finds that the highest levels of domestic asset ownership (i.e., low foreign presence) are in nations with weak minority shareholder protection and/or a high risk of appropriation. La Porta, Lopez-de-Silanes, and Shleifer (1999), who find that foreign asset ownership rises with minority shareholder protection, provide further support.

Diversification through Multinationals

Another explanation for familiarity bias is that investors can gain international diversification by investing in locally based multinationals, American depositary receipts (ADRs), country closed-end funds, and exchange traded funds (ETFs). For example, an American investor who buys a stake in the microchip maker Intel theoretically gains exposure to all of the markets in which Intel operates, as Intel's share price is determined in part by its profitability in these markets. Jacquillat and Solnik (1978) argue, however, that multinationals present a poor substitute for foreign assets, with only 2 percent of the variance in multinational returns attributable to the foreign markets in which they operate. More recent studies such as Rowland and Tesar (2004) as well as Cai and Warnock (2006) find more support for diversification through multinationals. Yet, even with hedging through multinationals, there are still gains from further international diversification. Hedging through closed-end funds or ETFs presents challenges as noted by the closed-end fund puzzle in which funds trade at a discount to their net asset values. Furthermore, the volume of trade in these asset classes is not nearly enough to achieve the international diversification suggested by both the model and data-based approaches.

Asymmetric Information

Perhaps the most popular institutional explanation for familiarity bias is asymmetric information. Investors may choose to invest in the familiar simply because they know more about it. The perceived risk of foreign assets is larger because forecasts about foreign returns are less precise. Brennan and Cao (1997) find that investors tend to buy foreign assets when returns are high and sell them when returns are low. This kind of return-chasing behavior is indicative of a limited-information setting. Brennan, Cao, Strong, and Xu (2005) find further support for this result with investors tending to be more "bullish" about a market following a strong performance by that market. That investors are forecasting returns based solely

on past returns (adaptive expectations) rather than using all available information (rational expectations) suggests an information asymmetry.

Economic and cultural distance appears to be a barrier to the flow of information. Portes and Rey (2005) find that home bias declines as the number of foreign bank branches rises, as bilateral telephone traffic increases, and as the number of overlapping hours in equity trading markets rises. Li, Yan, and Faruqee (2004) find that larger countries, about which information is more readily available, tend to have more of their assets held by foreigners. Others show that language is also an important determinant of foreign asset holdings. For example, Grinblatt and Keloharju (2001) find that Finnish investors prefer to invest in firms that have Finnish managers both at home and abroad. Numerous other studies report that countries sharing a common language have more cross-border investment, suggesting that language can be a significant barrier to cross-border information flow. This result is supported by Hau (2001), who examines the performance of 756 professional traders on the German Security Exchange. He finds that traders located outside Germany in non-German-speaking cities tend to underperform traders located in German-speaking cities, even those located outside Germany.

Economic and cultural distance appears to matter more for less sophisticated investors as well. Giofré (2008) finds that information proxies such as language, distance, and asset market transparency have a much stronger influence on the foreign equity holdings of household investors than institutional investors. That households depend more on country-specific rather than firm-specific factors suggests that asymmetric information may be limiting diversification.

Information asymmetries also appear to affect performance. Coval and Moskowitz (2001) find that mutual fund managers earn an excess return of nearly 3 percent on investments located within 100 kilometers of the fund headquarters. Grote and Umber (2006) find that the most successful mergers and acquisitions deals are those involving firms that are geographically close together. Choe, Kho, and Stulz (2005) look at Korean data and find that foreign money managers pay more when they buy Korean assets as opposed to when they sell those same assets. Dvorak (2005) finds a similar result in Indonesia with foreign investors more likely to sell their assets shortly before a large positive return.

Familiarity bias is essentially a puzzle of capital immobility. By appealing to asymmetric information as an explanation for the bias, are investors simply replacing the puzzle of capital immobility with an even less plausible puzzle of information immobility? If investors can make truly large gains through greater diversification, then a market should develop in which local information is traded abroad. Van Nieuwerburgh and Veldkamp (2009) argue that information about foreign markets is not limited, but rather that investors are constrained in their capacity to absorb information. Given this capacity constraint, investors will choose to maximize their comparative advantage in local information. In doing so, they should invest more heavily in domestic assets. Thus, information is asymmetric not by nature but by choice.

A criticism of the limited information explanation is that it only fits the data when investors forecast higher returns on domestic assets than foreign assets. If domestic investors base their expectations on a different information set than foreign investors, then there must be times in which domestic investors actually forecast lower domestic returns than foreign investors. During these times, domestic

portfolios should tilt toward foreign assets. However, home bias remains stable and persists over time. This suggests that investors are consistently over-estimating local returns, a behavioral rather than institutional explanation explored in the next section.

The literature investigating institutional explanations for familiarity bias has generally discarded explanations such as hedging against domestic risks, diversification through multinationals, and higher explicit transaction costs on foreign assets. Although explanations such as currency risk, appropriation risk, and asymmetric information find greater support, they still have limitations. The next section provides an examination of some behavioral finance explanations for familiarity bias.

BEHAVIORAL EXPLANATIONS

Rational explanations for familiarity bias can only explain part of the observed bias toward local assets. Several studies have turned to behavioral finance explanations to explain the remainder of the puzzle. These explanations cover such behavioral biases as investing in own-company stock, overconfidence, regret, patriotism, and social identification, and offer compelling explanations for why investors willingly "leave cash on the table" in order to invest in the familiar.

Overinvestment in Own-Company Stock

A study by Muelbroek (2005) estimates that holding a large position in own-company stock over a long period of time is worth 50 cents on the dollar when compared to a diversified portfolio. Investing heavily in company stock carries with it both the idiosyncratic risk of holding a single asset and the risk of losing both labor income and wealth if the company goes bankrupt. Despite the perils of investing in company stock, Mitchell and Utkus (2004) report 11 million participants in discretionary retirement plans held more than 20 percent of their assets in company stock. Within this group, five million held more than 60 percent of their assets in company stock. Why are employees investing so heavily in assets that, while familiar, present much greater risks than a diversified portfolio?

Benartzi, Thaler, Utkus, and Sunstein (2007) survey 500 employees participating in 401(k) programs and ask whether the high levels of investment in company stock can be rationalized. Although there is a tax advantage to investing in company stock, Benartzi et al. find that only 10 percent of employees are even aware of this. In fact, the authors find a higher percentage of employees who believe that company stock carries a tax disadvantage. Despite empirical evidence to the contrary, employees view company stock as being safer than even a well-diversified portfolio. The fact that employers match employee contributions with company stock is seen as an implicit endorsement of the stock, leading to even larger employee investment in company stock.

Employees overinvest in company stock because they fail to accurately assess the risk of doing so. Benartzi (2001) finds that only 16 percent of employees believe that investing in company stock is riskier than a broad market index. Choi, Laibson, and Madrian (2005) argue that this risk assessment failure is not due to a lack of information, but rather a behavioral bias. They examine how the bankruptcies

of Enron, WorldCom, and Global Crossing affected employer stockholdings by workers at other companies. Even in Enron's headquarters of Houston, Texas, where media coverage of the firm's collapse was at its highest, employees did not appreciably change their investment patterns despite the stark example of the risks of owning company stock.

Overconfidence

The propensity to overinvest in company stock suggests that even in the absence of asymmetric information, investors may feel more confident in their ability to forecast domestic returns. Kilka and Weber (2000) use experimental data (thus controlling for information asymmetries) to show that German investors display more confidence in their forecasts of German asset returns than in their forecasts of American asset returns, while American investors feel more confident forecasting returns on American assets. As the investors in this controlled experiment had equal access to information about both German and American companies, this result represents a behavioral overconfidence around predicting domestic returns. Barber and Odean (2001) find that overconfident investors tend to invest more in those assets with which they are familiar, suggesting that overconfidence may help explain familiarity bias.

Goetzmann and Kumar (2008) provide further evidence for this theory. They examine individual brokerage accounts for 40,000 U.S. investors and find that familiarity bias is highest for young, low-income, less educated, and less sophisticated investors. Hau and Rey (2008) find a similar result with mutual funds displaying less of a home bias than individual investors. For example, the average home domestic equity share in the United States is 87 percent, but it is only 68 percent for mutual funds. This evidence suggests that unsophisticated investors who feel more confident forecasting returns on familiar assets may partly drive familiarity bias.

Karlsson and Nordén (2007) document a gender bias in overconfidence. They use Swedish pension data to show that the greatest familiarity bias is for older single men with low levels of education. This result supports work by Barber and Odean (2001) who find that men tend to be more subject to overconfidence than women. While these studies imply that investor sophistication is negatively related to home bias, even investment professionals are not immune to being overly optimistic about local returns. Strong and Xu (2003) survey mutual fund managers in Europe, Japan, and the United States. They find that managers are most optimistic about the performance of markets in their own countries, which is a prediction that cannot be correct for all of these managers.

Regret

Another potential explanation for familiarity bias is that investors care more about minimizing losses than optimally trading off risk and return as suggested by both the data- and model-based approaches discussed at the beginning of this chapter. Investors also care about potential regret if their foreign assets underperform domestic stocks. Of course, these same investors would be elated if their foreign stocks delivered higher returns than domestic stocks *ex-post*, but estimates of regret

theory as in Loomes and Sugden (1982) and Bell (1982) find that investors weight potential losses relative to a benchmark more in their utility than in gains.

Solnik (2006) develops a model in which investors take return, risk, and regret into account when determining portfolio weights on foreign equity. Investors are only willing to hold foreign assets if they pay a "regret premium," which is increasing in regret aversion across investors. Solnik argues that with symmetric regret aversion across countries, investors may still observe familiarity bias. Even if only one country exhibits regret aversion, this may be enough to generate global home bias. Although this theory lacks empirical confirmation, it does present an avenue for further research.

Patriotism and Social Identification

Other studies have considered patriotism and social identification as behavioral explanations for familiarity bias. Morse and Shive (2006) find that measures of patriotism such as positive responses to survey questions about national pride are significantly related to home bias, even after controlling for such factors as capital controls, diversification benefits, information advantages, and familiarity. Thus, investors may derive some positive utility from investing in local assets despite monetary gains from diversification.

Using controlled laboratory experiments, Fellner and Maciejovsky (2003) offer additional support and find that social identification can influence asset choices. The authors arbitrarily assign participants and assets into one of two groups. Conducting experiments in which there is both symmetric and asymmetric information across groups, the authors find that social identification has at least as much explanatory power as asymmetric information. This relates to the growing literature on culture, trust, and economic transactions as reviewed by Guiso, Sapienza, and Zingales (2006). Investors may prefer to stay with familiar assets because they are better able to gauge the risk in the familiar because of their social identification with the country or region issuing that asset.

Another study supporting social identification and investment is Foad (2008b), who looks at how immigration affects foreign asset holdings. While immigrants may socially identify with either their native or adopted countries, they do have stronger ties with their native countries than the average investor to their adopted country. As a result, the perceived risk of investing in foreign (i.e., native country) assets may be lower for an immigrant. An immigrant may also perceive an information advantage in investing in native country assets and be subject to the same overconfidence that domestic investors have with domestic assets. Foad finds that immigration into a country increases that country's investment in the immigrant's native country. Yet, there is no corresponding increase in investment coming from the immigrant's native country to their adopted nation. This suggests that immigrants are bringing their own familiarity biases with them.

SUMMARY AND CONCLUSIONS

This chapter has examined the validity of multiple explanations for familiarity bias. The evidence suggests that there is not a single explanation for the bias. Instead, a mixture of the theories reviewed in this chapter drive the portfolio

allocation decisions of investors. On the institutional side, currency risk, asymmetric information, corporate governance, and weak property rights limit investors from diversification into unfamiliar assets. A new and growing literature ascribing behavioral explanations finds that investors fail to accurately assess the risk of company stock, perhaps due to overconfidence in predicting familiar asset returns, preferring local assets to avoid regret, and viewing familiar assets more favorably due to social identification.

Familiarity bias suggests that investors hold suboptimal portfolios. Greater diversification could generate both higher returns and lower risk. Furthermore, investors could better insulate consumption risk from income risk through diversification. Lewis (1999) estimates that efficient portfolios could increase investor wealth by 10 to 28 percent, with these gains increasing in investor risk aversion. Reducing familiarity bias could lead to greater financial market integration. Pungulescu (2008) finds that countries with lower rates of familiarity bias have higher rates of economic growth, controlling for a wide variety of factors. Given the potential welfare gains from reducing familiarity bias, finding viable explanations and therefore solutions to the bias will continue to be a fruitful area for further research.

DISCUSSION QUESTIONS

1. Identify one problem with using the model-based approach to estimate familiarity bias. What is one problem with the data-based approach?
2. Some suggest higher transaction costs on foreign assets as an explanation for why investors are so heavily weighted in domestic assets. Cite two studies that do not support the notion that transaction costs are responsible for familiarity bias. What are some less observable costs of foreign assets that could still limit foreign ownership?
3. Why would limited information about unfamiliar assets be an explanation for familiarity bias? What evidence supports this theory? Is there any reason to doubt asymmetric information as the key driver of familiarity bias?
4. Why would investing in own-company stock present greater risk than investing in a diversified fund? Despite this higher risk, many employees hold much of their 401(k) plan in company stock. Why does this phenomenon exist? Can heavy investment in company stock be rationalized? If so, how?
5. Why would a less-educated male be expected to display a larger familiarity bias than a better-educated female?
6. Why would social identification have a larger effect on investment patterns when information about financial markets is limited rather than abundant?

REFERENCES

Adler, Michael, and Bernard Dumas. 1983. International portfolio choice and corporate finance: A synthesis. *Journal of Finance* 38:3, 925–984.

Amadi, Amir, and Paul Bergin. 2006. Understanding international portfolio diversification and turnover rates. NBER Working Paper No. 12473.

Barber, Brad, and Terrance Odean. 2001. Boys will be boys: Gender, overconfidence, and common stock investment. *Quarterly Journal of Economics* 116:1, 261–292.

Baxter, Marianne, and Urban J. Jermann. 1997. The international diversification puzzle is worse than you think. *American Economic Review* 87:1, 170–180.

Bell, David E. 1982. Regret in decision making under uncertainty. *Operations Research* 30:5, 961–981.

Benartzi, Shlomo. 2001. Excessive extrapolation and the allocation of 401(k) accounts to company stock. *Journal of Finance* 56:5, 1747–1764.

Benartzi, Shlomo, Richard H. Thaler, Stephen P. Utkus, and Cass R. Sunstein. 2007. The law and economics of company stock in 401(k) plans. *Journal of Law and Economics* 50:1, 45–79.

Bodnaruk, Andiry. 2009. Proximity always matters: Local bias when the set of local companies change. *Review of Finance*, forthcoming.

Brennan, Michael J., and H. Henry Cao. 1997. International portfolio investment flows. *Journal of Finance* 52:5, 1851–1880.

Brennan, Michael. J., H. Henry Cao, Norman Strong, and Xinzhong Xu. 2005. The dynamics of international equity market expectations. *Journal of Financial Economics* 77:2, 257–288.

Cai, Fang, and Francis E. Warnock. 2006. International diversification at home and abroad. NBER Working Paper No. 12220.

Choe, Hyuk, Bong-Chan Kho, and René M. Stulz. 2005. Do domestic investors have an edge? The trading experience of foreign investors in Korea. *Review of Financial Studies* 18:3, 795–829.

Choi, James, David Laibson, and Brigitte C. Madrian. 2005. Are empowerment and education enough? Under-diversification in 401(k) plans. *Brookings Papers on Economic Activity* 36:2, 151–198.

Cooper, Ian, and Evi Kaplanis. 1994. Home bias in equity portfolios, inflation hedging, and international capital market equilibrium. *Review of Financial Studies* 7:1, 45–60.

Coval, Joshua, and Tobias Moskowitz. 1999. Home bias at home: Local equity preferences in domestic portfolios. *Journal of Finance* 54:6, 2045–2073.

Coval, Joshua, and Tobias Moskowitz. 2001. The geography of investment: Informed trading and asset pricing. *Journal of Political Economy* 109:4, 811–841.

Dahlquist, Magnus, Lee Pinkowitz, René M. Stulz, and Rohan Williamson. 2003. Corporate governance and the home bias. *Journal of Financial and Quantitative Analysis* 38:1, 87–110.

De Santis, Roberto A. 2006. The geography of international portfolio flows, international CAPM, and the role of monetary policy. European Central Bank Working Paper No. 678.

Dvorak, Tomas. 2005. Do domestic investors have an information advantage? Evidence from Indonesia. *Journal of Finance* 60:2, 817–839.

Engel, Charles, and Akito Matsumoto. 2006. Portfolio choice in a monetary open-economy DSGE model. NBER Working Paper No. 12214.

Fellner, Gerlinde, and Boris Maciejovsky. 2003. The equity home bias: Contrasting an institutional with a behavioral explanation. Max Planck Institute Discussion Papers on Strategic Interaction No. 2003/03, Max Planck Institute of Economics.

Fidora, Michael, Marcel Fratzscher, and Christian Thimann. 2007. Home bias in global bond and equity markets: The role of real exchange rate Volatility. *Journal of International Money and Finance* 26:4, 222–225.

Foad, Hisham. 2008a. Equity home bias and the euro. Working Paper, San Diego State University. Available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=959270.

Foad, Hisham. 2008b. Familiarity breeds investment: Immigration and equity home bias. Working Paper, San Diego State University. Available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1092305.

French, Kenneth, and James Poterba. 1991. Investor diversification and international equity markets. *American Economic Review* 81:2, 222–226.

Garlappi, Lorenzo, Raman Uppal, and Tan Wang. 2007 Portfolio selection with parameter and model uncertainty: A multi-prior approach. *Review of Financial Studies* 20:1, 41–81.

Giofré, Maela. 2008. Bias in foreign equity portfolios: Households vs. professional investors. MPRA Working Paper No. 13929.
Glassman, Debra A., and Leigh A. Riddick. 2001. What causes home asset bias and how should it be measured? *Journal of Empirical Finance* 8:1, 35–54.
Goetzmann, William N., and Alok Kumar. 2008. Equity portfolio diversification. *Review of Finance* 12:3, 433–463.
Grinblatt, Mark, and Matti Keloharju. 2001. How distance, language, and culture influence stock holdings and trades. *Journal of Finance*, 56:3, 1053–1073.
Grote, Michael H., and Marc Umber. 2006. Home biased? A spatial analysis of the domestic merging behavior of U.S. firms. Working Paper 161, Goethe University Frankfurt am Main.
Guiso, Luigi, Paola Sapienza, and Luigi Zingales. 2006. Does culture affect economic outcomes? *Journal of Economic Perspectives* 20:2, 23–48.
Hau, Harald. 2001. Location matters: An examination of trading profits. *Journal of Finance* 56:5, 1959–1983.
Hau, Harald, and Hélène Rey. 2008. Home bias at the fund level. *American Economic Review*, 98:2, 333–338.
Hong, Harrison, Jeffrey D. Kubik, and Jeremy C. Stein. 2008. The only game in town: Stock-price consequences of bias. *Journal of Financial Economics* 90:1, 20–37.
Huberman, Gur. 2001. Familiarity breeds investment. *Review of Financial Studies* 14:3, 659–680.
Ivković, Zoran, and Scott Weisbenner. 2005. Local does as local is: Information content of the geography of individual investors' common stock investments. *Journal of Finance* 60:1, 267–306.
Jacquillat, Bertrand, and Bruno Solnik. 1978. Multinationals are poor tools for diversification. *Journal of Portfolio Management* 4:2, 8–12.
Jeske, Karsten. 2001. Equity home bias: Can information cost explain the puzzle? *Economic Review—Federal Reserve Bank of Atlanta* 86:3, 31–42.
Karlsson, Anders, and Lars Nordén. 2007. Home sweet home: Home bias and international diversification among individual investors. *Journal of Banking & Finance* 31:2, 317–333.
Kilka, Michael, and Martin Weber. 2000. Home bias in international stock return expectation. *Journal of Behavioral Finance* 1:3, 176–192.
La Porta, Rafael, Florencio Lopez-de-Silanes, and Andrei Shleifer. 1999. Corporate ownership around the world. *Journal of Finance* 58:2, 471–517.
Lewis, Karen. 1999. Trying to explain home bias in equities and consumption. *Journal of Economic Literature* 37:2, 571–608.
Li, Shujing, Isabel K. Yan, and Hamid Faruqee. 2004. The determinants of international portfolio holdings and home bias. IMF Working Paper No. 04/34.
Loomes, Graham, and Robert Sugden. 1982. Regret theory: An alternative theory of rational choice under uncertainty. *Economic Journal* 92:368, 805–824.
Markowitz, Harry M. 1952. Portfolio selection. *Journal of Finance* 7:1, 77–91.
Martin, Philippe, and Hélène Rey. 2004. Financial super-markets: Size matters for asset trade. *Journal of International Economics* 64:2, 335–361.
Massa, Massimo and Andrei Simonov. 2006. Hedging, familiarity and portfolio choice. *Review of Financial Studies* 19:1, 633–686.
Merton, Robert C. 1980. On estimating the expected return on the market. *Journal of Financial Economics* 8:4, 323–361.
Meulbroek, Lisa. 2005. Company stock in pension plans: How costly is it? *Journal of Law and Economics* 48:2, 443–474.
Mitchell, Olivia S., and Stephen P. Utkus. 2004. The role of company stock in defined contribution plans. In *The pension challenge: Risk transfers and retirement income security*, ed. Olivia Mitchell and Kent Smetters, 33–70. Oxford: Oxford University Press.

Morse, Adair, and Sophie Shive. 2006. Patriotism in your portfolio. Available at http://ssrn.com/abstract=406200.

Pástor, Lubos. 2000. Portfolio selection and asset pricing models. *Journal of Finance* 55:1, 179–223.

Portes, Richard, and Hélène Rey. 2005. The determinants of cross-border equity flows. *Journal of International Economics* 65:2, 269–296.

Pungulescu, Crina. 2008. Real effects of financial market integration: Does lower home bias lead to welfare benefits? Mimeo, Tilburg University. Available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1271894.

Rowland, Patrick F., and Linda Tesar. 2004. Multinationals and the gains from international diversification. *Review of Economic Dynamics* 7:4, 789–826.

Sercu, Piet. 1980. A generalization of the international asset pricing model. *Revue de l'Association Française de Finance* 1:1, 91–135.

Sharpe, William. 1963. A simplified model for portfolio analysis. *Management Science* 9:2, 277–293.

Solnik, Bruno. 2006. Home bias and regret: An international equilibrium model. Available at http://ssrn.com/abstract=828405.

Strong, Norman, and Xinzhong Xu. 2003. Understanding the equity home bias: Evidence from survey data. *Review of Economics and Statistics* 85:2, 307–312.

Stulz, René M. 2005. The limits of financial globalization. *Journal of Finance* 60:4, 1595–1638.

Tesar, Linda, and Ingrid Werner. 1995. Home bias and high turnover. *Journal of International Money and Finance* 14:4, 467–492.

Van Nieuwerburgh, Stijn, and Laura Veldkamp. 2009. Information immobility and the home bias puzzle. *Journal of Finance*, forthcoming.

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CHAPTER 16

Limited Attention

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INTRODUCTION

The standard theoretical models in accounting and finance assume individuals make decisions using all available information. Evidence from the psychology literature and casual observation suggests, however, that people often fail to incorporate all relevant information when they make decisions. Huberman and Regev (2001) provide an illuminating example of investor inattention in the case of EntreMed (ENMD). On Sunday, May 3, 1998, the front page of the *New York Times* reported a recent breakthrough in cancer research featuring EntreMed, a small biotechnology company with licensing rights to the process. The impact of the story was very large, with a one-day stock return of 330 percent. The stock price stayed well above its pre-publication level for the rest of the year. Yet, that news story contained no new information because *Nature* and other popular press including the *New York Times* in November 1997 previously published the same content.

Limited attention is a necessary consequence of cognitive constraints and the vast amount of information available in the environment. The amount of information relevant to the valuation of a particular firm and the time and cognitive operations required to process such information are not trivial. Additionally, there are thousands of firms investors need to evaluate. While individual investors are more likely to be affected by their limited attention, evidence suggests that experts such as analysts and mutual fund managers also tend to neglect relevant information. For example, Abarbanell and Bushee (1997) find that analysts do not efficiently use information contained in a set of financial ratios, and Teoh and Wong (2002) find that analysts do not discount discretionary accruals of new issue firms adequately.

This chapter provides a review of the theoretical and empirical studies on limited attention. Recent studies argue that limited attention may underlie a wide range of stylized empirical findings such as underreaction to public news, stock return co-movements, and strategic behavior by corporate managers. A simple model is offered to illustrate how to capture limited attention effects in capital markets. The model shows that stock prices do not fully incorporate relevant

information when some investors are inattentive, and predicts that the degree of return predictability increases with the degree of investor inattention. The chapter also provides a review of recent evidence for the model prediction. Next discussed is how limited attention affects investor trading decisions, market prices, and corporate decision making. The chapter reviews studies that examine how individuals with limited attention allocate attention across relevant signals and the empirical evidence for such strategic allocations of attention. Finally, the chapter provides a discussion of how limited attention is related to other well-known psychological biases such as narrow framing and the use of heuristics.

LIMITED ATTENTON AND RETURN PREDICTABILITY: THEORY

When investors have limited attention, they use only a subset of publicly available information to value a stock. Information ignored by these investors is impounded into prices only later when its relevance for stock value becomes more salient. Two such anomalies that have been shown to be robust across many studies are the post-earnings announcement drift (PEAD) anomaly and the accruals anomaly. Regarding the PEAD, Bernard and Thomas (1989) suggest that prices underreact to earnings news, as would occur if some participating investors are inattentive to earnings announcements. The accruals anomaly, which refers to the negative abnormal stock returns for firms with high accruals, suggests that investors overreact to accruals, which are a component of earnings (Sloan, 1996; Teoh, Welch, and Wong, 1998a, 1998b; Xie, 2001).

Hirshleifer, Lim, and Teoh (2009b) provide a model that reconciles these seemingly contradictory reactions. In a market where a subset of investors attends to earnings news, there is underreaction to the earnings news. Among the subset of earnings-attentive investors, some are inattentive to the implication about differential persistence of future cash flows from the two major components of earnings, namely, accruals and cash flow from operations. The persistence of future cash flows is lower if the earnings are derived from accruals than from cash flows from operations, possibly owing to the greater ease of manipulating accruals than cash flows. Hirshleifer et al. show that the possibility exists of obtaining both anomalies, depending on the relative frequencies of investor types.

This chapter presents a simple model of limited attention modified from Hirshleifer and Teoh (2003) and Hirshleifer et al. (2009b). Assume investors have mean-variance preferences and are identical except that some are inattentive and form their beliefs using only a subset of all available information. While investor inattention is often modeled as omission of information signals, broadly speaking one can model investor inattention as the use of heuristics or simplified models when they form their expectations. The fraction of inattentive investors is denoted as f. Fraction $(1 - f)$ is attentive and forms fully rational expectations based on all available information. Alternatively, all investors can be assumed to be identical, and f is the probability that an investor becomes inattentive to certain information signals.

Evidence from the psychology literature suggests that f can be modeled as a function of the salience of the information, the resources expended by investors on

attending to the information, and how easily investors can process the information. The resources expended by investors in turn can depend on the amount of competing information for investors' attention.

There is a single risky security (stock) and cash in the economy. At date 1, investors receive public information about the terminal value of the stock. At date 2, investors realize the terminal payoff of the stock. Assuming that the stock is in zero net supply, Hirshleifer and Teoh (2003) show that there is no risk premium and that the equilibrium stock price at date 1 can be written as a weighted average of the beliefs of the two investor groups,

$$P_1 = \kappa E^I[P_2] + (1-\kappa)E^A[P_2], \tag{16.1}$$

where the superscript I or A denotes the belief of inattentive or attentive investors, respectively, and κ is an increasing function of f, the fraction of inattentive investors.

$$\kappa = \frac{\dfrac{f}{\text{var}^I(P_2)}}{\dfrac{f}{\text{var}^I(P_2)} + \dfrac{1-f}{\text{var}^A(P_2)}} \tag{16.2}$$

To simplify the analysis, assume that attentive and inattentive investors agree on the variance of the future stock price ($\text{var}^I(P_2) = \text{var}^A(P_2)$) but that they may disagree on the expectations of the future price. Under this assumption, the weight on inattentive investors' belief κ in date 1 stock price is equal to the fraction of inattentive investors ($\kappa = f$).

Replacing κ with f in Equation 16.1, the expected price change based on information set ϕ can be written as follows:

$$E[P_2 - P_1 | \phi] = f(E^A[P_2 | \phi] - E^I[P_2 | \phi]). \tag{16.3}$$

Equation 16.3 implies that the price change is predictable based on the available information when inattentive investors do not have a fully rational expectation about the future stock price. As a simple example, suppose attentive investors update their expectation of the date 2 stock price from V to V+ θ after receiving a signal θ, while inattentive investors do not update their expectation and hold the same belief *V*. In such a case, the expected price change is predictable based on θ, with the predictability increasing with the degree of investor inattention (f):

$$E[P_2 - P_1 | \phi] = f(V + \theta - V) = f\theta. \tag{16.4}$$

For instance, after positive earnings news, attentive investors will revise their expectations of future stock price upward, while inattentive investors do not update their expectations. In such a case, the future abnormal return after positive earnings news is expected to be positive because attentive investors have a higher expectation of future price compared to the inattentive ones

$$E^A[P_2 | \phi] > E^I[P_2 | \phi]$$

On the other hand, when accruals are high, inattentive investors hold a higher expectation of the future stock price compared to attentive investors

$$E^A[P_2|\phi] < E^I[P_2|\phi]$$

because inattentive investors do not recognize the fact that accruals tend to reverse in the future. This implies that future abnormal returns are lower for stocks with high accruals.

LIMITED ATTENTION AND RETURN PREDICTABILITY: EVIDENCE

The finance and economics literatures provide a large body of evidence consistent with limited attention about public information affecting securities prices, including the post-earnings announcement drift, the accruals anomaly, and stock return momentum (see Daniel, Hirshleifer, and Teoh, 2002). Various accounting fundamentals predict future abnormal returns including net operating assets (Hirshleifer, Hou, Teoh, and Zhang, 2004), intrinsic value-to-price (Frankel and Lee, 1988), a set of financial ratios that measure accounting operating performance and distress (Lev and Thiagarajan, 1993), and cash-flow-to-price ratio (Desai, Rajgopal, and Venkatachalam, 2004).

When investors have limited attention, the amount of attention that they pay to particular information or the degree to which information is incorporated into stock valuation is likely to be greater when there are fewer competing stimuli (less distraction) and/or the information is salient and easy to process. To test the effect of limited attention on market prices, recent studies use empirical proxies of investor attention based on (1) competing stimuli that distract investors from relevant information, (2) salience of the information and the ease of processing the information, or (3) variables that are indicative of the degree of investor attention such as trading volume and Internet search volumes. The following categorizes those studies into three groups based on how they identify the proxy for investor attention.

Competing Stimuli as a Measure of Investor Inattention

Investors have difficulty paying attention to relevant information when other stimuli compete for their attention. As Kahneman and Tversky (1973) point out, attention to one task requires a substitution of attention from other tasks. For instance, in studies of dichotic listening (Cherry, 1953; Broadbent, 1958; Moray, 1959), one message is played into a subject's left ear while a different message is played into his right ear simultaneously. Subjects are instructed to attend to one of two messages, sometimes to repeat back the words of that message. When asked about the unattended message, they remember very little about it, especially when they had to exert extra attention to repeat back the words. This evidence implies that investors may have difficulty absorbing relevant information about a firm when they are distracted by other tasks or information signals competing for their attention.

DellaVigna and Pollet (2009) identify Fridays as days on which investors are more distracted from the task of stock valuation and so are less attentive to earnings

announcements. They find more muted immediate stock market reactions to Friday earnings announcements followed by stronger drift, compared to other weekday announcements. Similarly, Francis, Pagach, and Stephan (1992), and Bagnoli, Clement, and Watts (2005) find a greater underreaction to earnings news made during non-trading hours.

Hirshleifer, Lim, and Teoh (2009a) measure the amount of information overload by the number of earnings announcements on a given day. They find that the announcement day reaction is weaker and the drift stronger when an earnings announcement is made on days with many competing announcements, and that same day earnings announcements from unrelated industries are more distracting than industry-related announcements.

Salience of Information and Processing Ease

People perceive and process some stimuli more easily than others. Stimuli are more salient if they are more prominent (stand out) or if they contrast more with other stimuli in the environment. Thus, people are more likely to process salient information and to ignore non-salient information. Perhaps the most striking evidence is that stock prices react to salient news that is already public information (Ho and Michaely, 1988; Hand, 1990; Klibanoff, Lamont, and Wizman, 1998; Huberman and Regev, 2001). Also, attention is more likely to be directed toward information that is easy to access and process. Individuals pay attention and assess event probability according to how easily they remember confirmatory examples (availability heuristics in Tversky and Kahneman, 1973). They are also likely to remember information that falls into easily summarized patterns. According to Nisbett and Ross (1980, p. 45), stimuli that are more "proximate in a sensory, temporal or spatial way" are salient and easy to process. According to the psychology literature, salience effects are robust and widespread (Fiske and Taylor, 1991). This literature suggests that investors are likely to have a greater difficulty attending to and processing information when information is less salient and harder to process. A lower attention implies greater return predictability based on such information.

DellaVigna and Pollet (2007) examine the effect of demographics on cross-sectional returns. Information about demographics predicts demand shifts and so future profits for age-sensitive goods. If investors are fully attentive, these predictable changes will be fully incorporated into stock prices. DellaVigna and Pollet find that forecasted long-term growth rates of demand due to demographics predict industry abnormal returns, implying that investors are inattentive to the long-term implications of demographic changes that are less salient and harder to process compared to short-term implications.

Cohen and Frazzini (2008) find that the market underreacts to news about economically related firms, which are identified using customer-supplier linkages. They also report that the return predictability varies with the extent of investor attention. Presumably, investors can more easily pay attention to the economic link when they hold stocks in both the supplier and the customer firms. Using mutual fund holding data, Cohen and Frazzini show that the return predictability is stronger when a smaller fraction of a firm's investors hold its economically-linked firms.

Engelberg (2008) categorizes earnings news into hard (quantitative) and soft (qualitative) information and examines how they are related to the post-earnings

announcement drift. He finds that the harder-to-process soft information (proxied by the number of negative words in earnings press release) has incremental predictability, and that the predictability extends to a longer horizon compared to that of quantitative information. Similarly, Peress (2008) finds stronger market reactions and less subsequent drift for quarterly earnings announcements that are covered in the *Wall Street Journal* (more salient) than those that are not.

Accounting research from experimental and archival studies finds that placement, categorization, and labeling affect financial statement users' perceptions, including professionals. Salience influences judgments about causality and the importance of the information. So, disclosure of equivalent information about a firm that is presented in different ways affects how investors value and trade the stock.

Investors weigh accounting information that is reported on the financial statements more heavily than footnote disclosures. They also value recognized write-down information (included in the calculation of net income) more strongly than merely disclosed write-down information in the footnotes for the oil and gas industry (Aboody, 1996). Before the requirement that firms report post-retirement benefits (Statement of Financial Accounting Standards 106) in the early 1990s, Amir (1993) finds that investors underweight footnote disclosures of these costs until policy discussions leading up to the policy change made the costs of these long-term benefits salient. Davis-Friday, Folami, Liu, and Mittelstaedt (1999) find that investors more heavily weigh recognized non-pension retiree benefits more heavily than disclosed liabilities among SFAS 106 adopters.

Experimental studies find similar differences in perceptions about the importance of accounting items according to how they are presented or classified. Hopkins (1996) shows that experimental subjects treat the same hybrid financial instrument differently depending on whether it is classified as debt, equity, or mezzanine financing in the balance sheet. They also report that financial statement users prefer the pooling-of-interest method accounting for business combinations over the purchase method (Hopkins, Houston, and Peters, 2000). The latter accounting method often results in lower earnings because the merger premium is expensed over many future periods. Finally, financial statement users weight other comprehensive income items more when they are included in the income statement than when they are reported in the less salient form such as in footnotes or in the less used statement of changes in shareholders' equity (Hirst and Hopkins, 1998; Dietrich, Kachelmeier, Kleinmuntz, and Linsmeier, 2001). In a recent study, Cai, Garvey, and Milbourn (2008) show that stock prices do not reflect the costs of option grants until they materialize upon exercise. They also find that the return predictability is mitigated after the implementation of the revised accounting standards that require firms to report the fair market value of stock option grants against their earnings.

Other Proxies of Investor Attention

Some studies use trading volume as a proxy for investor attention (Hou, Peng, and Xiong, 2008). Because investors are more likely to trade when they are paying attention to the stock market than when they are not, high trading volume may indicate greater investor attention. Da, Engelberg, and Gao (2009) propose that Google search volume provides a more direct measure of investors' attention.

While the first two approaches of measuring attention—competing stimuli and salience/ease of processing—focus on the *determinants* of investor attention, trading volume and Internet search volume can be considered the *results* of investor attention.

Hou, Peng, and Xiong (2008) examine the role of investor attention in both market underreaction and overreaction using trading volume and market state as a proxy for investor attention. Their use of market state is motivated by evidence in Karlsson, Loewenstein, and Seppi (2005) that investors monitor the stock market more closely in up markets than in down markets. They find a stronger underreaction to earnings news among low trading volume stocks and in down markets, indicating greater investor attention leads to more prompt market reactions to earnings news.

Loh (2009) examines the effect of investor attention on market reactions to stock recommendations. Analyst stock recommendations are often accompanied by subsequent drift, indicating an underreaction to stock recommendations. He uses trading volume as a main proxy for investor attention, and also uses other proxies of investor attention such as analyst coverage, institutional ownership, and the number of earnings announcements on the same day. The results show that the recommendation drift is stronger for stocks with low turnover, low analyst coverage or institutional ownership, and when a greater number of announcements occur on the same day.

THE INTERACTION OF ATTENTION AND INVESTOR BIASES AND MARKET IMPERFECTIONS

Some may assume that the stock market becomes more efficient when investors pay more attention, as stock prices incorporate information faster. A few studies argue, however, that greater investor attention can exacerbate the effect of investor behavioral biases on market prices. For irrational investors to affect market prices, they need to pay attention to the stock market and participate in trading.

One of the well-known investor biases is overconfidence. When investors are overconfident, they can overreact to their private information as they think their information is more precise than it actually is. Daniel, Hirshleifer, and Subrahmanyam (1998) show that overconfidence-induced overreactions to private information lead to price momentum and subsequent reversals. Greater attention by overconfident investors can amplify the effect of their overconfidence, as their expectations carry a greater weight in the equilibrium price when they pay attention to the stock market and participate in trading. Hou et al. (2008) test such a prediction using trading volume and market states as proxies of investor attention and find that price momentum is stronger among high volume stocks and in up markets.

Da et al. (2009) propose that a large search volume for a stock in Google indicates that many people are paying attention to and looking for information about that stock. They find a strong positive relation between search volume changes and investor trading, especially for less sophisticated investors. Their evidence also shows that increases in investor attention are associated with large first-day returns and long-run underperformance of IPO stocks; in addition, a stronger

momentum exists among stocks with high search volume levels. The findings of Hou et al. (2008) and Da et al. suggest that greater investor attention can sometimes make a market less efficient, as greater attention by less sophisticated investors accentuates the effect of investor biases on market prices.

Due to short-sale constraints, attention may play an asymmetric role in its effect on buy and sell trades, and therefore on up versus downward price movements. Barber and Odean (2008) argue that attention plays a more important role in individual investors' buying decisions rather than in their selling decisions. When buying a stock, investors need to search thousands of stocks, while they usually focus on the few stocks they own when selling a stock due to short-sale constraints. Therefore, attention-grabbing events can increase stock purchases more than stock sales by individual investors who have short-sale constraints.

Barber and Odean (2008) consider three types of attention-grabbing events—news about the stock, abnormal trading volume, and extreme returns. They find that individual investors are net buyers on high trading volume days, following extreme one-day returns (both positive and negative), and when stocks are in the news. On the other hand, institutional investors do not show attention-driven purchase behavior. Unlike individual investors, institutional investors devote more time and resources to stock searching. Furthermore, institutional investors likely face a significant search problem either selling or buying because they own a large number of stocks and are less short-sale constrained.

Other studies also observe attention-driven stock purchases by individual investors. Lee (1992) finds that small traders (orders of less than $10,000) are net buyers after both positive and negative earnings surprises. Using trading records of individual investors at a large discount brokerage house, Hirshleifer, Myers, Myers, and Teoh (2008) document that individual investors are net buyers after both positive and negative extreme earnings news. Consistent with the notion that bad news is more salient than good news, they also find that the amount of abnormal trading is greater after extreme negative earnings surprises than after extreme positive surprises. Seasholes and Wu (2007) show that individual investors at the Shanghai Stock Exchange are net buyers for stocks that hit the upper price limits on the previous day. Huddart, Lang, and Yetman (2009) find that trading volume is significantly higher when the stock price crosses either the highest or lowest prices over the prior year (52-week high and low), with more buy-initiated orders than sell-initiated ones, especially among small trades. Because extreme earnings surprises and price limit events are often associated with media coverage and likely to draw investor attention, these findings provide additional evidence that attention affects purchase decisions more than sales decisions of individual investors.

If increased attention leads to stock purchases more than sales due to short-sale constraints and search costs, the price of a stock may increase when the stock attracts investor attention. Gervais, Kaniel, and Mingelgrin (2001) show that stocks experiencing unusually high trading volume tend to appreciate in the following month. They argue that this is consistent with the idea that the increased visibility of a stock associated with the high trading volume leads to greater demand and a higher price for that stock. Chemmanur and Yan (2009) find that a greater amount of advertising is associated with a larger contemporaneous return and a smaller subsequent return. The effect of advertising on stock return is stronger

among stocks that are more costly to arbitrage (illiquid and have high idiosyncratic volatilities). This evidence is consistent with the argument that the asymmetric effect of attention on purchases versus sales is due to short-sale constraints.

Frazzini and Lamont (2006) show that stock prices, on average, increase around earnings announcement dates. This earnings announcement premium is greater for stocks with high concentration of trading activity around earnings announcement dates, and stocks that earn higher premiums experience greater small investor purchases. These results indicate that an increase in investor attention generates investor purchases and leads to higher stock prices.

ALLOCATION OF ATTENTION

While the amount of attention is influenced by external factors and the characteristics of the information, investors also make conscious decisions to determine the amount of attention they pay to particular information. This section provides a review of recent theoretical and empirical studies that incorporate the process through which individuals allocate their limited attention.

Peng (2005) models the learning process of a representative investor who has an attention constraint. In this model, the investor optimally allocates her limited attention capacity to process information about fundamental factors of the economy and makes her consumption and portfolio choice decisions based on her inference about the fundamental factors. Peng shows that the investor allocates more attention toward assets with greater fundamental volatility. As a result, those stocks incorporate fundamental shocks at a faster speed and exhibit less volatility to exogenous announcements.

Peng and Xiong (2006) impose a similar attention constraint as that of Peng (2005) and consider the effect of limited attention and overconfidence on asset price dynamics. Their model shows that, due to limited attention, investors show category-learning behavior, where they allocate more attention to market- and sector-level information than to firm-specific information. The model provides explanations for recent empirical evidence on asset comovement—why return correlations of stocks can be higher than the correlations of their fundamentals, a negative relation between the average return correlation of firms in a sector and their stock price informativeness, and the declining trend in the return correlation of U.S. stocks.

Peng (2005) and Peng and Xiong (2006) suggest that investors first process information about the market factor before processing asset-specific information. Therefore, after a macroeconomic shock that increases the market-level uncertainty, contemporaneous asset comovement would rise as investors focus on marketwide information. Still, the comovement would subsequently drop as investors shift their attention back to asset-specific information. Peng, Xiong, and Bollerslev (2007) test such a prediction by using the daily realized volatility of the 30-year Treasury bond futures as a proxy for macroeconomic shocks. Consistent with the prediction, they find that both market volatility and comovement of individual stocks with the market increase contemporaneously with the arrival of marketwide macroeconomic shocks, but decrease significantly in the following trading days.

Kacperczyk, Nieuwerburgh, and Veldkamp (2009) model how investment managers allocate their limited attention when processing signals about aggregate

and stock-specific information. In their model, skilled managers can observe a fixed number of signals and choose how many of those signals contain aggregate versus stock-specific information. Signals containing aggregate information become more valuable when aggregate stocks have high volatility, which is more likely during recessions than expansions. Because skilled investors are more likely to acquire signals to update their beliefs, their portfolio holdings will become more sensitive to aggregate information during recessions. Therefore, differences in portfolio holdings between skilled and unskilled investors will be larger during recessions than during expansions. Furthermore, the average risk-adjusted performance of investment managers is higher in recessions because the information acquired by skilled managers is more valuable in recessions. The authors find evidence consistent with the predictions of their model using portfolio holdings and returns of actively managed mutual funds in the United States.

Corwin and Coughenour (2008) and Chakrabarty and Moulton (2009) test the effect of limited attention on market making on the NYSE. A specialist handles each security traded on the NYSE, and most specialists handle multiple securities. Therefore, specialists need to allocate their attention across the set of securities for which they are responsible. Limited attention implies that a specialist's ability to provide liquidity for a given stock is negatively related to the attention requirements of other stocks in his portfolio. Corwin and Coughenour hypothesize that a specialist allocates more attention toward the largest and most active securities because they have the greatest impact on the risk and profit of the specialist. Their results suggest that specialists allocate more attention toward their most active stocks during periods of increased trading activity and when the attention constraint is more likely to be binding. As a specialist devotes more attention to his most active stocks, there are less frequent price improvements and increased transaction costs for other stocks in his portfolio. Chakrabarty and Moulton also find evidence consistent with attention constraints binding on market makers. When some stocks handled by a market maker have earnings announcements, they find that the liquidity of other non-announcement stocks handled by the same market maker worsens.

Gabaix and Laibson (2005) model how consumers allocate cognitive resources to choose among alternative consumption goods. In their model, agents sequentially apply myopic option calculations to evaluate benefit of cognitive operations and when to stop cognition and make a final decision about which good to consume. Gabaix, Laibson, Moloche, and Weinberg (2006) test the predictions of the directed cognition model in Gabaix and Laibson and find that subjects' behavior matches the predictions of the directed cognition model better than that of rational models.

THE EFFECT OF INVESTOR LIMITED ATTENTION ON CORPORATE DECISION MAKING

The evidence reviewed so far suggests that investor limited attention significantly affects stock prices. Therefore, managers who care about the value of their firm's stock should take into account investor limited attention in their decisions.

In a famous speech about the earnings numbers game, Levitt (1998), then chairman of the Securities and Exchange Commission (SEC), expressed concern

about many misleading accounting practices during the stock market boom days in the latter half of the 1990s. One of these is the effort by firms to promote favorable investor perceptions by disclosing pro forma earnings (instead of the bottom line number reported to the SEC on Form 10K) conspicuously in their press releases to allow them to beat analysts' forecasts. Lynn Turner (2000), an SEC chief accountant, refers to these as EBS (earnings before the bad stuff) releases. There is no standard or consistency across time in the items that are excluded.

Hirshleifer and Teoh (2003) provide a model with limited attention investors that predicts that pro forma earnings are, on average, upwardly biased, though more accurate for valuation than GAAP earnings, and that the degree of bias predicts future abnormal returns. The empirical evidence supports these predictions. Bradshaw and Sloan (2002) find evidence that pro forma earnings often exclude expenses that are required to be included under GAAP. Doyle, Lundholm, and Soliman (2003) find that the market responds to the pro forma earnings, and that the excess of pro forma earnings over GAAP earnings predicts subsequent abnormal stock returns. The SEC finally imposed Regulation G, requiring firms to give equal prominence to pro forma and GAAP earnings in their releases and to provide reconciliation between these two measures of earnings.

Hirshleifer, Lim, and Teoh (2004) examine the effect of limited attention on disclosure. In their model, informed players (e.g., managers) decide whether to disclose a signal to an audience (e.g., investors) with limited attention. Due to limited attention, investors do not pay full attention to the disclosed signal or to the implication of non-disclosure. Because the occurrence of an event is more salient than non-occurrence, the amount of attention toward a disclosed signal is greater than that toward the absence of disclosure. In such a case, the authors show that informed players disclose signals above a certain threshold, while holding bad signals. Because investors are not fully attentive, especially toward the absence of disclosure, their beliefs are, on average, optimistic. There is less disclosure when investors pay more attention toward the disclosed signal, while there is more disclosure when investors pay more attention toward the implication of non-disclosure. Hirshleifer et al. also show that regulations requiring more disclosure can reduce the accuracy of belief and investor welfare.

As DellaVigna and Pollet (2009) show, managers who maximize short-term stock prices may choose to disclose bad news when investor attention is low because the impact of the negative news on the stock price is smaller when investors pay less attention to the news. This can explain the well-documented empirical findings that Friday announcements tend to contain more negative information about the firm compared to other weekday announcements (e.g., Bagnoli et al., 2005; Damodaran, 1989), and that firms tend to release bad earnings news late in the trading day (Patell and Wolfson, 1982) and after-hours (Bagnoli et al., 2005).

LIMITED ATTENTION AS A SOURCE OF OTHER PSYCHOLOGICAL BIASES

Many well-known decision biases are derived from, influenced by, or related to limits to attention and processing power. These include the saliency effect, narrow framing, loss aversion, mental accounting, and availability heuristics.

Narrow Framing, Loss Aversion, and Mental Accounting

Individuals exhibit a tendency to frame decisions in narrow or specific contexts and ignore broader considerations (Tversky and Kahneman, 1981). Instead of evaluating the entire probability distribution of outcomes, investors with limited attention tend to simplify the decision problem to discrete choices, often dichotomous, using a reference point (Hirshleifer, 2001). They are particularly more sensitive to losses relative to an arbitrary reference point than to gains (Kahneman and Tversky, 1979), perhaps because losses are more salient than gains. People decide differently depending on whether the problem is framed as contemplated gains or as losses. This *loss salience* effect extends to the financial decision problem and implies that people care more about the financial losses than financial gains. The losses are amplified at the social level to the extent that conversation or media reporting are biased toward transmitting adverse and emotionally charged news (Heath, Bell, and Sternberg, 2001). Risk perceptions are also affected in that investors and analysts focus on the potential for loss (Koonce, McAnally, and Mercer, 2005). Instead of focusing on the variance or other risk measures that affect the overall payoff distribution, in practice, the Value-at-Risk (VAR) methodology for risk management focuses on worst-case scenarios measured by maximum possible loss.

Thaler's (1985) mental accounting describes a psychological phenomenon where individuals divide transactions into separate accounts and treat payoffs differently across these accounts, despite the fungibility of money. As in prospect theory, gains or losses are measured relative to an arbitrary reference point such as the historical purchase price. When there is mental accounting, unrealized gains and losses are considered less important than realized ones. Profits are viewed as not mattering until the position is closed. The same psychological forces may underlie the revenue recognition principle (Hirshleifer and Teoh, 2009). Recognizing profits only when transactions are virtually completed feels natural and psychologically attractive.

Financial reporting exhibits conservatism. Generally accepted accounting principles require companies to anticipate losses but to delay recognizing profits until certain. Hirshleifer and Teoh (2003) explain why users and regulators find conservatism appealing. By delaying recognition of profits, conservatism reduces the likelihood of future disappointments (Hirshleifer and Teoh, 2009). Early recognition of losses feels bad now, but it is compensated by the pleasure of a gain when losses do not materialize.

Investors often use past performance as the reference point on judging future performance. There is extensive literature both in accounting and finance on the importance of benchmarks in the stock market. Schrand and Walther (2000) find that managers strategically select the form of the prior-period earnings benchmark when announcing earnings. Their evidence shows that managers are more likely to mention prior-period special gains than prior-period special losses, apparently to lower the benchmark for current-period evaluation. Miller (2002) finds that firms at the end of periods of sustained earnings increases shift from long-term forecasts to short-term forecasts, thereby deferring the need to forecast adversely. Degeorge, Patel, and Zeckhauser (1999) find that firms avoid reporting losses, decreases in earnings relative to prior-year same quarter, and misses of analysts' consensus forecasts. In the earnings numbers game, firms try hard to beat analysts'

consensus forecasts by either managing earnings or guiding forecasts to beatable levels (Teoh, Yang, and Zhang, 2009). Firms are harshly punished when they break earnings patterns (Myers, Myers, and Skinner, 2007).

Functional Fixation and Heuristics Decision Making

Because of limited processing power, individuals rely on heuristics (Kahneman and Tversky, 1973), or algorithms (Simon, 1955) or mental modules (Cosmides and Tooby, 1992) that rely on a subset of cues. The use of some price-fundamental ratios is widespread in the stock market. For example, high tech start-up firms often have negative earnings so investors use price/revenue or price/"clicks" multiples to value these firms. Reliance on heuristics reduces processing costs but induces processing errors such as functional fixation.

When investors with limited attention simplify by focusing on the bottom-line earnings, they fail to understand the implications of different accounting methods for earnings. Therefore, they make systematically biased mistakes in valuing the firm. In reviewing the experimental literature on the use of accounting information, Libby, Bloomfield, and Nelson (2002, p. 783) write, "Some participants in nearly every study of this type demonstrate some degree of functional fixation; they do not fully adjust for differences in the effects of accounting alternatives on the bottom line."

As archival data studies generally show, there is some market adjustment for the effect of differences in accounting methods on net income. For example, some evidence suggests that the market adjusts imperfectly for earnings from last-in first-out (LIFO) versus from first-in first-out (FIFO), but the difference does not fully reflect the tax savings that are associated with LIFO (Biddle and Ricks, 1988). Hand (1990) finds that debt-equity swaps increase reported earnings by about 20 percent in the quarter the swap is undertaken for a sample of firms between 1981 and 1984. He finds that the market fails to discount this purely accounting effect that has no real cash flow consequence and instead is positively surprised. Further, the effect is stronger when the firm's investor base contains fewer institutional investors.

SUMMARY AND CONCLUSIONS

The theoretical and empirical studies reviewed in this chapter illustrate that limited attention has extensive effects on the capital markets. When some stock market participants are inattentive to publicly available information, the evidence shows that the stock price underreacts to the public information and this information predicts future patterns in stock returns. Using different proxies for the degree of investor attention in many varied circumstances, the evidence also shows that the degree of underreaction increases with the degree of inattention. Limited attention affects investor trading behavior and corporate decision making. Limited attention also helps to explain, without appealing to political or contracting constraints, some characteristics of accounting rules and regulation. Accounting information is often highly aggregated; and placement, categorization, and labeling affect how financial statement readers use the information. Finally, the chapter provides a discussion

of how limited attention is related to psychological biases such as saliency effects, narrow framing, loss aversion, mental accounting, and availability heuristics.

DISCUSSION QUESTIONS

1. What are some psychological factors that affect how much individuals pay attention to particular information?
2. Discuss the empirical evidence suggesting that investor inattention drives market underreaction.
3. Discuss how corporate managers may exploit investor inattention.
4. Discuss how limited attention is related to other psychological biases such as narrow framing and the use of heuristics.

REFERENCES

Abarbanell, Jeffery, and Brian Bushee. 1997. Fundamental analysis, future earnings, and stock prices. *Journal of Accounting Research* 35:1, 1–24.

Aboody, David, 1996. Recognition versus disclosure in the oil and gas industry. *Journal of Accounting Research* Supplement 34:3, 21–32.

Amir, Eli. 1993. The market valuation of accounting information: The case of postretirement benefits other than pensions. *Accounting Review* 68:4, 703–724.

Bagnoli, Mark, Michael B. Clement, and Susan G. Watts. 2005. Around-the-clock media coverage and the timing of earnings announcements. Working Paper, Purdue University.

Barber, Brad, and Terrance Odean. 2008. All that glitters: The effect of attention and news on the buying behavior of individual and institutional investors. *Review of Financial Studies* 21:2, 785–818.

Bernard, Victor L., and Jacob K. Thomas. 1989. Post-earnings-announcement drift: Delayed price response or risk premium? *Journal of Accounting Research*, Supplement 27:3, 1–48.

Biddle, Gary, and William E. Ricks. 1988. Analyst forecast errors and stock price behavior near the earnings announcement dates of LIFO Adopters. *Journal of Accounting Research* 26:2, 169–194.

Bradshaw, Mark, and Richard Sloan. 2002. GAAP versus the street: An empirical assessment of two alternative definitions of earnings. *Journal of Accounting Research* 40:1, 41–66.

Broadbent, Donald E. 1958 *Perception and communication*. New York: Pergamon Press.

Cai, Jian, Gerald T. Garvey, and Todd T. Milbourn. 2008. How well do investors process (more subtle) information? The case of employee stock options. Working Paper, Washington University, St. Louis.

Chakrabarty, Bidisha, and Pamela C. Moulton. 2009. Earning more attention: The impact of market design on attention constraints. Working Paper, Fordham University.

Chemmanur, Thomas, and An Yan. 2009. Advertising, attention, and stock returns. Working Paper, Boston College.

Cherry, E. Colin. 1953. Some experiments on the recognition of speech, with one and two ears. *Journal of the Acoustical Society of America* 25:5, 975–979.

Cohen, Lauren, and Andrea Frazzini. 2008. Economic links and predictable returns. *Journal of Finance* 63:4, 1977–2011.

Corwin, Shane A. and Jay Coughenour. 2008. Limited attention and the allocation of effort in securities trading. *Journal of Finance* 63:6, 3031–3067.

Cosmides, Leda, and John Tooby. 1992. Cognitive Adaptations for Social Exchange. In Jerome H. Barkow, Leda Cosmides, and John Tooby (eds.). *The Adapted Mind*, 121–228. New York: Oxford University Press.

Da, Zhi, Joseph Engelberg, and Pengjie Gao, 2009. In search of attention. Working Paper, University of North Carolina, Chapel Hill.
Damodaran, Aswath. 1989. The weekend effect in information releases: A study of earnings and dividend announcements. *Review of Financial Studies* 2:4, 607–623.
Daniel, Kent, David Hirshleifer, and Avanidhar Subrahmanyam. 1998. Investor psychology and security market under- and overreactions. *Journal of Finance* 53:6, 1839–1885.
Daniel, Kent, David Hirshleifer, and Siew Hong Teoh. 2002. Investor psychology in capital markets: Evidence and policy implications. *Journal of Monetary Economics* 49:1, 139–209.
Davis-Friday, Paquita, Buky Folami, Chao-shin Liu, and Fred Mittelstaedt. 1999. The value relevance of financial statement recognition versus. Disclosure: Evidence from SFAS No. 106. *Accounting Review* 74:4, 403–423.
Degeorge, Francois, Jayendu Patel, and Richard Zeckhauser. 1999. Earnings management to exceed thresholds. *Journal of Business* 72:1, 1–33.
DellaVigna, Stefano, and Joshua M. Pollet. 2007. Demographics and industry returns. *American Economic Review* 97:5, 1167–1702.
DellaVigna, Stefano, and Joshua Pollet. 2009. Investor inattention and Friday earnings announcements. *Journal of Finance* 64:2, 709–749.
Desai, Hemang, Shivarajam Rajgopal, and Mohan Venkatachalam. 2004. Value-glamour and accruals mispricing: One anomaly or two. *Accounting Review* 79:2, 355–385.
Dietrich, Richard, Steven Kachelmeier, Donald Kleinmuntz, and Thomas Linsmeier. 2001. Market efficiency, bounded rationality and supplemental business reporting disclosures. *Journal of Accounting Research* 39:2, 243–268.
Doyle, James, Russell Lundholm, and Mark Soliman. 2003. The predictive value of expenses excluded from pro forma earnings. *Review of Accounting Studies* 8: 2–3, 145–174.
Engelberg, Joseph. 2008. Costly information processing: Evidence from earnings announcements. Working Paper, University of North Carolina.
Fiske, Susan, and Shelley Taylor. 1991. *Social cognition*. New York: McGraw-Hill.
Frankel, Richard, and Charles Lee. 1988. Accounting valuation, market expectation, and cross-sectional stock returns. *Journal of Accounting and Economics* 25:3, 283–319.
Francis, Jennifer, Donald Pagach, and Jens Stephan. 1992. The stock market response to earnings announcements released during trading versus nontrading periods. *Journal of Accounting Research* 30:2, 165–184.
Frazzini, Andrea, and Owen Lamont. 2006. The earnings announcement premium and trading volume. NBER Working Paper w13090, Cambridge.
Gabaix, Xavier, and David Laibson. 2005. Bounded Rationality and directed cognition. Working Paper, Harvard University.
Gabaix, Xavier, David Laibson, Guillermo Moloche, and Stephen Weinberg. 2006. Costly information acquisition: Experimental analysis of a boundedly rational model. *American Economic Review* 96:4, 1043–1068.
Gervais, Simon, Ron Kaniel, and Dan H. Mingelgrin. 2001. The high-volume return premium. *Journal of Finance* 56:3, 877–919.
Hand, John. 1990. A test of the extended functional fixation hypothesis. *Accounting Review* 65:4, 740–763.
Heath, Chip, Chris Bell, and Emily Sternberg. 2001. Emotional selection in memes: The case of urban legends. *Journal of Personality and Social Psychology* 81:6, 1028–1041.
Hirshleifer, David. 2001. Investor psychology and asset pricing. *Journal of Finance* 64:4, 1533–1597.
Hirshleifer, David, and Siew Hong Teoh. 2003. Limited attention, information disclosure, and financial reporting. *Journal of Accounting and Economics* 36:1-3, 337–386.
Hirshleifer, David, and Siew Hong Teoh. 2009. The psychological attraction approach to accounting and disclosure policy. *Contemporary Accounting Research* 6:4, forthcoming

Hirshleifer, David, Kewei Hou, Siew Hong Teoh, and Yinglei Zhang. 2004. Do investors value balance sheet bloat? *Journal of Accounting and Economics* 38:1, 297–331.

Hirshleifer, David, Sonya S. Lim, and Siew Hong Teoh. 2004. Disclosure to a credulous audience: The role of limited attention. Working Paper, The Ohio State University.

Hirshleifer, David, Sonya S. Lim, and Siew Hong Teoh. 2009a. Driven to distraction: Extraneous events and underreaction to earnings news. *Journal of Finance* 64:5, 2287–2323.

Hirshleifer, David, Sonya S. Lim, and Siew Hong Teoh. 2009b. Limited investor attention and stock market misreactions to accounting information, Working Paper, University of California, Irvine.

Hirshleifer, David, James Myers, Linda Myers, and Siew Hong Teoh. 2008. Do individual investors drive post-earnings announcement drift? Direct evidence from personal trades. *Accounting Review* 83:6, 1521–1550.

Hirst, Eric, and Patrick Hopkins. 1998. Comprehensive income reporting and analysts' valuation judgments. *Journal of Accounting Research* 36:Supplement, 47–75.

Ho, Thomas, and Roni Michaely. 1988. Information quality and market efficiency. *Journal of Financial and Quantitative Analysis* 5:3, 357–386.

Hopkins, Patrick. 1996. The effect of financial statement classification of hybrid financial instruments on financial analysts' stock price judgments. *Journal of Accounting Research* 34:Supplement, 33–50.

Hopkins, Patrick, Richard Houston, and Michael Peters. 2000. Purchase, pooling, and equity analysts' valuation judgments. *Accounting Review* 75:3, 257–281.

Hou, Kewei, Lin Peng, and Wei Xiong. 2008. A tale of two anomalies: The implication of investor attention for price and earnings momentum. Working Paper, The Ohio State University.

Huberman, Gur, and Tomer Regev. 2001. Contagious speculation and a cure for cancer. *Journal of Finance* 56:1, 387–396.

Huddart, Steven, Mark Lang, and Michelle Yetman. 2009. Volume and price patterns around a stock's 52-week highs and lows: Theory and evidence. *Management Science* 55:1, 16–31.

Kacperczyk, Marcin, Stijn Van Nieuwerburgh, and Laura Veldkamp. 2009. Attention allocation over the business cycle: Evidence from the mutual fund industry. Working Paper, New York University.

Kahneman, Daniel, and Amos Tversky. 1973. On the psychology of prediction. *Psychological Review* 80:4, 237–251.

Kahneman, Daniel, and Amos Tversky. 1979. Prospect theory: An analysis of decision under risk. *Econometrica* 47:2, 263–291.

Karlsson, Niklas, George Loewenstein, and Duane Seppi. 2005. The "ostrich effect": Selective attention to information about investments. Working Paper, Carnegie Mellon University.

Klibanoff, Peter, Owen Lamont, and Thierry Wizman, 1998. Investor reaction to salient news in closed-end country funds. *Journal of Finance* 53:2, 673–699.

Koonce, Lisa, Mary McAnally, and Molly Mercer. 2005. How do investors judge the risk of financial and derivative instruments? *Accounting Review* 80:1, 221–241.

Lee, Charles M. C. 1992. Earnings news and small traders. *Journal of Accounting and Economics* 15:2-3, 265–302.

Lev, Baruch, and Ramu Thiagarajan. 1993. Fundamental information analysis. *Journal of Accounting Research* 31:2, 190–215.

Levitt, Arthur. 1998. The numbers game. Remarks by the chairman of the Securities and Exchange Commission delivered at New York University Center for Law and Business, New York, September 28, 1998.

Libby, Robert, Robert Bloomfield, and Mark Nelson. 2002. Experimental research in financial accounting. *Accounting, Organizations and Society* 27:8, 775–810.

Libby, Robert, and HunTong Tan. 1999. Analysts' reactions to warnings of negative earnings. *Journal of Accounting Research* 37:2, 415–436.

Loh, Roger. 2009. Investor inattention and the underreaction to stock recommendations. Working Paper, Singapore Management University.

Miller, Gregory. 2002. Earnings performance and discretionary disclosure. *Journal of Accounting Research* 40:1, 173–204.

Myers, James, Linda Myers, and Douglas Skinner. 2007. Earnings momentum and earnings management. *Journal of Accounting, Auditing & Finance* 22:2, 249–284.

Moray, Neville. 1959. Attention in dichotic listening: Affective cues and the influence of instructions. *Quarterly Journal of Experimental Psychology* 11:1, 56–60.

Nisbett, Richard, and Lee Ross. 1980. *Human inference: Strategies and shortcomings of social judgment*. Englewood Cliffs, NJ: Prentice-Hall.

Patell, James, M., and Mark A. Wolfson. 1982. Good news, bad news, and the intraday timing of corporate disclosures. *Accounting Review* 57:3, 509–527.

Peng, Lin. 2005. Learning with information capacity constraints. *Journal of Financial and Quantitative Analysis* 40:2, 307–329.

Peng, Lin, and Wei Xiong. 2006. Investor attention, overconfidence, and category learning. *Journal of Financial Economics* 80:3, 563–602.

Peng, Lin, Wei Xiong, and Tim Bollerslev. 2007. Investor attention and time-varying comovements. *European Financial Management* 13:3, 394–422.

Peress, Joel. 2008. Media coverage and investors' attention to earnings announcements. Working Paper, INSEAD.

Schrand, Catherine, and Beverly Walther. 2000. Strategic benchmarks in earnings announcements: The selective disclosure of prior-period earnings components. *Accounting Review* 75:2, 151–177.

Seasholes, Mark S., and Guojun Wu. 2007. Predictable behavior, profits, and attention. *Journal of Empirical Finance* 14:5, 590–610.

Simon, Herbert. 1955. A behavioral model of rational choice. *Quarterly Journal of Economics* 69:1, 99–118.

Sloan, Richard. 1996. Do stock prices fully reflect information in accruals and cash flows about future earnings? *Accounting Review* 71:3, 289–315.

Teoh, Siew Hong, and T. J. Wong. 2002. Why do new issues and high accrual firms underperform? The role of analysts' credulity. *Review of Financial Studies* 15:3, 869–900.

Teoh, Siew Hong, Ivo Welch, and T. J. Wong. 1998a. Earnings management and the long run market performance of initial public offerings. *Journal of Finance* 53:6, 1935–1974.

Teoh, Siew Hong, Ivo Welch and, T. J. Wong. 1998b. Earnings management and the underperformance of seasoned equity offerings. *Journal of Financial Economics* 50:1, 63–99.

Teoh, Siew Hong, George Yang, and Yinglei Zhang. 2009. The earnings numbers game: Rewards to walk down and penalties to walk up of analysts' forecasts of earnings. Working Paper, University of California, Irvine.

Thaler, Richard. 1985. Mental accounting and consumer choice. *Marketing Science* 4:3, 199–214.

Turner, Lynn. 2000. Opportunities for improving quality. Remarks before the Colorado Society of CPAs, December 15. Available at http://www.sec.gov/news/speech/spch451.htm.

Tversky, Amos, and Daniel Kahneman. 1973. Availability: A heuristic for judging frequency and probability. *Cognitive Psychology* 5:2, 207–232.

Tversky, Amos, and Daniel Kahneman. 1981. The framing of decisions and the psychology of choice. *Science* 211:4481, 453–458.

Xie, Hong. 2001. The mispricing of abnormal accruals. *Accounting Review* 76:3, 357–373.

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CHAPTER 17

Other Behavioral Biases

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INTRODUCTION

This chapter discusses three groups of biases: inertia, self-deception, and affect. *Inertia* is the influence on investor decision making of slow updating of beliefs (conservatism), choosing the default option when presented with a range of choices (status quo bias), and displaying unwillingness to part with goods (endowment effect). *Self-deception* refers to how people can influence investor decision making by attributing successes to their own choices and attributing failures to the impact of others (biased self-attribution), and how being "excessively optimistic" impacts decision making. *Affect* refers to selected emotional influences on investors, including the influence of emotions (liking or disliking), on risk-return perceptions (the affect heuristic), and the influence of regret aversion on decision making. The next three sections discuss these three groups of biases, followed by some concluding remarks on the importance of developing a holistic picture of the influence of biases on investor decision making.

INERTIA

Inertial biases are best described as biases wherein economic actors fail to update their economic conditions despite there being potential gains to them from doing so. They instead "stick" to a position (such as failing to sell a stock) or otherwise act in a manner that is suboptimal. Three main biases can be detected: conservatism, the status quo bias, and the endowment effect.

Conservatism

Conservatism is essentially the opposite of representativeness: the bias describing how people underweight base rates such as extrapolating trends from patterns in a small data set (Kahneman and Tversky, 1973). Under the heuristic of conservatism, people overweight base rates and underweight new information, which leads to slow base rate adjustment when new information arises (Edwards, 1968). A similar

heuristic is proposed by Lord, Ross, and Lepper (1979), who find that people are slow to change their beliefs even if evidence suggests that they should.

The principle of conservatism appears to be in conflict with representativeness. Fama (1998) claims this to be a fundamental flaw in behavioral finance. However, he does not base his claim on an analysis of the relevant psychological literature but rather on a re-examination of finance studies that claim the presence of either underreaction (conservatism) or overreaction (representativeness).

Griffin and Tversky (1992) analyze the apparent conflict between conservatism and representativeness. They argue that new information either has "strength" or "weight." Of course, new information may contain both of these characteristics. Information with strength is extreme and has high salience, while information with weight is strongly representative of the population or the data-generation model. A decision maker who processes information according to Bayes Law will devote the greatest attention to high-weight information because this provides the most additional knowledge about the underlying population and data-generation model. Yet, a person making heuristic-based decisions will devote too little attention to high-weight information because it will tend to be statistical and thus has low salience; this leads to conservatism and slowupdating of base rates. This decision maker will also pay too much attention to high-strength information because of its salience, which leads to base-rate neglect.

Conservatism is particularly important as a short-term decision-making heuristic. As discussed previously, Lord et al. (1979) find that people are slow to change their beliefs. This partly stems from the cognitive, time, and potential financial cost of assessing new information to update probability assessments.

This short-term hesitance and reluctance to update beliefs is attributed as a cause of various financial pricing anomalies. These are generally classified as *underreaction* anomalies. An example of these studies includes the post-earnings announcement drift, where equity prices appear to react gradually to earnings announcements (Bernard and Thomas, 1990). Other examples including stock splits (Desai and Jain, 1997), equity repurchase tenders (Lakonishok and Vermaelen, 1990), dividend omissions and initiations (Michaely, Thaler, and Womack, 1995), and mergers and takeovers (Agrawal, Jaffe, and Mandelker, 1992) also show evidence of a slow-updating of information arising from these events.

Researchers have attempted to integrate representativeness (base-rate underweighting and small sample neglect) and conservatism to develop what they claim to be a "unified theory" of financial market pricing, that is, an explanation for the seemingly contradictory findings of overreaction and underreaction. Barberis, Shleifer, and Vishny (1998) propose a model where investors assume that the market fluctuates between two states, either a mean-reverting state or a trending state. The mean-reverting state arises from investors assuming that earnings are more static than they actually are (conservatism), and the trending state arises from investors extrapolating trends from multiple positive (or negative) surprises to earnings.

Hong and Stein (1999) propose an alternative model involving two groups of investors—newswatchers and momentum traders—that are boundedly rational. The newswatchers primarily concentrate on their private information about future fundamentals and do not attempt to gain information from price trends, while the momentum traders primarily concentrate on information to be gained from

price trends. The authors also assume that information about future fundamentals diffuses gradually through the newswatchers group. Because of this gradual diffusion of information, equity prices underreact to fundamental news. Hong and Stein argue that the momentum traders who follow price trends lead to overreaction. Momentum traders accelerate the price trend caused by the newswatchers who first receive the information about changes in future fundamentals.

Endowment Effect

The endowment effect is the tendency for agents to want more to sell a good than they would be willing to pay for the good. Thaler (1980) first articulated the endowment effect as a particular manifestation of loss aversion and Kahneman, Knetsch, and Thaler (1990) later expanded on this concept. These authors provide numerous examples demonstrating the asymmetry of agents' willingness to buy versus the willingness to sell. Thaler shows that agents require a premium an order of magnitude greater to accept a very small increase in risk than they would pay to reduce risk by the same amount. Kahneman et al. note from a series of experiments that the discrepancy cannot be attributed to transaction costs.

The endowment effect has been shown to exist in environments ranging from trading to initial public offerings (IPOs) to exchange goods to public goods. Loughran and Ritter (2002) suggest that the endowment effect potentially explains the IPO phenomenon of "leaving money on the table," where IPO first-day returns are typically very high. They argue that investors see the opportunity cost of leaving money on the table (i.e., money they did not have), as greater than paying direct fees to obtain a "truer" price. Zhang (2004) also examines the endowment effect in the IPO market and suggests that IPO over-allocations induce greater aftermarket allocation via the effect. A paper on the market for corporate control by Baker, Coval, and Stein (2007) suggests the importance of the endowment effect for mergers via its impact on inertia. Investors, especially in mergers where firms use stock as a payment mechanism, are likely to keep shares in the merged entity even if they would not have been inclined to buy shares in the acquiring company. The endowment effect has been demonstrated in "exchange" goods, goods and specie held only to facilitate transactions by van de Ven, Zeelenberg, and van Dijk (2005) and in public goods by Bischoff (2008), despite these being theoretically immune from the effect. For public goods in particular, this is an important finding, showing that agents see public goods as part of their endowment.

Some question the origin of the endowment effect. Evidence suggests that the endowment effect emerges not from any systemic overvaluation of endowed assets but from the psychic pain of parting with these endowments, a premium being required by the agent to endure this pain (Zhu, Chen, and Dasgupta, 2008). This argument links to the emotional aspects of decision making in which pain induces a negative emotional state. Some research suggests that the endowment effect is stronger when the transaction has a positive emotional context (e.g., Lin, Chuang, Kao, and Kung, 2006). Lerner, Small, and Loewenstein (2004) indicate that particular negative emotions (disgust) enhance the effect while most other negative emotional states reverse the effect.

Other circumstances can also moderate or change the endowment effect. Experience and investor sophistication have been shown to be extremely important

(List, 2004; Nicolosi, Peng, and Zhu, 2009). Although experience and sophistication are related, they are not identical. Measuring sophistication by diversification (Feng and Seasholes, 2005) shows that experience is slightly more important than sophistication but, taken together, investors who are both experienced and sophisticated can greatly reduce the endowment effect. Indeed, some recent evidence by Sokol-Hessne, Hsu, Curley, Delgado, Camerer, and Phelps (2009) suggests that the benefits come from the mental framework and framing that such experience/sophistication provides. When asked to adopt an internal mental framework that mimicked professional traders, the measured endowment effects of the participants in the experiment decreased. Finally, some national cultural characteristics may moderate the endowment effect (Feng and Seasholes, 2005). One hypothesis is that these measures are a proxy for the degree of experience of the average investor in the country.

The existence and origins of the endowment effect have also been evaluated as being dependent on reference and background framing. Koszegi and Rabin (2006) suggest that the effect is dependent on framing and reference setting. Lin et al. (2006) note the issue of reference point setting as being an important element in the strength of the effect. Knetsch and Wong (2009) advocate that careful consideration of the prior beliefs of individuals, the heterogeneity of beliefs in the markets, and the distinction between entitlement and endowment are required in any evaluation of the endowment effect.

Status Quo Bias

Samuelson and Zeckhauser (1988) provide the core paper from which discussion of the status quo bias emerges. They examine numerous economic decision-making processes, such as health insurance and pension planning, and find that investors disproportionally and (economically) inappropriately remain as they are, sticking with the status quo. Status quo bias is similar to, and can in some degrees be seen as an expression of, the endowment effect. The two overlap considerably, and much of the research on the endowment effect noted above also partly addresses issues around status quo.

Much of the financial research that emerges from the status quo bias focuses on three issues: pension and personal financial planning, health decisions, and insurance decisions. In the pension and personal planning literature, status quo bias is illustrated by research showing that once a personal financial strategy, for example, a pension allocation, is "set up," investors are likely to remain with their initial position. Madrian and Shea (2001), Thaler and Benartzi (2004), and Brown, Liang, and Weisbenner (2007) examine aspects of status quo bias in pension planning. The key finding that emerges from Thaler and Benartzi and subsequent research is that automatic enrollment delivers significantly higher take-up in 401(k) and related plans. The recently popular decision-making book *Nudge* by Thaler and Sunstein (2009) discusses a range of strategies to improve people's pension planning based, in part, on the status quo bias.

This finding has also been examined in the health industry (e.g., Marquis and Holmer, 1996; Loewenstein, Brennan, and Volpp, 2007), where status quo bias has influenced presumed consent laws and health insurance design. Frank and Lamiraud (2009) examine the Swiss health insurance market and find that as the

number of plans available to a consumer increases, the willingness to switch, for a given price differential, declines. They find that the status quo bias is favored compared to alternative explanations. Boonen, Schut, and Koolman (2008) report similar findings for Dutch pharmacy consumers. In general, they find that the extent of the status quo bias is greater for larger numbers of alternatives from which the decision maker can choose. This result applies to the mutual fund industry in Kempf and Ruenzi (2006) and to generalized economic choice situations (Fox, Bizman, and Huberman, 2009), where the status quo bias can result in the "escalation of commitment" phenomenon, also known as "good money after bad."

SELF-DECEPTION

Self-deception biases examine how mistakes arising from people's desire for a positive self-image affect their reasoning and decision making. Positive self-image can be colloquially described as "feeling good about oneself" and can be seen as a useful personality trait. For example, good self-esteem can have a self-fulfilling effect with people externalizing their internal confidence about themselves to help persuade others of their abilities and their viewpoints. This natural desire also has negative aspects. Self-deception biases occur when people deceive themselves in order to attain or maintain a positive self-image.

The most common of the self-deception biases is overconfidence, which involves an excessive belief in one's own abilities (Kruger, 1999). Because Chapter 13 provides a discussion of this bias, it is not discussed here except when it interacts with the other self-deception biases. Of particular interest in this section are the concepts of self-attribution bias and excessive optimism. These two biases represent either side of overconfidence; that is, biased self-attribution can lead to overconfidence, which can lead to excessive optimism. The following section emphasizes biased self-attribution because it is a better defined bias in the psychology literature.

Biased Self-Attribution

The origin of biased self-attribution theory is attributed to Heider (1958), who observed how people tend to attribute successful outcomes from decisions to their own actions and bad outcomes to external factors. While self-attribution of this type is usually a bias, it emerges from two important human traits: self-protecting, which is the desire to have a positive self-image, and self-enhancement, which is the desire for others to see us positively. This desire for a good self-image and a good image among others sometimes leads people to deceive themselves when decisions do not turn out well.

Meta-analyses by Zuckerman (1979) and Miller and Ross (1975) provide support for the presence of self-attribution bias and describe the common method of testing for the bias. The tests involve subjects being told to perform a task and then being randomly assigned an outcome of either "win" or "lose." Subjects are then asked to explain why they think they won or lost. The usual response when winning is for the subject to describe actions that they did in order to win, whereas when losing, the subjects generally concentrated on external factors that caused them to lose.

Studies outside of psychology laboratories also provide support for the presence of self-attribution bias. For example, Mullen and Riordan (1988) find biased self-attribution to be present in sports settings; Skaalvik (1994) reports that students use it in explaining their performance in the subjects they are learning; and Stewart (2005) finds drivers involved in driving incidents to attribute accidents to external factors and near misses to their own skill.

People do not engage in biased self-attribution for all tasks and are not biased to the same extent. Much research has attempted to determine the causes of biased self-attribution. Campbell and Sedikides (1999) conduct a meta-analysis of the moderators of use of biased self-attribution. The following are important moderators that relate to finance.

- *Importance of the task being undertaken.* If participants believe a task is important, they are more likely to use biased self-attribution to explain outcomes.
- *Self-esteem.* People who have a high self-esteem are more likely to engage in biased self-attribution.
- *Prior performance and experience.* People who have a good prior record in a task are likely to seek external reasons when they fail and attribute success to their own actions. Similarly, those who describe themselves as "high achievers" are more likely to view failing a task as reflecting badly on their prior good record and thus attribute failure to external reasons.
- *Competitive environment.* Participants undertaking tasks in a competitive environment (e.g., where the performance of the participants might be compared) tend to engage in more biased self-attribution than participants in a non-competitive environment.
- *Gender.* Males, perhaps because of a higher average self-esteem than females (Harter, 1993), tend to be more likely than females to attribute causes of outcomes to biased reasons.
- *Cultural differences.* Other research, not covered in Campbell and Sedikides (1999), finds significant cultural differences in the extent of biased self-attribution. In Western cultures, biased self-attribution is present to a greater degree than in Eastern (Confucian; e.g., China, Korea, and Japan) cultures (Heine and Hamamura, 2007). This may result from a lower connection between self-esteem and succeeding or failing in individual tasks in Eastern culture, where people tend to place a greater emphasis on group success or failure, whereas the Western culture shows a strong link between self-esteem and performance at individual tasks. Thus, finding self-attribution bias in, for example, U.S. investors would not necessarily be fully applicable to understanding Japanese investors.
- *Feedback delay.* Einhorn (1980) finds that self-attribution bias is more present in tasks with delayed versus immediate feedback.

Many studies apply biased self-attribution theory in a financial context. These studies focus mainly on individual investor or other financial market participant behavior, but some studies examine aggregate stock pricing. For example, Gervais and Odean (2001) develop a theoretical model based on biased self-attribution of how investors become overconfident (for a similar model see Daniel, Hirshleifer, and Subrahmanyam, 1998). Their multiperiod model starts with some investors

successfully predicting dividend payout for the next period. Those investors attribute their success to personal skills and ignore external reasons such as luck. This teaches them to become overconfident. Only as investors make more decisions do they learn their true ability at investing. Gervais and Odean suggest that in a market containing a large proportion of young or new traders who have only experienced bull conditions, overconfidence is likely to be high due to biased self-attribution. The psychological research on the bias justifies this notion by showing that prior experience and performance help moderate the extent of biased self-attribution.

Billett and Qian (2008) and Malmendiera and Tate (2008) apply this notion to a study of U.S. mergers and acquisitions. These researchers find that when chief executive officers (CEOs) of acquiring companies have success with their first acquisition, they appear to attribute too much of that success to their own actions and become overconfident. As a result, the CEOs destroy value by engaging in other acquisitions.

Other studies focus on biased self-attribution in professional and individual investors, and also confirm the presence of the bias. Similarly to the previously described studies on CEOs and acquisitions, these studies primarily concentrate on prior experience as a moderator for the presence of biased self-attribution. Choi and Lou (2007) study fund managers and find that poor managers (i.e., those in the bottom 25 percent of performance) show evidence of self-attribution bias. These managers are more likely to increase the "active" part of their portfolio ("the portion of the portfolio which is different from its benchmark index") following periods of increased volatility. The authors note that in times of high volatility the number of positive and negative outcomes is likely to increase. Choi and Lou suggest that managers with poor performance are similar to those in the Gervais and Odean (2001) model who have not yet learned to overcome their self-attribution bias. Thus, in high-volatility periods, these managers attribute the increase in positive outcomes to their own actions and the increase in negative outcomes to external factors, which results in an increase in overconfidence and subsequently a willingness to increase the proportion of their portfolio actively invested.

Coval and Shumway (2005) find evidence contrary to the self-attribution bias. They position self-attribution bias and loss aversion as two opposing theories for how Chicago Board of Trade professional futures traders will trade during a day. If the self-attribution bias is "true," winning traders (defined as traders who have made profits in the morning of trading) will become overconfident and increase their risk taking in their afternoon trading. If loss aversion is present, winning traders will not want to take risks in the afternoon in order to finish the day with a profit. Coval and Shumway find that professional traders who have a winning morning tend to take below-average risk in the afternoon and suggest that this behavior is support for loss aversion. However, this finding is not necessarily at variance with self-attribution because it may not be a good test of self-attribution. This is because the previously discussed psychological study by Einhorn (1980) finds that the bias is low when the feedback on a decision is quick and the nature of futures trading means there is almost immediate feedback. Hilary and Menzly (2006) find that stock analysts, who are the most successful at predicting earnings in one year, subsequently underperform the median analyst. The authors attribute this to self-attribution bias leading to overconfidence.

In a study of individual investors, Barber and Odean (2002) find that online investors previously had good investment performance when trading over the phone. They suggest that biased self-attribution arising from this prior good performance is one reason such investors subsequently overtrade and underperform when they go online. More direct evidence comes from Hsu and Shiu (2007), who study individual and institutional bidders in IPO auctions in Taiwan. Their evidence shows that bidders who initially outperformed other bidders tend to subsequently bid more frequently and at higher prices than other bidders, and thus underperform compared to the average bidder.

The financial studies discussed up to this point have concentrated on the role of prior experience and performance and self-esteem in determining biased self-attribution. This is the most researched determinant of self-attribution. However, there is also a limited literature on the role of gender and culture as moderators of the presence of the bias.

Gender differences in investor decision making have mainly been studied within the context of overconfidence rather than self-attribution biases. This makes understanding the overall role of biased self-attribution in influencing investor decision making more difficult. The most commonly cited study in this area is Barber and Odean (2001). The study examines actual trading records and reports that men trade more than women, and as a result tend to have worse investment performance. The authors attribute this result to self-serving biases being greater in men than in women. Yet, Deaves, Lüders, and Luo (2009) are unable to replicate this finding in an experimental trading study.

Only a limited number of studies examine culture, self-attribution, and investor decision making. This could be because the psychological link between culture and self-attribution bias is a new concept. The main finance study is by Chui, Titman, and Wei (2009), who examine the differences in investor behavior between collectivist cultures (such as Eastern cultures) and individualistic cultures (such as Western culture) using the work of Hofstede (2001). They hypothesize that if attribution bias is more prevalent in individualistic cultures, this will lead to greater overconfidence and thus greater trading in individualistic countries. Their findings confirm that trading and volatility are positively related to being in a country that is more individualistic. Further, Chui et al. find that momentum trading is more prevalent in individualistic Western societies. This finding relates to research by Hong and Stein (1999) who hypothesize that momentum is related to positive feedback trading, with traders becoming increasingly confident and over-attributing past successes to their own actions. Perhaps the greater self-attribution of individualism of Western societies could be a cause of momentum in financial markets. These findings also relate to the studies discussed earlier by Barber and Odean (2002) and Hsu and Shiu (2007), which find that successful investors are more likely to increase their trading than unsuccessful traders.

Excessive Optimism

Excessive optimism is related to overconfidence, but they are two distinct psychological biases. Overconfidence involves placing too much weight on the accuracy of private information and an excessive belief in personal skills. Excessive

optimism follows from overconfidence and involves a belief that future events are more likely to be positive than is realistic.

Weinstein (1980) offers an early example of the existence of excessive optimism. His experiment asks college students to rate the probability of a range of events being more likely to happen to them as opposed to their classmates. The range of events includes good events (e.g., liking the job received after graduation) and bad events (e.g., having a heart attack before the age of 40). Students judge themselves to have a higher probability than their classmates of achieving the good future events and a lower probability of the bad things happening to them. Weinstein concludes that people focus on what they can do to achieve the positive events to a greater extent than others, but fail to give enough weight to the fact that others can also take actions to improve their chances of achieving the same outcome. Dunning, Heath, and Suls (2004) provide a comprehensive analysis confirming the extent of excessive optimism in a range of environments including health and the workplace.

In a financial context, there are few studies of excessive optimism. A theoretical paper by Gervais, Heaton, and Odean (2002) examines the influence of both excessive optimism and overconfidence on the decisions of managers. The authors find that overconfidence is usually a positive influence because it encourages managers to make investments. This influence is positive because risk aversion usually has a negative impact on firm value. Yet, over-optimism can have a negative impact because it can lead to firms taking negative net present value (NPV) decisions. This is because their optimism leads managers to believe that the decision will actually deliver a positive NPV outcome.

Lin, Hu, and Chen (2005) build on this theoretical work to show that excessively optimistic managers (those who make an above-average number of forecasts for firm future financial earnings that turn out to be too high) tend to run cash-constrained firms because they are reluctant to raise new equity funds when they exhaust internal reserves. The authors contend that this result is partly because the optimistic managers believe the stock market is undervaluing the firm.

AFFECT

Studying the dynamics of emotions and investor decision making has recently been a productive area of research in finance. This research usually consists of finding a measure of mood that is hypothesized to influence all investors in a reasonably uniform manner (e.g., the weather) and testing whether there is a relationship with aggregate stock prices (e.g., Hirshleifer and Shumway, 2003; Kamstra, Kramer, and Levi, 2003). This is the subject of Chapter 7 of this book.

This section on affect addresses a different type of emotional influence. The research discussed in Chapter 7 investigates whether the mood at the time of decision making influences investors, while this section concentrates on whether *a priori* emotions and emotional processes have an influence on investor decision making. The *a priori* emotions described and analyzed are *regret aversion* (not wanting to experience losses, not wanting to lose out on gains), and the *affect heuristic* (how liking or disliking something influences the way people analyze the risks and benefits associated with the decision).

Regret Aversion

Regret aversion is the term used to describe the emotion of regret experienced after making a choice that either turns out to be a bad choice or at least an inferior one. Regret aversion is primarily concerned with how the *a priori* anticipation of possible regret can influence decision making. Loomes and Sugden (1982) and Bell (1982) initially developed the theory as a formalized alternative to expected utility theory. The bias is somewhat unique when compared with the other biases in this chapter in that economists rather than psychologists primarily developed it.

Regret, particularly anticipated regret, appears to influence decisions. The main finding is that people under the influence of anticipated regret are motivated to take less risk because this lessens the potential for poor outcomes (Simonson, 1992; Connolly and Reb, 2003). However, an aversion to regret not only can play a role in reducing the risks that people take, but also can encourage them to take risks. Zeelenberg (1999) explains this apparent paradox as being determined by the type of feedback to be received after making a decision. For example, when making a choice about whether to be vaccinated, the anticipation of possible regret mostly revolves around not getting vaccinated and then getting ill. Thus, the anticipation of regret centers almost exclusively on the negative outcomes associated with the risky option of not being vaccinated. This should lead people to make a decision to get vaccinated. In some situations, there can be anticipated regret associated with the safe option. Zeelenberg gives the example of playing the lottery where the safe option is to not play and thus be guaranteed an unchanged level of wealth. The risky option is to play and thus be exposed to a (usually) poor gamble with the possibility of a large payoff. In this case, there will be anticipated regret of missing out on a large gain attached to the safe option of not playing, which might encourage people to take the risky choice.

Financial research provides many applications of regret aversion as a means of explaining investor behavior. For example, Shefrin and Statman (1985) use regret aversion to explain why investors do not like to sell "losing" stocks because it gives them "undeniable" feedback that they have made a bad decision. Odean (1998) proposes a similar explanation for his finding of investor reluctance to sell losing investments.

These explanations for investor behavior are valuable (see Chapter 10 for further discussion), but perhaps of greater value is research showing how the anticipation of regret influences initial investment choice. Unfortunately, the application of this form of regret aversion has not yet been widely applied in a finance context.

Dodonova and Khoroshilov (2005) propose one model of how regret aversion might influence investor decision making and aggregate stock prices. They base their model on how anticipation of regret can lead to investors selecting past "winning" stocks (i.e., past outperformers). The authors argue that this occurs because investors will feel regret at having missed out on the gains of these stocks in the past, and anticipating that they will feel even more regret if the stock continues to perform well in the future and they still have not invested in the stock. Other models of regret and investor behavior in insurance (Braun and Muermann, 2004) and in currency exposure hedging (Michenaud and Solnik, 2008) also suggest that regret can perversely lead to investors taking more risk.

The Affect Heuristic

Paul Slovic and his colleagues (Slovic, 1987, 2000; Slovic, Peters, Finucane, and MacGregor, 2005) developed the affect heuristic as a theory of how people allow their initial emotional reactions or feelings toward a decision to influence their subsequent evaluations of its risks and benefits. This theory is distinguished from regret aversion in that people usually make a conscious effort to avoid regret, but the emotional influence described by the affect heuristic is often subconscious.

Research on the affect heuristic initially arose from funding provided by the U.S. nuclear industry for Slovic to conduct research into why the public's perception of a high risk from nuclear power differed so dramatically from the more objective assessment of a low risk from nuclear power held by experts. The theory that emerged from this research on the nuclear industry has subsequently been applied to understanding risk/benefit assessments in a wide variety of areas including finance.

Slovic (1987, 2000) finds that the public feared the unknown risks associated with nuclear power (which they termed "dread" risk), and that media coverage creates unfair negative risk images associated with nuclear power. People associate nuclear power with nuclear weapons; thus they also associate the negative risk image of nuclear weapons with nuclear power. This finding was not limited to nuclear power. Slovic (1987) also finds risk assessment differences between the public and the experts for virtually all of 30 analyzed activities and technologies. Slovic argues that there is consistency in the public's deviations from objective risk assessments (the experts' opinions of risk tend to be close to the objective risk). This view occurs where dread risk is high, that is, where (1) a potential for a major accident exists; (2) death is an easily identifiable risk from the technology; and (3) a perceived lack of control over the technology is present. "Unknown risk" is also important as a determinant of the level of affect in decision making. As Slovic (1987, p. 226) notes, unknown risk is where people view risks as being "unobservable, unknown, new and delayed in their manifestation of harm."

At the other end of the scale, people tend to underestimate the risks of activities and technologies that they consider to be useful. In X-rays, for example, the public rated the risk as being low (out of 30 activities and technologies, with 1 being the riskiest and 30 being the least risky, the public rated X-rays as 22), but the more objective expert opinion is that X-rays are one of the most risky activities or technologies (7 of 30).

In other work, Slovic and colleagues further developed their findings on the relationship between risk and benefit/return. They find that affect appears to direct both the perceived benefit and the perceived risk (Alhakami and Slovic, 1994; Finucane, Alhakami, Slovic, and Johnson, 2000). Finucane et al. (p. 4) find through a series of experimental studies that "If an activity was 'liked', people tended to judge its risks as low and its benefits as high. If the activity was 'disliked', the judgements were the opposite—high risk and low benefit." The latter finding is the opposite of normative theory, which would suggest that high-risk activities and technologies should have high benefits; otherwise they would not be acceptable to society. Similarly, low-benefit activities would be expected to have low risk.

The research on the affect heuristic has important implications for understanding the role of mood in investor decision making. The primary implication is

a confirmation that mood or affect plays an important role in decisions involving risk and uncertainty and, in fact, can drive the assessment of the level of risk and benefit associated with a decision outcome. A further implication of this theory is the finding that unknown risk is a determinant of the level of affective influence. This evidence suggests that investment decisions involving greater uncertainty might show a greater level of mood influence compared to investment decisions involving low uncertainty.

Research applying the affect heuristic to finance has primarily been conducted by the original proponent of the affect heuristic, Slovic and a team of colleagues (MacGregor, Slovic, Dreman, and Berry, 2000; Dreman, Johnson, MacGregor, and Slovic, 2001; MacGregor, 2002). For example, MacGregor argues that stock market investors face a multitude of images. These include the corporate images of stocks presented in annual reports and advertisements, brokerage advertisements encouraging participation in the stock market, and the images created by the financial media. Understanding the power of these images is important because MacGregor finds a close correlation between the images that investors have of the stock market and their judgments of how the stock market will perform, suggesting that these images influence investors.

In a study that tested whether image influences investors' decisions, MacGregor et al. (2000) collected image ratings of various industries from a sample of 57 participants. The authors collect image ratings from each participant for 20 industries. In addition to finding the image rating associated with each industry, they also ask participants to estimate the performance of the industry in the previous financial year, the performance over the coming year, and to say whether they would be willing to buy into an IPO from a company in the industry. The results illustrate what the authors termed "internal consistency," that is, affective rating is closely correlated with judgments of past performance and judgments of future performance and willingness to invest in an IPO. Thus, liking an industry is linked to viewing that industry as a good investment. For example, participants liked pharmaceutical companies and viewed them as a good investment. The same is true for disliking an industry. Because the participants disliked the military electronics industry, this was linked to them not thinking the industry will perform well next year and not being willing to buy IPOs in the industry.

Ackert and Church (2006) conduct a further experimental study to investigate whether participants would allocate a notional portfolio based on affect. Participants are given nonfinancial historical information about a number of companies that is designed to elicit positive, neutral, or negative affect. The authors find participants to be significantly more likely to allocate funds to the positive affect companies. Kempf, Merkle, and Niessen (2009) report similar findings in their study examining attitudes toward German stocks.

Because these participants were not actually making real investment decisions, they may not follow the same process as if they were investing their own money. Still, if investors allow their image of an industry to influence their investment strategy, then potential flaws in their decision making become apparent. The most obvious flaw is that just because a person likes or dislikes an industry does not necessarily make it a good or bad investment. The tobacco or military industries may be considered unlikable sectors of the economy, but may offer superior returns to liked industries such as recreation and consumer electronics. Another potential

flaw is that views of liking or disliking tend to be uniform. This could lead to overinvestment and hence bubbles in liked industries and insufficient investment in industries that might be disliked but which might perform an important role in the economy.

Barber, Heath, and Odean (2003) provide some support for the idea that investors actually invest based on affect. In a study of 78,000 brokerage accounts, they find that investors tend to invest disproportionately in "admired companies" (based on *Fortune* magazine annual rankings of admiration for companies). The authors find that individual investors concentrate 56 percent of their purchases in the top 30 percent of admired companies. They also show that returns on these investments are generally poor. Returns from the bottom 70 percent, or un-admired companies, outperformed the top 30 percent of admired companies. In fact, a simple portfolio consisting of the bottom 10 percent (termed the "despised portfolio") outperformed the top 10 percent of admired companies over a 23-year period between 1983 and 2006 (Statman, Fisher, and Anginer, 2008).

Fehle, Tsyplakov, and Zdorovtsov (2005) provide some indirect support for investing based on image and affect in a study investigating whether Super Bowl advertising influenced investing and stock prices. They find abnormal positive returns for companies that promote themselves (i.e., promote their company image rather than just their products) during advertising breaks at 19 different Super Bowls. Companies that promote themselves rather than their products and show at least two advertisements during a Super Bowl had a cumulative abnormal positive return of 2.01 percent in the 20 days following the Super Bowl. The buying pressure on these stocks came primarily from small investors, who may be more influenced by the affect heuristic because their lack of knowledge leads to them facing greater "unknown risk" when investing in the stock market. Perhaps small investors allow the positive image built by the high-profile advertising to influence their assessment of potential risk and return for these companies.

SUMMARY AND CONCLUSIONS

Besides describing, analyzing, and placing the biases associated with inertia, self-deception, and affect within a financial context, this chapter demonstrates that few, if any, psychological biases can be viewed in simple isolation. This can best be illustrated by the section on self-deception, which shows that overconfidence is not just a "stand-alone" bias, but instead the extent of self-attribution bias determines overconfidence. Deep interactions are present in all behavioral biases studied in finance and offer the potential to develop a truly rich and holistic knowledge of investor decision making.

DISCUSSION QUESTIONS

1. In the section on the status quo bias, the main finance discussion related to pension planning. What other aspects of investor behavior might also be influenced by status quo bias?
2. The discussion of biased self-attribution occurred primarily within the context of poor investment decision making. How might investors overcome the negative influences of this bias?

3. The sections on the endowment effect and biased self-attribution cited recent research on differing influences dependent on cultural background. What limitations might there be to the application of American-centered research in finance when attempting to gain an understanding of the behavior of investors from different cultures?
4. The last section of the chapter discussed the idea of affect influencing both risk and return with even high-profile advertising appearing to have an influence on affective reactions. Why might advertising and other media influence investor decision making?

REFERENCES

Ackert, Lucy F., and Bryan K. Church. 2006. Firm image and individual investment decisions. *Journal of Behavioral Finance* 7:3, 155–167.

Agrawal, Anup, Jeffrey F. Jaffe, and Gershon N. Mandelker. 1992. The post-merger performance of acquiring firms: A re-examination of an anomaly. *Journal of Finance* 47:4, 1605–1621.

Alhakami, Ali, and Paul Slovic. 1994. A psychological study of the inverse relationship between perceived risk and perceived benefit. *Risk Analysis* 14:6, 1085–1096.

Baker, Malcolm, Joshua Coval, and Jeremy C. Stein. 2007. Corporate financing decisions when investors take the path of least resistance. *Journal of Financial Economics* 84:2, 266–298.

Barber, Brad M., Chip Heath, and Terrance Odean. 2003. Good reasons sell: Reason-based choice among group and individual investors in the stock market. *Management Science* 49:12, 1636–1652.

Barber, Brad M., and Terrance Odean. 2001. Boys will be boys: Gender, overconfidence, and common stock investment. *Quarterly Journal of Economics* 116:1, 261–292.

Barber, Brad M., and Terrance Odean. 2002. Online investors: Do the slow die first? *Review of Financial Studies* 15:2, 455–487.

Barberis, Nicholas, Andrei Shleifer, and Robert Vishny. 1998. A model of investor sentiment. *Journal of Financial Economics* 49:3, 307–343.

Bell, David E. 1982. Regret in decision making under uncertainty. *Operations Research* 30:5, 961–981.

Bernard, Victor L., and Jacob K. Thomas. 1990. Evidence that stock prices do not fully reflect the implications of current earnings for future earnings. *Journal of Accounting & Economics* 13:4, 305–331.

Billett, Matthew T., and Yiming Qian. 2008. Are overconfident CEOs born or made? Evidence of self-attribution bias from frequent acquirers. *Management Science* 54:6, 1037–1051.

Bischoff, Ivo. 2008. Endowment effect theory, prediction bias and publicly provided goods: An experimental study. *Environmental and Resource Economics* 39:3, 283–296.

Boonen, Lieke H., Frederik T. Schut, and Xander Koolman. 2008. Consumer channelling by health insurers: Natural experiments with preferred providers in the Dutch pharmacy market. *Health Economics* 17:3, 299–316.

Braun, Michael, and Alexander Muermann. 2004. The impact of regret on the demand for insurance. *Journal of Risk and Insurance* 71:4, 737–767.

Brown, Jeffrey R., Nellie Liang, and Scott Weisbenner. 2007. Individual account investment options and portfolio choice: Behavioral lessons from 401(K) plans. *Journal of Public Economics* 91:10, 1992–2013.

Campbell, W. Keith, and Constantine Sedikides. 1999. Self-threat magnifies the self-serving bias: A meta-analytic integration. *Review of General Psychology* 3:1, 23–43.

Choi, Darwin, and Dong Lou. 2007. A test of self-serving attribution bias: Evidence from mutual funds. Working Paper, Yale School of Management.

Chui, Andy C. W., Sheridan Titman, and K. C. John Wei. 2009. Individualism and momentum around the world. *Journal of Finance*, forthcoming.

Connolly, Terry, and Jochen Reb. 2003. Omission bias in vaccination decisions: Where's the "omission"? Where's the "bias"? *Organizational Behavior and Human Decision Processes* 91:2, 186–202.

Coval, Joshua D., and Tyler Shumway. 2005. Do behavioral biases affect prices? *Journal of Finance* 60:1, 1–34.

Daniel, Kent, David Hirshleifer, and Avanidhar Subrahmanyam. 1998. Investor psychology and security market under- and overreactions. *Journal of Finance* 53:6, 1839–2885.

Deaves, Richard, Erik Lüders, and Guo Ying Luo. 2009. An experimental test of the impact of overconfidence and gender on trading activity. *Review of Finance* 13:3, 555–575.

Desai, Hemang, and Prem C. Jain. 1997. Long-run common stock returns following splits and reverse splits. *Journal of Business* 70:3, 409–433.

Dodonova, Anna, and Yuri Khoroshilov. 2005. Applications of regret theory to asset pricing. Working Paper, University of Ottawa.

Dreman, David, Stephen Johnson, Donald G. MacGregor, and Paul Slovic. 2001. A report on the March 2001 investor sentiment survey. *Journal of Psychology and Financial Markets* 2:3, 126–134.

Dunning, David, Chip Heath, and Jerry M. Suls. 2004. Flawed self-assessment: Implications for health, education and the workplace. *Psychological Science in the Public Interest* 5:3, 69–106.

Edwards, Ward. 1968. Conservatism in human information processing. In *Formal Representation of Human Judgment*, ed. Benjamin Kleinmutz, 17–52. New York: John Wiley & Sons, Inc.

Einhorn, Hillel J. 1980. Overconfidence in judgment. *New Directions for Methodology of Social and Behavioral Science* 4, 1–16.

Fama, Eugene F. 1998. Market efficiency, long-term returns, and behavioral finance. *Journal of Financial Economics* 49:3, 283–306.

Fehle, Frank, Sergey Tsyplakov, and Volodymyr M. Zdorovtsov. 2005. Can companies influence investor behaviour through advertising? Super Bowl commercials and stock returns. *European Financial Management* 11:5, 625–647.

Feng, Lei, and Mark S. Seasholes. 2005. Do investor sophistication and trading experience eliminate behavioral biases in financial markets? *Review of Finance* 9:3, 305–351.

Finucane, Melissa L., Ali Alhakami, Paul Slovic, and Stephen M. Johnson. 2000. The affect heuristic in judgments of risks and benefits. *Journal of Behavioral Decision Making* 13:1, 1–17.

Fox, Shaul, Aharon Bizman, and Oren Huberman. 2009. Escalation of commitment: The effect of number and attractiveness of available investment alternatives. *Journal of Business and Psychology*, forthcoming.

Frank, Richard G., and Karine Lamiraud. 2009. Choice, price competition and complexity in markets for health insurance. *Journal of Economic Behavior and Organization* 71:2, 550–562.

Gervais, Simon, J.B. Heaton, and Terrance Odean. 2002. The positive role of overconfidence and optimism in investment policy. Working Paper, Rodney L. White Center for Financial Research.

Gervais, Simon, and Terrance Odean. 2001. Learning to be overconfident. *Review of Financial Studies* 14:1, 1–27.

Griffin, Dale, and Amos Tversky. 1992. The weighting of evidence and the determinants of overconfidence. *Cognitive Psychology* 24:3, 411–435.

Harter, Susan. 1993. Causes and consequences of low self-esteem in children and adolescents. In *Self-esteem: The puzzle of low self-regard*, ed. Roy F. Baumeister, 87–116. New York: Plenum.

Heider, Fritz. 1958. *The psychology of interpersonal relations*. New York: John Wiley & Sons.
Heine, Steven J., and Takeshi Hamamura. 2007. In search of east Asian self-enhancement. *Personality and Social Psychology Review* 11:1, 4–27.
Hilary, Giles, and Lior Menzly. 2006. Does past success lead analysts to become overconfident? *Management Science* 52:4, 489–500.
Hirshleifer, David, and Tyler Shumway. 2003. Good day sunshine: Stock returns and the weather. *Journal of Finance* 58:3, 1009–1032.
Hofstede, Geert. 2001. *Culture's consequences: Comparing values, behaviors, institutions, and organizations across nations*. Beverly Hills, CA: Sage Publications.
Hong, Harrison G., and J. C. Stein. 1999. A unified theory of underreaction, momentum trading and overreaction in asset markets. *Journal of Finance* 54:6, 2143–2184.
Hsu, Yenshan, and Cheng-Yi Shiu. 2007. The overconfidence and self-attribution bias of investors in the primary market. Working Paper, National Chengchi University and Taiwan National Central University.
Kahneman, Daniel, Jack L. Knetsch, and Richard H. Thaler. 1990. Experimental tests of the endowment effect and the Coase theorem. *Journal of Political Economy* 98:6, 1325–1348.
Kahneman, Daniel, and Amos Tversky. 1973. On the psychology of prediction. *Psychological Review* 80:4, 237–251.
Kamstra, Mark J., Lisa A. Kramer, and Maurice D. Levi. 2003. Winter blues: A SAD stock market cycle. *American Economic Review* 93:1, 324–343.
Kempf, Alexander, Christoph Merkle, and Alexandra Niessen. 2009. Low risk and high return—How emotional attitudes shape stock expectations. Working Paper, University of Cologne.
Kempf, Alexander, and Stefan Ruenzi. 2006. Status quo bias and the number of alternatives: An empirical illustration from the mutual fund industry. *Journal of Behavioral Finance* 7:4, 204–213.
Knetsch, Jack L., and Wei-Kang Wong. 2009. The endowment effect and the reference state: Evidence and manipulations. *Journal of Economic Behavior and Organization* 71:2, 407–413.
Koszegi, Botond, and Matthew Rabin. 2006. A model of reference-dependent preferences. *Quarterly Journal of Economics* 121:4, 1133–1165.
Kruger, Justin. 1999. Lake Wobegon ge gone! The "Below-Average Effect"' and the egocentric nature of comparative ability judgments. *Journal of Personality and Social Psychology* 77:2, 221–232.
Lakonishok, Joseph, and Theo Vermaelen. 1990. Anomalous price behavior around repurchase tender offers. *Journal of Finance* 45:2, 455–477.
Lerner, Jennifer S., Deborah A. Small, and George Loewenstein. 2004. Heart strings and purse strings: Carryover effects of emotions on economic decisions. *Psychological Science* 15:5, 337–341.
Lin, Chien-Huang, Shih-Chieh Chuang, Danny T. Kao, and Chaang-Yung Kung. 2006. The role of emotions in the endowment effect. *Journal of Economic Psychology* 27:4, 589–597.
Lin, Yueh-Hsiang, Shing-Yang Hu, and Ming-Shen Chen. 2005. Managerial optimism and corporate investment: Some empirical evidence from Taiwan. *Pacific-Basin Finance Journal* 13:5, 523–546.
List, John A. 2004. Neoclassical Theory Versus Prospect Theory: Evidence from the Marketplace. *Econometrica* 72:2, 615–625.
Loewenstein, George, Troyen Brennan, and Kevin G. Volpp. 2007. Asymmetric paternalism to improve health behaviors. *Journal of the American Medical Association* 298:20, 2415–2417.
Loomes, Graham, and Robert Sugden. 1982. Regret theory: An alternative theory of rational choice under uncertainty. *Economic Journal* 92:368, 805–824.

Lord, Charles G., Lee Ross, and Mark R. Lepper. 1979. Biased assimilation and attitude polarization: The effects of prior theories on subsequently considered evidence. *Journal of Personality and Social Psychology* 37:11, 2098–2109.

Loughran, Tim, and Jay R. Ritter. 2002. Why don't issuers get upset about leaving money on the table in IPOs? *Review of Financial Studies* 15:2, 413–443.

MacGregor, Donald G. 2002. Imagery and financial judgment. *Journal of Psychology and Financial Markets* 3:1, 15–22.

MacGregor, Donald G., Paul Slovic, David Dreman, and Michael Berry. 2000. Imagery, affect, and financial judgment. *Journal of Psychology and Financial Markets* 1:2, 104–110.

Madrian, Brigitte C., and Dennis F. Shea. 2001. The power of suggestion: Inertia in 401(K) participation and savings behavior. *Quarterly Journal of Economics* 116:4, 1149–1187.

Malmendiera, Ulrike, and Geoffrey Tate. 2008. Who makes acquisitions? CEO overconfidence and the market's reaction. *Journal of Financial Economics* 89:1, 20–43.

Marquis, M. Susan, and Martin R. Holmer. 1996. Alternative models of choice under uncertainty and demand for health insurance. *Review of Economics and Statistics* 78:3, 421–427.

Michaely, Roni, Richard H. Thaler, and Kent Womack. 1995. Price reactions to dividend initiations and omissions. *Journal of Finance* 50:2, 573–608.

Michenaud, Sebastien, and Bruno Solnik. 2008. Applying regret theory to investment choices: Currency hedging decisions. *Journal of International Money and Finance* 27:5, 677–694.

Miller, Dale T., and Michael Ross. 1975. Self-serving biases in the attribution of causality: Fact or fiction? *Psychological Bulletin* 82:2, 213–225.

Mullen, Brian, and Catherine A. Riordan. 1988. Self-serving attributions for performance in naturalistic settings: A meta-analytic review. *Journal of Applied Social Psychology* 18:1, 3–22.

Nicolosi, Gina, Liang Peng, and Ning Zhu. 2009. Do individual investors learn from their trading experience? *Journal of Financial Markets* 12:2, 317–336.

Odean, Terrance. 1998. Are investors reluctant to realize their losses? *Journal of Finance* 53:5, 1775–1798.

Samuelson, William, and Richard Zeckhauser. 1988. Status quo bias in decision making. *Journal of Risk and Uncertainty* 1:1, 7–59.

Shefrin, Hersh, and Meir Statman. 1985. The disposition to sell winners too early and ride losers too long: Theory and evidence. *Journal of Finance* 40:3, 777–790.

Simonson, Itamar. 1992. The influence of anticipating regret and responsibility on purchase decisions. *Journal of Consumer Research* 19:1, 105–118.

Skaalvik, Einar M. 1994. Attribution of perceived achievement in school in general and in maths and verbal areas: Relations with academic self-concept and self-esteem. *British Journal of Educational Psychology* 64:1, 133–143.

Slovic, Paul. 1987. Perception of risk. *Science* 236:4799, 280–285.

Slovic, Paul. 2000. *The Perception of risk*. London: Earthscan.

Slovic, Paul, Ellen Peters, Melissa L. Finucane, and Donald G. MacGregor. 2005. Affect, risk, and decision making. *Health Psychology* 24:4, S35–S40.

Sokol-Hessner, Peter, Ming Hsu, Nina G. Curley, Mauricio R. Delgado, Colin F. Camerer, and Elizabeth A. Phelps. 2009. Thinking like a trader selectively reduces individuals' loss aversion. *Proceedings of the National Academy of Sciences of the United States of America* 106:13, 5035–5040.

Statman, Meir, Kenneth L. Fisher, and Deniz Anginer. 2008. Affect in a behavioral asset-pricing model. *Financial Analysts Journal* 64:2, 20–29.

Stewart, Alan E. 2005. Attributions of responsibility for motor vehicle crashes. *Accident Analysis & Prevention* 37:4, 681–688.

Thaler, Richard. 1980. Toward a positive theory of consumer choice. *Journal of Economic Behavior and Organization* 1:1, 39–60.

Thaler, Richard, and Shlomo Benartzi. 2004. Save more tomorrow: Using behavioral economics to increase employee saving. *Journal of Political Economy* 112:1, S164–S187.
Thaler, Richard, and Cass Sunstein. 2009. *Nudge*. London: Penguin Books.
van de Ven, Niels, Marcel Zeelenberg, and Eric van Dijk. 2005. Buying and selling exchange goods: Outcome information, curiosity and the endowment effect. *Journal of Economic Psychology* 26:3, 459–468.
Weinstein, Neil D. 1980. Unrealistic optimism about future life events. *Journal of Personality and Social Psychology* 39:5, 806–820.
Zeelenberg, Marcel. 1999. Anticipated regret, expected feedback and behavioral decision making. *Journal of Behavioral Decision Making* 12:2, 93–106.
Zhang, Donghang. 2004. Why do IPO underwriters allocate extra shares when they expect to buy them back? *Journal of Financial and Quantitative Analysis* 39:3, 571–594.
Zhu, Rui, Xinlei Chen, and Srabana Dasgupta. 2008. Can trade-ins hurt you? Exploring the effect of a trade-in on consumers' willingness to pay for a new product. *Journal of Marketing Research* 45:2, 159–170.
Zuckerman, Marvin. 1979. *Sensation seeking beyond the optimal level of arousal*. Hillsdale, NJ: Erlbaum.

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PART III

Behavioral Aspects of Asset Pricing

CHAPTER 18

Market Inefficiency

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INTRODUCTION

Over the history of financial research, scholars have focused on rational investors and how they make decisions in the presence of information. If investors are indeed rational, their decision choices can be understood using mathematical models relating their choices to fundamental information. This focus on rational investors has led researchers to make the fundamental assumption that markets are efficient and that prices reflect fundamental values. Moreover, researchers have argued that even if investors are not rational, their biases are unlikely to be systematic. In other words, because the biases of different investors vary, these biases should all wash out across the cross-section of investors. In addition, even if investors are systematically biased, unbiased rational investors should be able to take advantage of these biases and irrational investors should eventually be driven out of the market, as in the survival of the fittest.

Over the last two decades, researchers have documented that contrary to the efficient markets hypothesis, anomalies can be observed in returns to firms after an enormous variety of corporate events—from mergers to share repurchases to stock splits. In other words, returns after these types of corporate events are predictable. For example, evidence shows that share repurchases are followed by significantly positive long-term excess returns, while stock-financed mergers are followed by significantly negative excess returns. Why do not rational investors take advantage of these predictable patterns and drive the returns to zero?

This chapter reviews the literature on market inefficiency to examine whether behavioral biases influence managerial and investor actions. It shows that neither of the two assumptions behind market efficiency is correct. Investor biases are systematic, and predicting how investors will behave in different situations is possible. However, even though these biases are systematic and predictable, limits to arbitrage prevent arbitrageurs from taking advantage of these biases and restoring market efficiency.

A BRIEF REVIEW OF THE EFFICIENT MARKETS HYPOTHESIS

Mathematically, the efficient markets hypothesis (EMH) is the assertion that the current price, P, of a security equals the expected value of all future cash flows to

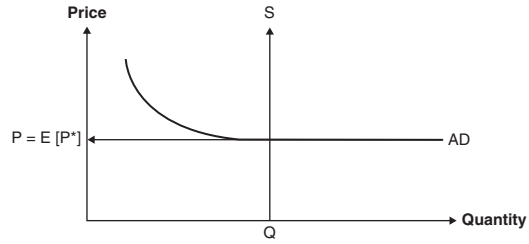

Exhibit 18.1 Aggregate Supply and Demand Curves
Note: This figure shows how price for a security is determined as the intersection of aggregate supply and demand curves.

be received from owning that security.

$$P = E[P^{Y*}] \tag{18.1}$$

where $E[P^*]$ is the fundamental value of the security defined as

$$E[P^*] \equiv \sum_{t=1}^{\infty} \frac{E[CF_t]}{(1 + E[R])^t} \tag{18.2}$$

$E[CF]$ is the cash flow to the investor in period t and $E[R]$ is the discount rate derived from a model of expected returns.

The EMH does not say anything about which $E[R]$ or $E[CF]$ to use. It just says that what the market uses is "right," that is, the EMH asserts that P equals the best possible estimate of P^* that market participants can make using a given "information set."

What are the economics behind the EMH? Exhibit 18.1 illustrates how the market price, P, is the outcome of supply and demand. The EMH can be thought of as a hypothesis about the relative shape or position of the supply and demand curves. The supply curve traces the quantity supplied to the market as a function of the security's current price. The supply is set by firms on the primary markets. For simplicity, assume that supply is fixed in the short run. The aggregate demand curve traces out the quantity demanded by investors in total, as a function of the price, P. It aggregates each investor's individual demand. Day-to-day price movements usually reflect fluctuations in aggregate demand. The aggregate demand (AD) curve is the horizontal sum of all investors' personal demand curves. The current market price, P is where the supply curve intersects with investors' aggregate demand curves.

The EMH is the hypothesis that the AD curve intersects the supply curve, S, at the specific point where AD is flat. Using this framework, three situations exist where the market will be efficient.

1. All investors are rational. Rational investors value securities as equivalent to the value of their expected discounted cash flows. They accurately use all information to determine $E[P^*]$. If $P < E[P^*]$, every rational investor demands much more, if $P > E[P^*]$, they demand much less (and demand

can even be negative, i.e., investors short-sell). Hence the aggregate demand curve is flat at $P = E[P^*]$.

2. Some investors are irrational, but their uncorrelated misperceptions cancel each other out. If some "optimists" think that $P < E[P^*]$ and an equal number of "pessimists" think $P > E[P^*]$, they can trade with each other without affecting P. So, assuming $P = E[P^*]$, $P = E[P^*]$ remains accurate.
3. Arbitrage is unlimited. Arbitrageurs can be thought of as cash-unconstrained rational investors who know $E[P^*]$ and trade large quantities when $P \neq E[P^*]$. So, even if some investors are systematically irrational, these arbitrageurs might still enforce market efficiency. If arbitrageurs are large enough, they effectively flatten the aggregate demand curve.

TESTING MARKET INEFFICIENCY

The easiest way to test market inefficiency is to examine whether, using a given information set, the security earns "abnormal" returns above an arbitrary benchmark (i.e., returns over and above normal $E[R]$). What is the right benchmark $E[R]$?

All asset pricing models emphasize risk-return tradeoffs. They state that riskier assets should have lower prices, giving them higher expected returns. Different asset pricing models emphasize different risks. The capital asset pricing model (CAPM) is the most popular model of expected returns and makes several assumptions about investors. Investors are rational, like higher portfolio returns, and dislike portfolio variance. They choose to optimally diversify, holding varying proportions of the risk-free asset and the market portfolio. The appropriate risk emphasized by the CAPM is the level of covariance a security has with the value of the overall market portfolio held by all investors. The consumption CAPM (CCAPM) recognizes that the ultimate purpose of wealth is to finance consumption. Therefore, the risk of a security depends on the risk it adds to ultimate consumption. What matters is the covariance of the security returns (beta) with ultimate consumption. The arbitrage pricing theory (APT) assumes that numerous factors drive the return to a security. The number and nature of factors is left unspecified. According to the APT, the expected return on the stock is the weighted average of beta loadings on a number of factor portfolios, where the weights on each factor are the expected return on a portfolio whose beta with factor j is 1 and with all others is 0.

Each model makes debatable assumptions. None of them is "true," but they are the best available options. In addition, each has its own implementation problems. In the CAPM, the market portfolio is unspecified. In the CCAPM, consumption is hard to measure, and the consumption risk premium is unspecified. In the APT, both the factors and factor risk premium are unspecified. None of the three models really accounts for changing betas. Given the problems in finding the perfect benchmark, testing market inefficiency is always a joint hypothesis problem: The test must determine whether markets are truly inefficient *and* the model of abnormal returns is appropriate.

Fama (1970) proposed three forms of efficient markets. A *weak-form efficient* market incorporates all information in past prices. This implies that technical trading rules, such as "buy a stock if its price falls 10 percent in a week, sell if it rises 10 percent", do not earn abnormal returns. Testing this form of efficiency involves

regressing security returns on a model of expected returns and prior security returns. If markets are weak-form efficient, prior returns should be insignificant in predicting future returns. Early tests of weak-form market efficiency generally support the weak-form EMH. While some papers (see, for example, Brock, Lakonishok, and LeBaron, 1992; Lo, Mamaysky, and Wang, 2000) find evidence of return predictability using technical trading rules, the profitability of these rules is usually fleeting (Neely, Weller, and Ulrich, 2009) even before including transaction costs, and in most cases, disappear after transaction costs are included.

A *semi-strong efficient* market incorporates all public information. Because public information includes the past history of prices, a market that is semi-strong form efficient is necessarily weak-form efficient. The classic methodology used to test semi-strong form efficiency is called an event study. Event study methodology is standard (see, for example, Brown and Warner, 1980) and will not be covered here. In the first event study published, Fama, Fisher, Jensen, and Roll (1969) study 940 stock split events. Consistent with semi-strong market efficiency, Fama et al. find that abnormal returns post-split are indistinguishable from zero. In other words, they find that using a stock split once it becomes public information to form a trading rule would not earn abnormal returns. Researchers used event study methodology to study short-term reactions after a wide range of corporate events. Overwhelmingly, the results are similar—there are no excess returns to be found after most corporate events. Markets react fast and apparently accurately to any new information. Busse and Green (2002) provide a striking illustration of the speed with which prices reflect new information in their study of the Morning Call and Midday Call segments on CNBC TV. The segments report analysts' views about individual stocks and are broadcast when the market is open. Prices respond to the reports within seconds of the initial mention.

Another approach to testing semi-strong market efficiency is to examine the performance of mutual fund managers. Mutual fund managers rely mainly on publicly available information. Beginning with Jensen (1968), a popular research question has been: Do returns on mutual funds just reflect their risk, or do some managers have a positive "alpha" (a specific measure of abnormal return)? Jensen examines 115 mutual funds over the years 1945 to 1964. Using the CAPM to model $E[R]$, he runs 115 regressions to get 115 alphas. He finds most estimated alphas are around zero.

Overall, early tests support semi-strong EMH. Most event studies find that the market reacts correctly to news. There is no systematic over- or underreaction, hence no easy trading rules. Even highly skilled investors using public information (mutual fund managers) do not earn abnormal profits. However, the "joint hypothesis problem" is always a caveat to these conclusions.

Finally, a *strong-form efficient* market incorporates all public and private information. It implies that even insiders cannot make abnormal profits. However, many early studies such as Seyhun (1988) find that insider trades are profitable, suggesting that the market is not strong form efficient.

EVIDENCE OF MARKET INEFFICIENCY

In addition to concluding that markets are not strong-form efficient, over the past two decades, researchers have documented apparent violations for both weak- and semi-strong forms of market efficiency as well.

Weak-Form EMH Violations

The earliest identified violations of weak-form market efficiency are apparent in calendar patterns. Researchers report that average returns seem to differ systematically within the calendar year. For example, while Banz (1981) documents that small-capitalization firms listed on the New York Stock Exchange (NYSE) earned significantly higher returns than those predicted by the CAPM, Reinganum (1983) shows that much of the abnormal return to small firms occurs during the first two weeks in January (the January effect). Cooper, McConnell, and Ovtchinnikov (2006) show that January returns have predictive power for market returns over the next 11 months of the year (the other January effect). French (1980) documents that the average return to the Standard & Poor's (S&P) composite portfolio was significantly negative over weekends in the period 1953 to 1977 (the weekend effect). McConnell and Xu (2008) find that over the period 1926 to 2005 in 31 out of 35 countries, investors on average received no reward for bearing market risk except at turns of the month. Santa-Clara and Valkanov (2003) show that the average excess return in the stock market is higher under Democratic than Republican presidents. In many of these cases, the predictability of these patterns is still a puzzle despite extensive research.

Other examples of violations in weak-form market efficiency are seen in price patterns. One such example is short-horizon momentum: Abnormal returns on individual stocks are significantly positively correlated over a 3- to 12-month horizon (Jegadeesh and Titman, 1993). The magnitude of this pattern is strikingly large. That is, the difference in average returns between high-momentum and low-momentum portfolios formed on the basis of prior 12-month momentum is 1.5 percent per month. This is not simply due to the higher risk of high momentum stocks. Jegadeesh and Titman report that the beta of the low-momentum losers is higher than for the high-momentum winners. In the longer term, the short-horizon momentum discussed above disappears, and in fact reverses. DeBondt and Thaler (1985) compare future performance of extreme "winner" and "loser" stocks as measured over the previous five years. They find a significant negative autocorrelation in long-horizon abnormal returns at horizons of three to eight years.

Semi-Strong EMH Violations

Scholars also document apparent violations of the semi-strong EMH. The first type of violation is based on firm characteristics such as size, book-to-market (B/M) ratios, growth in sales, earnings/price (E/P) ratios, accruals, and asset growth. The literature documents that these characteristics seem to identify firms that earn returns in excess of those predicted by their benchmarks. Most of these characteristics are related to fundamental Gordon growth–type models. For example, both the B/M and the E/P ratio are based on the Gordon growth model:

$$P = \frac{E_1(1-d)}{(r-g)} \tag{18.3}$$

where E_1 is the next-period earnings, d is the dividend payout ratio, r is the expected discount rate, and g is the growth rate. This is the basis behind the concept of "value" investing by money and hedge fund managers. Value investors assume

that the price for a security is lower than that predicted by the right-hand side of the equation. The idea is that the market somehow misinterprets the growth or discount rate in the above equation. This holds even in characteristics that are not directly related to the Gordon growth model. For example, the accruals factor is based on the idea that investors "fixate" on total earnings, failing to separate information contained in the accrual from the cash flow components of current earnings (Sloan, 1996).

Fama and French (1992) find evidence for both size and B/M effects—firms with low market capitalizations and high book-equity value relative to market equity earn significantly higher returns than that predicted by the CAPM. As noted earlier, this is also related to the January effect—outside January, there is no small-firm effect. Lakonishok, Shleifer, and Vishny (1994) extend this idea to portfolios based on past B/M, cash-flow to price (C/P), E/P, and growth in sales. They find that "value" portfolios (formed on the basis of these benchmarks) significantly outperform "glamour" portfolios (measured by low B/M, low C/P, low growth in sales, or low E/P). Sloan (1996) finds that stock prices do not reflect the differential persistence of accruals and cash flows. Investors tend to overweight accruals relative to cash flows when forming future earnings expectations only to be systematically surprised when accruals (cash flows) turn out, in the future, to be less (more) persistent than expected. As a result, low-accrual firms earn positive abnormal returns in the future. Cooper, Gulen, and Schill (2008) find that asset growth rates are strong predictors of future abnormal returns even after controlling for book-to-market ratios, firm capitalization, lagged returns, accruals, and other factors described above.

What leads to these effects? One possibility is that they are related to distress risk. Researchers compute CAPM betas using past returns. Therefore, if these returns do not capture an increased probability of financial distress going forward, the CAPM beta will be too low relative to the "true" beta. Lakonishok et al. (1994) show, however, that the value portfolio does well in all the scenarios they study and better in worse scenarios (when the market turns down). In other words, these portfolios are not fundamentally riskier. Daniel and Titman (1997) show that high B/M firms do not load significantly on any common risk factors, suggesting that the characteristics of the firms are more important than the covariance structure of returns in explaining the returns to these firms.

A second form of violation of the semi-strong EMH lies in investor reactions to news events. When researchers examine corporate events over longer time periods, event studies show that market reactions are no longer as efficient as they seemed to be in the short run. Ball and Brown (1968) show that after firms announced their earnings, the cumulative abnormal returns (CARs) continue to drift up for "good news" firms and down for "bad news" firms, suggesting that the market does not react completely at the time of the announcement of earnings. Researchers have extensively studied this post-earnings-announcement drift (PEAD). Bernard and Thomas (1989) sort firms into deciles based on their standardized unexpected earnings (SUE), the difference between actual and forecast earnings standardized by the typical deviation of forecast errors. They forecast earnings using a first-order autoregressive model and find a PEAD monotonically increasing in unexpected earnings. A long position in the highest SUE decile with a short position in the lowest decile would have earned an annualized abnormal return of around

18 percent. Moreover, the drift spikes again at subsequent earnings announcement dates. Investors seem to be underreacting to corporate earnings announcements.

Other examples of market inefficiency include investor reactions to other corporate news events. Ritter (1991) finds that initial public offerings (IPOs) significantly underperform relative to a set of comparable firms matched on size and industry. By investing in a sample of IPOs, investors would have earned around 17 percent less than investors in matching firms. Loughran and Ritter (1995) extend these results to seasoned equity offerings (SEOs). They find that investors investing $1 in each IPO or SEO immediately following the event would earn, at the end of five years, about 70 percent of the amount they would have earned had they invested in a sample of stocks matched to the IPOs and SEOs on size. The pattern for repurchases is exactly the opposite for share issues. Ikenberry, Lakonishok, and Vermaelen (1995) show that the average abnormal four-year buy-and-hold return for repurchasing firms measured after the initial announcement is 12.1 percent. For value stocks, companies more likely to be repurchasing shares because of undervaluation, the average abnormal return is 45.3 percent.

Loughran and Vijh (1997) show that over the five years following the acquisition, firms that complete stock-financed mergers earn significantly negative excess returns of −25 percent while firms that complete cash-financed tender offers earn significantly positive excess returns of 62 percent. Rau and Vermaelen (1998) show the existence of a book-to-market effect in addition to the method of payment effect documented by Loughran and Vijh. Glamour bidders, characterized by low B/M ratios, earn negative abnormal returns of −17 percent on average while value bidders outperform other firms with similar sizes and B/M ratios, earning statistically significant positive abnormal returns of 15.5 percent for tender offers and 7.64 percent for mergers.

One caveat to most of these papers is that they are not consistent in explaining why investors react incorrectly. For instance, Loughran and Ritter (1995) argue that investor overreaction explains the negative long-run abnormal returns following an SEO. They base this conclusion on the good past performance of firms announcing an SEO. Loughran and Ritter ignore the investor reaction to the negative news conveyed by the SEO (Myers and Majluf, 1984). Ikenberry et al. (1995) argue that investor underreaction explains the positive long-run abnormal returns following a share repurchase, a conclusion based on the information conveyed by the share repurchase. They ignore the investor reaction to the prior poor performance of firms announcing share repurchases in concluding that investor underreaction explains the long-run positive trend in returns.

Kadiyala and Rau (2004) argue that if investors are indeed underreacting (or overreacting) to news events, then presumably their reaction to an event is incomplete at the time of the next corporate event. They examine four separate types of corporate events: SEOs, stock-financed acquisitions, share repurchases, and cash-financed acquisitions. Firms that announce a corporate event after prior negative news underperform relative to firms announcing the same event after prior positive news regardless of whether the event itself conveys good or bad news. Overall, Kadiyala and Rau show that investor underreaction seems to explain most types of reactions to corporate events.

A third form of violation lies in investor reactions to non-news events. Under semi-strong EMH, the price is supposed to react quickly and accurately to news

on $E[P^*]$ only. Cutler, Poterba, and Summers (1989) find evidence that violates this statement. They look at major events and corresponding changes in the S&P index between 1941 and 1987. The standard deviation on major event days (such as the bombing of Pearl Harbor and the assassination of Kennedy) is 2.08 percent. The daily average is 0.82 percent. If every day were as newsworthy as these major event days, the standard deviation of annual returns would have been 32 percent. The actual annual standard deviation is 13 percent, suggesting that news events of this kind cannot be the only explanation of the standard deviation for shares.

However, when Cutler et al. (1989) examine whether prices react only to news events, in many cases they are unable to identify news events that correspond to major movements in the S&P index. Along the same lines, Roll (1984) studies the efficiency of frozen orange juice futures markets. Under semi-strong EMH, most day-to-day price changes should be attributable to Orlando weather news. While weather is important, he finds much "excess" volatility unrelated to fundamentals.

Weather seems to be important in predicting returns to ordinary stocks as well, even though it is unrelated to fundamental firm activity. Hirshleifer and Shumway (2003) examine the relationship between morning sunshine in the city of a country's leading stock exchange and daily market index returns across 26 countries from 1982 to 1997. They find a strong and significant correlation between sunshine and stock returns. Kamstra, Kramer, and Levi (2003) argue that stock market returns exhibit seasonal patterns consistent with the influence of seasonal affective disorder on investor risk aversion. Factors other than the weather may also affect investor "mood" and hence affect prices. Edmans, Garcia, and Norli (2007) use international soccer results as a mood variable and find evidence of significant market declines after soccer losses. A loss in the World Cup elimination stage, for example, leads to a next-day abnormal stock return of –49 basis points.

INVESTOR BEHAVIORAL ASPECTS THAT INFLUENCE PRICES

In standard finance and economics classes, an investor is deemed "rational" if he or she forms rational expectations, and then maximizes expected utility given those expectations. In contrast, a "behavioral" investor does not know the fundamental value of the security $E[P^*]$. The investor may form irrational expectations of future cash flows, leading to incorrect estimates of fundamental value. He or she may also have odd preferences. For example, he or she may rely on heuristics and not make expected-utility-maximizing decisions.

However, recall that if investor misperceptions are uncorrelated, markets would still be efficient. According to evidence by Barber, Odean, and Zhu (2009), the notion that investor misperceptions are uncorrelated is not necessarily true; trading by individuals is highly correlated and persistent. In addition, systematic trading of individual investors is driven by their own decisions—trades they initiated—rather than by passive reactions to institutional herding. If individual investors are net buyers of a stock this month, they are likely to be net buyers of the stock next month. In other words, while investors may disagree about the value of an asset at any point in time, they tend to agree that a given piece of information is on balance good or bad.

Why are investor perceptions likely to be correlated? There are two reasons: limits on processing ability (deciding how to process the information rationally) and limits on attention (deciding what piece of information is important enough to process). Both are extremely difficult tasks.

First consider limits on processing. For prices to be efficient, at least some traders must be able to calculate $E[P^*]$. Even supposing the investor knows the discount rate $E[R]$ (which he does not), he or she still needs to be able to write down all possible cash-flow outcomes, CF_t, and attach probabilities to each one in order to calculate $E[CF_t]$. If new information arrives, the investor uses Bayes's rule to adjust the probabilities.

How do individuals compute probabilities? Consider the following example. All companies pay either a dividend or no dividend. Based on historical data, the unconditional probability of a company choosing to pay no dividend in any quarter (with no prior warning) is 0.5 percent. A star analyst, who by reputation is known to be right 99 percent of the time, predicts that firm X will not pay its dividend next quarter. How should the investor update his or her probability that the company will pay no dividend? In experiments, most subjects given this information are very confident that the company will not pay a dividend. This is because they focus on the analyst being accurate 99 percent of the time. Bayes's rule indicates that the correct probability is 33 percent. In other words, typical individuals tend to ignore the low baseline probability for the event. The rarer the event, the more likely it is that a diagnosis that the event that has occurred will be a false positive. Bayes's rule is useful because it is a rational benchmark and makes precise predictions. However, people are unlikely to use Bayes's rule in real life because they tend to use "heuristics" or "rules of thumb" when making probabilistic judgments (see Chapter 4 for a further discussion of heuristics).

In the availability heuristic, investors estimate probability by the ease with which they can bring to mind similar instances or associations. Biases occur when "availability" and true frequency diverge. For example, Klibanoff, Lamont, and Wizman (1998) show that dramatic country-specific news affects the response of closed-end country fund prices to asset value. In a typical week, prices underreact to changes in fundamentals. In weeks where news of the particular country appears on the front page of the *New York Times*, prices react much more aggressively. The representativeness heuristic is based on mental stereotypes. Investors estimate the probability that event X belongs to set Y on the basis of how similar X is to the stereotype of Y. Here, biases occur by ignoring prior probabilities (base rates). The local representativeness heuristic suggests individuals expect random data to have no pattern, not only globally in the entire sequence, but also locally in each of its parts. The bias appears because a locally representative sequence may deviate systematically from chance and the investor detects spurious non-randomness. A classic example of this type of bias is the gambler's fallacy. Money pours into mutual funds that have recently beaten the average. Money moves toward stocks that have performed well and away from those that have done badly, encouraging short-term momentum.

The anchoring bias appears when investors make estimates starting from an initial value (anchor) that is adjusted to yield the final answer. The anchor may be implied by the formulation of the problem or may be irrelevant. The bias occurs when adjustment is insufficient or is too conservative. Baker, Pan, and Wurgler

(2009) show that offer prices in mergers and acquisitions are highly influenced by the target's 52-week high stock price. A number of bidders offer exactly this price, suggesting that bidders and targets use it as a reference point in negotiations. Bids that exceed the 52-week high discontinuously increase the probability of deal success. The overconfidence bias occurs when investors set their subjective confidence intervals too tightly. They are surprised too often. The optimism bias occurs when beliefs are biased in the optimistic direction. Optimists are often prone to an illusion of control. That is, they have an exaggerated sense of how much they control fate and underestimate the role of chance.

The optimism and overconfidence biases are likely to be especially important in financial markets. People who are overconfident in their investment abilities may be more likely to seek jobs as traders or to actively trade on their own account. Survivorship bias may also favor overconfidence. Traders who have been successful in the past may overestimate the degree to which they were responsible for their own successes and grow increasingly overconfident. Odean (1999) shows that investors trade excessively in the sense that their returns are, on average, reduced through trading. There are also significant gender differences. Men are more over-confident than women, and this hurts their returns. Barber and Odean (1999) document that men trade 45 percent more than women, thereby reducing their net returns by 2.65 percentage points a year as opposed to 1.72 percentage points for women. Overconfidence may also affect firm corporate policies. Malmendier and Tate (2005) classify overconfident managers based on their personal option exercise policies and document that the investment spending of firms managed by overconfident CEOs is more sensitive to internal cash flows. Malmendier and Tate (2008) show that overconfident CEOs are more likely to engage in acquisitions that are value-destroying. Deshmuk, Goel, and Howe (2009) argue that because overconfident CEOs are more confident that their firms are undervalued, they are reluctant to raise external funds. They show that the level of dividend payout is lower in firms managed by overconfident CEOs.

Next, consider limits on attention. For any one person to quickly and accurately process all public information would require infinite attention and cognitive ability. Human limits on attention are probably the root of the heuristics such as the availability heuristic in particular and possibly the local representativeness bias. Rashes (2001) examines the comovement between the stocks of MCI Communications (Nasdaq ticker: MCIC), a telecom giant with market capitalization around $20 billion, and Massmutual Corporate Investors (NYSE: MCI), a closed-end fund with around $200 million corporate bonds as assets during 1996 to 1997 when MCIC was in merger negotiations. Rashes finds a high comovement in both firms' returns, trading volume, and return volatility, especially around merger news days.

Limited attention has significant consequences for prices and portfolio allocation. Barber and Odean (2008) show a concentration of investor portfolio choice among attention-grabbing stocks such as those in the news. Huberman and Regev (2001) document that the publication of a Sunday *Times* news article on the potential of a new drug to cure cancer caused the price of the drug company to soar, even though the news had been reported in *Nature* several months earlier. Corwin and Coughenour (2008) find that specialists allocate effort only toward their most active stocks during periods of intense activity, resulting in high transaction costs and adverse liquidity effects for those stocks from which investors' attention is

withdrawn. Mola, Rau, and Khorana (2010) show that firms that lose all analyst coverage are significantly more likely to be delisted than similar firms matched on publicly available financial characteristics.

A consequence of limited attention is categorization. Investors tend to group similar but not identical assets together and evaluate/update their beliefs about this group categorically. This grouping has evolutionary benefits because it reduces complexity and facilitates the speed of information processing. Individuals can respond to category, rather than to each individual item. Investors do not learn about novel objects if those objects can effectively be grouped into pre-existing categories. They can use existing knowledge of items in the category to infer attributes. Barberis and Shleifer (2003) show that individuals do categorize—assets in the same style such as growth and value co-move too much, while assets in different styles co-move too little.

Categorization also has implications for firm behavior. If investors, for whatever reason, assign greater values to particular categories, firms make efforts to move into those categories. The clearest examples of such behavior appear in the area of name changes. Name changes are essentially meaningless from a finance perspective, conveying no information on the fundamental value $E[P^*]$ of the firm. According to Cooper, Dimitrov, and Rau (2001), firms that changed their names to Internet-related dot-com names earned CARs on the order of 74 percent for the 10 days surrounding the announcement, regardless of the firm's actual level of involvement with the Internet. Cooper, Khorana, Osobov, Patel, and Rau (2004) show that after the end of the Internet bubble, there was a dramatic reduction in the pace of dot-com additions, accompanied by a rapid increase in dot-com name deletions. After the bubble, investors reacted positively to name changes for firms that removed dot-com from their name, with firms earning CARs on the order of 64 percent for the 60 days surrounding the deletion announcement.

According to Cooper, Gulen, and Rau (2005), in the year after a mutual fund changes its name to reflect a current style, the fund experiences an average cumulative abnormal flow of 28 percent with no improvement in performance. The increase in flows is similar across funds whose holdings match the style implied by their new name and those whose holdings do not, suggesting that investors are "irrationally" influenced by cosmetics. Baker and Wurgler (2004) argue that these catering incentives also substantially affect corporate policy. Managers cater to investors by paying dividends when investors put a stock price premium on payers and by not paying dividends when investors prefer non-payers. Non-payers tend to initiate dividends when demand is high.

WHY DO THESE ANOMALIES PERSIST?

So far the evidence seems to indicate that investors are indeed irrational, and that their biases do not cancel each other. To show that markets are inefficient, the need exists to establish that arbitrageurs cannot restore the market to efficiency.

Scholes (1972, p. 179) argues that "the shares a firm sells are not unique works of art but abstract rights to an uncertain income stream for which close counterparts exist either directly or indirectly via combinations of assets of various kinds." Consequently, taking advantage of arbitrage opportunities should be easy. The arbitrageur buys an underpriced asset and gains the intermediate cash flows.

He or she is betting on high returns as he believes that $P \leq E[P^*]$. On the opposite side, the arbitrageur borrows the overpriced asset that he or she does not own, sells it, and eventually covers by repurchasing the asset and returning it to the lender. The arbitrageur loses the cash flows while betting on low returns under the belief that $P \geq E[P^*]$. If the arbitrage is correctly done, the two sets of intermediate cash flows should exactly offset each other. As Scholes describes, long-short arbitrage is easy and appealing. It requires no capital up front, gives a profit today, and is low-risk. Aggressive competition for such juicy trades, Scholes argues, should keep aggregate demand curves flat. Scholes estimates the slope of aggregate demand curve from the price reaction to large sales. He reports a high negative price elasticity of demand—if the price goes up by 1 percent (above $E[P^*]$), aggregate demand goes down by 3,000 percent. This nearly flat AD curve supported the EMH and led Scholes to conclude that long-short arbitrage was working in the background.

As noted above, recent evidence shows that shifts in investor demand (without news about $E[P^*]$) affects prices. Why are arbitrageurs not taking advantage of these opportunities? One reason is that it is not a straightforward process to identify the presence of an arbitrage opportunity. As an example, suppose Walmart (WMT) is quoted for £30 on the London Stock Exchange and for $49 on the New York Stock Exchange. Current exchange rates between the dollar and the pound are $1.67/1£. One share in New York could be bought for $49 and sold in London at $50 for a $1 profit. Executing these trades with 20,000 WMT shares earns a risk-free $20,000.

Whether this is really an arbitrage opportunity is unclear. In the profit calculations above, there is also a need to account for direct and indirect transaction costs. What is the commission due to the brokers? Is $51 the London bid price at which an investor can sell, and $50 the NYSE ask price at which the investor can buy? Could the share prices move when the investor wants to transact a large number of shares? Perhaps only the first 100 shares may be available for $49 for a net profit of $100. The next 900 shares may cost $49.50—still worthwhile, but less profitable. Purchasing the remaining 19,000 shares may cost $50 or more. Perhaps the price or exchange rate changes between the time the investor buys the shares in New York and the time he or she sells the shares in London. If such execution timing risk exists, this is not pure arbitrage because there is a chance of a negative outflow.

This example illustrates many of the considerations for real-world arbitrageurs. In general, arbitrageurs are less effective enforcers of EMH if the expected abnormal return (over the trading horizon) is low, the risk (over the trading horizon) is high, and arbitrageurs have short trading horizons.

The biggest risk an arbitrageur faces is noise-trader risk. If noise traders drive mispricing, then noise trading may get worse before it gets better. If the arbitrageur has a short horizon (for example, limited capital to meet margin calls or if he or she is a hedge fund manager with investors who do not understand that trade will eventually turn a profit), he or she may have to close a good trade when mispricing is greatest. DeLong, Shleifer, Summers, and Waldmann (1990) provide a formal model of how systematic noise-trader risk increases equilibrium-expected returns.

Froot and Dabora (1999) empirically study "Siamese twin" securities. These are securities with the same cash flow stream (no "fundamental" risk) but which sell

at different prices. One example of a Siamese twin company was Royal Dutch and Shell, with Royal Dutch incorporated in Netherlands and Shell in England. Royal Dutch trades mostly in the Netherlands/United States and Shell in the United Kingdom. Due to a 1907 merger agreement, all cash flows are effectively split 60:40. According to the EMH, the price of a share of Royal Dutch should be 1.5 times the price of a share of Shell. In real life, when the U.S. market moves up relative to the U.K. market, the price of Royal Dutch (which trades relatively more in New York) tends to rise relative to the price of its twin Shell (which trades relatively more in London). Similarly, when the dollar appreciates against the pound, the price of Royal Dutch tends to increase relative to that of Shell. Wurgler and Zhuravskaya (2002) show that stocks without close substitutes experience higher price jumps upon inclusion into the S&P 500 Index. They argue that arbitrage is weaker and mispricing is likely to be more frequent and more severe among stocks without close substitutes.

Limits to arbitrage explain why many anomalies continue to persist. Consider the B/M effect. If the B/M effect is really the correction of mispricing, then subsequent return predictability should be clearest in higher-arbitrage-risk stocks. Such stocks are, all else being equal, more likely to be mispriced (extreme B/M ratios are less likely to reflect unusual accounting value of book equity B and more likely to reflect unusual price M). There should be no relation under the EMH. Ali, Hwang, and Trombley (2003) find that the B/M effect is greater for stocks with higher idiosyncratic return volatility, higher transaction costs, and lower investor sophistication. The B/M effect for high-volatility stocks exceeds that of the low-volatility stocks in most years. Similarly, Mashruwala, Rajgopal, and Shevlin (2006) show that the accrual anomaly documented by Sloan (1996) is concentrated in firms with high idiosyncratic stock return volatility, making it risky for risk-averse arbitrageurs to take positions in stocks with extreme accruals. Mendenhall (2004) shows that the magnitude of the PEAD is strongly related to measures of arbitrage risk.

In addition to noise-trader risk, another source of risk is shorting costs. Many securities are impossible to short. In addition, while the risk of the lender recalling the stock loan after a price increase is low, the risk increases in the divergence of opinion among investors (D'Avolio, 2002).

This inability to short can lead to extreme price mismatches (Lamont and Thaler, 2003). One example involves 3Com, a profitable company selling computer network systems and services that owns Palm, which makes handheld computers. In March 2000, 3Com sold a fraction of its stake in Palm to the general public via an IPO for Palm. In this transaction, called an equity carve-out, 3Com retained ownership of 95 percent of the shares; 3Com shareholders would receive about 1.5 shares of Palm for every share of 3Com that they owned. Because 3Com held more than $10 a share in cash and securities in addition to its other profitable business assets, one might expect 3Com's price to be well above 1.5 times the price of Palm. The day before the Palm IPO, 3Com closed at $104.13 per share. After the first day of trading, Palm closed at $95.06 a share, implying that the price of 3Com should have jumped to at least $145. Instead, 3Com fell to $81.81. The "stub value" of 3Com (the implied value of 3Com's non-Palm assets and businesses) was $63. In other words, the stock market was saying that the value of 3Com's non-Palm business was –$22 billion.

SUMMARY AND CONCLUSIONS

For markets to be efficient, investors need to be rational. If they are not rational, their biases need to be uncorrelated. If their biases are correlated, rational arbitrageurs need to be able to take large offsetting trades to restore the market to efficiency. This chapter demonstrates that investor biases are systematic and predictable. However, in spite of this predictability, limits to arbitrage mean that arbitrageurs cannot take advantage of these biases and restore market efficiency. Noise-trader risk and limited arbitrage explain several anomalies in efficient markets.

DISCUSSION QUESTIONS

1. Why does market efficiency matter? Why is having "correctly" priced securities so important?
2. Consider the following trade. German government bond (bund) futures trade on the LIFFE (London) and DTB (Frankfort) exchanges. The futures contracts have identical terms involving the delivery of €250,000 face value bonds at time T. An investor observes that the LIFFE contract trades for €240,000 while the DTB contract trades for €245,000. Construct an arbitrage trade to take advantage of this. Is this perfect arbitrage? What are some of the risks involved?
3. A researcher has conducted an event study of all mergers that eventually fail. After the announcement date of the merger, the share price drops quite substantially over a period of several months until the merger eventually fails. Can investors take advantage of this finding to construct an arbitrage opportunity?

REFERENCES

Ali, Ashiq, Lee-Seok Hwang, and Mark A. Trombley. 2003. Arbitrage risk and the book-to-market anomaly. *Journal of Financial Economics* 69:2, 355–373.

Baker, Malcolm P., Xin Pan, and Jeffrey Wurgler. 2009. The psychology of pricing in mergers and acquisitions. Unpublished working paper, Harvard Business School.

Baker, Malcolm, and Jeffrey Wurgler. 2004. A catering theory of dividends. *Journal of Finance* 59:3, 1125–1165.

Ball, Ray, and Philip Brown. 1968. An empirical evaluation of accounting income numbers. *Journal of Accounting Research* 6:2, 159–178.

Banz, Rolf W. 1981. The relationship between returns and market value of common stocks. *Journal of Financial Economics* 9:1, 3–18.

Barber, Brad M., and Terrance Odean. 2001. Boys will be boys: Gender, overconfidence, and common stock investment. *Quarterly Journal of Economics* 116:1, 261–292.

Barber, Brad M., and Terrance Odean. 2008. All that glitters: The effect of attention and news on the buying behavior of individual and institutional investors. *Review of Financial Studies* 21:2, 785–818.

Barber, Brad M., Terrance Odean, and Ning Zhu. 2009. Systematic noise. *Journal of Financial Markets*, forthcoming.

Barberis, Nicholas, and Andrei Shleifer. 2003. Style investing. *Journal of Financial Economics* 68:2, 161–199.

Bernard, Victor, and Jacob Thomas. 1989. Post-earnings-announcement drift: Delayed price response or risk premium? *Journal of Accounting Research* 27:1, 1–36.

Brock, William, Josef Lakonishok, and Blake LeBaron. 1992. Simple technical trading rules and the stochastic properties of stock returns. *Journal of Finance* 47:5 1731–1764.

Brown, Stephen J., and Jerold B. Warner. 1980. Measuring security price performance. *Journal of Financial Economics* 8:3, 205–258.

Busse, Jeffrey A., and T. Clifton Green. 2002. Market efficiency in real time. *Journal of Financial Economics* 65:3, 415–437.

Cooper, Michael J., Orlin Dimitrov, and P. Raghavendra Rau. 2001. A rose.com by any other name. *Journal of Finance* 56:6, 2371–2388.

Cooper, Michael J., Huseyin Gulen, and P. Raghavendra Rau. 2005. Changing names with style: Mutual fund name changes and their effects on fund flows. *Journal of Finance* 60:6, 2825–2858.

Cooper, Michael J., Huseyin Gulen, and Michael J. Schill. 2008. Asset growth and the cross-section of stock returns. *Journal of Finance* 63:4, 1609–1651.

Cooper, Michael J., Ajay Khorana, Igor Osobov, Ajay Patel, and P. Raghavendra Rau. 2004. Managerial actions in response to a market downturn: Valuation effects of name changes in the dot.com decline. *Journal of Corporate Finance* 11:1-2, 319–335.

Cooper, Michael J., John J. McConnell, and Alexei V. Ovtchinnikov. 2006. The other January effect. *Journal of Financial Economics* 82:2, 315–341.

Corwin, Shane A., and Jay F. Coughenour. 2008. Limited attention and the allocation of effort in securities trading. *Journal of Finance* 63:6, 3031–3067.

Cutler, David M., James M. Poterba, and Lawrence H. Summers. 1989. What moves stock prices? *Journal of Portfolio Management* 15:3, 4–12.

Daniel, Kent, and Sheridan Titman. 1997. Evidence on the characteristics of cross sectional variation in stock returns. *Journal of Finance* 52:1, 1–33.

D'Avolio, Gene. 2002. The market for borrowing stock. *Journal of Financial Economics* 66:2-3, 271–306.

DeBondt, Werner F. M., and Richard Thaler. 1985. Does the stock market overreact? *Journal of Finance* 40:3, 793–808.

DeLong, J. Bradford, Andrei Shleifer, Lawrence H. Summers, and Robert J. Waldmann. 1990. Positive feedback investment strategies and destabilizing rational speculation. *Journal of Finance* 45:2, 379–395.

Deshmuk, Sanjay, Anand Goel, and Keith Howe. 2009. CEO overconfidence and dividend policy: Theory and evidence. Unpublished working paper, De Paul University.

Edmans, Alex, Diego Garcia, and Øyvind Norli. 2007. Sports sentiment and stock returns. *Journal of Finance* 62:4, 1967–1998.

Fama, Eugene F. 1970. Efficient capital markets: A review of theory and empirical work. *Journal of Finance* 25:2, 383–417.

Fama, Eugene F., Lawrence Fisher, Michael C. Jensen, and Richard Roll. 1969. The adjustment of stock prices to new information. *International Economic Review* 10:1, 1–21.

Fama, Eugene F., and Kenneth R. French. 1992. The cross-section of expected stock returns. *Journal of Finance* 47:2, 427–465.

French, Kenneth R. 1980. Stock returns and the weekend effect. *Journal of Financial Economics* 8:1, 55–69.

Froot, Kenneth A., and Emil Dabora. 1999. How are stock prices affected by the location of trade? *Journal of Financial Economics* 53:2, 189–216.

Hirshleifer, David A., and Tyler G. Shumway. 2003. Good day sunshine: Stock returns and the weather. *Journal of Finance* 58:3, 1009–1032.

Huberman, Gur, and Tomer Regev. 2001. Contagious speculation and a cure for cancer: A non-event that made stock prices soar. *Journal of Finance* 56:1, 387–396.

Ikenberry, David, Josef Lakonishok, and Theo Vermaelen. 1995. Market underreaction to open market share repurchases. *Journal of Financial Economics* 39:2-3, 181–208.

Jegadeesh, Narasimhan, and Sheridan Titman. 1993. Returns to buying winners and selling losers: Implications for stock market efficiency. *Journal of Finance* 48:1, 65–91.

Jensen, Michael C. 1968. The performance of mutual funds in the period 1945–1964. *Journal of Finance* 23:2, 389–416.
Kadiyala, Padma, and P. Raghavendra Rau. 2004. Investor reaction to corporate event announcements: Under-reaction or over-reaction? *Journal of Business* 77:2, 357–386.
Kamstra, Mark J., Lisa A. Kramer, and Maurice D. Levi. 2003. Winter blues: A SAD stock market cycle. *American Economic Review* 93:1, 324–343.
Klibanoff, Peter, Owen Lamont, and Thierry A. Wizman. 1998. Investor reaction to salient news in closed-end country funds. *Journal of Finance* 53:2, 673–699.
Lakonishok, Josef, Andrei Shleifer, and Robert W. Vishny. 1994. Contrarian investment, extrapolation, and risk. *Journal of Finance* 49:5, 1541–1578.
Lamont, Owen A., and Richard H. Thaler. 2003. Can the market add and subtract? Mispricing in tech stock carve-outs. *Journal of Political Economy* 111:2, 227–268.
Lo, Andrew W., Harry Mamaysky, and Jiang Wang. 2000. Foundations of technical analysis: Computational algorithms, statistical inference, and empirical implementation. *Journal of Finance* 55:4, 1705–1770.
Loughran, Tim, and Jay R. Ritter. 1995. The new issues puzzle. *Journal of Finance* 50:1, 23–51.
Loughran, Tim, and Anand M. Vijh. 1997. Do long-term shareholders benefit from corporate acquisitions? *Journal of Finance* 52:5, 1765–1790.
Malmendier, Ulrike, and Geoffrey Tate. 2005. CEO overconfidence and corporate investment. *Journal of Finance* 60:6, 2661–2700.
Malmendier, Ulrike, and Geoffrey Tate. 2008. Who makes acquisitions? CEO overconfidence and the market's reaction. *Journal of Financial Economics* 89:1, 20–43.
Mashruwala, Christina, Shivaram Rajgopal, and Terry Shevlin. 2006. Why is the accrual anomaly not arbitraged away? The role of idiosyncratic risk and transaction costs. *Journal of Accounting and Economics* 42:1-2, 3–33.
Mendenhall, Richard R. 2004. Arbitrage risk and post-earnings announcement drift. *Journal of Business* 77:4, 875–894.
McConnell, John J., and Wei Xu. 2008. Equity returns at the turn of the month. *Financial Analysts Journal* 64:2, 49–64.
Mola, Simona, P. Raghavendra Rau, and Ajay Khorana, 2010. Is there life after the end of analyst coverage? Unpublished working paper, Purdue University.
Myers, Stewart C., and Nicholas S. Majluf. 1984. Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics* 13:2, 187–221.
Neely, Christopher J., Paul A. Weller, and Joshua M. Ulrich. 2009. The adaptive markets hypothesis: Evidence from the foreign exchange market. *Journal of Financial and Quantitative Analysis* 44:2, 467–488.
Odean, Terrance. 1999. Do investors trade too much? *American Economic Review* 89:5, 1279–1298.
Rashes, Michael S. 2001. Massively confused investors making conspicuously ignorant choices (MCI-MCIC). *Journal of Finance* 56:5, 1911–1927.
Rau, P. Raghavendra, and Theo Vermaelen. 1998. Glamour, value and the post-acquisition performance of acquiring firms. *Journal of Financial Economics* 49:2, 223–253.
Reinganum, Marc R. 1983. The anomalous stock market behavior of small firms in January: Empirical tests for tax-loss selling effects. *Journal of Financial Economics*, 12:1, 89–104.
Ritter, Jay R. 1991. The long-run performance of initial public offerings. *Journal of Finance* 46:1, 3–27.
Roll, Richard. 1984. Orange juice and weather. *American Economic Review* 74:5, 861–880.
Santa-Clara, Pedro, and Rossen Valkanov. 2003. The presidential puzzle: Political cycles and the stock market. *Journal of Finance* 58:5, 1841–1872.
Scholes, Myron S. 1972. The market for securities: Substitution versus price pressure and the effects of information on share prices. *Journal of Business* 45:2, 179–211.

Seyhun, H. Nejat, 1988, The information content of aggregate insider trading. *Journal of Business* 61:1, 1–24.

Sloan, Richard G. 1996. Do stock prices fully reflect information in accruals and cash flows about future earnings? *Accounting Review* 71:3, 289–315.

Wurgler, Jeffrey, and Ekaterina V. Zhuravskaya. 2002. Does arbitrage flatten demand curves for stocks? *Journal of Business* 75:4, 583–608.

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CHAPTER 19

Belief- and Preference-Based Models

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INTRODUCTION

The neoclassical financial theory was based on various strong assumptions including decision makers' rationality, common risk aversion, perfect markets with no frictions such as transaction costs or taxes, and easy access to information for all market participants. Although many of the assumptions of neoclassical financial theory were unrealistic, financial economists initially accepted the theory because its predictions seemed to fit reality. Moreover, this complex and coherent neoclassical theory is replete with mathematical functions and equations that offered predictions of a normative character.

Any theory is only as good as its ability to explain or predict the processes actually taking place. However, various empirical studies in the 1980s and 1990s provided results that were at odds with the traditional perception of the capital market. In response to growing anomalies, behavioral finance emerged. Highly intuitive and convincing explanations referring to irrational behavior and psychological biases of investors have gained popularity among professionals and academics.

Yet, behavioral finance is affected by an ailment typical of relatively young and scarcely penetrated areas of knowledge. That is, a plethora of research carried out in an uncoordinated manner produced fragmentary outcomes that are difficult to unite in a comprehensive theory. Issues related to investors' behavior and the way it affects valuation of assets are complex. Thus, researchers face much difficulty in specifying all the factors and relationships that describe the phenomena taking place in the capital market. However, limiting attention to selected aspects of the market leads to behavioral models that appear fragmentary and designed only to fit selected peculiarities.

This chapter is intended to address those issues and fill in existing gaps. The first section presents early attempts of behavioral modeling based on beliefs and preferences of market participants. Some models cannot describe all phenomena observed empirically in the market. Each model does well with explaining some aspects but lacks the power to describe other peculiarities of market behavior. Next, the generalized behavioral model (GBM) of asset pricing is presented. The

model develops a generalized approach that can be applied to a broad array of phenomena observed in the market. The GBM identifies key categories of psychologically driven factors and describes how these factors might determine the pricing and returns-generating processes. The final section provides a summary and conclusions.

BELIEF-BASED MODELS

The early belief-based models are Barberis, Shleifer, and Vishny's (1998) model of investor sentiment; Daniel, Hirshleifer, and Subrahmanyam's (1998) model of overconfident informed traders; and Hong and Stein's (1999) model of contrasting fundamental investors and momentum traders.

The Model of Investor Sentiment

Barberis, Shleifer, and Vishny (1998) suggest a model where attitudes of investors correspond to two behavioral patterns found in the literature. According to the first pattern, investors are convinced that the profitability of each corporation has a tendency to fluctuate around a specific mean value. Hence, if the company reported a recent high profitability, deterioration of results should be expected during the coming period. In turn, the second pattern assumes the opposite—that there is a continuing trend with regard to the profitability of corporations.

An investor convinced of the validity of the first pattern will react unfavorably to financial reports in fear that a good/bad outcome for the last period is incidental and it may be eliminated during the subsequent period. Consequently, price adjustment to the new information is delayed, and returns may periodically continue to follow a trend. Barberis et al. (1998) associate such investor behaviors with cognitive conservatism documented by Edwards (1968) and others. People change their previous convictions in view of new information slowly and carefully. For any opinion to completely change, the original signal needs to be confirmed by consecutive observations, which usually takes time.

On the other hand, investors who follow the second pattern attach great importance to the latest results and excessively extrapolate them into the future. In this case, Barberis et al. (1998) associate this attitude with the phenomenon generally referred to by psychologists as the representativeness heuristic (Kahneman and Tversky, 1973; Tversky and Kahneman, 1974; Grether, 1980). Under the representativeness heuristic, the probability of a specific event is judged based on how closely it resembles the explicit characteristics of the sample, subjectively distinguished from the general population (see Chapter 14). As a result of representativeness heuristic error, the weight of individual characteristics that comply with a specific pattern will be overstated, and the significance of the actual statistical breakdown will be understated. Problems associated with the perception of representativeness of information signals result in premature conclusions based on too little observation (the so-called short series error) and in seeking regularities in completely random datasets.

Imagine a corporation that reported systematically growing profits over recent reporting periods. Perceiving this situation from the angle of the representativeness heuristic, investors may overstate the importance of the latest positive results.

They may rashly conclude that the positive dynamics of the company's latest results reflect a permanent change in its condition and justify high future growth potential. Meanwhile, good financial results during the last several periods may be nothing more than coincidence. As a result, the stock of that corporation may be overvalued and may correct when the expected future profit growth does not occur.

Investors in the Barberis et al. (1998) model are homogenous; that is, the model assumes that at a given time, all investors think alike. They either perceive financial results of companies in line with the first pattern, or are convinced that the second pattern is right. The authors suggest that investors are slightly more often convinced of the correctness of the first pattern, which usually results in underreaction to new information. However, a series of observations that indicate trend continuation will result in investor belief in the second pattern. That, in turn, will be valid until the traders realize that their trend extrapolation reached too far into the future. However, the change in investor belief will only happen as the result of several observations that differ from expectations. In other words, investors are "sentimental" about the pattern that they previously adopted as valid. Hence, they prolong the process of transition to the other pattern.

According to Barberis et al. (1998), the aforementioned mechanism, which is based on delayed changes in prevalence between the two alternative patterns of financial results perception, may explain the simultaneous occurrence of market underreaction in the short term and overreaction in the long term. Hence, the Model of Investor Sentiment suggests that trend reversals should always be observed in a long-term perspective.

Yet, the literature shows examples of both long-term reversals and long-term abnormal return continuations, that is, stock splits (Ikenberry, Rankine, and Stice, 1996), changes in dividend policy (Michaely, Thaler, and Womack, 1995), or cases of share buy-backs (Ikenberry, Lakonishok, and Vermaelen, 1995; Mitchell and Stafford, 2000). The investors' behavior pattern suggested by Barberis et al. (1998) is unable to explain such phenomena.

DHS Model

Daniel, Hirshleifer, and Subrahmanyam (1998) assume that investors can be divided into two categories: the informed and the underinformed. According to these authors, actions of underinformed traders have no significant impact on the market. Informed traders, however, may influence the market through their overconfidence. They overestimate their analytical abilities and understate their potential errors. Usually, their perceived margin of error is too narrow. In other words, investors often fall victim to the so-called calibration bias. That is, the more a person contributes personally to the analysis, the greater the error. People overestimate the precision and overstate the importance of private information as compared to the weight of the information available publicly. The results of one's own analyses are usually considered more reliable than the commonly available market information.

Investors often emphasize their contribution in achievement of a positive outcome even if it has only been achieved by accident. On the other hand, they underestimate events that do not agree with their previous conjectures and fail to notice their own mistakes. People try to attribute these failures to other factors.

If an investor assesses perspectives of a given company as positive and the assessment is subsequently confirmed by good financial results or higher stock quotes, the investor's confidence in his own skills will usually be reinforced. This happens regardless of whether the predictions are shown to be correct as a result of substantial analysis or simply by chance (e.g., as the result of other positive factors of which the investor could not have been previously aware).

In a reverse situation (i.e., if a given corporation does not measure up to expectations), investors will usually seek explanations other than self-error. The investor will usually point to independent factors or third parties that are either at fault or were misleading. Investors frequently fail to notice or underestimate the unfavorable signals that contradict the earlier private diagnosis. For example, the investor will think that he or she is experiencing a temporary turbulence that will soon pass and previous expectations will be restored. Only a compilation of multiple public contradictory signals, usually received over an extended period of time, may prevail over the original private signal and change the opinion of the investor.

Daniel et al. (1998) propose a model in which investor overconfidence results in overreaction to private information, whereas distortions related to incorrect attribution of events are responsible for underreaction to public signals. They show that such investor behavior may cause short-term continuations and long-term reversals in stock returns.

In this respect, the Daniel et al. (1998) model is similar to the Barberis et al. (1998) proposal. Contrary to the investor sentiment model that assumes investors overreact to a sequence of information signals of similar significance and underreact to new information contradicting the previous perception of reality, the Daniel et al. model differentiates between the overreaction and underreaction depending on whether information is private or public. In this way, Daniel et al. are not only able to explain short-term continuations and long-term reversals, but also the long-term continuations observed in some cases. Under this model, investors' reactions are incomplete when new information is first published because they attach more importance to their own previous assessment than to an individual public signal contradicting their private opinion. Their view changes only after receiving further public information. The duration of the continuation period depends on the pace of the build-up and the significance of the new public information.

Daniel et al.'s (1998) model anticipates that the continuation effect will occur as a consequence of all "selective events," that is, events temporarily motivated by incorrect valuation of the company. Meanwhile, the literature also contains examples of cases where the original reaction to the announced information is contrary to the later observed post-announcement long-term returns. One example concerns initial public offerings (IPOs). The Daniel et al. model has difficulties explaining this type of observation.

Hong and Stein's Model

Hong and Stein (1999) formulate a hypothesis that the market is composed of two categories of investors: (1) the supporters of fundamental analysis, who carefully follow the incoming information affecting the value of companies ("news watchers"); and (2) the momentum traders, who primarily attach importance to

the development of short-term price trends. Each group of investors is characterized by limited rationality, which, even though their average assessment of signals is correct, allows them to analyze only a specific subset of all information publicly available. The limitation of the news watchers results from the fact that they focus only on the information related to future perspectives and to the value of a given company, while completely ignoring the signals arising from historic price movements. Additionally, Hong and Stein assume that fundamental information is distributed among these investors gradually, which causes a certain delay in the reaction of the entire market. Momentum traders, in turn, only observe price movements and do not pay any attention to fundamental information.

Based on the aforementioned assumptions, Hong and Stein (1999) show that when the market is dominated by news watchers, prices adjust to the new information gradually, and the market reaction is usually slightly delayed. Gradual inclusion of fundamental information results in continuation of returns and the occurrence of a trend. This, in turn, is a signal to the momentum traders, who quickly eliminate the possible absence of adjustment to the fundamental news. They also bring the prices of assets to the proximity of their intrinsic values. Momentum traders are unaware of fundamentally justified levels as their knowledge comes only from observing stock prices and searching for trends. Hence, reaching the limits set by the fundamental signals will not constitute any barrier for the activity of the momentum traders. To the contrary, their actions are stimulated by increasingly clear price changes and will trigger overreaction of the market. The more stock prices diverge from their intrinsic value, the more the news watchers come into prominence. The growing mispricing will motivate news watchers to take action. At some point, activities of the news watchers will become so significant that the critical mass will be exceeded, and they will prevail over the activities of the momentum traders. A correction will occur, and the general direction of market price changes will reverse.

Similarly to the Barberis et al. (1998) and Daniel et al. (1998) models discussed above, the model proposed by Hong and Stein (1999) appropriately handles the explanation of short-term continuations and long-term reversals. As in the case of the other models, long-term post-announcement drift after selective events is a source of certain difficulty for this model. For example, return patterns after stock splits or changes in dividend policy contradict the model expectations. This is because such events are usually accompanied by price changes of the same direction long before the news announcement, upon the announcement, and during the post-announcement period.

PREFERENCE-BASED MODELS

Models of Shifting Risk Attitude

Barberis, Huang, and Santos (2001) propose a model drawn on three main ideas. First, investors care about fluctuations in the value of their financial wealth and not simply about the total level of consumption. Second, they are much more sensitive to reductions in their wealth than to increases (Kahneman and Tversky, 1979). Third, people are less risk averse after prior gains and more risk averse after prior losses (Thaler and Johnson, 1990).

A positive fundamental signal will generate a high stock return. This event lowers investors' risk aversion because any future losses may be cushioned by the prior gains. Therefore, investors apply a lower discount rate to the future dividend stream, giving stock prices an extra push upward. A similar mechanism holds for a bad fundamental signal. It generates a negative stock return, reducing prior gains or increasing prior losses. Investors become more risk averse than before and apply a higher discount rate, pushing prices still lower. One result of this effect is that stock returns are much more volatile than dividend changes. Normally, this pattern could be viewed as exhibiting market overreaction to initial good/bad news. In this case, stock returns are made up of two "justified" components: one due to fundamental signals and the other to a change in risk aversion.

Barberis et al. (2001) demonstrate that their model fits well with several empirical observations. Price-dividend ratios are inversely related to future stock returns. The returns are predictable in time series, weakly correlated with consumption, and have a high mean. The equity premium is justified because loss-averse investors require a high reward for holding a risky or excessively volatile asset.

Barberis et al. (2001) study an economy with a single risky asset. Their work is applicable to the capital market on the aggregated level. Barberis and Huang (2001) further elaborate the model and focus on firm-level returns. In a similar framework of loss aversion and shifting risk attitude depending on prior outcomes, they compare two economies that differ by a degree of narrow framing exhibited by investors: one in which investors are loss averse over the fluctuations of their overall stock portfolio (portfolio mental accounting), and another in which investors are loss averse over the fluctuations of individual stocks that they own (individual stock mental accounting). Returns in both views of narrow framing have a high mean, are excessively volatile, and are predictable in the time series using lagged variables. However, as an investor's decision frame broadens from stock to portfolio accounting, the behavior of individual stock returns changes considerably. The mean value falls, returns become less volatile and more correlated with each other, and the cross-section predictability disappears. Overall, the model assuming narrow framing at the level of individual stocks is more successful in explaining the actual data.

Although the Barberis et al. (2001) and Barberis and Huang (2001) models shed light on many empirical phenomena, they do not directly address cases of market underreaction. The additional return component resulting from a change in the applied discount rate may be associated with overreaction, leading to excess volatility. However, short-term underreaction could be incorporated into these models, assuming that shifts in attitude toward risk are delayed and the discount rate applied by investors changes only after considerable price movements. Under such circumstances, underreaction to fundamental signals may persist in short periods due, for example, to the disposition effect (see Chapter 10).

Probability Misperception Model

Dacey and Zielonka (2008) suggest a model in which some investors make two types of errors in their pursuit of subjective utility maximization. First, the errors may relate to incorrect initial estimation of the probability of events. Second, errors may also result from assigning incorrect weight to the estimated probability level

as provided by the weighing function in the prospect theory of Kahneman and Tversky (1979).

Dacey and Zielonka (2008) distinguish two categories of investors. The quasi-rational investors, who are in the majority, incorrectly estimate or wrongly transform the probability. Rational investors, who are in the minority, correctly assign probabilities. Importantly, this model also assumes that the preferences of both categories of investors are similar and may be described with a utility function from the prospect theory of Kahneman and Tversky (1979). All investors maximize the subjective utility in relation to the reference point, most often in the form of the purchase price of a given stock (for those who have already invested) or the level of the last price quote (for those who are only considering the purchase). What clearly differentiates investors is the probability values assigned to the potential changes in financial instrument prices. Actually, the differentiating factor is the investors' convictions about future returns that determine whether an investor decides to buy, hold, or sell the assets.

A simplification is made for the purposes of the model. Only two sets of circumstances may occur during a given period: a price growth by h value may occur with p probability, or the price may drop by the h value with the $(1 - p)$ probability. Hence, the model does not account for the multivariant scenarios of price development. It neither accounts for the situation where a high price growth may occur with low probability nor where a slight drop may occur with high probability. Moreover, the model assumes that the subsequent price change will not be higher than the absolute value of the change observed during the preceding period.

Their model does not permit defining critical probability values assigned to further directions of price changes, which will determine whether an investor continues the investment after a respective prior change. If, having earned profit during the preceding observation period, the investor estimates the chance of occurrence of another price growth as lower than the p_{GAIN} critical probability value, the investor will always decide to sell stock. In turn, if experiencing loss, the investor estimates the probability of the price growth at the level exceeding the p_{LOSS} critical value, the investor will always decide to continue the investment.

Dacey and Zielonka (2008) demonstrate that the p_{GAIN} critical value is higher than the p_{LOSS} critical value for both rational and quasi-rational investors. This results from the S-shaped value function, which, according to the assumptions of the model, is common for both categories of investors. The function is concave in the gains area ($v''(x) < 0$ for $x > 0$) and convex in the loss area ($v''(x) > 0$ for $x < 0$). Simultaneously, the weighting function typical for quasi-rational investors is responsible for understating the weight of relatively high probability values and for overstating the weight of relatively low probability values. Therefore, the critical probability values will be more extreme in the case of quasi-rational investors than in the case of the rational investors. The aforementioned relations may be described by the following inequality:

$$0 < \underset{QR}{p_{LOSS}} < \underset{R}{p_{LOSS}} < 0.5 < \underset{R}{p_{GAIN}} < \underset{QR}{p_{GAIN}} < 1 \tag{19.1}$$

where QR refers to quasi-rational and R to rational investors.

Applying the weighing and value function parameters empirically estimated by Gonzalez and Wu (1999), Dacey and Zielonka (2008) suggest that critical probability values are around 0.70 for decisions made after prior gains and about 0.35 for decisions made after prior losses. Hence, in order to decide to keep stocks after their price has grown, the investor must assess the probability of further gains as at least 70 percent. On the other hand, to continue the investment following a prior loss, the investor needs a much lower conviction about the probability of gain, that is, only at the level of about 35 percent.

At the level of individual investor decisions, the model of Dacey and Zielonka (2008) offers a good explanation of the disposition effect. The model enables precise definition of the effect applying probability and forecast price changes, instead of defining it in less distinctive time lapse–related terms. The existing literature often defines the disposition effect as an investor's tendency to sell profit-gaining stocks "too fast" and to keep the loss-generating items "too long" (Shefrin and Statman, 1985). Meanwhile, Dacey and Zielonka define the disposition effect as a tendency to sell a rising stock when the probability of further growth is higher than the critical value for rational investors, but this probability is estimated below the critical value within the quasi-rational group:

$$p_{\underset{R}{GAIN}} < p_{\underset{QR}{GAIN}} \tag{19.2}$$

The tendency to continue investments after losses occurs when the growth probability is lower than the critical value for rational traders, but higher than the critical value for quasi-rational traders, is also considered a symptom of the disposition effect:

$$p_{\underset{QR}{LOSS}} < p_{\underset{R}{LOSS}} \tag{19.3}$$

However, selling growth stocks if the probability of further growth is estimated below the critical value for rational investors $p_{\underset{R}{GAIN}}$ will not result from the disposition effect. Similarly, the tendency to continue an investment if the probability of further growth is higher than the critical value for rational investors $p_{\underset{R}{LOSS}}$ will not result from the disposition effect.

At the aggregated level, the model allows for the explanation of short-term return continuations, particularly negative ones. Assigning a relatively low probability to a future price growth after the original price drop will be sufficient for investors to decide to continue the investment. In the context of the overconfidence effect, psychology has documented unrealistic optimism and wishful thinking. Thus, one can easily imagine that at least in the beginning. investors usually do not trust negative information but rather continue hoping for future price growth. If such attitudes are pervasive, they will contribute to the limitation of the supply of dropping stocks and hence result in temporary overpricing. The overpricing will be gradually eliminated when the expected price reversal does not occur and investors start to assign an increasingly low probability to the realization of their wishful thinking. Consequently, investors will decide to sell stocks even with a loss.

The model's ability to explain short-term continuations of positive returns is slightly worse. This is because the model requires an additional assumption that the market is dominated by traders who simply believe in trend continuation. Having purchased stocks whose prices had been growing, supporters of the *momentum* strategy tend to assign high probability values to subsequent price growths. The high degree of conviction about further growth will trigger decisions to continue investments and thus will limit supply. This may act as a self-fulfilling prophecy and actually translate into further price growths.

Directly applying the model to short-term continuations and long-term reversals is impossible. To accomplish this would require determining how the model parameters, that is, the investors' evaluation of probability, change as a function of time.

GENERALIZED BEHAVIORAL ASSET PRICING MODEL

Assumptions of the Model

The starting point of the Generalized Behavioral Model (GBM) proposed by Szyszka (2009) is the assumption that fundamental value follows a random walk:

$$\tilde{F}_t = \tilde{F}_{t-1} + \tilde{\nu}_t \tag{19.4}$$

where $\tilde{\nu}_t$ is an independent random variable of zero average, related to an inflow of new information affecting the fundamental value. The randomness of the fundamental value arises from the nature of this process. The company's value changes as a consequence of the inflow of new information where the new information signal is one that cannot be predicted and is therefore random. An assumption is that fundamental value can be estimated, although only as an approximation. Even the efficient market price does not have to exactly reflect the fundamental value because, as Fama (1965, p. 36) notes, "... in a world of uncertainty, intrinsic values are not known exactly." Nonetheless, the efficient market price serves as the best approximation of fundamental values:

$$\tilde{P}_t = \tilde{F}_t + \tilde{\xi}_t \tag{19.5}$$

where P_t stands for the market price of an asset at the t moment and ξ_t is an independent zero-mean random variable.

Up to this point, the model is in unison with the neoclassical theory but the fundamental value and the price established in such a manner serve merely as a benchmark. Next, asset prices can at least temporarily be systematically detached from the fundamental values as a result of irrational investors' behavior. The model focuses on the deviations from the fundamental values and links them to psychological factors. Therefore, this behavioral model supplements rather than replaces the neoclassical asset pricing models. In line with such an understanding, security prices develop as follows:

$$\tilde{P}_t = \tilde{F}_t + \tilde{B}_t + \tilde{\xi}_t \tag{19.6}$$

where B_t stands for a mispricing caused by factors of behavioral origin. As by definition, $\tilde{P}_t > 0$, the maximum value of asset underpricing ($\tilde{B}_t < 0$) can be no higher than the fundamental value minus the residual component:

$$-\tilde{B}_t < \tilde{F}_t + \tilde{\xi}_t \tag{19.7}$$

The maximum value of asset overpricing ($\tilde{B}_t > 0$) is theoretically unlimited.

Two categories of investors are assumed to be present in the market: (1) rational traders in the sense of the neoclassical theory and (2) irrational ones who are subject to psychologically driven heuristics and biases. These two investor categories coexist in the market at all times. Despite the errors made, irrational investors are not eliminated from the market over time. They do not tend to steadily lose capital to the benefit of rational investors. This is because a behavioral mispricing is another random variable that is not taken into account by the neoclassical theory, which rational investors use. Also, rational investors only have at their disposal imperfect tools that are incongruent with actual market conditions. Hence, such investors make decisions that are, at best, suboptimal. Errors made by irrational investors do not necessarily imply that they should generate worse investment results than rational traders.

What elements make up the behavioral mispricing? An in-depth analysis of the literature on cognitive psychology as well as the existing body of work on behavioral finance, summarized by Szyszka (2007), provides a basis for distinguishing among the three crucial categories of errors made by irrational investors. The combined impact of these errors is partially alleviated by the activities of rational arbitrageurs. For this reason, the model contains a measure to account for the market's ability to self-correct.

Therefore, the deviations from fundamental value occurring in the market at any t moment are a random variable, which can be described with the following equation:

$$\tilde{B}_t = (\tilde{\varepsilon}_1(x_t) + \tilde{\varepsilon}_2(x_t) + \tilde{\varepsilon}_3(x_t)) \cdot (1 - A) \tag{19.8}$$

where in reaction to a random event x_t at a moment t:

$\tilde{\varepsilon}_1$ is a random variable resulting from aggregate errors in the processing of information,

$\tilde{\varepsilon}_2$ is a random variable resulting from aggregate representativeness errors,

$\tilde{\varepsilon}_3$ is a random variable resulting from the biases in investor preferences, and

$A \in [0,1]$ is a measure of the market's ability to self-correct.

The process of asset pricing can be thus described in the form of the following GBM originating from equations (19.6) and (19.8):

$$\tilde{P}_t = \tilde{F}_t + (\tilde{\varepsilon}_1(x_t) + \tilde{\varepsilon}_2(x_t) + \tilde{\varepsilon}_3(x_t)) \cdot (1 - A) + \tilde{\xi}_t \tag{19.9}$$

At any t moment, there are N investors active on the market. The $\tilde{\varepsilon}_1$, $\tilde{\varepsilon}_2$, and $\tilde{\varepsilon}_3$ values depend on the value and direction of individual errors committed at a given moment by market participants and also on the relative wealth held by them. If w_n stands for the share of the value of the W_n portfolio held by an n investor in the total value of the market portfolio

$W_m = \sum_n W_n$, that is, $w_n = \frac{W_n}{\sum_n W_n}$, then:

$$\tilde{\varepsilon}_1(x_t) = \sum_n w_n \tilde{\varepsilon}_{1_n}(x_t) \tag{19.10}$$

$$\tilde{\varepsilon}_2(x_t) = \sum_n w_n \tilde{\varepsilon}_{2_n}(x_t) \tag{19.11}$$

$$\tilde{\varepsilon}_3(x_t) = \sum_n w_n \tilde{\varepsilon}_{3_n}(x_t) \tag{19.12}$$

If all investors were rational, the $\tilde{\varepsilon}_1$, $\tilde{\varepsilon}_2$, and $\tilde{\varepsilon}_3$ values would be zero. A similar result would be attained if investors committed errors only at an individual level, which, on an aggregate basis, would be mutually neutralized given the opposite directions of the errors. In such cases the market would be efficient in the informational sense. Remember, though, that one of the central themes of behavioral finance is the assumption that investors are not rational and that the errors they commit are systematic in nature and are not mutually neutralized. Hence, the probability that at a given t moment, individual investor errors do not occur or are mutually neutralized should be deemed close to zero:

$$P\left(\tilde{\varepsilon}_1(x_t) = \sum_n w_n \varepsilon_{1_n}(x_t) = 0\right) \approx 0 \tag{19.13}$$

$$P\left(\tilde{\varepsilon}_2(x_t) = \sum_n w_n \varepsilon_{2_n}(x_t) = 0\right) \approx 0 \tag{19.14}$$

$$P\left(\tilde{\varepsilon}_3(x_t) = \sum_n w_n \varepsilon_{3_n}(x_t) = 0\right) \approx 0 \tag{19.15}$$

The more homogenous the behavior of irrational investors (by cognitive error), the larger is their share in the total market portfolio and the more prominent a role they play. Stated differently, herding based on a cognitive error can drive the process from fundamental value.

The aggregated $\tilde{\varepsilon}_1$, $\tilde{\varepsilon}_2$, and $\tilde{\varepsilon}_3$ values may exert a concurrent impact in the same or opposite directions. The ultimate value of mispricing is the result of the intensity and direction of the impact of the individual components at a given t moment. In addition, the ultimate scale of the mispricing depends on the market's ability to immediately self-correct, which is measured with the A measure.

Factors affecting the value of the $\tilde{\varepsilon}_1$, $\tilde{\varepsilon}_2$, and $\tilde{\varepsilon}_3$ errors are discussed below. This discussion demonstrates the situations in which psychological biases are

prominent and the way in which they can distort correct asset pricing. The factors influencing the market's ability to self-correct are also discussed.

Errors in Information Processing

Errors in the processing of information (the impact of which is measured with the $\tilde{\varepsilon}_1$ value) sometimes lead to underreaction and at other times contribute to market overreaction. Insufficient response to new positive information or overreaction to bad news results in asset underpricing ($\tilde{\varepsilon}_1 < 0$). Conversely, overreaction to positive signals or underreaction to bad news contributes to asset overpricing ($\tilde{\varepsilon}_1 > 0$). Possible underreaction and overreaction are not mutually exclusive. Investors can underreact to a given type of information while at the same time overreacting to other news. The $\tilde{\varepsilon}_1$ value is a result of both underreaction and overreaction to the news of fundamental nature.

Among the key psychological phenomena that may cause market underreaction are anchoring to the existing price levels (Tversky and Kahneman, 1974), cognitive conservatism toward new explicit information signals (Edwards, 1968), and a confirmation effect. The confirmation effect is a subconscious search for information to confirm the hypothesis previously assumed while at the same time avoiding any confrontation of facts that could be contrary to the opinion so far expressed (Wason, 1966; Lord, Ross, and Lepper, 1979). The more contrary the new information is to earlier expectations and beliefs of investors, the greater the market underreaction.

Investors tend to display unrealistic optimism (Olsen, 1997; Montgomery, 1997; Barberis and Thaler, 2003) and wishful thinking (Buehler, Griffin, and Ross, 2002). Additionally, there is a strong loss aversion among investors resulting in reluctance to close out positions at a loss (Kahneman and Tversky, 1979). These behavioral heuristics suggest that market underreaction may occur particularly in the face of negative information.

The accuracy, quality, and manner of presentation of information are also of considerable importance for the $\tilde{\varepsilon}_1$ value. Precise signals of a high degree of reliability, yet not presented in a clear or comprehensive way (e.g., numerically) requiring additional interpretation, usually induce a delayed market response.

On the other hand, market overreaction can stem from such behavioral heuristics as the availability bias (Tversky and Kahneman, 1973; Taylor, 1982), overconfidence accompanied with the calibration effect (Lichtenstein, Fischhoff, and Phillips, 1982; Yates, 1990; De Bondt, 1998), and also the illusion of truth (Reber and Schwarz, 1999). When judging the probability of an event, people often search their memories for relevant information. However, not all memories are equally "available." More recent and salient events will weigh most heavily and can produce biased estimates. Through overconfidence and calibration bias, people underestimate the probability of being wrong and assign too narrow confidence intervals. Events they think are certain sometimes do not occur, and things they deem impossible may actually happen. Illusion of truth is another bias that distorts the cognitive process in such a way that the human mind more often accepts information presented in a simple manner and rejects information that is harder to interpret, disregarding if the actual content of information is actually true or false.

Unrealistic optimism and wishful thinking lead to a situation where market overreaction is more frequently seen in the case of positive signals. Investors also usually overreact to news presented in a descriptive manner and widely publicized in mass media, even if such information has not been fully verified and confirmed (e.g., rumor, discussions in the media, and comments by analysts). Problems with a verification of the actual quality of such communication tend to make people overrate its accuracy and attach excessive importance thereto.

Representativeness Errors

Among representativeness errors, two phenomena—the short series problem and the so-called gambler's fallacy—exert the largest impact on asset pricing. Each phenomenon has the opposite impact on the stock market.

The short series effect takes place when an investor draws premature conclusions based on limited observations and thus establishes ill-founded rules or regularities. Psychological surveys show that such situations take place when decision makers do not know the rules that underpin the generation of successive observations (Bar-Hillel, 1982; Gilovich, Vallone, and Tversky, 1985; Shefrin, 2000). On the other hand, if the distribution of a random process is well known, underestimation of the importance of the sample size may lead to the so-called gambler's fallacy: an unjustified belief that even in small samples the number of outcomes should be in line with the probability distribution.

In the capital market, a short series effect leads to attempts to discover any regularity in random sequences of price changes. Some traders may interpret a totally random, relatively short series of rises and falls in price as initiating a new and continuing trend. As surveys carried out by Shefrin (2000) and Szyszka (2007) show, the expectation that a trend should continue is stronger among individual investors. An excessive extrapolation of the growth trend will result in the overpricing of assets ($\tilde{\varepsilon}_2 > 0$), whereas a persistent downturn may lead to asset underpricing ($\tilde{\varepsilon}_2 < 0$). Because people tend to be excessively optimistic, the deviation from fundamental value will presumably be stronger in the growth trend.

The surveys by Shefrin (2000) and Szyszka (2007) also point to a different behavior of professional market participants. Because professionals are better acquainted with the actual rules affecting asset pricing, such investors often fall victim to the so-called gambler's fallacy. These traders underestimate the possibility of a periodical continuation of returns on a random basis, for example in response to sequentially occurring fundamental news of similar impact on prices. As a result, they too quickly consider such a situation to be a manifestation of market overreaction and expect a price correction too early. If such expectations translate into the corresponding activity of professional traders, it would contribute to an incomplete reflection of the news in the prices. Underreaction to good news reduces the $\tilde{\varepsilon}_2$ value, whereas insufficient response to unfavorable signals makes this variable increase.

The ultimate impact of representativeness errors on asset pricing, measured with the $\tilde{\varepsilon}_2$ value at any t moment, is therefore a result of the activities of traders expecting a continuation and of traders betting on the trend reversal. Shefrin's (2000) observations suggest that the $\tilde{\varepsilon}_2$ value may be linked to the measure of

impact of irrational individual investors relative to the activity of professional investors at a particular t moment.

Preferences

Among symptoms of irrational development of preferences, one that is central to the possible mispricing of securities is investor behavior as outlined in Kahneman and Tversky's (1979) prospect theory (see Chapter 11). While evaluating investment alternatives, traders often focus not on the aggregate final values but primarily on changes in the value of their investment from a particular reference point. These reference points are, for example, the asset purchase price, comparison with the investment performance of other traders, or a particular market benchmark. If a comparison of their situation with the chosen reference point is favorable, a trader tends to display aversion to risk. Conversely, if the investor sees his or her position as worse than the reference point, the investor becomes strongly motivated to change this situation. An option may be to take more risk, provided the investor believes the final loss could ultimately be avoided, limited, or at least delayed. Satisfaction with potential gains and the pain of losses are not symmetrical. Finding oneself below the reference point is, as a rule, more painful than a possible satisfaction with being above it. In other words, investors dislike losses much more than they desire gains.

The higher the degree of risk aversion, the more valuable an investment is above the reference point. Therefore, a common presumption about assets that have recently increased by a substantial amount in price (e.g., as a result of new positive fundamental information) is that investors will try to secure the gains and begin closing out the positions. Any additional supply generated by the investors who decided to sell at a profit will lead to an underreaction to the good fundamental news and temporary underpricing ($\tilde{\varepsilon}_3 < 0$).

However, from the point of view of the investors who find themselves above the reference point, a weaker-than-expected price reaction to the good news does not necessarily imply underpricing. Alternatively, the degree of risk aversion in this group of investors increased, and now they demand higher expected returns (risk premium). Consequently, these investors discount with a higher discount rate that reduces the stock's appreciation despite the incoming good news.

In the case of assets whose prices declined, for example, as a result of new bad fundamental information coming to the market, the situation is different. The investors who held such assets would have to incur a definitive loss when selling. A strong dislike for selling at a loss, accompanied by a hope that the losses are only temporary and will be recouped soon, encourages traders to take further risk and to hold the positions. This results in a limited supply of stock. This situation leads to a weaker-than-expected price reaction to the initially unfavorable fundamental news. As a result, a temporary overpricing of assets ($\tilde{\varepsilon}_3 > 0$) takes place in the market.

In the group of investors who find themselves below the reference point, the degree of risk aversion declines and can even transform into an inclination to take risk. In such a case, one often speaks about loss aversion rather than risk aversion. Those investors who want to avoid selling at a definitive loss now demand lower

expected returns. Hence, they apply lower discount rates in company valuation. From their point of view, the objectively too weak market reaction to unfavorable news does not have to imply that the current asset prices are overestimates.

The scale of temporary overpricing of assets in decline is much larger than that of underpricing of assets whose prices have gone up. This stems from the fact that investors dislike losses much more than they desire gains. Reduction of the risk aversion as a consequence of finding oneself below the reference point will be stronger than the increase of risk aversion when one considers oneself to be above the reference point. This is corroborated by empirical findings demonstrating a more prominent post-announcement drift in response to adverse events (Szyszka, 2002) or a higher profitability of short positions in investment portfolios created according to the momentum strategy (Jegadeesh and Titman, 2002).

Market Ability to Self-correct

A key premise underlying the market efficiency hypothesis is that investors who behave irrationally and affect prices will still be confronted with rational investors who use arbitrage to wipe out the mispricing effect almost immediately. Behavioral finance does not call into question the arbitrage mechanism itself or its favorable impact on the correct pricing of assets. Yet, it points out various limitations that may stop rational arbitrageurs from taking immediate actions to correct prices.

The most important limits to arbitrage include fundamental risk, noise-trader risk (De Long, Shleifer, Summers, and Waldmann, 1990, 1991; Shleifer and Summers, 1990), synchronization risk (Abreu and Brunnermeier, 2002), as well as implementation costs and institutional or regulatory barriers (Shleifer and Vishny, 1997).

The larger the mispricing at a given t moment, representing the total of $\tilde{\varepsilon}_1$, $\tilde{\varepsilon}_2$, and $\tilde{\varepsilon}_3$, the larger the potential tendency on the part of rational arbitrageurs to engage in activities that bring prices to fundamental values. However, the limits of arbitrage mentioned above inhibit such a tendency. Therefore, the value A in equations (19.8) and (19.9) is the result of the value of mispricing (the total of the $\tilde{\varepsilon}_1$, $\tilde{\varepsilon}_2$, and $\tilde{\varepsilon}_3$ values) and the obstacles faced by rational traders who do not exploit or do not fully exploit the opportunities offered by the mispricing.

Thus, the A value is a measure of the market's ability to self-correct and can even be treated as a measure of the market efficiency. $A = 0$ means that at a particular t moment, the self-regulation mechanism is not working and the price deviates from the fundamentals by a value resulting from behavioral errors B. In turn, $A = 1$ reflects the market's full ability to immediately eliminate the impact of irrational factors. This relationship suggests that the larger the market's self-regulation ability ($A \to 1$), the less the impact of behavior-driven errors ($B_t \to 0$) on asset pricing.

Self-correction is possible mostly when the arbitrage mechanism works efficiently. This is fostered by a well-developed capital market where numerous companies from each sector of the economy are listed and short selling is easy. In addition, the development of derivatives markets is important so as to enable the creation of adequate structures that can serve as a substitute for the underlying instrument. Further, the market needs a large number of professional traders who are financially strong and not bound by too many restrictions in applying arbitrage

strategies. Using a longer time horizon to evaluate asset managers should encourage them to exploit the opportunities offered by mispricing. They will have more time to wait for the prices to return to the fundamental values should the activities of irrational noise traders intensify. The reduction of transaction costs, especially the costs of holding short positions, should also foster increased informational efficiency of the market.

Mispricing and Returns from Investment

The return R_i on investment i over the period $(t-1, t)$ results from the change of the price P of the asset and from possible payments to the holder D (e.g., of dividends) in the period concerned. The logarithmic return is thus defined as follows:

$$R_i = \ln\left(\frac{P_t + D_t}{P_{t-1}}\right) \tag{19.16}$$

whereas the arithmetic return is:

$$R_i = \frac{P_t - P_{t-1} + D_t}{P_{t-1}} \tag{19.17}$$

For this discussion, assume that the investment does not generate any periodic payments, meaning $D = 0$.

In an efficient market, the rate of return results from the change in the fundamental value F of the asset. A change in the residual component ξ, which is random in nature with an expected value of zero, can also affect the rate of return. However, given the negligible importance of the ξ parameter, it will be disregarded further in this discussion. Behavioral finance argues that asset prices may deviate from fundamental values as a consequence of systematic cognitive errors of some market participants. In such a case, the return on the investment i in the period $(t - 1, t)$ depends not only on the change in the fundamental value F, but also on the change in the value of the mispricing, B. Substituting equation (19.6) into equations (19.16) and (19.17) results in the following:

$$R_i = \ln\left(\frac{F_t + B_t}{F_{t-1} + B_{t-1}}\right) \tag{19.18}$$

or using the definition of the arithmetic return:

$$R_i = \frac{F_t + B_t - F_{t-1} + B_{t-1}}{F_{t-1} + B_{t-1}}. \tag{19.19}$$

Define b as a relative measure of the mispricing:

$$b_t = \frac{B_t}{F_t} \tag{19.20}$$

The higher the absolute value of b, the larger the importance of behavioral errors relative to the fundamental value in a development of the current market price. A change in the relative value of b should be interpreted in various ways depending on whether there is overpricing or underpricing. In the event that $B > 0$, an increase in the value of measure b on a period-to-period basis will mean that the asset is increasingly overpriced. In the case of underpricing, meaning $B < 0$, the increase in the relative value of b (namely, in this case a decline in the absolute value) can be interpreted as an improvement in the quality of pricing.

Using the measure b introduced here, convert equation (19.18) as follows:

$$R_i = \ln\left(\frac{F_t + b_t F_t}{F_{t-1} + b_{t-1} F_{t-1}}\right) = \ln\left(\frac{F_t \cdot (1 + b_t)}{F_{t-1} \cdot (1 + b_{t-1})}\right) \tag{19.21}$$

Using the properties of the logarithmic function, it follows that:

$$R_i = \ln\left(\frac{F_t}{F_{t-1}}\right) + \ln\left(\frac{1 + b_t}{1 + b_{t-1}}\right) \tag{19.22}$$

The first element of the above equation represents the return in the efficient market:

$$R_{i,efficient} = \ln\left(\frac{F_t}{F_{t-1}}\right) \tag{19.23}$$

The second element relates to a possible change in the relative value of the mispricing in the period $(t - 1, t)$.

$$R_{i,behavioral} = \ln\left(\frac{1 + b_t}{1 + b_{t-1}}\right) \tag{19.24}$$

It follows from condition (7) and definition (20) that $b_t > -1$ for each t. Hence the argument of the logarithmic function (24) will always be positive.

Using definition (20), the components of the return in arithmetical terms can be found:

$$\begin{aligned} R_i &= \frac{F_t + b_t F_t - F_{t-1} + b_{t-1} F_{t-1}}{F_{t-1} + b_{t-1} F_{t-1}} = \frac{F_t(1 + b_t) - F_{t-1}(1 + b_{t-1})}{F_{t-1}(1 + b_{t-1})} \\ &= \frac{F_t}{F_{t-1}} \cdot \frac{(1 + b_t)}{(1 + b_{t-1})} - 1 \end{aligned} \tag{19.25}$$

It follows from the definition of the arithmetic return that in the efficient market conditions:

$$R_{i,efficient} = \frac{F_t}{F_{t-1}} - 1 \tag{19.26}$$

Hence, substituting (26) into (25), results in:

$$R_i = \left(1 + R_{i,efficient}\right) \frac{(1 + b_t)}{(1 + b_{t-1})} - 1 = \left(1 + R_{i,efficient}\right) \frac{1 + b_{t-1} + b_t - b_{t-1}}{1 + b_{t-1}} - 1$$
$$= \left(1 + R_{i,efficient}\right) \left(1 + \frac{b_t - b_{t-1}}{1 + b_{t-1}}\right) - 1 \tag{19.27}$$

Thus, the behavioral component of the arithmetic return is:

$$R_{i,behavioral} = \frac{b_t - b_{t-1}}{1 + b_{t-1}} \tag{19.28}$$

$$R_i = \left(1 + R_{i,efficient}\right)\left(1 + R_{i,behavioral}\right) - 1 \tag{19.29}$$

Irrespective of using logarithmic or arithmetic return definitions, both make common observations on the impact of behavioral factors on those returns. First, if the market is efficient and behavioral elements do not affect asset prices at all, meaning that at the beginning of the period (i.e., at the $t-1$ moment) and at the end of the period (i.e., at the t moment), the assets are priced correctly ($B_{t-1} = B_t = 0$), then also $b_{t-1} = b_t = 0$. As a result, the value of equations (19.24) and (19.28) is zero. Second, if the value of the mispricing is other than zero ($B_t \neq 0$), but the mispricing value B changes proportionately to changes in the fundamental value F (the relative mispricing as compared with the fundamental value is constant), the returns observed will be the same as in the case when the market is efficient. The value $R_{i,behavioral}$ is in such a situation zero both for the logarithmic and the algorithmic definition of the return and $R_i = R_{i,effcient}$. If the value of measure b increases ($\Delta b > 0$), then $R_{i,behavioral} > 0$ and then the return R_i on the asset is higher than one that would result merely from the change in the fundamental value of the underlying instrument. Such a situation may take place where the overpricing trend increases or possibly when the previous underpricing decreases. An opposite situation occurs when the value of measure b declines ($\Delta b < 0$). Then, the rate of return will be lower than the change in the fundamental value. This is possible when the scale of the previous overpricing relatively decreases or when the instrument becomes increasingly underpriced.

Summary of the GBM Predictions

The GBM assumes that the level of asset prices is affected by fundamental value and three behavioral variables resulting from errors in the processing of informational signals, representativeness errors, and unstable preferences. Errors made by investors may result in considerable deviations from the fundamental value, thus leading to a temporary overpricing or underpricing of assets. The ultimate scale of mispricing depends on the market's ability to self-correct. This ability is measured by the measure A introduced to the model. The model presents factors influencing the value of random variables representing these error categories.

The psychological factors specified in the GBM can induce distortion in asset pricing and influence returns, the latter being made up of two elements: the rational ($R_{i,efficient}$) and the behavioral ($R_{i,behavioral}$). Gradual escalation or reduction of the behavioral error B may result in continuations or reversals of returns. A continuation of gains does not necessarily follow from the initial market underreaction. Likewise, any reversal does not necessarily result from the previous market overreaction. In addition, the positive (negative) value of the behavioral element ($R_{i,behavioral}$) does not have to explicitly mean that the asset is overpriced (underpriced).

The GBM is capable of describing not only continuations and reversals of returns but also other market anomalies. Fluctuations in the intensity of the behavioral error B may be responsible for an excessive volatility of asset prices. Temporary intensification of behavioral factors can explain calendar anomalies. Dispersion in the intensity of errors among different markets or assets can be responsible for the manifestations of a violation of the law of one price and the existence of potential unexploited arbitrage opportunities. Finally, varied intensity of behavioral factors with respect to various asset classes results in different levels of returns for the particular categories of companies (e.g., the firm size effect and the book-to-market value effect).

Fluctuations of the behavioral error B may be seen as an additional factor of systematic risk. In this context, rational investors should demand an increased risk premium on investment in certain classes of assets that are particularly susceptible to irrational traders. A gradual escalation of behavioral errors may lead to an increase in returns expected by rational investors as compensation for the growing unpredictability of the market and may thus reduce the asset's fundamental value. The discrepancy between the behavioral and the rational valuation will escalate until the impact of irrational factors lessens or is outweighed by the market's ability to self-correct. In this way the GBM explains various market manias and temporary investment fads as well as their subsequent corrections.

SUMMARY AND CONCLUSIONS

Early preference- and belief-based models are successful in describing some market phenomena but lack power regarding some other peculiarities. The GBM offers an explanation for a vast array of market anomalies. However, it is characterized by a high level of generality. This is a necessary compromise in order to arrive at a comprehensive model of complex human behaviors that influence asset pricing in a multidirectional and multilevel manner.

The GBM model is descriptive rather than normative in character. It quantifies the relationships between psychological factors, investor behavior, and valuation of assets. The model can be used to describe processes and to explain events *ex post*, but it is not directly applicable for pricing and precise *ex ante* predictions. This is a general ailment of behavioral models, particularly when compared to neoclassical theory that usually offers normative predictions. In this sense neoclassical and behavioral finance might be seen as complementing each other. The neoclassical model delivers a kind of benchmark on how markets should behave while the behavioral model explains why empirical findings differ from neoclassical predictions.

DISCUSSION QUESTIONS

1. Compare the behavioral finance versus neoclassical finance approaches to capital market modeling.
2. What are the main assumptions, successes, and limitations of belief-based models?
3. Explain how errors in information processing may influence asset prices.
4. What are two major categories of representativeness errors, and what impact do they have on investor behavior?
5. What market phenomena may be caused by unstable preferences of investors?

REFERENCES

Abreu, Dilip, and Markus K. Brunnermeier. 2002. Synchronization risk and delayed arbitrage. *Journal of Financial Economics* 66:2–3, 341–60.

Barberis, Nicholas, and Ming Huang. 2001. Mental accounting, loss aversion, and individual stock returns. *Journal of Finance* 56:4, 1247–92.

Barberis, Nicholas, Ming Huang, and Tano Santos. 2001. Prospect theory and asset prices. *Quarterly Journal of Economics* 116:1, 1–53.

Barberis, Nicholas, Andrei Shleifer, and Robert Vishny. 1998. A model of investor sentiment. *Journal of Financial Economics* 49:3, 307–43.

Barberis, Nicholas, and Richard Thaler. 2003. A survey of behavioral finance. In *Handbook of the economics of finance (eds.)* George M. Constantinides, Milton Harris, and René M. Stulz, Volume 1B, 1051–121. Amsterdam: North-Holland.

Bar-Hillel, Maya. 1982. Studies of representativeness. In *Judgment under uncertainty: Heuristics and biases*, (eds.) Daniel Kahneman, Paul Slovic, and Amos Tversky, 69–83. Cambridge: Cambridge University Press.

Buehler, Roger, David Griffin, and Michael Ross. 2002. Inside the planning fallacy: The causes and consequences of optimistic time predictions. In *Heuristics and biases: The psychology of intuitive judgment*, (eds.) Thomas Gilovich, Dale Griffin, Daniel Kahneman, 250–70. Cambridge: Cambridge University Press.

Dacey, Raymond, and Piotr Zielonka. 2008. A detailed prospect theory explanation of the disposition effect. *Journal of Behavioral Finance* 9:1, 43–50.

Daniel, Kent, David Hirshleifer, and Avanidhar Subrahmanyam. 1998. Investor psychology and security market under- and overreactions. *Journal of Finance* 53:6, 1839–85.

De Bondt, Werner F. M. 1998. A portrait of the individual investor. *European Economic Review* 42:3-5, 831–44.

De Long, Bradford J., Andrei Shleifer, Lawrence H. Summers, and Robert J. Waldmann. 1990. Noise trader risk in financial markets. *Journal of Political Economy* 98:4, 703–38.

De Long, Bradford J., Andrei Shleifer, Lawrence H. Summers, and Robert J. Waldmann. 1991. The survival of noise traders in financial markets. *Journal of Business* 64:1, 1–19.

Edwards, Ward. 1968. Conservatism in human information processing. In *Formal representation of human judgment*, (ed.) Benjamin Klienmuntz, 17–52. New York: John Wiley & Sons, Inc.

Fama, Eugene F. 1965. The behavior of stock-market prices. *Journal of Business* 38:1, 34–105.

Gilovich, Thomas, Robert Vallone, and Amos Tversky. 1985. The hot hand in basketball: On the misperception of random sequences. *Cognitive Psychology* 17:3, 295–314.

Gonzales, Richard, and George Wu. 1999. On the shape of the probability weighting function. *Cognitive Psychology* 38:1, 129–66.

Grether, David M. 1980. Bayes' rule as a descriptive model: The representativeness heuristic. *Quarterly Journal of Economics* 95:4, 537–57.

Hong, Harrison, and Jeremy C. Stein. 1999. A unified theory of underreaction, momentum trading and overreaction in asset markets. *Journal of Finance* 54:6, 2143–184.

Ikenberry, David L., Josef Lakonishok, and Theo Vermaelen. 1995. Market underreaction to open market share repurchases. *Journal of Financial Economics* 39:2–3, 181–208.

Ikenberry, David L., Graeme Rankine, and Earl K. Stice. 1996. What do stock splits really signal? *Journal of Financial and Quantitative Analysis* 31:3, 357–75.

Jegadeesh, Narasimhan, and Sheridan Titman. 2002. Cross-sectional and time series determinants of momentum returns. *Review of Financial Studies* 15:1, 143–57.

Kahneman, Daniel, and Amos Tversky. 1973. On the psychology of prediction. *Psychological Review* 80:4, 237–51.

Kahneman, Daniel, and Amos Tversky. 1979. Prospect theory: An analysis of decision under risk. *Econometrica* 47:2, 263–92.

Lichtenstein, Sarah, Baruch Fischhoff, and Lawrence D. Phillips. 1982. Calibration of probabilities: The state of the art to 1980. In *Judgment under uncertainty: Heuristics and biases*, (eds.) Daniel Kahneman, Paul Slovic, and Amos Tversky, 306–34. Cambridge: Cambridge University Press.

Lord, Charles G., Lee Ross, and Mark L. Lepper. 1979, Biased assimilation and attitude polarization: The effects of prior theories on subsequently considered evidence. *Journal of Personality and Social Psychology* 37:11, 2098–109.

Michaely, Roni, Richard H. Thaler, and Kent L. Womack. 1995. Price reactions to dividend initiations and omissions: Overreaction or drift? *Journal of Finance* 50:2, 573–608.

Mitchell, Mark L., and Erik Stafford. 2000. Managerial decisions and long-term stock price performance. *Journal of Business* 73:3, 287–329.

Montgomery, Henry. 1997. Naturalistic decision making. Working Paper, Conference on Subjective Probability, Utility and Decision Making, Mannheim.

Olsen, Robert A. 1997. Investment risk: The experts' perspective. *Financial Analysts Journal* 53:2, 62–6.

Reber, Rolf, and Norbert Schwarz. 1999. Effects of perceptual fluency on judgments of truth. *Consciousness and Cognition* 8:3, 338–42.

Shefrin, Hirsh. 2000. *Beyond greed and fear. Understanding behavioral finance and the psychology of investing.* Boston: Harvard Business School Press.

Shefrin, Hirsh, and Meir Statman. 1985. The disposition to sell winners too early and ride losers too long: Theory and evidence. *Journal of Finance* 40:3, 777–90.

Shleifer, Andrei, and Lawrence H. Summers. 1990. The noise trader approach to finance. *Journal of Economic Perspectives* 4:2, 19–33.

Shleifer, Andrei, and Robert W. Vishny. 1997. The limits of arbitrage. *Journal of Finance* 52:1, 35–55.

Szyszka, Adam. 2002. Quarterly financial reports and the stock price reaction at the Warsaw Stock Exchange. Discussion Paper, European Finance Association, 2002 Berlin Meeting.

Szyszka, Adam. 2007. *Valuation of securities on the capital market in light of behavioral finance*. Poznań: Poznań University of Economics Press.

Szyszka, Adam. 2009. Generalized behavioral asset pricing model. *ICFAI, Journal of Behavioral Finance* 6:1, 7–25.

Taylor, Shelley E. 1982. The availability bias in social perception and interaction. In *Judgment under uncertainty: Heuristics and biases*, (eds.) Daniel Kahneman, Paul Slovic, and Amos Tversky, 190–200, Cambridge: Cambridge University Press.

Thaler, Richard, and Eric Johnson. 1990. Gambling with the house money and trying to break even: The effects of prior outcomes in risky choice. *Management Science* 36:6, 643–60.

Tversky, Amos, and Daniel Kahneman. 1973. Availability: A heuristic for judging frequency and probability. *Cognitive Psychology* 5:2, 207–32.

Tversky, Amos, and Daniel Kahneman. 1974. Judgment under uncertainty: Heuristics and biases. *Science* 185:4157, 1124–31.

Wason, Paul C. 1966. Reasoning. In *New horizons in psychology*, (ed.) Brian M. Foss, 131–51. Harmondsworth, Penguin.
Yates, Frank J. 1990. *Judgment and decision making*. Englewood, NJ: Prentice Hall.

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PART IV

Behavioral Corporate Finance

CHAPTER 20

Enterprise Decision Making as Explained in Interview-Based Studies

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INTRODUCTION

Most analyses of decision making at the enterprise level are based on data from experimental laboratories or on publicly available information. Almost all of these studies reflect the result of decision-making processes. Only a few studies are based on open-ended interviews with decision makers and attempt to ferret out the reasoning underlying the decisions. Although these interview-based analyses have several objectives, they primarily attempt to draw attention to the most promising among the available hypotheses about enterprise decision making. In a few cases, they suggest more realistic theories of business behavior. This chapter focuses on the small number of analyses that are based on real-time contact with decision makers and attempts to explain the reasoning processes underlying decision making. What follows provides considerable detail in the hope of encouraging similar studies that emphasize finance. The chapter notes where the existing studies touch on financial matters. The material draws heavily on Schwartz (2006).

Two recent studies employing personal contacts are in the tradition of household surveys and ask the same set of questions of all respondents. Recanatini, Wallsten, and Xu (2000) report on surveys prepared by the World Bank over the course of a decade. The second of the survey-based analyses, by the former Vice Chairman of the Federal Reserve Board and several associates, considers which of the many theories available best explains the stickiness of prices (Blinder, Canetti, Lebow, and Rudd, 1998).

Bromiley (1986) breaks from the survey approach. His study provides an analysis based on highly structured interviews with a small number of enterprises but allows for extensive open-ended follow-up comments. Bewley, an economist known for his work on general equilibrium theory, interviews business and labor leaders with the aim of understanding the downward stickiness of wages in recession. Bewley (2002) includes some preliminary observations from a study in which he analyzes a large number of enterprises in an effort to explain price formation. Schwartz (1987, 1998, 2004, 2006) focuses primarily on industrial development.

Those studies include interviews with business economists as well as enterprise leaders and attempt to capture the essence of the reasoning processes employed in several types of decisions.

THE APPROACH OF THE WORLD BANK SURVEYS

The purpose of the Recanatini et al. (2000) study is to bring greater consistency to the World Bank's enterprise-level surveys and to provide data for its operations and policy analyses. Their surveys stress the importance of microeconomic data underlying macroeconomic phenomena. The authors urge that the Bank's surveys use standard questions of firm performance to get consistent data on output, profitability, and productivity. They recommend estimating production functions to determine if financially constrained firms are less productive than those not so affected. The overview discusses the coverage of corporate governance, human capital, technology, market structure, transaction analysis, the role of the state, and the micro foundations of macroeconomics, particularly with respect to the relationship of investment and growth. The surveys queried respondents about their attitudes toward various issues and their recollection of past events. Recanatini et al. recommend that these surveys endeavor to avoid inappropriate and ambiguous wording, multipurpose questions, manipulative information, inappropriate emphasis, and emotional phrases. They also recommend avoiding questions that people who have the same opinion can answer differently, as well as questions that people with divergent views can answer identically.

Recanatini et al. (2000) discuss problems related to response scales, the order or rank effect, "don't know" responses, filters and branching, context effects such as the sequencing of specific and general questions, and the use of sensitive questions. They note the importance of pretests and offer a list of lessons learned. Except for a general question concerning how to check for data quality, the report does not consider ex post audits to gauge the order of accuracy of the various categories of information. Without such guidelines, difficulties arise in knowing whether researchers should use certain categories of data in analyses intended to explain economic relationships. While one of the surveys covered concludes that the lack of financial resources was the most serious bottleneck to industrial activity in a certain country, subsequent open-ended questioning by Schwartz (1993) reveals that lack of financial resources, though of some importance, was a second-order consideration at the time considered. The instructions to the interviewers who carry out these surveys encourage them to employ follow-up, in-depth questioning. Yet, time constraints, the large number of topics generally covered, and the lack of experience of most of the questioners with such an approach all reduce the feasibility of that type of follow-up. In any event, subsequent country reports of the institution in question did not assign as much importance to financial constraints as the original survey.

THE BLINDER PROJECT ON PRICE STICKINESS

The Blinder project was based on interviews that began in 1990 and ended in 1992. Blinder et al. (1998) give two justifications for resorting to a survey that asks business leaders not only for factual information but also for assessments of what

they had done. First, the authors maintain that econometric inquiries had failed to resolve which theory or theories best explain the stickiness of prices. Second, they contend that decision makers recognize their own chain of reasoning. The study acknowledges that as a result of the extent to which the true reasons for price stickiness are buried deep in the subconscious, interviews would be unlikely to recover them. Blinder et al. defend against the contention that interviews might be unreliable by outlining the crosschecks they took. They note many response problems and acknowledge that using free-form interviews could have mitigated some of them.

Blinder et al. (1998) consider 12 theories of price stickiness, including one suggested by businesspeople in a pretest of the questionnaire. The authors eliminate a few plausible theories because they assume that such theories might induce respondents to give evasive answers or because the theories are too difficult to formulate in a manner some businesspeople can easily comprehend. The theories selected are based on the nature of costs, demand, contracts, market interactions other than those involving collusion, imperfect information, and the hierarchical structure of large firms. When asked if there were other important factors, the respondents did not provide any, which may be due to the large number of theories already mentioned, the absence of any specific follow-up questions, and the short time period assigned for this task.

Blinder et al. (1998) take 11 earlier studies into account. They characterize Hall and Hitch (1939), the earliest of these studies, as the only one to have had a major impact on the thinking of economists. Although the Hall and Hitch study suffers from some methodological shortcomings, it contributes four possible explanations for sticky prices. Initially, Blinder, the senior author, had intended to conduct free-form interviews with about 20 companies, tailoring the questions to each respondent. However, he decided to expand the number to 200 companies and to aim for a random sample survey of the entire GDP (actually, the private, non-farm, for-profit GDP) in order to achieve statistically significant conclusions. Of the companies contacted, 61 percent agreed to be interviewed. The interview usually involves the CEO in the case of the smaller companies and an executive below that level in the larger firms.

The study finds that prices are sticky, especially in periods of low inflation. Respondents representing 78 percent of the sample of private, non-farm, for-profit GDP indicate that they reprice quarterly or less frequently, and those representing half of GDP change prices only once a year. Nearly a quarter maintain that changing prices would antagonize customers or cause difficulties for them. About 15 percent of the respondents cite competitive pressures for not changing prices. Another 15 percent each cite the cost customers would incur by making the price changes and the fact that their own costs do not change more often. Blinder et al. (1998) find no evidence for the general belief that increases in price take place more rapidly than decreases, or for the supposition that firms react more rapidly to cost than to demand shocks. Large firms report that they change prices somewhat more frequently than their smaller colleagues. The frequency of price changes varies greatly from one sector to another. Half of the firms contend that they never take the general level of inflation into account. Although many respondents report being unaccustomed to thinking in terms of elasticity responses, nearly half seem to believe that demand for their products is insensitive to price. Most claim

that they can gauge their marginal costs well but have difficulty distinguishing between fixed and variable costs. Almost 50 percent claim that they produce under conditions of essentially constant marginal costs, and 40 percent state that they have declining costs, casting doubt on the textbook U-shaped cost curves.

Of the 12 theories explaining price stickiness, Blinder et al. (1998, p. 269) find the greatest support for coordination failure, summarizing as follows: "Coordination failures can lead to price rigidity if each firm would adjust its price if it expects other firms to do so, but also would hold prices fixed if it expected other firms not to change their prices." The second most popular theoretical explanation for price rigidity is cost-based pricing (that a firm's prices respond to costs with a lag), followed by non-price competition. Another theory supported as relatively important in explaining price stickiness is the use of implicit contracts. Contrary to general expectations, the study concludes that economic theories do a better job of explaining upward price stickiness rather than downward.

The study's only explicit reference to behavioral economics is the discussion of fairness in the context of a theory of implicit contracts. Blinder et al. (1998) maintain that the standard investigative economic tools are unable to discriminate among alternative theories that would explain price stickiness and contend that interviews might provide a more promising route. Indeed, in-depth interviews might have led to a fuller list of theoretical explanations for price stickiness. As for upward price adjustment, for example, one should take account of price movements or the lack thereof in markets in which a dominant firm has achieved pricing power. Many firms seek to develop one or more products in which they have a dominant market position and enjoy pricing power for those products. Where the firms enjoy that pricing power, there may be a kind of price rigidity, perhaps most notably in that the firms are able to avoid reducing the price of those products as much after technological progress, as would take place in a more competitive market environment. However, such a lack of price flexibility is unlikely to be explained by coordination failure, which the study found to be the leading explanation of price rigidity. Beyond that, globalization and increasing new supply even in the absence of price increases also limit price increases in some product markets, especially those of low-to-intermediate–level technology. Businesspeople should have a larger number of analytical alternatives as to why prices are upwardly rigid. Those should include a wider spectrum of competitive responses, and such responses would be likely to emerge from in-depth interviews with individual enterprises. Moreover, psychological factors should be among those offered to explain price movements, especially for any study of finance.

BROMILEY'S INTERVIEWS WITH FOUR LARGE ENTERPRISES

Bromiley (1986) incorporates data from interviews undertaken between 1979 and 1982, in addition to the results of simulations and econometric studies. In the preface of this book, Simon hails the study for revealing how executives cope with bounded rationality in decision making. Bromiley uses multiple interviews with each of four Fortune 1000 companies. The purpose of the study is to understand the corporate planning and investment processes related to investment and to

generate a model based on the planning process in one of the firms. The study then incorporates the data from the other three firms interviewed into the model to make econometric estimates of investment in those firms. Bromiley concludes with a conceptual framework for the determinants of capital investment. He recommends using further interviews to check the hypotheses, and he suggests employing large samples in subsequent research.

Bromiley (1986) summarizes his empirical findings on the following topics: (1) the capital investment process (the result of aggregate planning, project approval, and implementation considerations); (2) the cash flow equations; (3) the changes in "hurdle" rates; (4) the limits on debt; (5) corporate forecasts; (6) asymmetries with the response of capital expenditures to sales or income less than forecast; (7) constraints on investment; (8) inter-temporal differences; (9) inter-firm differences; and (10) research strategy. Schwartz (2006) provides details on these findings.

According to the conceptual framework of Bromiley (1986), planning involves the desire for investment, the ability to implement, and financial constraints. His "multi-constraint" framework uses many of the same variables as standard economic theories, but he contends that the variables need to be combined in a very different manner. The framework is guided by what he has grasped from his interviews, extensive data collection, and presumably from the relevant context. Bromiley maintains that there may be substantial, systematic inter-firm and inter-temporal variations in the determinants of investment. He suggests the implications of those differences for corporate practice, research about corporate management, and public policy. Bromiley's conceptual framework captures the details of the planning process well enough to predict investment satisfactorily, at least for the few firms that he examines. However, he does not attempt to indicate where the differences between the corporate practice he observes and the decisions of traditional economic models reflect rules of thumb among the best obtainable in the circumstances, and where they represent a much less optimal decision.

BEWLEY'S ANALYSIS OF DOWNWARD WAGE RIGIDITY

Bewley (1999) provides a major breakthrough in revealing the potential of in-depth interviews. He published preliminary reports of his analysis of wages in 1995 and 1998 with a final version appearing at the end of the decade.

Drawing on his study of prices still in progress as well as the book on downward wage rigidity, Bewley (2002, p. 343) remarks, "An obvious way to learn about motives, constraints and the decision making process is to ask decision makers about them." An obstacle, he observes, is that respondents consider many kinds of decisions to be highly confidential. While this prevents precise replication, other investigators can undertake similar studies using the same general method. Given that networking might have led to a certain bias in the study on wages, he approached most possible respondents without intermediaries. On the other hand, in the study of pricing that potentially involves greater sensitivity, Bewley relied entirely on networking.

Bewley (2002) stresses the importance of using a variety of approaches to facilitate seeing the connections between responses and the circumstances of various

types of respondents. He observes that release of confidential information can close off the investigator's access to a wide range of business entities and impede the access of other investigators as well. Another reason for encouraging discretion is that judicial authorities can require an academic investigator to testify in court.

As Bewley (2002, p. 346) states, "If the objective [of interviewing] is to test given theories, you should be sure to cover the questions relevant to those theories. If the objective is to understand the shape of a general phenomenon with a view to formulating new theories, then the style should be less structured in the hopes that the respondent will come up with unexpected description and arguments." Bewley concludes that while systematically following a fixed list of questions leads to more inconsistencies and contradictions, those can be partially offset by broaching important issues at several separate times and in different ways. He also recommends using looser, more relaxed language but keeping the discussion as concrete as possible, by requesting specific examples, and by confining the discussion to the realm of the informant's experience.

To sustain the interest of busy interviewees, Bewley (2002) stresses the importance of eye contact and the desirability of not looking down at notes. He observes that people enjoy being provoked in a humorous tone. Note that telephone interviews may have an advantage in studies requiring multiple sessions. Business exigencies often make some scheduled interview times inconvenient. If the interviews are by phone, the researcher can postpone to a time that is better for respondents. If the interview is scheduled in another city, the respondent may be more reticent to change the arrangement and may be more inconvenienced. As a result, respondents may be less willing to accept subsequent follow-up sessions because such sessions might unduly constrain their activities or make the participant uneasy about any inconveniences caused for the interviewer.

Bewley (2002) notes the importance of asking certain background questions such as the nature of a company and the informant's function within it. Bewley (p. 347) stresses: "The main questions have to do with the person's decision problems: its objectives, the possible actions, the constraints on them, the decisions made, how they are arrived at, and how they change with circumstance. Finally, you might ask how respondents acquired their knowledge; were they educated by experience or business culture." Bewley did not use a tape recorder because he was concerned that it might inhibit respondents, but in the more sensitive study of pricing, he did use one, and few seemed to be bothered by it. Nonetheless, the interviewer should be ready to turn the recorder off and not just when the interviewee requests it. Sometimes respondents let themselves get carried away and begin to enter into details that they may regret having mentioned and that the investigator best not use.

Bewley (2002) recommends organizing interview transcripts or notes into two kinds of documents, namely spreadsheets and lists of questions. He urges that examination of the relation between the circumstances informants face and what they say is particularly important because this can reveal the factors in the environment that influence decisions. This view is consistent with the work of Gigerenzer and Selten (2001), which emphasizes the degree to which the heuristics of successful decision making are tied to context or domain.

The Bewley (2002) analysis finds a surprising amount of uniformity between informants in similar circumstances but concedes that the rationale for this

uniformity is difficult to determine. The uniformity could be due to the logic of the circumstances or to the culture of the business community or of particular industries. He indicates that disagreement often reflects ambiguity as to what the correct decisions are. Moreover, he maintains that because the economic world is full of imponderables, it is not always clear how to maximize profits or to best protect the interests of a business. As for candor, Bewley acknowledges that the most a researcher can expect is a coherent story of the interaction of motivation and constraints that leads to decisions.

Rather than merely accepting at face value what people say about their actions, Bewley (2002) suggests that an investigator should observe actions if possible to do so. Some critics hold that interview data should not be trusted because such data lead to an emphasis on irrational behavior, whereas rationality is the common thread that holds economic theory together. Bewley observes that interviews reveal both rationality and irrationality. He rebuts the well-known argument regarding the irrelevance of a theory's assumptions, maintaining that a deeper understanding is required for successful prediction if conditions change or if one wants to interpret phenomena for policy purposes. Bewley (p. 352) concludes that researchers should supplant existing standard statistical sources with "a kind of main street economics" such as that provided by interviews.

In his study of wage behavior, Bewley (1999) has four objectives. Most important, he offers the results of 336 interviews with business leaders, union officials, employment counselors, and business consultants in the northeastern United States (principally Connecticut) during the recession of the early 1990s. Although his overriding concern is wage rigidity, he also examines a host of factors regarding employment. These factors include company risk aversion, internal and external pay structures, hiring and the pay of new hires, layoffs, severance benefits, voluntary turnover, the situation of the unemployed, labor negotiation, and morale. He maintains that understanding the mechanisms creating unemployment is necessary to determine how to reduce it.

Second, Bewley (1999) offers arguments for and against the less structured, open-ended approach of listening to firms with only a memorized list of questions and concerns, not all of which are necessarily to be asked of all of those interviewed. Although Bewley's approach eschews statistical analysis of the data generated, he incorporates in his study the results of many other statistical analyses to set the framework and to help assess the interview findings.

Third, Bewley (1999) describes and critiques the leading theories offered to explain wage rigidity and evaluates those theories based on interviews with respondents and other evidence. He concludes that only one theoretical explanation seems to be consistent with the evidence. This explanation deals with the importance of morale and the decisions of managers in response to their judgments about the likely effects of morale factors. His analysis attempts to deal with the rather imprecise concept of morale and builds upon existing theories emphasizing morale while also drawing on the interview data and introspection.

Finally, Bewley (1999) offers suggestions for future areas of research. This might include the use of surveys and tests of his reinforced theory along with other theories of wage rigidity. He provides extended quotations from the interviews and refers to numerous empirical and theoretical analyses concerning employment.

According to Bewley (1999), his interview findings support only those economic theories of wage rigidity that emphasize the impact of pay cuts on morale. Other theories tend to fail because they are based on the unrealistic psychological assumption that ability does not depend on a person's state of mind. From the outset, Bewley (p. 2) affirms that "wage rigidity is the more complicated employee behavior, in the face of which manager reluctance to cut pay is rational." Bewley (p. 2) adds, "A model that captures the essence of wage rigidity must take into account the capacity of employees to identify with their firm and to internalize its objectives." Bewley points to the models of Solow (1979), Akerlof (1982), Akerlof, Rose, and Yellen (1988), and Akerlof and Yellen (1990), all of which maintain that pay rates have a positive effect on productivity through their impact on morale.

Bewley (1999, p. 7) states that "the implications of rationality depend on the conditions constraining decision makers." He discusses problems with surveys and notes that he has compared the information obtained with official data as well as with econometric and other studies. He observes that motives may be unconscious. That is, people may not be aware of the principles governing their behavior. As an example of this, he cites implicit contracting (unspecified, but mutually understood agreements).

Bewley (1999) notes that in the course of the study he learned that cutting pay would have almost no effect on employment. He also learned that hiring new workers at reduced pay would antagonize them, reducing the pay of existing workers would affect worker attitudes, and turning to layoffs in preference to pay cuts has the advantage of getting misery out of the door. None of the employers interviewed stated that their firms had offered a choice between layoffs and lower pay. (In the current recession, some employers have reduced pay by reducing hours worked, also without offering employees a choice.) Bewley's interviews reveal that labor is in excess supply during recessions (contrary to the reasoning of some prominent macroeconomic models) and that employers avoid hiring overqualified workers. To the extent that there is some downward wage flexibility, Bewley finds that this flexibility occurs in secondary markets characterized by heavy turnover and relatively more part-time work.

The New Haven Chamber of Commerce and personal connections arranged the initial interviews, but Bewley solicited the majority of interviews from those companies and from cold calls. Bewley (1999) aimed for a varied sample but looked particularly for companies that had experienced large layoffs. He observed that there was a trade-off between randomness and interview quality. He changed the focus of the interviews over time, moving from an initial emphasis on wage and salary structures to a greater emphasis on questions of morale and overqualification. Bewley undertook all of the interviews personally (usually an hour and a half to two hours) and made some follow-up telephone calls. He concluded that the sessions with a fixed list of questions were less successful than those that were more free-flowing. The focus was on the experience of the companies interviewed, and his questions avoided economic jargon. He reserved any theoretical queries for the end of the sessions, emphasized factual matters, and did not ask direct questions about interpretive issues. Bewley did not attempt to avoid discussions that might be considered to be disturbing to those interviewed (such as

those bearing on collusion), as the Blinder et al. (1998) study did. However, he did avoid gathering precise quantitative data.

Bewley (1999) finds that managers believe morale is vital for productivity, recruitment, and retention. He characterizes good morale by a common sense of purpose consistent with company goals, cooperativeness, happiness or tolerance of unpleasantness, zest for the job, moral behavior, mutual trust, and ease of communication. In discussing what affects morale, he notes a sense of community, an understanding of company actions and policies, and a belief that company actions are fair. He emphasizes these factors along with an employee's emotional state, ego satisfaction from work, and trust in co-workers and in company leadership. His respondents indicate that poor morale leads to low productivity, poor customer service, high turnover, and recruiting difficulties. Bewley does not specify trade-offs that might be involved between the factors contributing to morale. He also does not indicate the precise impact of morale on productivity or the role of that morale-based productivity in keeping wages relatively rigid.

Bewley (1999) contends that only the pay structure within a firm is important for internal harmony and morale, job performance, and turnover. His results indicate that the rigidity of the pay of new hires in the primary sector stems from considerations about the internal pay structure. The findings on salary increases reveal that beyond what is required by contracts, managers view pay raises as important in providing incentives and motivation. The same factors drive salary increases during both recessions and good times: profits, the cost of living, raises in other firms, product market competition, and the competition for labor. Firms do not delay raises because of concern about turnover of key employees. Managers resist reducing pay during a recession for fear of the effect on morale and productivity, along with concern for turnover of the best employees. These factors play a more important role than pressure from labor unions.

Employers prefer layoffs to pay cuts because they believe that the latter have a more negative effect on the morale and productivity of the remaining workforce more. In addition, data show that labor costs are a small part of total costs (thus pay reductions would facilitate only small reductions in prices) and demand is often held to be relatively inelastic. Employers prefer layoffs to pay cuts when they believe that competitors would not match pay cuts or when competition is based on more than price. They also prefer layoffs when sales levels in the overall industry are lower and when the firms involved have only moderate financial difficulties that would not be alleviated much by wage reductions because of the level of benefits also available to employees. The same preference holds because of considerations of technological change, the opportunity to reorganize operations and eliminate organizational slack, and the opportunity to increase the work of the remaining employees. Bewley (1999) finds that severance pay obligations were not high because employers believed that there was a lack of employee interest. Firms seldom replace employees with cheaper labor because they conclude that such actions would result in a loss of skill and morale. Managers acknowledged that layoffs dealt a heavy blow to those laid off, but concluded that the psychological impact does not extend to the remaining workforce.

Interviews with labor officials indicate that the information asymmetries economists assumed in some theoretical explanations of wage rigidity are not

of much significance. The interviews do not support the shirking theory as an explanation of wage rigidity. (This theory assumes that workers are paid more than necessary and are dismissed if they do not meet certain standards.) The findings also reject all the efficiency wage theories as explanations of wage rigidity.

Bewley (1999) outlines the principal critique of the theories considered. He deals with the labor supply theories in which wages are downwardly rigid because people withdraw their labor when wages fall. Interview and other data indicate that voluntary quits do not increase but, rather, decrease sharply during recessions. The attitudes of the unemployed are not consistent with their choosing leisure over work; indeed, workers who can find second jobs generally accept them to maintain their income.

The interview findings reject worker bargaining theories in which the bargaining power of workers causes downward rigidity. Similarly, the monopoly union model is not accepted because of the low percentage of companies that are unionized and because the first line of resistance to pay cuts almost always comes from management. The "insider-outsider" model does not correspond to observations in as much as few non-union employers bargain with their employees, and usually no conflict exists between insiders and outsiders over pay cuts.

In reviewing the evidence of the theories based on market interaction, Bewley (1999) considers the search models—market misperception theories and theories involving the transactions approach—and those relating to the "holdup" problem, as well as to Keynes's relative wage theory. (The holdup problem refers to actions of a usually small group that can prevent progress on overall negotiations.) The study examines theories that attribute wage behavior to enterprise behavior and theories of recessions as reallocators of labor. The first group includes implicit contracts (the implicit insurance contract model and the moral obligation, implicit contract model), the efficiency wage theories, models assuming asymmetric information, the adverse selection model, the menu-cost theories, and the stigma-of-unemployment explanation. Bewley criticizes all of these and the theories of labor reallocations on both logical and empirical grounds. He finds that the morale and fair wage models come closest to explaining downward wage rigidity.

Bewley (1999) summarizes the evidence from his interviews in presenting his theory of morale as the cause of wage rigidity. The model maintains the utility maximization principle of traditional economic analysis. He argues that the concern of businesspeople with morale and its effect on productivity is a result of the impact of the latter on profits. Nonetheless, in his morale model, he includes both unconsciously and consciously felt mental and physical goals and costs. He suggests further studies and tests of hypotheses. Bewley also raises questions that he insists can be best answered with the aid of data collection that is possible only in direct personal interviews.

Although Bewley (1999) is a seminal work, a few words of caution are in order. He acknowledges that wages are more downwardly flexible in firms in financial difficulty, particularly when employees recognize the situation. The latter is particularly relevant to today's economic situation. This raises the question whether wage rigidity is not seriously tempered or even eliminated if a recession lasts long enough (as in Japan during the 1990s) or is severe enough (as in the United States and throughout the world beginning in 2008 or as in the Great Depression of the 1930s). Similarly, might not wage rigidity be greatly lessened if

the adversity is great enough for entire industries or regions? There seems to be a point at which wage rigidity breaks down, and the seeds of that breakdown are captured in some of the responses that those interviewed give to Bewley.

A second caution concerns the Bewley (1999) affirmation that the adverse psychological impact of layoffs does not extend to the workforce that continues in employment. This seems less true in 2008–2009 than in 1990–1991. Currently, many in the workforce fear that layoffs may lie in their future. Thus, the psychological advantage of layoffs as compared to pay cuts may diminish with the length or severity of a recession.

Bewley's (1999) interviews and other available studies provide ample grounds for rejecting most of the theoretical explanations of wage rigidity, a rejection that seems to be due largely to the unrealistic assumptions of those theories. Nonetheless, some of the reasoning of Bewley's morale-based theory is speculative. Still, the notable contribution is in showing that interviews can uncover data about decisions and the assumptions underlying people's motivations that help explain their decisions. These data are not only rich in detail but also differ from much of the introspection of economists and other analysts restricting themselves solely to more traditional empirical approaches.

Bewley (1999) characterizes the information gathered from interviews as uncovering motives, constraints, and an understanding of the decision-making process. He acknowledges the uncertain reliability of some interview responses and offers suggestions as to how one might detect and deal with inconsistencies. Even where the information about the underlying motives is accurate, the reasoning processes used in arriving at some decisions may involve other considerations. Decision makers may recall these with ease, at least for a few months, particularly where circumstances lead decision makers to deviate from customary guidelines. Dealing with responses referring to events that are more distant in time may require additional supporting material, which perhaps may include an indication of certain actions that the decision maker took at that time or the reasoning at the earlier point in time.

THE SCHWARTZ INQUERIES ON INDUSTRIAL DEVELOPMENT

Schwartz (1987) interviewed 113 metalworking enterprises in several regions each of the United States, Mexico, and Argentina in an effort to understand decision-making processes in a particular group of industries. Schwartz (1998) deals with a broad range of industries in a single country but focuses on a narrower range of issues. In that study, Schwartz and an associate interviewed 36 firms, investigating the decision making of Uruguayan manufacturers in the months before increased integration of their country with Brazil, Argentina, and Paraguay. Schwartz (2004) reports on interviews with a dozen business economists approximately once a month over the course of a year. The principal objectives were to discern the degree to which those economists deviated from traditional optimizing calculations in preparing their analyses for management, the rules of thumb they select when they do so, and the extent to which they make efforts to allow for the biases in those rules of thumb or attempt to improve the rules of thumb.

The Interviews with Metalworking Firms

Schwartz (1987) interviews 113 metalworking firms and 9 trade associations in 3 regions of the United States, Mexico, and Argentina between September 1976 and June 1977. Trade associations recommended the enterprises in response to a request for the names of well-regarded and financially successful companies. Eighty percent of the companies agreed to participate in the study. Schwartz interviewed all of the firms, with most a second time, and conducted follow-up observation sessions with 10 of them. The analysis is based on notes taken during and immediately after the sessions. Most of the interview sessions lasted two to three hours and the observation sessions from three hours to three days. At the time of the interviews, the industries selected were characterized by relatively stable technologies, only moderate economies of scale, and relatively little market power in most product lines.

The principal assumption of the study was that the firms would understate the degree to which they sought profit maximization when speaking in broad terms, but that they would reveal a behavior inclining toward optimization in resolving specific problems. As with all economic agents, businesspeople do not always perceive data accurately. In the study, economic perception refers to the values of technological, market, and public policy data as the businesspeople perceive them, which may vary from their true values. Economic judgment refers to the process of assessing the probable economic consequences of perceived technological, market, and public policy data and also includes optimization techniques, heuristics, and perhaps largely intuitive "seat-of-the-pants" responses.

The overall findings and hypotheses are as follows:

- Businesspeople do not perceive most small (marginal) differences in financial and economic data well. Ordinarily, they require greater differences in order to take them into account—what some psychologists term a "just noticeable difference."
- Businesspeople often fail to recognize that small samples do not have the properties of larger ones, and there is a failure to allow for regression toward the mean.
- Businesspeople often rely on the anchoring and adjustment heuristic. (See Chapter 4.)
- Businesspeople have a diminishing marginal response to incentives, both market incentives and those from public policy. In the case of those emanating from public policy, extraordinarily large incentives can lead to negative responses in anticipation of a reaction of the community that results in the withdrawal or substantial reduction of the incentive.
- The key findings and hypotheses concerning economic perception follow:
- Decision makers reveal differences in their ability to perceive the various categories of data. This was noted, in particular, for a new metalworking technology and also for the cost of inputs, the price differential between domestic and imported goods, and the cost of equipment. This difference in the ability of individuals to perceive the same data similarly (asymmetries in perception) is in addition to the differences in information that participants to transactions often have (information asymmetry). Money illusion

often differs from one individual to another, reflecting a tendency for different individuals to perceive certain categories of the same information differently.
- The differing perception of economic data is partly explained by differences in professional background and the frequency of exposure to similar data, as well as by institutional factors such as a long tradition of historical cost accounting.

Major findings and preliminary hypotheses concerning economic judgment:

- Small- and medium-size enterprises rarely estimate market demand at prices substantially different from prevailing levels.
- The imperfect perception of some input prices combined with limited record keeping leads many small enterprises to miscalculate opportunity costs. Rapid inflation accentuates this tendency.
- Many enterprises do not determine the composition of output by careful calculation and doubt that their prevailing product mix is the most profitable one.
- The anchoring and adjustment heuristic is an important determinant of inventory decisions.
- The reasons cited by small-firm managers who do not have a business administration degree (or substantial business experience) for not undertaking second or third shifts are refutable more often than not.
- Production managers assess defective production by using a heuristic rather than by careful calculation, particularly for components that are not sold, but are used in-house.
- The firms interviewed typically do not undertake systematic efforts to improve operational efficiency at the time interviewed. They responded primarily to adversity or anticipated adversity.
- The responses to special depreciation or investment allowances are generally consistent with published financial guidelines, perhaps in large measure because professional advisors intervene in interpreting the allowances.

The principal finding concerning the acquisition and processing of information was that enterprises elect not to receive a considerable amount of information that is readily available and inexpensive to obtain. This is often counter to the interests of their profitability. This tendency lessens as the market structure becomes more competitive. (To an extent, the decision to receive less of such information in the late 1970s, undoubtedly more common than at present, was related to the way in which data had been processed, which had not changed much over several decades.)

Regarding enterprise objectives and motivation, the results show that the high profits objective stated by most firms does not lead to consistently maximizing behavior. Differences emerged between stated and revealed objectives due in part to failure to pursue an entirely maximizing process, but also because of difficulties in realizing objectives despite efforts to do so. However, in two firms, improved perception of economic data enabled them to record higher rates of return than a decade before, even in the context of reduced profits objectives.

In summary, Schwartz (1987) finds that decision makers sometimes fail to perceive data accurately. Consequently, in those cases, they focus on problems that are variants of the ones they actually confront. Decision makers often use heuristics, leading to results that usually differ from those of optimizing calculations. The objectives of decision makers are often more complicated than simple profit maximization or maximization of any type. Such multifaceted objectives are not congenial to traditional optimization calculations.

Schwartz (1987) groups the study's findings into three categories: those largely consistent with traditional economic analysis; those inconsistent with traditional analysis but of limited consequence; and those inconsistent with traditional economic analysis and of major consequence. Among the implications is that obtaining the necessary insights about producer behavior often requires going directly to the individuals involved, preferably in their own environment, observing them in action, and asking them for open-ended comments. Relying on yes or no answers to survey questions about behavior is often insufficient. Indications of business behavior based on essentially hypothetical laboratory experiments may not provide reliable indicators for all types of situations. Moreover, the ex post evidence of the marketplace often reflects too many changes in variables to ascertain the response to any specific incentives.

The Uruguayan Interviews

Schwartz (1998) reports the results of 36 interviews involving Uruguayan manufacturing enterprises in 1994 to learn about their decision making in preparation for the forthcoming increased integration of their country with Brazil, Argentina, and Paraguay. About three-quarters of the firms contacted agreed to participate. Two-thirds of the firms were entirely Uruguayan-owned and the remainder were internationally owned. More than two-thirds of the firms exported, but only 10 thought that they could compete in the emerging integration scheme without substantial difficulties. The study provides preliminary verification of behavioral hypotheses useful in designing policies for promoting more efficient responses of enterprises to the changing incentives of increased economic liberalization and integration. The study delves into the reasoning processes underlying decision making, acknowledges the use of traditional economic analysis, and notes any alternative behavioral lines of reasoning with attention given to framing.

The principal findings that lend themselves to further testing are:

- The reasoning of decision makers usually involves heuristics rather than careful calculation. Reasoning by analogy from past experience is particularly common.
- Competitive pressures influence the degree to which the study finds profit maximization as the principal objective of the enterprises. Results show that competitive pressures are also critical to fostering the implementation of such cost minimization and profit maximization as takes place.
- Even firms stating that they seek to maximize profits do not always employ implementation procedures consistent with that objective, particularly in the search for information.

- Loss aversion and attitudes toward risk aversion in dynamic contexts vary somewhat from the results reported in experimental economics studies.
- Problems in accurately perceiving data are almost as important as the lack of data. Increased coordination within enterprises often overcomes some of the most serious problems that are attributable to economic perception.
- An understanding of the way in which businesspeople respond to what they perceive as obstacles is as important as the identification of the obstacles themselves in determining the most effective means of alleviating adverse consequences and of designing policies.

The Interviews with Business Economists

Schwartz (2004, 2006) analyzes interviews with a dozen business economists about once a month over the course of a year. Eleven of the economists were employed in or recently retired from Fortune 1000 companies, and one spent his career consulting with leading financial institutions. Just over half of those asked agreed to participate. The objective of the study is to ascertain the extent to which business economists use optimization techniques and the degree to which they employ heuristics. Where the latter is the case, the study attempts to determine how the economists developed those heuristics and how they took the associated biases into account.

All of the business economists interviewed express their conviction about the efficiency of the market and regard themselves as neoclassical in orientation. Yet they do not hesitate to use the approaches of behavioral economics in some contexts. They often include heuristics in their analyses (rules of thumb in their terminology) along with more traditional techniques. A number of factors oblige them to resort to rules of thumb. These include the pressure of time, the lack of data (or the cost of obtaining missing data), technological change, and the need for alternative frameworks at turning points. In most cases, they concede that the heuristics they use are inconsistent with Bayesian analysis. However, they almost never use several common (and usually more biased) heuristics that are prevalent in consumer behavior and in public policy decision making. Many of the respondents believe that their approach reflects Simon's procedural rationality (Simon, 1982). The economists who most emphasize this are those who insist on the multiple character of rationality. They incorporate both economic and social factors and include what they characterize as rational behavior with respect to different personality types. The last two elements reflect considerations of fairness and of the role of emotional states.

Even in these private enterprises, the information most sought from the economists was macro- rather than microeconomic. The interviews reveal that enterprises leave much microeconomic analysis to noneconomists. Those who are not economists vary greatly in the degree to which they make decisions as if they were taking the principles of economics into account. The economists vary in the extent to which they attempt to help educate their colleagues and influence them to take account of economic principles. Most of the economists recognized that their companies have problems of slack, reflecting other than the most efficient use

of resources even when the latter are most efficiently allocated. However, these economists are neither generally close enough to the activities with the slack to help much in its elimination, nor do they propose guidelines to help others in reducing slack.

While most of the economists recognize the inconsistencies of certain accounting conventions with economic principles, they are not active in efforts to alleviate the problem such as by contributing to the development of activity-based accounting. Similarly, although they reject the sunk cost fallacy, they do not always take steps to overcome the problem. Moreover, the economists report on productivity trends ex post and include productivity assumptions in projections, but do not offer criteria for cost reduction and ongoing productivity improvement. With few exceptions, the economists do not participate in preparing corporate approaches to risk management or in decisions concerning the hurdle rate heuristics used in assessing investment projects.

Many of the business economists refrain from pressing an economic point of view when it runs counter to the strong preferences of a key corporate leader and when they believe that expressing such a view would reduce their influence in other areas. Finally, although the economists generally record the detail of optimization calculations, they usually do not record the heuristics used in combination with those calculations, the context in which they use those rules of thumb, or the dimensions of the biases involved.

Perhaps the strongest recommendations of the business economists is that university and MBA courses in economics should give more attention to applications of theoretical economics and to the communication of economic concepts to noneconomists. The applications would include discussions of how to increase profitability by using heuristics when circumstances require something other than standard calculation techniques.

SUMMARY AND CONCLUSIONS

In-depth, interview-based analyses usually require more time than other types of studies and are subject to a number of other limitations. Financial analysts have largely ignored such studies despite their potential.

First, studies allowing for open-ended responses can reveal the inadequacy of models based on assumptions that are manifestly poor indicators of the reasoning processes that underlie decision making. With the results of in-depth interview-based studies to take into account, analysts can avoid a wasteful use of resources in testing theories that are devoid of the psychological assumptions that reflect actual human behavior. Given the mediocre record of financial projections based on models relying on the result of transactions, this should be of considerable interest.

Second, although a reasonable number of interview-based studies would be necessary to provide a firm foundation for new hypotheses about financial and economic behavior, even isolated efforts may uncover explanations that others have overlooked. Thus, these interview-based studies could lead to better hypotheses about financial and economic behavior. Moreover, case studies that reflect an improved understanding of decision making may motivate more successful financial and economic behavior.

Third, interview-based studies may help to improve understanding of and ability to modify behavior that inhibits successful decision making.

Fourth, in-depth interview-based studies may improve understanding of how to better take the biases associated with heuristics into account, how to adapt heuristics to different contexts, and how to improve performance when lack of time, lack of data, uncertain technological change, or other dynamic factors simply prevent calculation of what would be optimal.

Fifth, by focusing on reasoning processes in real-life contexts, the in-depth interview-based studies may facilitate the development of better hypotheses of how to implement recommendations that emanate from good analyses.

DISCUSSION QUESTIONS

1. Explain whether enterprise decision making should be judged primarily by what the marketplace reveals or by some other basis.
2. Discuss whether the responses of participants in interview-based studies are too dissimilar to be judged by statistical analysis.
3. Indicate whether efforts to explain the downward rigidity of wages are worth undertaking when much of the current evidence in the world economy suggests the reverse.
4. Given that recent refinements and reduced costs of both data and programs to use data have made optimization more feasible, is enterprise decision making more predictable than previously?

REFERENCES

Akerlof, George A. 1982. Labor contracts as partial gift exchange. *Quarterly Journal of Economics* 97:4, 543–69.

Akerlof, George A., and Janet L. Yellen. 1990. The fair wage-effort hypothesis and unemployment. *Quarterly Journal of Economics* 105:2, 255–83.

Akerlof, George A., Andrew K. Rose, and Janet L. Yellen. 1988. Job switching and job satisfaction in the U.S. labor market. *Brookings Papers on Economic Activity* 17:2, 495–582.

Bewley, Truman F. 1999. *Why wages don't fall during a recession*. Cambridge, MA: Harvard University Press.

Bewley, Truman F. 2002. Interviews as a valid empirical tool in economics. *Journal of Socio-Economics* 31:4, 343–53.

Blinder, Alan S., Elie R. D. Canetti, David E. Lebow, and Jeremy B. Rudd. 1998. *Asking about prices: A new approach to understanding price stickiness*: New York: Russell Sage Foundation.

Bromiley, Philip. 1986. *Corporate capital investment: A behavioral approach*. Cambridge, England: Cambridge University Press.

Gigerenzer, Gerd, and Reinhard Selten (eds.). 2001. *Bounded rationality: The adaptive toolbox*. Cambridge, MA: MIT Press.

Hall, R. L., and C. J. Hitch. 1939. Price theory and business behavior. *Oxford Economic Papers* 2:May, 12–45.

Recanatini, Francesca, Scott J. Wallsten, and Lixin Colin Xu. 2000. *Surveying surveys and questioning questions: Learning from World Bank experience*. World Bank Policy Research Working Paper #2307. Washington, DC: World Bank.

Schwartz, Hugh. 1987. Perception, judgment and motivation in manufacturing enterprises. Findings and preliminary hypotheses from in-depth interviews. *Journal of Economic Behavior and Organization* 8:4, 543–65.

Schwartz, Hugh. 1993. Bottlenecks to industrial development in Uruguay. Manuscript. Montevideo, Uruguay.

Schwartz, Hugh. 1998. A case study: Entrepreneurial response to economic liberalization and integration. Appendix C in Schwartz, *Rationality gone awry? Decision making inconsistent with economic and financial theory*. Westport, CT: Praeger.

Schwartz, Hugh. 2004. The economic analysis underlying corporate decision making: What economists do when confronted with business realities—and how they might improve. *Business Economics* 39:3, 50–9.

Schwartz, Hugh. 2006. In-depth interviews as a means of understanding economic reasoning: Decision making as explained by business leaders and business economists. In *Handbook of contemporary behavioral economics: Foundations and developments*, (ed.) Morris Altman, 356-375. Armonk, NY, and London, England: M.E. Sharpe.

Simon, Herbert A. 1982. *Models of bounded rationality: Behavioral economics and business organization*, Volume 2. Cambridge, MA: MIT Press.

Solow, Robert M. 1979. Another possible source of wage stickiness. *Journal of Macro-economics* 1:1, 79–82.

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Hugh Schwartz received a PhD in economics from Yale University and has taught at the University of Kansas, Yale University, and Case Western Reserve University. He served as an economist in the Inter-American Development Bank (IDB), a Fulbright lecturer in Uruguay and Brazil, and a visiting professor in both countries and in the Department of Finance of the Technological Institute of Monterrey in Mexico. Dr. Schwartz has edited volumes on cost-benefit analysis and manufacturing exports for the IDB. He has written many articles and three books. Two of his books concern behavioral economics; the most recent is *A Guide to Behavioral Economics* (2008), published by Higher Education Publications, Falls Church, VA. In July 2009, he participated in two panels at the conference of the Society for the Advancement of Behavioral Economics (SABE) and the International Association for Research in Economic Psychology (IAREP) in Halifax, Nova Scotia.

CHAPTER 21

Financing Decisions

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INTRODUCTION

Economists generally focus on models in which agents are rational and have homogeneous expectations. Yet, a large and growing body of research in experimental psychology reports that people frequently depart from this traditional paradigm; people tend to be excessively optimistic and overconfident (Taylor and Brown, 1988). That is, people predict that favorable future events are more likely than they actually are, and people also believe that they have more precise knowledge about future events than they actually have. Top executives are particularly likely to possess such personality traits. A frequent argument is that this bias has some bearing on corporate financial decision making. Consequently, understanding how these managerial traits affect financing and hence shareholder welfare is important. This chapter examines some recent insights from research on behavioral corporate finance where irrational managers deal with rational markets. The chapter places particular emphasis on the role of financing decisions.

Throughout the chapter, capital markets and, in particular, investors, are assumed to be homogeneous and have rational expectations when setting security prices in that they are able to foresee the implications of managers' actions. Another assumption is that managers are rational except for how they perceive their firm's future. Biased beliefs originate from managerial optimism or managerial overconfidence about the firm's future, which are characteristics of individual managers, not of firms or markets. In particular, optimistic managers overestimate the firm's expected earnings (value). Overconfident managers underestimate the riskiness of the firm's expected earnings (value). An alternative to the irrational manager approach surveyed in this chapter is an inefficient market with rational managers, which leads to the irrational investors' approach of behavioral corporate finance (Stein, 1996; Baker, Ruback, and Wurgler, 2007).

Based on this simple framework, this chapter first reviews pure financing and bankruptcy decisions to examine the role of managerial traits absent any other frictions. Subsequently, the chapter reviews the implications of biased managers when these decisions are integrated into a standard trade-off model with bankruptcy

costs and corporate taxes. The discussion also allows for the interaction of more traditional conflicts of interest with these behavioral biases. That is, the chapter discusses results of managerial traits for manager-shareholder conflicts, such as Jensen's (1986) free cash flow problem, and for bondholder-shareholder conflicts, such as Myers's (1977) underinvestment problem.

Overall, managerial traits enrich trade-off theory by allowing personal characteristics to affect capital structure decisions. As such, managerial traits theory does not part from traditional capital structure theories but augments these theories. However, it shows that both the magnitude and the combination of managerial biases determine preferences regarding debt versus equity. Specifically, managerial traits theory is consistent with the standard pecking order prediction for managerial optimism, but perhaps surprisingly, not for managerial overconfidence. Following a standard pecking order, managers prefer internal to external and debt to equity financing. The standard explanation for a pecking order goes back to Myers and Majluf (1984), who argue that this preference structure emerges from asymmetric information between investors and managers. Managerial traits theory, therefore, complements the understanding of trade-off theory in ways that suggest a rethinking of how to conduct and interpret tests of capital structure. Surprisingly, managers with mildly biased beliefs can also play a positive role in that they may increase firm value (and hence shareholder welfare) in the presence of more traditional conflicts of interests.

Empirical evidence suggests that managerial traits theory can explain residual variation both across and within firms. Bertrand and Schoar (2003) document that corporate financing decisions exhibit substantial manager fixed effects, which raises the questions of why managers act differently given comparable economic environments and whether these effects stem from optimism and overconfidence. To this end, several empirical studies examine the effect of managerial traits on financing decisions, employing either indirect empirical proxies (e.g., Malmendier and Tate, 2005a, 2005b; Malmendier, Tate, and Yan, 2007) or direct survey responses (e.g., Ben-David, Graham, and Harvey, 2007; Puri and Robinson, 2007) to identify managerial optimism and overconfidence. A review of these studies' findings appears at the end of the chapter. Malmendier et al. and Ben-David et al. analyze how biases affect financing decisions, while Campbell, Johnson, Rutherford, and Stanley (2009) investigate the question of whether biases can be beneficial for shareholder welfare. Overall, the findings are consistent with the theoretical predictions that managerial biases affect firms' financing decisions and may enhance shareholder value.

The remainder of this chapter is organized as follows. The next section reviews models and their empirical predictions, while the following section presents an overview of empirical tests. Finally, the last section concludes and provides some possible directions for future research.

THEORY

This section presents theoretical arguments of how managerial biases affect financing decisions. Initially, the chapter analyzes how optimism and overconfidence determine financing preferences in the absence of any other factors. Thereafter, the chapter introduces tax benefits and bankruptcy costs and then studies the impact

of managerial biases when conflicts exist among claim holders, that is, manager-shareholder conflicts and bondholder-shareholder conflicts. Each subsection illustrates the mechanisms that drive the results, derives empirical predictions, and makes statements about the shareholder welfare implications of biases. The behavioral literature uses several notions of overconfidence. This chapter follows Kyle and Wang (1997), Odean (1998), and Hackbarth (2008) in defining overconfidence as a bias in the second moment, more specifically an underestimation of risk. The overestimation of the expected value, a bias in the first moment, is called optimism.

Pure Financing Decisions

The following considerations are largely based on Heaton (2002), who offers the first model to link managerial biases to financing decisions, and Malmendier et al. (2007). Heaton models a situation in which an optimistic manager believes that capital markets undervalue corporate securities and thus exhibits a standard pecking order preference. This chapter extends Heaton's approach to the analysis of managerial overconfidence.

Managerial optimism and overconfidence can in principle have very different implications for financing decisions, in particular with respect to the choice between equity and debt. A clear distinction of these two managerial traits yields interesting differences. Compared to optimism, overconfidence implies a different story with respect to financing decisions in that these managerial traits can generate both pecking order and reverse pecking order preferences.

Financing Decisions of an Optimistic Manager

Consider a simple, one-period, two-date model, in which all agents are risk neutral. The risk-free rate is normalized to zero. At time 0, a manager decides upon the financing of an investment project, which requires an initial investment outlay of K, and yields an uncertain cash flow in the future at time 1: with probability p the outcome is high (V_H) and with $(1 - p)$ the outcome is low (V_L). The model assumes that undertaking the project is socially desirable, that is,

$$\mathrm{E}[V] = p \cdot V_H + (1 - p) \cdot V_L > K.$$

There are three financing choices: internal financing over internal cash or riskless debt, risky debt, or equity. A debt contract is a financial security that promises to pay a fixed amount in the future in exchange for money today. Risk-free debt offers a payment that is made with certainty, that is, with a probability of one. For the fixed payment that risky debt promises to make, a strictly positive probability exists that the debt holders do not receive the payment. This happens if the project payoff is smaller than the promised fixed payment. In the case of bankruptcy, the firm defaults, meaning the debt holders assume control of the project. Equity is a security that receives all cash flows left in the firm at time 1. The manager chooses the financing alternative that minimizes perceived financing costs and hence maximizes equity (i.e., initial firm) value. For the moment, the discussion abstracts from taxes and financial distress.

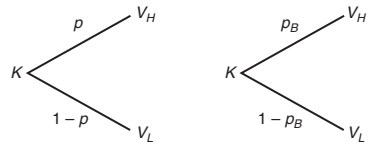

Exhibit 21.1 Rational and Optimistic Managers' Beliefs
Note: The figure shows the future cash flows and probabilities of the investment project from the perspectives of a rational and an optimistic manager. An optimistic manager overestimates the probability of the good state and underestimates the probability of the bad state.

For the issue of risky debt to make sense, assume that if the bad state of nature occurs, the project payoffs are insufficient to make the fixed payment of K to debt holders, that is, $V_L < K$. Rational investors know the true parameters and set prices efficiently. An optimistic manager expects the good state to occur with $p_B > p$ where subscript B denotes the biased parameter values; she attaches too much weight to the good state and too little to the bad state (see Exhibit 21.1).

Financing costs are $c = X/K - 1$, where X denotes the expected payment to investors. The cost of internal financing and the cost of financing with risk-free debt are given as

$$c_I = K/K - 1 = 0$$

Now consider the cost of equity financing. Investors receive a share s of the firm in exchange for the initial investment outlay K. Rational investors expect the future value of the firm to be

$$\mathrm{E}[V] = p \cdot V_H + (1 - p) \cdot V_L$$

Hence, in exchange for the upfront payment of K, investors demand a fraction $s = K/\mathrm{E}[V]$ of the firm to break even in expectation. A biased manager believes that the future value of the firm is

$$\mathrm{E}[V_B] = p_B \cdot V_H + (1 - p_B) \cdot V_L > \mathrm{E}[V]$$

As a consequence, she is only willing to offer a smaller fraction of

$$s_B = K/\mathrm{E}[V_B] < s$$

to investors. A manager biased in this way perceives financing costs of equity issuance of

$$c_E = s \cdot \mathrm{E}[V_B]/K - 1$$

Next, consider the cost of debt financing. Debt holders require a risk-adjusted interest rate i such that

$$K = p \cdot K \cdot (1 + i) + (1 - p)V_L$$

to break even in expectation. The perceived financing costs of risky debt are thus given by

$$c_D = [p_B \cdot K \cdot (1 + i) + (1 - p_B) \cdot V_L]/K - 1$$

Proposition 1. An optimistic manager with biased beliefs $p_B > p$ exhibits a standard pecking order preference. That is, she prefers (1) internal financing to risky debt and (2) risky debt to equity.

Proof:

1. Risky debt being more costly than internal financing is equivalent to $c_D > 0$. Substituting i and rearranging terms yields $p_B > p$, which is true by assumption for an optimistic manager.
2. To establish the second implication, the model has to show $c_E > c_D$. This inequality is equivalent to $s[p_B V_H + (1 - p_B)V_L] > p_B D + (1 - p_B)V_L$, where s denotes the break-even share in the firm demanded in exchange for K by rational equity holders and $D \equiv [K - (1 - p)V_L]/p$ denotes the principal repayment including interest demanded by rational bondholders. As the conjectured inequality suggests, equity pays less in the bad state of nature but more in the good state of nature. Substituting s and D into the preceding inequality and rearranging terms yields $[p_B V_H + (1 - p_B)V_L] \cdot K/[pV_H + (1 - p)V_L] > (p_B/p) \cdot K + (1 - p_B/p) \cdot V_L$. Subtracting $(p_B/p)K$ and multiplying by $p[pV_H + (1 - p)V_L]$ on both sides of the inequality yields $(p - p_B)K > (p - p_B) \cdot [pV_H + (1 - p)V_L]$. For an optimistic manager $(p - p_B) < 0$, the result is $K < pV_H + (1 - p)V_L$, which is true by assumption.

   The simple model suggests that an optimistic manager exhibits a pecking order preference structure due to a perceived wedge in the costs of internal and external funds. Internal financing is insensitive to biases in beliefs. To complete the pecking order, an optimistic manager prefers the issue of risky debt over equity. The intuition behind this result is as follows: Equity is more sensitive to biases in beliefs than risky debt. This is a consequence of risky debt consisting of a fixed (and therefore insensitive) and a contingent (and therefore sensitive) claim. Hence, an optimistic manager perceives the undervaluation of equity to be more severe than the undervaluation of risky debt.

   As a result, the model predicts that an optimistic manager seeks to reduce the firm's reliance on external capital markets, for example, by retaining cash within the firm rather than disbursing it, by avoiding high debt levels, and by hedging cash flows to avoid the chance of a financing deficit. As shown, the assumption of managerial biases can serve as an alternative explanation for Myers and Majluf's (1984) approach to explain pecking order preferences by asymmetric information, where the manager also minimizes perceived financing costs. The pecking order emerges due to a wedge between actual and perceived financing costs, but in the asymmetric information model, the investors and not the managers have biased beliefs.

Notably, managerial biases do not necessarily result in a pecking order preference. Malmendier et al. (2007) point out that the overall effect on financing preferences hinges upon the precise nature of the bias. Building on the explicit distinction between optimism and overconfidence as suggested by Hackbarth (2008), the following introduces overconfidence into the model.

Financing Decisions of an Overconfident Manager

Overconfidence is specified as a bias in beliefs about the value of the project in the good and in the bad state while the expectation of the future value remains constant to eliminate optimism (see Exhibit 21.2). An overconfident manager believes that the value of the project is $V_H - b/p$ in the good state and $V_L + b/(1-p)$ in the bad state, where $b > 0$. Therefore, the expectation about the future firm value is equal to $\mathrm{E}[V] = pV_H + (1-p)V_L$ for both an overconfident manager and rational investors. Now consider the value of equity for a *levered* firm, that is, a firm that has risky debt outstanding. Assume that the investment is financed by risky debt with face value $V_L < F < K$ and equity bears investment expenses of $K - F$. Rational investors expect to receive a payment of $pF \cdot (1+i) + (1-p)V_L$ in exchange for F, which implies a gross interest rate of $1 + i = [F - (1-p)V_L]/(pF)$. Debt holders and an overconfident manager disagree about the expected payment in the bad state; while debt holders expect V_L, an overconfident manager expects them to receive $V_L + b/(1-p)$. Assume that b is sufficiently small such that the perceived value in the good state is still higher than the perceived value in the bad state and such that an overconfident manager still expects default in the bad state, that is, $V_L + b/(1-p) < F$.

An overconfident manager, who contemplates bondholders' break-even condition with her expects to effectively pay $pF(1+i) + (1-p)V_L + b = F + b$ back to bondholders rather than paying only F. Equity is a residual claim that is protected by limited liability. Accordingly, equity holders receive their share in the firm value after bondholders' claims have been satisfied, the worst case being nil in case of default. In expectations they receive $s \cdot \mathrm{E}[\max\{V - F(1+i), 0\}] = s(p[V_H - F(1+i)] + (1-p) \cdot 0) = sp[V_H - F(1+i)]$. Substituting for i this gives $s \cdot (\mathrm{E}[V] - F)$. Rational equity holders demand a fraction s such that $s = (K-F)/(\mathrm{E}[V] - F)$. Yet an overconfident manager perceives that a fraction of $s_B = (K - F - b)/(\mathrm{E}[V] - F)$ is the fair offer to equity holders.

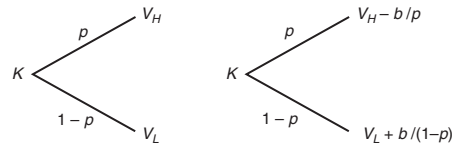

Exhibit 21.2 Rational and Overconfident Managers' Beliefs

Note: The figure shows the future cash flows and the probabilities of the investment project from the perspectives of a rational and an overconfident manager. An overconfident manager overestimates the cash flow in the good state and underestimates the cash flow in the bad state.

Proposition 2. The overconfident manager in a levered firm exhibits a reverse pecking order preference. She prefers (1) internal financing over risky debt and (2) equity to internal financing.

Proof:

1. The model must show $c_D > 0$. Rational debt holders demand interest rate $i = [(F - (1-p)V_L)/(pF)] - 1$. An overconfident manager perceives the cost of risky debt to be $c_D = [pF(1+i) + (1-p)V_L + b]/F - 1 = b/F > c_I = 0$ given that $b > 0$ by assumption.
2. The model must show $c_E < 0$. An overconfident manager perceives the cost of equity to be $c_E = s(\mathrm{E}[V] - F - b)/(K - F) - 1 = -b/(\mathrm{E}[V] - F) < 0 = c_I$ as long as $b > 0$, which holds by assumption.
   An overconfident manager perceives risky debt to be undervalued because, according to her view, investors underestimate the payoff they receive if the firm defaults. However, an overconfident manager perceives equity to be overvalued because she thinks that equity holders underestimate the expected payoff to bondholders and therefore overestimate the residual payoff to equity holders. This result is due to the convexity of equity. Equity can be interpreted as a call option on the firm's assets. The value of an option increases with the risk of the underlying asset and thus the value of equity rises with the risk of the project payoff. As a result, an overconfident manager, who perceives less risk surrounds the firm, strictly prefers equity over internal financing in case of a levered firm. If the assumption on b made earlier is relaxed and allowing for $V_L + b/(1-p) \geq F$, an overconfident manager thinks that she can issue riskless debt, although from the perspective of rational investors this is not the case. She continues to view equity to be overvalued and debt to be undervalued. If the firm is unlevered, then the result shows that $s = s_B$ for overconfidence: that is, an overconfident manager views equity to be fairly priced, and she is indifferent between equity financing and internal financing. However, an overconfident manager always prefers internal financing over the issue of risky debt. Consequently, a (weakly) reverse pecking order emerges for an overconfident manager.
   So far the chapter has shown that the distinction between optimism and overconfidence generates interesting predictions. To assume that managers are either exclusively optimistic or exclusively overconfident is restrictive. In the real world, co-existing biases exist. Whether a firm exhibits a pecking order or reverse pecking order structure then depends on the actual mix of the two managerial biases. The intuition of the model above can also provide an explanation for equity timing: A manager who perceives equity to be overvalued issues new shares, while a manager who views equity to be undervalued repurchases shares.
   The empirical evidence on pecking order preferences is ambiguous. While Shyam-Sunder and Myers (1999) find support for the standard pecking order, Frank and Goyal (2003) cannot find any supportive evidence, and Fama and French (2002) reveal inconclusive results. In particular, the latter two studies find that small growth firms prefer equity to debt financing although

the theory predicts that asymmetric information should be especially high for these firm types. The above reasoning provides an explanation: The preference structure may depend on the magnitude and combination of managerial optimism and overconfidence.

Pure Bankruptcy Decisions

Bankruptcy denotes a transfer of ownership where debt holders assume control of the firm. The firm loses value in case of default due to direct bankruptcy costs, such as auditors' and legal fees, and indirect costs of financial distress, such as the reluctance of suppliers to continue business with the firm, or operational inefficiencies due to managerial resources being tied to the bankruptcy event. Default can be modeled exogenously or endogenously (Leland, 1994). Exogenous default is triggered according to covenants or other exogenous constraints such as regulatory capital requirements, for example, if the firm value falls sufficiently far beneath face value. But as often observed, firms continue even when there is little net worth of equity. Endogenous default represents an alternative according to which managers choose the bankruptcy level that maximizes equity value. Equity can be interpreted as a call option on the firm's asset value. Managers then optimally decrease the bankruptcy threshold to the point beyond which a further decrease would lead to negative equity values. For example, an endogenous bankruptcy threshold increases with the chosen debt level and decreases with the riskiness of the firm.

As Hackbarth (2008) shows, optimistic managers select a lower default level, and overconfident managers select a higher default threshold when financing decisions are taken as given. To put this differently, the manager with an optimism bias is more likely to declare default too late (i.e., when earnings are too low), but a manager with an overconfidence bias does the opposite. This makes intuitive sense because in financial distress both debt and equity exhibit option-like characteristics and both are driven predominantly by the risk of earnings rather than by the mean of earnings. Managerial traits hence result in a divergence from the default policy preferred by rational equity holders.

These results change when managers jointly choose bankruptcy and financing decisions. For jointly optimal financing decisions, both optimistic and/or overconfident managers choose a higher default level. With respect to the optimistic manager, the previous observation for given debt levels is reversed: an optimistic manager chooses a higher debt level. Because the default level increases with the debt level, she then also selects a higher default level. In corporate practice, managers do not make bankruptcy and financing decisions in isolation.

Trade-off Model: Balancing Bankruptcy Costs and Tax Benefits

The preceding sections have focused on the manager's bankruptcy and financing decision absent any other advantages or disadvantages of debt or equity financing. In the latter case, the only determinant of the choice between equity and debt is the differential perception of mispricing. In this frictionless world without any bankruptcy costs and taxes, capital structure decisions are irrelevant as argued by Modigliani and Miller (1958). Now, this chapter considers the interaction between managerial biases and capital structure determinants

suggested by traditional trade-off theory, which leads to an augmented trade-off theory.

Previously, in the absence of biases, the manager is indifferent between equity and debt financing. Now assume that debt financing is attractive because it generates tax benefits relative to equity. Fully financing by issuing risky debt is inadvisable because debt financing also generates bankruptcy costs. The manager can increase the value of the firm by issuing debt that shelters income from tax authorities as long as the risk of entering financial distress is not too high. In case of default, bondholders assume control and liquidate the assets of the firm. The assumption is that liquidation of the firm is costly and therefore the entire asset value cannot be recovered. The higher the leverage of the firm, the more likely the firm defaults. As a result, the value of the firm now consists of the value of the unlevered assets, tax benefits, and bankruptcy costs, which leads to an interior optimum for the firm's financing decisions.

Malmendier et al. (2007) develop a corporate financing model that includes tax benefits and bankruptcy costs, which is similar to Heaton's (2002) model. According to their model in which bankruptcy costs are fixed and do not vary with the amount of debt financing, a rational manager chooses either full debt or full equity financing, depending on whether tax benefits are high or low relative to bankruptcy costs. An optimistic manager perceives corporate securities to be undervalued by the market and thus views external financing as unduly costly. As a result, she first exhausts cash reserves and riskless debt capacities before she issues risky securities. If internal financing is available, she underutilizes debt relative to its tax deductibility. If internal financing is unavailable, an optimistic manager is more likely to select debt financing because she overestimates tax benefits and perceives equity to be unduly costly. The central results of Malmendier et al. (2007) are that (1) conditional on tapping external financing, an optimistic manager chooses more debt than a rational one, and (2) unconditionally, an optimistic manager issues debt more conservatively. In sum, standard pecking order preferences again follow from managerial optimism.

In a related study, Hackbarth (2008) builds a complementary model, which distinguishes between optimism and overconfidence. He develops a trade-off model using a dynamic contingent claims approach in which earnings evolve stochastically over time with a mean and risk of earnings. Optimism is modeled as an upward bias in the mean of the firm's uncertain earnings while overconfidence is a downward bias in the risk of the earnings. Another benefit of this approach is that bankruptcy and financing decisions are treated jointly within the presence of a standard trade-off model of capital structure. Assume the presence of bankruptcy costs that increase with the level of debt financing and decrease in firm value. Crucially, the manager's optimal financing decisions hinge upon the perceived tax benefits-bankruptcy costs trade-off.

The model predicts that a biased manager has a predisposition for debt finance because she overestimates tax benefits relative to bankruptcy costs. An optimistic manager thinks that the firm is more profitable than it actually is. Therefore, the manager believes that the firm is less prone to experience financial distress, while an overconfident manager underestimates the uncertainty of the firm's environment and therefore also underestimates the likelihood of bankruptcy. As a consequence, an optimistic and/or overconfident manager chooses higher debt levels compared

to a rational manager. This mechanism constitutes the *leverage effect* of managerial biases, which is a crucial driver for the results in the following sections. Despite choosing higher debt levels, an overconfident manager still perceives equity to be overvalued as has been established in the preceding section.

To sum up, managerial biases in a trade-off world imply the following empirical predictions. First, biased managers choose higher debt levels because both optimistic and overconfident managers believe that they are less likely to experience financial distress and overestimate the use of tax shields. Second, biased managers do not necessarily exhibit a standard pecking order preference. Moreover, in this pure trade-off environment where firm value consists only of the value of unlevered assets, tax benefits, and bankruptcy costs, managerial biases lead to costly deviations from the capital structure that optimally balances tax benefits and bankruptcy costs. Specifically, firms use too much debt, which leads to welfare losses for shareholders. Thus, in this environment managerial biases are detrimental to shareholder welfare.

From a shareholder welfare point of view, biased managers may also destroy value because of inefficient investment behavior; managerial optimism can lead to investment in negative net present value (NPV) projects. If external funding is perceived as too costly and internal funding is unavailable, optimistic managers might refrain from undertaking positive NPV projects (Heaton, 2002). Moreover, if internal funding is available, optimistic managers might undertake negative NPV projects that they misperceive to be efficient (Gervais, Heaton, and Odean, 2009). In the modeling environment considered by Hackbarth (2009), overconfidence does not hurt as much as optimism because overconfident managers only undertake weakly positive NPV projects. The chapter proceeds by discussing and integrating interactions between financing and investment decisions before considering several empirical test results.

Trade-off Model: Incorporating Manager-Shareholder Conflicts

Capital structure decisions are not only driven by corporate taxes and bankruptcy costs but also by conflicts of interests among claim holders. Hereinafter, the discussion now builds on the arguments brought forward by Hackbarth (2008) on how managerial traits affect financing decisions in the presence of conflicts among claim holders. The present section analyzes the interaction of managerial biases and manager-shareholder conflicts. A manager-shareholder conflict arises if a manager does not use corporate resources to maximize shareholder value but uses them for the consumption of private benefits (Jensen and Meckling, 1976) or to divert discretionary funds (Jensen, 1986). Because shareholders cannot perfectly monitor managers and collectively organize to exert control, managers are inclined to invest in negative NPV projects from the perspective of shareholders. A manager's opportunity to divert funds depends on the disciplinary forces, such as the board of directors or the market of corporate control. The losses accruing to shareholders due to manager-shareholder conflicts are called agency costs. The managerial discretion to use corporate resources for the maximization of her utility at the expense of shareholders tends to increase with the free cash flow available. Debt can serve as a disciplinary tool in the presence of manager-shareholder conflicts because it reduces free cash flow and, as a result, the leeway that a manager enjoys.

Now suppose that a manager can use part of the free cash flow for private consumption. The magnitude of agency costs due to managerial diversion opportunities increases in the level of earnings available relative to the debt coupon. The value of the firm now consists of the value of unlevered assets, tax benefits, bankruptcy costs, and agency costs. A firm without a self-interested manager, or with a self-interested manager who is constrained from diverting funds, is more valuable because agency costs are nil. In the base case, consider the scenario without managerial biases. A self-interested manager chooses a lower debt level because this increases the funds that are available for diversion. This lowers firm value for two reasons: The tax shield is not sufficiently exploited, which reduces tax benefits, and agency costs are higher.

Analyzing the effects of managerial biases on the manager-shareholder conflict, the discussion now addresses the question of whether biased managers make better financing choices compared to their unbiased counterparts. An optimistic and/or overconfident manager perceives lower expected bankruptcy costs because she underestimates the likelihood of default. Therefore, she chooses a higher debt coupon and thereby unknowingly constrains herself as she reduces the funds available for potential diversion. This mechanism called the *leverage effect*, which was introduced in the previous section, alleviates agency costs, raises tax benefits from a suboptimal level, and hence leads to a larger firm value. Put differently, mild biases are beneficial for shareholder welfare. By contrast, extreme biases may be detrimental because they can lead to excessive bankruptcy costs, which offset the positive role of curbing agency conflicts.

Trade-off Model: Incorporating Bondholder-Shareholder Conflicts

Managerial traits also have implications for a different class of conflicts among claim holders—bondholder-shareholder conflicts arise if firms have risky debt outstanding and managers maximize the value of equity rather than the value of the firm. Under the assumption that investment decisions are not pre-contractible, managers can make investment decisions after risky debt is in place and thereby hurt bondholders to serve shareholders' interest. Potential sources of the contractual incompleteness are contracting costs, complexity, or limited verifiability of investments. There are several variants of bondholder-shareholder conflicts such as debt overhang, risk shifting, and asset stripping. This section largely focuses on the debt overhang problem, as studied in detail by Hackbarth (2009), and then extends the discussion to other variants. To allow for the possibility that the manager can choose the investment policy requires endogenizing the investment along with bankruptcy and financing decisions.

The debt overhang or underinvestment problem goes back to Myers (1977), who argues that managers who maximize equity value (second-best) rather than firm value (first-best) have an incentive to defer investment inefficiently. The underinvestment problem arises because risky debt captures some investment benefits without bearing the costs. From the perspective of shareholders, shareholders bear the costs of some investment from which only bondholders benefit. This may lead to underinvestment, as managers maximizing shareholder value may not be willing to undertake the investments that make equity holders worse off. Bondholders

anticipate the manager's behavior and impound the underinvestment into prices. As a result, risky debt is more costly. The additional costs are labeled "agency costs of debt." Agency costs of debt increase with the amount of debt financing and with the attractiveness of the investment opportunity set. The higher initial cost of debt is the source of inefficient investment behavior when equity is maximized at the investment date.

Managerial biases affect the underinvestment problem through two countervailing effects: a *timing effect* that alleviates the underinvestment problem and a *leverage effect* that aggravates the problem. According to the *timing effect*, a biased manager—optimistic and/or overconfident—invests earlier than her unbiased counterpart. The investment strategy entails an optimal point of exercise of the option to invest. The perception of a higher growth rate reduces the opportunity costs of waiting to invest. The perception of reduced uncertainty implies a lower perceived value of the option to wait for new information to arrive and thus decreases the value of waiting to invest. As a result, both biases lead to earlier investment and thus more investment according to an NPV interpretation. If any other benefits or costs are ignored, biased managers choose inefficient investment policies and thus undermine shareholder welfare.

These biases also imply different financing policies. Recall the *leverage effect* that has been established above. Both managerial traits create a predisposition for debt finance; an optimistic and/or overconfident manager chooses more debt compared to her unbiased counterpart. Higher debt levels aggravate the underinvestment problem. Anticipating mild biases, the timing effect outweighs the leverage effect.

The discussion now turns to the combined effects on the underinvestment problem. Rational bondholders anticipate that the manager has an incentive to deviate from the investment strategy that maximizes firm value to an investment strategy that maximizes equity value. Biased beliefs lead to more favorable corporate policies from the bondholders' point of view: more investment and earlier bankruptcy. Over some region of mild biases, the timing effect outweighs the leverage effect. Biased managers who maximize the perceived value of equity unknowingly approach the first-best debt and investment policies: that is, they choose more debt and more investment. Although the value of equity is reduced due to an increased debt coupon, higher proceeds from issuing debt due to an alleviated underinvestment problem can more than offset the decline in the value of equity. Consequently, shareholder welfare is improved. Yet, extreme forms of biases exacerbate the debt overhang problem because the leverage effect dominates the timing effect, which leads to additional efficiency losses for shareholders.

The results above can be extended to other real option exercise decisions by managers that generate bondholder-shareholder conflicts due to a lack of *ex-ante* contractibility. Leland (1998), for example, studies the risk-shifting problem in a similar setting. Assuming managers can choose the investment risk of a levered firm ex post, they have an incentive to increase risk in order to maximize equity value. Recall that the equity value in a levered firm can be interpreted as a call option on the firm's assets. Therefore, the value of equity increases, with risk creating an opportunity to transfer wealth from bondholders to shareholders.

Asset stripping constitutes a further variant of conflicts between bondholders and shareholders. The term refers to the possibility of managers stripping some of the firm's assets and paying out dividends to shareholders when financial distress

is approaching. In healthy firms, dividend payments are nearly irrelevant from the perspective of shareholders and bondholders. In situations of financial distress, however, this is no longer true; dividend payouts financed by asset sales serve the interest of shareholders while hurting bondholders' recoveries. A firm in financial distress cannot satisfy the bondholders' claims. According to the residual nature of shareholders' claims, they should not receive anything unless the firm does not obey the priority rules. By paying out dividends that are financed by asset sales, shareholders can nevertheless extract resources from the firm and thereby reverse the contractual priority of debt over equity claims (Scharfstein and Stein, 2008).

Analogous to debt overhang, risk shifting and asset stripping present real option exercise problems. What do they have in common? They imply a favorable *timing effect* in that mildly overconfident and/or optimistic managers bring firms closer to first-best outcomes. The biases increase the perceived value of the firm's options in bad states, and therefore an optimistic and/or overconfident manager chooses lower critical thresholds, which tends to be more consistent with (first-best) firm value-maximization.

More specifically, option exercise to defer bankruptcy by risk shifting becomes attractive only after mediocre firm performance (i.e., for low values of earnings or firm value, respectively). Optimistic managers perceive a higher growth rate and hence a lower probability of bankruptcy. This lowers the opportunity cost of waiting or increases the option value of waiting to risk shift or asset strip. The lower value of the option to ex post deviation implies a later change in the investment risk or respectively a later initiation of asset sales (i.e., at lower critical thresholds). Similarly, overconfident managers perceive a less uncertain environment with a lower risk of bankruptcy. This renders the opportunity to wait for more information to arrive more valuable. Hence, there is a higher option value to wait to risk-shift or asset-strip. As a result, an overconfident manager also selects a lower critical threshold to exercise the option, which implies later risk shifting and asset stripping.

To sum up, managerial biases can play a positive role for levered firms because they ameliorate manager-shareholder conflicts and bondholder-manager conflicts. The following empirical predictions result. First, rational investors seek out the labor market for mildly biased managers. Second, firms with mildly biased managers are more valuable than otherwise comparable firms. This implies, for example, that in the presence of conflicts among claim holders, hiring biased managers should be associated with positive abnormal announcement returns.

TESTS

This section reviews empirical evidence regarding the impact of managerial biases on financing decisions. Before turning to direct evidence on the empirical predictions developed above, various proxies for managerial traits are considered.

Empirical Proxies

Measuring managerial traits is not straightforward because they are not directly observable. The following discussion considers two types of identification that have been proposed by the literature: revealed beliefs and outside perception

(see Exhibit 21.3 for an overview). The table contrasts advantages and disadvantages of the measures suggested in the empirical literature. There is a trade-off between the preciseness with which the nature of biases is captured and data availability; survey-based measures are more precise but difficult and costly to obtain whereas more indirect measures based on publicly available data such as executive compensation, accounting figures, or press statements are more noisy.

The revealed beliefs proxies for biases are derived from information about executive compensation, accounting figures, or survey data. Malmendier and Tate (2005a, 2005b) are the first to propose a measure for managerial biases. They develop a proxy that is based on managers' personal portfolio choices. The basic idea behind their approach is that managers suffer from under-diversification because they receive stock-based compensation and have human capital invested in the firms. Even modest degrees of risk aversion suggest that managers should diversify their portfolios by exercising in-the-money options early or selling company stock. Malmendier and Tate argue that managers who hold options too long and increase their exposure to the firm by purchasing additional shares reveal that they are overly optimistic about the firm's prospects.

One may expect that managers exercise options late and purchase additional stock because they have superior information about the true value of the firm and not because they are biased. To control for this alternative explanation, Malmendier and Tate (2005b) test whether managers earn abnormal returns from exercising late. They find that, on average, late-exercisers do not earn significant abnormal returns and would have been better off with early exercise. They conclude that, on average, their measures capture a bias in beliefs and not inside information. Malmendier and Tate also perform a comprehensive list of further robustness checks that address potential alternative explanations of late exercise such as tax considerations, signaling, and risk tolerance.

The assumption that late-exercisers and net stock purchasers always suffer from biased beliefs and never act on the basis of superior information is inconsistent with the strong empirical evidence on the private information content of trading by corporate insiders (Seyhun, 1986). Hence, the ability to distinguish between inside information and optimism on an individual level would increase the robustness of the measure developed by Malmendier and Tate (2005b).

A further drawback of this approach is its failure to capture overconfidence. As argued previously, an overconfident manager perceives equity to be (weakly) overvalued and would hence opt to exercise early or sell stock respectively.

Using survey data, Ben-David, Graham, and Harvey (2007) and Puri and Robinson (2007) develop a complementary approach to measure overconfidence and optimism building on a method from experimental research. While Puri and Robinson analyze personal financing choices of individuals, Ben-David et al. investigate corporate policies. The following discussion, therefore, focuses on the latter work. Managers, in their case chief financial officers (CFOs), are asked to predict the expected rate of return of the S&P 500 as well as the internal rate of return of their own firm and the 10th and 90th percentiles of the distributions. A narrow (wide) confidence interval reflects high (low) overconfidence. The main advantages of this approach are that it allows researchers to disentangle optimism and overconfidence and to separate the effects from the overestimation of forecasting abilities and from the overestimation of control over firm performance.

Exhibit 21.3 Comparison of Overconfidence Measures

Note: The table compares overconfidence measures suggested by the empirical literature. It compares and contrasts data requirements, advantages, and disadvantages.

Measure	Authors	Approach	Idea	Data	Advantages	Disadvantages
Late option exercise	Malmendier et al. 2007	Revealed beliefs	Managers should exercise options early and dispose of stock due to under diversification; failure to do so indicates optimism	Executive stock and stock options	Public data	Optimism and overconfidence difficult to disentangle, difficult to distinguish from inside information
Press perception	Malmendier et al. 2007	Outside perception	Managers classified as biased if press portrays them as "confident" and "optimistic"	Press	Public data	Assumes unbiased press coverage, ambiguity of language: Meaning of attributes may be different in press compared to meaning in behavioral research
Return distribution forecasts of stock market and firm	Ben-David et al. 2007	Revealed beliefs	Comparison between forecasts and realizations in first and second moments allows for identification of optimism and overconfidence	Survey data	Clear distinction between optimism and overconfidence, differentiation between biases toward economy and own firm possible	Difficulty to obtain survey data
Investment level	Campbell et al. 2009	Revealed beliefs	Indirect measurement over implications of biases to investment: high investment relative to industry-average as bias indicator	Accounting data	Public data	Indirect and hence noisy measure, no clear differentiation to asymmetric information possible

One may expect that narrow confidence bounds capture forecasting skill rather than overconfidence. Ben-David et al. (2007) address this concern by analyzing whether overconfident CFOs produce more accurate forecasts. They run a regression of the absolute forecasting error as a proxy for skill on overconfidence variables with the following result; overconfident CEOs predict future stock market returns more precisely. The authors argue that overconfidence overshadows accuracy on net and skill does not entirely explain the managers' tight confidence intervals. This finding provides a rationale to explicitly distinguish between overconfidence and skill. Interestingly, Ben-David et al. document that managers as a group are overconfident as only 38 percent of their forecasts lie within the 80 percent confidence interval. Still, they find that managers are not optimistic on average. This result suggests that overconfidence is the dominating trait and provides a rationale for explicitly distinguishing between both traits.

Campbell et al. (2009) suggest another measure that is based on the managers' revealed beliefs. Based on the prediction that overconfidence is positively related to investment, they use the industry-adjusted investment level as an instrument for overconfidence. This measure is expected to be noisy with respect to containing information about overconfidence, due to the existence of numerous alternative explanations such as growth prospects, but can nevertheless serve as an additional robustness check.

To increase the robustness of measuring biases, Malmendier and Tate (2005a) suggest using the perceptions of managers in the financial press. Based on the press portrayal of managers, they identify a manager as biased if she is more often described as "confident" and "optimistic" rather than "reliable," "cautious," "conservative," and "practical." The main weakness of this measure is the lack of clarity involving whether the financial press uses the terms in the strict meanings of biases in the first and second moments, namely mean and variance.

To sum up, a well-suited proxy should be able to capture optimism and overconfidence separately and to explicitly account for the possibility of superior information or skill.

Tests of Empirical Predictions

Bertrand and Schoar (2003) document that manager fixed effects can explain part of the variation of corporate decisions. Managerial traits theory provides an explanation for the existence of these fixed effects. The following reviews and discusses evidence regarding the empirical predictions developed in the preceding sections.

Malmendier and Tate (2005a, 2005b) and Malmendier et al. (2007) provide evidence on how managerial biases affect corporate policies. They find that optimistic managers exhibit high investment cash flow sensitivities, engage in unsuccessful mergers and acquisitions, avoid tapping external markets, and—conditional on tapping external markets—prefer debt over equity.

Based on the approach of Graham (2000), they find that optimistic managers underutilize debt relative to its tax benefits. The kink variable captures the amount of additional debt firms could issue before the marginal benefit of interest deduction begins to decline. The higher the kink variable, the more tax shield capacity remains unexploited. To analyze financing preferences conditional on tapping

external capital markets, Malmendier et al. (2007) consider the frequency of equity and debt issue conditional on public issuance as well as the net financing deficit approach by Shyam-Sunder and Myers (1999). The latter approach is advantageous as it is not restricted to public issues, but adds loans and other private sources of financing into the analysis. Furthermore, the approach allows identifying the impact of overconfidence separately from time-invariant firm fixed effects. Both specifications indicate that optimistic managers prefer debt over equity conditional on external financing. In sum, Malmendier et al. find that optimism can serve as an alternative determinant of standard pecking order preferences. Yet, the role of overconfidence remains largely unresolved by their empirical study, as their proxies are mainly designed to capture optimism.

Ben-David et al. (2007) analyze the relationship between survey-based measures and various corporate policies. They find that overconfident managers invest more, in particular into acquisitions, have higher leverage, are less likely to pay dividends, and are more likely to repurchase shares. The evidence is consistent with the leverage effect from Hackbarth's (2008, 2009) models. Despite this, the results do not indicate any significant influence of optimism on corporate policies.

The finding that overconfidence positively affects the likelihood of share repurchases is inconsistent with the empirical prediction of the model by Hackbarth (2008). The model predicts that purely overconfident managers perceive equity to be overvalued and hence prefer to issue equity rather than repurchase equity. Only if the degree of optimism is sufficiently high do managers switch to prefer share repurchases. Shedding more light on the co-variation of optimism and overconfidence in order to make more accurate statements about their differential influences on corporate policies would be interesting. Furthermore, using proxies based on firm-specific forecasting instead of forecasts on the U.S. economy would be desirable. The firm-specific measure is likely to be more informative with respect to biases because it is driven by both the overestimation of forecasting abilities and the overestimation of control over the firm's performance.

Campbell et al. (2009) are the first to study the implications of managerial traits for shareholder welfare. They test Goel and Thakor's (2008) model, which predicts that moderately overconfident managers maximize firm value because they alleviate losses stemming from managerial risk aversion. By the same token, Campbell et al. also test the predictions by Hackbarth (2008, 2009), who argues that mild forms of managerial biases are beneficial for shareholders.

Campbell et al. (2009) test the prediction that board of directors fire excessively overconfident managers because they overestimate the precision of information, underinvest in information acquisition, overinvest in projects, and hence destroy firm value. Rational managers are fired because they invest too little. The authors find that moderately overconfident managers minimize forced turnover rates. Their empirical findings thus support the predictions by Goel and Thakor (2008) and Hackbarth (2008) that mild forms of biases increase firm value.

On the one hand, considering forced turnover as the dependent variable is more powerful compared to firm value as it is less noisy. This approach presupposes the effectiveness of existing corporate governance systems. Campbell et al. (2009) directly address this issue and control for the strength of board governance. They find that the relationship between forced turnover and overconfidence

holds only among firms with strong governance. A worthwhile study would be to examine how managerial traits are directly related to firm value and the severity of conflicts among claimholders.

SUMMARY AND CONCLUSIONS

A nascent literature in financial economics focuses on managers' personality traits such as optimism and overconfidence that are two well-documented biases in the psychology literature on judgment under uncertainty. This chapter has reviewed some recent research in the area of behavioral corporate finance, which analyzes the implications of managerial optimism and overconfidence for capital structure decisions. Extending traditional capital structure theory to account for these managerial traits can apparently reduce some important gaps between known theoretical predictions and unresolved empirical facts.

Biases create a wedge between the actual financing costs and those perceived by biased managers. In particular, the distinction between optimism and overconfidence generates the following result: Depending on the magnitude and combination of optimism and overconfidence, both standard and reverse pecking order preferences may emerge. Against the background of the inconclusive empirical evidence of the asymmetric information theory, managerial traits theory offers an alternative explanation for financing preferences. In the presence of conflicts among claimholders, mild forms of managerial biases can enhance shareholder value by alleviating those conflicts. This result is due to managerial biases affecting the interaction between financing, bankruptcy, and investment decisions. In the presence of conflicts among claimholders, rational investors should seek out the labor market for mildly biased managers. The implication that mild biases enhance firm value suggests an alternative explanation for their persistence in the real world.

Empirical studies suggest that managerial traits significantly affect financing decisions in ways that are consistent with the theoretical predictions. Evidence shows that optimism is related to standard pecking order preferences. Biased managers tend to choose higher debt levels relative to their rational counterparts. Furthermore, the fact that moderately biased managers face lower forced turnover rates compared to rational or extremely biased managers is consistent with the empirical prediction that mild forms of biases increase firm value.

The topic offers several avenues for future theoretical and empirical research. The approach of modeling optimism and overconfidence separately could be extended to other corporate decisions such as investment, mergers, or dividends. Furthermore, to assume that either investors or managers are fully rational is very restrictive. Relaxing this assumption and combining managerial traits theory and asymmetric information theory into a single modeling framework for financing decisions would be worthwhile. Moreover, the explicit distinction between superior information and biased beliefs would be useful in order to empirically discriminate between asymmetric information theory and managerial traits theory. Progress in empirical research rests upon the construction of robust measures. For example, investigating the relationship between alternative measures and analyzing their determinants to construct instruments are likely to present promising routes to enhance the understanding of the effects of managerial biases.

DISCUSSION QUESTIONS

1. Which novel insights does managerial traits theory offer with respect to pure financing decisions?
2. Under which circumstances do managerial biases improve shareholder welfare?
3. In which alternative ways can optimism and overconfidence be empirically measured?
4. Which internal mechanisms could facilitate that rational managers become optimistic and overconfident?
5. What are alternative advantages and disadvantages of managerial optimism and overconfidence?

REFERENCES

Baker, Malcolm, Richard S. Ruback, and Jeffrey Wurgler. 2007. Behavioral corporate finance: A survey. In *Handbook of corporate finance: Empirical corporate finance*, (ed.) B. Espen Eckbo, Volume 1, 145–68. Amsterdam: Elsevier.

Ben-David, Itzahak, John R. Graham, and Campbell R. Harvey. 2007. Managerial overconfidence and corporate policies. Working Paper, University of Chicago.

Bertrand, Marianne, and Antoinette Schoar. 2003. Managing with style: The effect of managers on firm policies. *Quantitative Journal of Economics* 118:4, 1169–208.

Campbell, T. Collin, Shane A. Johnson, Jessica Rutherford, and Brooke W. Stanley. 2009. CEO confidence and forced turnover. Working Paper, Texas A&M University.

Fama, Eugene F., and Kenneth R. French. 2002. Testing tradeoff and pecking order predictions about dividends and debt. *Review of Financial Studies* 15:1, 1–33.

Frank, Murray Z., and Vidhan K. Goyal. 2003. Testing the pecking order theory of capital structure. *Journal of Financial Economics* 67:2, 217–48.

Gervais, Simon, James B. Heaton, and Terrance Odean. 2009. Overconfidence, compensation contracts, and labor markets. Working Paper, Duke University.

Goel, Anand M., and Anjan V. Thakor. 2008. Overconfidence, CEO selection, and corporate governance. *Journal of Finance* 63:6, 2737–84.

Graham, John R. 2000. How big are the tax benefits of debt? *Journal of Finance* 55:5, 1901–41.

Hackbarth, Dirk. 2008. Managerial traits and capital structure decisions. *Journal of Financial and Quantitative Analysis* 43:4, 843–82.

Hackbarth, Dirk. 2009. Determinants of corporate borrowing: A behavioral perspective. *Journal of Corporate Finance* 15:4, 389–411.

Heaton, James B. 2002. Managerial optimism and corporate finance. *Financial Management* 31:2, 33–45.

Jensen, Michael C. 1986. Agency costs of free cash flow, corporate finance and takeovers. *American Economic Review* 76:2, 323–29.

Jensen, Michael C., and William Meckling. 1976. The theory of the firm: Managerial behavior, agency costs, and ownership structure. *Journal of Financial Economics* 3:2, 305–60.

Kyle, Albert S., and F. Albert Wang. 1997. Speculation duopoly with agreement to disagree: Can overconfidence survive the market test? *Journal of Finance* 52:5, 2073–90.

Leland, Hayne E. 1994. Corporate debt value, bond covenants and optimal capital structure. *Journal of Finance* 49:4, 1213–52.

Leland, Hayne E. 1998. Agency costs, risk management and capital structure. *Journal of Finance* 53:4, 1213–43.

Malmendier, Ulrike, and Geoffrey Tate. 2005a. Does overconfidence affect corporate investment? CEO overconfidence measures revisited. *European Financial Management* 11:5, 649–59.

Malmendier, Ulrike, and Geoffrey Tate. 2005b. CEO overconfidence and corporate investment. *Journal of Finance* 60:6, 2661–700.
Malmendier, Ulrike, Geoffrey Tate, and Jon Yan. 2007. Capital structure and overconfidence. Working Paper, University of California, Berkeley.
Modigliani, Franco, and Merton Miller, 1958. The cost of capital, corporation finance, and the theory of investment. *American Economic Review* 48:3, 261–97.
Myers, Stewart C. 1977. Determinants of corporate borrowing. *Journal of Financial Economics* 5:5, 147–75.
Myers, Stewart C., and Nicholas S. Majluf, 1984. Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics* 13:2, 187–221.
Odean, Terrance. 1998. Volume, volatility, price and profit when all traders are above average. *Journal of Finance* 53:6, 1887–934.
Puri, Manju, and David T. Robinson. 2007. Optimism and economic choice. *Journal of Financial Economics* 86:1, 71–99.
Scharfstein, David S., and Jeremy C. Stein. 2008. This bailout doesn't pay dividends. *New York Times*, October 21, 29.
Seyhun, Nejat H. 1986. Insiders' profits, cost of trading, and market efficiency *Journal of Financial Economics* 16: 2, 189–212.
Shyam-Sunder, Lakshmi, and Stewart C. Myers. 1999. Testing static trade-off against pecking order models of capital structure. *Journal of Financial Economics* 51:2, 219–44.
Stein, Jeremy C. 1996. Rational capital budgeting in an irrational world. *Journal of Business* 69:4, 429–55.
Taylor, Shelley E., and Jonathon D. Brown. 1988. Illusion and well-being: A social psychological perspective on mental health. *Psychological Bulletin* 103:2, 193–210.

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CHAPTER 22

Capital Budgeting and Other Investment Decisions

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INTRODUCTION

Capital budgeting is the process by which firms determine how to invest their capital. Included in this process are the decisions to invest in new projects, reassess the amount of capital already invested in existing projects, allocate and ration capital across divisions, and acquire other firms. In essence, the capital budgeting process defines the set and size of a firm's real assets, which in turn generate the cash flows that ultimately determine its profitability, value, and viability.

In principle, a firm's decision to invest in a new project should be made according to whether the project increases the wealth of the firm's shareholders. For example, the net present value (NPV) rule specifies an objective process by which firms can assess the value that new capital investments are expected to create. As Graham and Harvey (2001) document, this rule has steadily gained in popularity since Dean (1951) formally introduced it, but its widespread use has not eliminated the human element in capital budgeting. Because the estimation of a project's future cash flows and the rate at which they should be discounted is still a relatively subjective process, the behavioral traits of managers still affect this process.

Studies of the calibration of subjective probabilities find that individuals are overconfident, in that they tend to overestimate the precision of their knowledge and information (Fischhoff, Slovic, and Lichtenstein, 1977; Alpert and Raiffa, 1982). In fact, research shows that professionals from many fields exhibit overconfidence in their judgments, including investment bankers (Staël von Holstein, 1972), engineers (Kidd, 1970), entrepreneurs (Cooper, Woo, and Dunkelberg, 1988), lawyers (Wagenaar and Keren, 1986), negotiators (Neale and Bazerman, 1990), and managers (Russo and Schoemaker, 1992).

Several factors potentially explain why managers may also be expected to be overconfident, especially in a capital budgeting context. First, capital budgeting decisions can be complex. They often require projecting cash flows for a wide range of uncertain outcomes. People are typically most overconfident about such difficult problems.

Second, capital budgeting decisions are not well suited for learning. As Kahneman and Lovallo (1993, p. 18) note, learning occurs "when closely similar problems are frequently encountered, especially if the outcomes of decisions are quickly known and provide unequivocal feedback." In most firms, managers infrequently encounter major investment policy decisions, experience long delays before learning the outcomes of projects, and usually receive noisy feedback. Furthermore, managers often have difficulty rejecting the notion that every situation is new in important ways, allowing them to ignore feedback from past decisions altogether. Learning from experience is highly unlikely under these circumstances (Einhorn and Hogarth, 1978; Brehmer, 1980).

Third, unsuccessful managers are less likely to retain their jobs and be promoted. Those who succeed may become overconfident because of a self-attribution bias. Most people overestimate the degree to which they are responsible for their own success (Miller and Ross, 1975; Langer and Roth, 1975; Nisbett and Ross, 1980). This self-attribution bias causes successful managers to become overconfident (Daniel, Hirshleifer, and Subrahmanyam, 1998; Gervais and Odean, 2001).

Fourth, managers may be more overconfident than the general population because of a selection bias. Those who are overconfident and optimistic about their prospects as managers are more likely to apply for these jobs. Moreover, as Goel and Thakor (2008) show, firms may endogenously select and promote on the basis of overconfidence, as overconfident individuals are more likely to have generated extremely good outcomes in the past. Finally, as Gervais, Heaton, and Odean (2010) argue, overconfident managers may simply be easier to motivate than their rational counterparts, and so hiring them is more appealing to firms.

The idea that overconfidence can lead to investment distortions, predominantly overinvestment, dates back to Smith (1776, p. 149), who writes:

> *The over-weening conceit which the greater part of men have of their own abilities, is an ancient evil remarked by the philosophers and moralists of all ages. Their absurd presumption in their own good fortune has been less taken notice of. It is, however, if possible, still more universal. . . . The chance of gain is by every man more or less over-valued, and the chance of loss is by most men under-valued, and by scarce any man, who is in tolerable health and spirits, valued more than it is worth.*

Although the field of psychology eventually came to influence the work of Knight (1921), Pigou (1926), and Keynes (1936), the world of corporate finance remained largely unaffected by psychology until much later. Simon (1955, 1959), Margolis (1958), and Cyert and March (1963) are some of the early proponents of the need to incorporate findings from psychology into corporate finance. Noting that decisions are ultimately taken by individuals inside the firm, these authors advocate adding a human component with motives and biases into the process by which firms make choices. In particular, Simon emphasizes the importance of including a systematic role for the factors that influence the way individuals gather, process, and interpret information, as well as the way they choose to organize. March and Simon (1958) further argue that the rational bounds of executives, especially those of the top executive or chief executive officer (CEO), are likely to shape a firm's decisions. According to Katona (1946), the fact that managers

have their own preferences and traits directly affects how they make investment decisions on behalf of the firm and its shareholders.

The advent and impact of Modigliani and Miller's (1958) work, advocating the power of financial markets to endogenously prescribe a firm's real and financial decisions, combined with the popularity of the efficient market hypothesis (e.g., Fama, 1970), left little room for behavioral considerations in firms. Instead, the objective nature of capital budgeting prevailed as a firm's cost of capital became the product of a theorem on the irrelevance of financing. This approach came to dominate much of corporate finance until Roll (1986) proposed a hubris theory (reviewed in detail later) that seemed to reconcile much of the literature on mergers and acquisitions, reviving the behavioral approach in the process. As discussed in this chapter, the literature on the effects of behavioral biases on a firm's capital budgeting decisions has evolved considerably since then, especially in the last five to ten years.

Behavioral biases can affect the decisions of firms through their effects on investors (outside the firm) and managers (inside the firm). This review concentrates exclusively on the latter, or more specifically on the impact that managerial overconfidence has on a firm's investment decisions. The justification for this approach is intuitive. In capital markets, the presence of wealthy market participants who can afford to take large risks is likely to minimize the effects of biased decisions on security prices, resource allocations, and overall market efficiency. When biases affect the decisions of key employees within the firm, arbitraging them away is more difficult and costly for a third party. As such, the biases can have large and persistent effects. Baker, Ruback, and Wurgler (2007) provide an overview of the effects of investor irrationality on capital budgeting.

The remainder of the chapter has the following organization. The first section shows, using a simple theoretical model of capital budgeting, how managerial overconfidence and optimism lead to overinvestment. The second section presents a survey of the empirical literature that links the behavioral traits of managers to their firm's investment decisions. Some of the factors that can affect the extent to which managerial biases affect capital budgeting decisions are reviewed and discussed in the third section. Finally, the last section summarizes and offers some concluding remarks.

THEORY

This review begins with a simple model of capital budgeting that accommodates managerial overconfidence and optimism. This model and its predictions will guide the subsequent discussion.

A Model of Capital Budgeting with Overconfidence

Suppose that the economy has only one period and that, at time zero, an all-equity firm must make a capital budgeting decision. To make decisions, the firm relies on a manager who acts benevolently in the best interest of the shareholders: that is, the manager shares their value-maximization objective. The firm's manager must decide whether the firm should invest in a new project that generates a cash flow of $\tilde{v}$ at the end of the period, where $\tilde{v}$ is a random variable that takes values in

$(-\infty, \infty)$, and has a mean of $\bar{v}$. Assume that the cost of the project is $c > 0$, and that this cost is incurred at time zero. If the proper one-period discount rate for the project is $r > 0$, then the firm's profits from this project, in present value terms, are given by the random variable

$$\tilde{p} = i\left(\frac{\tilde{v}}{1+r} - c\right) \tag{22.1}$$

where $i \in \{0, 1\}$ represents the decision to undertake ($i = 1$) or drop ($i = 0$) the project. That is, the firm's profits from the project are exactly zero when the manager chooses not to undertake the project, and they are $\frac{\tilde{v}}{1+r} - c$ when the manager chooses to make an initial investment of c for an eventual project payoff of $\tilde{v}$.

Before choosing i, the manager receives a private signal about $\tilde{v}$, which he can use to make a more informed investment decision for the firm. Assume that this signal is given by

$$\tilde{s} = \tilde{\varepsilon}\tilde{v} + (1 - \tilde{\varepsilon})\tilde{\eta}, \text{ where } \tilde{\varepsilon} = \begin{cases} 1, & \text{prob. } a \\ 0, & \text{prob. } 1 - a \end{cases} \tag{22.2}$$

$a \in [0, \frac{1}{2}]$, and $\tilde{\eta}$ has the same distribution as $\tilde{v}$ but is independent from it. Thus the manager's signal has the same unconditional distribution as $\tilde{v}$, but the likelihood that it is actually equal to $\tilde{v}$ is measured by a, which can be interpreted as the manager's skill. Otherwise (i.e., with probability $1 - a$), the manager's information is pure noise. This implies that

$$\mathrm{E}(\tilde{v}|\tilde{s}) = a\tilde{s} + (1 - a)\bar{v} = \bar{v} + a(\tilde{s} - \bar{v}) \tag{22.3}$$

That is, a signal $\tilde{s}$ above (below) $\bar{v}$ leads to higher (lower) posteriors about $\tilde{v}$.

Larrick, Burson, and Soll (2007) find that when individuals face a relatively difficult task, the degree of overconfidence they exhibit is highly correlated with their thinking that they are better than average. That is, for such tasks, overconfidence can be viewed as an over-valuation of one's skill. This is in fact how Gervais and Odean (2001), Gervais and Goldstein (2007), and Gervais, Heaton, and Odean (2010) model overconfidence. This correspondence between overconfidence and perceived skills is also consistent with March and Shapira's (1987) finding that managers tend to believe outcomes to be largely controllable and projects under their supervision to be less risky than is actually the case. Larwood and Whittaker (1977), who find that managers tend to overestimate their ability to lead a project to success, document a similar illusion of control.

Therefore, the manager's overconfidence is modeled as his tendency to overestimate his own skill. More specifically, the manager is assumed to think that his skill is $a + b$, where $b \in [0, \frac{1}{2}]$. When $b = 0$, the manager is rational and properly weighs the information contained in $\tilde{s}$; when b is close to $\frac{1}{2}$ on the other hand, the manager grossly overestimates the precision of his information and puts much extra weight on it. In particular, for him,

$$\mathrm{E}_b(\tilde{v}|\tilde{s}) = (a + b)\tilde{s} + (1 - a - b)\bar{v} = \bar{v} + (a + b)(\tilde{s} - \bar{v}) \tag{22.4}$$

where the b subscript denotes the manager's expectation under his biased information set. Thus, compared to a rational manager, the overconfident manager overvalues (undervalues) the project's future cash flows when $\tilde{s} > \bar{v}$ ($\tilde{s} < \bar{v}$).

In his effort to maximize firm value, the manager will choose to undertake the new project if and only if its conditional NPV, $\frac{1}{1+r}\mathrm{E}_b(\tilde{v}|\tilde{s}) - c$, exceeds zero. Using (22.4), this is equivalent to $\tilde{s} > s_b^*$ where, assuming an interior solution,

$$s_b^* \equiv \bar{v} - \frac{\bar{v} - c(1+r)}{a+b} = \bar{v} - \frac{1+r}{a+b}\left(\frac{\bar{v}}{1+r} - c\right) \tag{22.5}$$

represents the information threshold above which projects are undertaken. Since a small value of s_b^* leads to more projects being undertaken (i.e., $\Pr\{\tilde{s} > s_b^*\}$ is decreasing in s_b^*), equation (22.5) shows that the effect of overconfidence on investment can go either way, depending on the sign of $\frac{\bar{v}}{1+r} - c$, the NPV of the project without any information about $\tilde{v}$. When the project's cash flow has a small expected value *ex ante* (i.e., $\bar{v}$ is small) or the project is expensive to undertake (i.e., c is large), overconfidence leads to overinvestment as the information threshold s_b^* used by the manager is lower than the threshold

$$s_0^* = \bar{v} - \frac{\bar{v} - c(1+r)}{a} \tag{22.6}$$

that the firm's shareholders would prefer the manager to adopt.

Clearly, overconfidence can also lead to underinvestment when $\bar{v}$ is large or c is small. This is because the manager then overturns more projects based on overweighed negative information than he undertakes based on overweighed positive information. As Gervais et al. (2010) point out, this possibility is less likely to apply when firms compete for projects, as the projects that require time-consuming and costly information gathering will be the ones that are not obviously profitable *ex ante.* For example, every firm has a permanent option to bid on a multitude of other firms, but a positive signal about the synergistic gains with one such firm is usually what triggers an acquisition. That is, in most reasonable situations, $\frac{\bar{v}}{1+r} - c < 0$, and only a sufficiently positive signal leads to an investment. The model therefore predicts that overconfidence will most often lead to overinvestment.

Overconfidence vs. Optimism

The meaning of overconfidence is different from that of optimism, the belief that favorable future events are more likely than they really are. Researchers generally find that individuals are unrealistically optimistic about future events. They expect good things to happen to them more often than to their peers (Weinstein, 1980; Kunda, 1987). For example, Ito (1990) reports that foreign exchange companies are more optimistic about how exchange rate moves will affect their firm than how they will affect others. Despite the fact that overconfidence and optimism are technically distinct, the two biases are often taken to mean the same thing in the finance literature. In the context of capital budgeting, this turns out to be legitimate, as only information that leads to new investments affects firm value. The fact that overconfident managers overweight negative information does not affect

the outcome that the investment is not made. Thus, the effect of overconfidence is one-sided, just like that of optimism.

To illustrate the similarity of the two biases in a capital budgeting context, managerial optimism is modeled by a perceived first-order stochastic shift in $\tilde{v}$. As a result of this bias, the manager estimates the unconditional mean of $\tilde{v}$ to be $\bar{v} + \beta$, with $\beta \geq 0$, as opposed to just $\bar{v}$. He also systematically overestimates the mean of $\tilde{v}$ conditional on $\tilde{s}$ as, for him,

$$E_\beta(\tilde{v}|\tilde{s}) = a\tilde{s} + (1-a)(\bar{v} + \beta) \tag{22.7}$$

which is increasing in β. As a result, the optimistic manager undertakes the project if and only if $\tilde{s} > s_\beta^{**}$ where

$$s_\beta^{**} \equiv \bar{v} + \beta - \frac{\bar{v} + \beta - c(1+r)}{a} \tag{22.8}$$

which, using the fact that $a < 1$, is seen to be decreasing in β. Therefore, just like overconfidence, optimism leads the manager to undertake more projects. Because this is the case, both biases will be discussed interchangeably throughout this chapter, as they typically are in the literature.

Worth noting is that Cassar and Gibson (2007) find that managers are not optimistic in their revenue forecasts; they do not systematically overestimate the cash flows that their firms are expected to generate. However, they do find that the same managers exhibit overconfidence, as their revenue forecasts tend to be too extreme and excessively volatile. Similarly, Ben-David, Graham, and Harvey's (2008) survey of CFOs allows them to measure both their overconfidence and optimism. They find that overconfidence is a key driver of investment, whereas optimism has a more marginal effect on investment.

EMPIRICAL EVIDENCE

This section surveys the empirical literature that documents the effects of managerial overconfidence and optimism on the capital budgeting decisions of firms.

Measuring Overconfidence

The first challenge faced by empiricists when testing for the presence and impact of managerial biases on corporate decisions is to develop a plausible measure of their biases. Although managerial overconfidence is likely to lead firms to overinvest, simply uncovering incidences of overinvestment to prove or disprove any behavioral theory of corporate decision making is generally insufficient. The reason is simple; many alternative theories revolving around asymmetric information or agency arguments can lead to the same predictions (Stein, 2003). As such, in order to make a convincing case about behavioral influences on capital budgeting, researchers must associate some measure of overconfidence with firms' eventual investment decisions and the outcome of these decisions.

For a long time, such measures of overconfidence were hard to find in finance, especially for agents making important decisions within corporations. In fact, in

his review of the literature on capital budgeting, Stein (2003) mentions managerial overconfidence as a "potentially very promising" avenue for studying the investment decisions of firms. As he argues, ample evidence from psychology shows that individuals tend to be biased in their estimates of probabilities and that these biases affect their economic decisions. For the most part, however, the lack of direct overconfidence measures prevented empiricists from making a convincing case about the effects of this bias on capital budgeting decisions. This has changed in recent years as researchers have found clever ways to measure the overconfidence of key employees in corporations. So far, overconfidence estimates have come from various sources of data: the personal decisions of executives about their stock options and acquisition of company stocks, the tone used to portray a company's chief executive officer (CEO) in magazine and newspaper articles, surveys administered to executives, and the earnings forecasts of management.

Malmendier and Tate (2005a, 2008) pioneered the idea of using stock and stock option data to proxy for executive overconfidence. The essence of their strategy is to classify CEOs according to their tendency to voluntarily remain under-diversified when they have the option not to do so. More specifically, the authors classify CEOs as overconfident when they hold on to their vested stock options past their optimal exercise time, and when they increase their exposure to their firm's specific risk by regularly acquiring additional company stock.

The second measure can also be attributed to Malmendier and Tate (2005b, 2008), who turn to articles about CEOs in the popular press (e.g., *The Economist*, *Business Week*, and *The New York Times*) to infer whether a CEO is overconfident. Specifically, they compare the number of articles that portray a CEO as being "confident" or "optimistic" to the number of articles that portray him as "cautious," "conservative," "not confident," or "not optimistic." The authors classify a CEO as being overconfident in a given year when the former exceeds the latter for that year's articles about him.

The third approach to measure the biases of executives is to construct and administer surveys that allow an inference on the respondents' behavioral traits. Such is the approach followed by Ben-David et al. (2008) and Sautner and Weber (2009). For example, Ben-David et al. poll senior finance executives (most of them CFOs) with a series of questions about the distribution of their forecast of returns on the S&P 500 index. The authors interpret tight distributions as a sign of overconfidence and high expected returns as a sign of optimism.

Finally, Lin, Hu, and Chen (2005) estimate the overconfidence of managers using data about their forecasts of company earnings. More specifically, they infer that a CEO is overconfident when he tends to overstate his firm's earnings forecasts, after controlling for the CEO's economic incentives to issue such inflated numbers. Interestingly, Ben-David et al. (2008) confirm the validity of such an approach by documenting a positive correlation between their measure of CFO overconfidence based on S&P 500 return forecasts and the tightness of the same CFO's estimates of his own firm's cash flows.

The Sensitivity of Investment to Cash Flow

According to classical economic theory, a firm's investment should be driven exclusively by the profitability of its opportunities. More specifically, the value of a

firm's Tobin's Q (1969) should be sufficient to explain the level of its investment. However, as documented by Fazzari, Hubbard, and Petersen (1988) and numerous authors following them (for a review of this literature, see Hubbard, 1998), this prediction does not seem to hold empirically. Firms that have more cash and rely less on debt financing tend to invest more than other firms, keeping investment opportunities fixed. The literature contains several explanations for this result, including the effects of adverse selection and moral hazard on the cost of external financing and Jensen's (1986) empire-building theory (for a review, see Stein, 2003). Another explanation is from Heaton's (2002) model of overconfident CEOs. Overconfident CEOs are reluctant to finance new investments by issuing risky securities that they perceive to be undervalued. Yet, the presence of cash or the ability to issue (almost) riskless debt creates the financial slack these CEOs require to pursue their aggressive investment strategies.

Malmendier and Tate (2005a) perform a series of regressions of investment on various variables known to explain the investment decisions of firms including Tobin's Q and cash flows. To test the prediction that CEO overconfidence increases the impact of cash flows on investment, they include an interaction term between cash flows and their measure of CEO overconfidence in their regressions. Their results confirm existing findings on investment-cash flow sensitivity; the coefficient on cash flow is positive and significant. Their results also show that, as predicted by Heaton (2002), the investment reaction of overconfident CEOs to cash flows is stronger. In all their regressions, the coefficient on the interaction term is positive and significant.

To refine their test of Heaton's (2002) model, Malmendier and Tate (2005a) test the prediction that financially constrained firms should be more affected by CEO overconfidence than other firms. After sorting their sample of firms according to Kaplan and Zingales's (1997) measure of a firm's financial constraint, they confirm that the impact of CEO overconfidence on the relationship between investment and cash flow is limited to firms that have difficulty in accessing capital markets to finance their investments.

Several other authors have confirmed Malmendier and Tate's (2005a) results, leading Campbell, Johnson, Rutherford, and Stanley (2009) to use firm investment data to proxy for executive overconfidence. For example, using a similar regression strategy with alternative measures of CEO overconfidence (as discussed above), Malmendier and Tate (2005b) and Lin et al. (2005) confirm that the investment-cash flow sensitivity gets stronger with CEO overconfidence. A related line of inquiry that is particularly promising can be found in the work of Glaser, Schäfers, and Weber (2008). They extend Malmendier and Tate's (2005a) study to a larger set of decision makers within the firm, including the CFO and members of the executive and supervisory boards. Besides confirming Malmendier and Tate's (2005a) results about the effect of CEO overconfidence on investment, Glaser et al. find that CFO overconfidence has little or no effect on investment, but that board overconfidence is partly responsible for the effect of overconfidence on investment.

Although Ben-David et al.'s (2008) results are not about the investment-cash flow sensitivity per se, they indicate that firms whose CFOs overestimate their ability to predict S&P 500 returns have capital expenditures that are 8 percent higher than the average firm. Interestingly, their results also show that only overconfidence regarding long-term return distributions (i.e., 10-year returns), as opposed

to overconfidence about short-term return distributions (i.e., one-year returns), helps explain the level of capital expenditures, which are themselves long-term investments for the most part.

Mergers, Acquisitions, and Takeovers

In their review of the literature on corporate control, Jensen and Ruback (1983) conclude, from the empirical evidence existing at that point (e.g., Dodd, 1980; Asquith, 1983; Eger, 1983), that mergers do not create any value for the bidding firms. Subsequent work by Bradley, Desai, and Kim (1988) and Berkovitch and Narayanan (1993) shows that acquisitions have a negative impact on the value of acquiring firms. More recently, Andrade, Mitchell, and Stafford (2001) document that from 1973 to 1998, acquiring firms experienced average abnormal returns of –0.7 percent during the three-day window surrounding the announcement of a merger. Similarly, Moeller, Schlingemann, and Stulz (2005) report that, in over 12,000 acquisitions from 1980 to 2001, acquiring firms have lost a combined value of $220 billion at the time they announce their plan to acquire firms for an aggregate amount of $3.4 trillion.

In an effort to explain the price patterns of bidding and target firms around takeovers, Roll (1986) proposes managerial overconfidence as an important driver of corporate acquisitions. His "hubris hypothesis" for takeovers (for a formal model see Xia and Pan, 2006) has two main ingredients. First, in the presence of a market price for a firm's equity, the outcome of the bidding process is asymmetric—a bidding firm will make an offer if its valuation is higher than the market price; otherwise, no offer is ever observed. That is, only the positive valuation errors of the bidder ever become public. This, of course, is not enough to conclude that acquiring firms will eventually overpay on average. A rational bidder would take this winner's curse into account and make sure that the expected gains, conditional on the acquisition taking place, are nonnegative. This is where the second ingredient comes into play. Although markets can be expected to eliminate the idiosyncratic mistakes of irrational individuals when they are aggregated across all market participants, the same cannot be said about the market for takeovers. In this market, the mistake of one exuberant CEO does not get instantly corrected by a host of competing arbitrageurs. Instead, this mistake directly leads to the takeover, and market prices subsequently adjust to aggregate and reflect the views of all. Thus, as Roll (p. 199) writes, "Takeovers reflect individual decisions."

The power of Roll's (1986) hubris hypothesis comes from its ability to jointly explain several empirical facts about takeovers. Overconfidence leads to overvaluation and in turn to bidding mistakes. As Roll argues, this process is largely consistent with the announcement of a takeover being associated on average with a reduction in value for the bidding firm, an increase in value for the target, and little or no change in combined value for the target and bidder firms. Since Roll's conjecture, the market for corporate acquisitions has become an important, if not the main, arena for testing the effects of managerial overconfidence on firms' investment decisions.

An early attempt to link CEO overconfidence with merger activity is the work of Rovenpor (1993), who relies on independent readers to rate the confidence level of CEOs based on their recent speeches. She finds the confidence of CEOs to be

positively related to the number of acquisitions they attempt, number of acquisitions they complete, and dollar value of the acquisition transactions. Observing that acquisitions lead to lower long-term profitability (e.g., Ravenscraft and Scherer, 1987) and stock returns (e.g., Agrawal, Jaffe, and Mandelker, 1992), Hayward and Hambrick (1997) proceed to investigate Roll's hubris hypothesis by correlating the acquisition premium with three proxies of CEO overconfidence: the recent performance of the acquiring firm, the recent media praise of the CEO, and the compensation of the CEO relative to that of the next highest paid executive. After controlling for various known determinants of the acquisition premium, they find that all three overconfidence proxies are positively correlated with the acquisition premium. They also show that the relationship between the two variables is stronger when the CEO is likely to have more decision-making power, that is, when he is also chairman of the board, and when the proportion of inside directors is large. All these results are consistent with the hubris hypothesis.

Malmendier and Tate (2008) also investigate this hubris hypothesis using stock option exercise decisions to estimate the overconfidence of CEOs. They find that firms whose CEO is overconfident are 65 percent more likely to make an acquisition, after controlling for various determinants of mergers, including the size, cash flow, and Tobin's (1969) Q of the acquiring firm. In line with Heaton's (2002) prediction that overconfident managers favor using internal resources to finance new investment, the authors show that their results get stronger when they concentrate on firms that are cash rich. Finally, because overconfident managers think that they are acting in the shareholders' best interest, the acquisitions of firms led by overconfident CEOs are expected to be even more damaging to firm value than the average acquisition. This is also confirmed by Malmendier and Tate (2008) who find that the price reaction of the acquirer, as measured by the three-day abnormal return around the announcement of the merger, is three times as negative as the average abnormal return (–0.90 percent vs. –0.29 percent). They also estimate that, over their sample period (1980 to 1994), CEO overconfidence accounts for roughly $2.15 billion of the $4.39 billion loss experienced by shareholders.

Liu and Taffler (2008) extend Malmendier and Tate's (2008) results by adding the overconfidence of the target firm's CEO, also estimated via their stock option exercise decisions, in the set of explanatory variables. They find that the overconfidence of the target firm's CEO negatively affects the acquiring firm's performance in the three-day window around the announcement of the deal. Their interpretation of the result is consistent with Gervais and Goldstein's (2007) theoretical prediction that firms with an overconfident CEO require a larger acquisition premium, as these CEOs are reluctant to part with the projects they overvalue. Another extension of Malmendier and Tate's (2008) results is the work of Croci, Petmezas, and Vagenas-Nanos (2009). Using a similar methodology on stock option and merger data from the United Kingdom between 1990 and 2005, they confirm that overconfident CEOs lead their firms into more value-destroying acquisitions than their rational counterparts. The authors also report that business cycles do not affect their results, which are similar in booms and in recessions.

Using press portrayal of the CEO to measure his overconfidence, Brown and Sarma (2007) also document that overconfident CEOs are more prone to engage in merger transactions. In addition, they document that CEO dominance, as measured

by the ratio of the CEO's total remuneration over their firm's total assets, reinforces the relationship between CEO overconfidence and acquisition frequency. Thus, the combination of the CEO's bias with a relatively free reign over the firm's decisions most likely engenders merger activity.

Finally, Ben-David et al. (2008) find that firms with overconfident CFOs tend to engage in more acquisitions than firms with more rational CFOs. As with capital expenditures, only the CFO's overconfidence about long-term return distributions has any explanatory power. Their evidence concerning announcement returns is also consistent with the rest of the literature. More specifically, they find that bidder returns during the three days that include the announcement date are 1.3 percent lower for firms with overconfident CFOs than for the median firm. Thus, overconfidence of both the CEO and the CFO appears to affect the frequency and value of mergers.

Entrepreneurs, New Markets, and Novel Projects

Another capital budgeting situation that is particularly prone to the effects of managerial overconfidence involves entrepreneurs in small, often private, firms. Because fewer people are involved in the capital budgeting process of these small firms, the biases of its key decision makers are less likely to be confronted by others or by a lengthy decision process. Exacerbating this problem is the fact that these small firms are often involved in projects and markets for which little or no data are available, rendering any kind of statistical model powerless in curbing hasty investment decisions. Finally, although the extreme risks involved in many entrepreneurial decisions can be paralyzing for most individuals, they are more easily handled and even welcome by overconfident individuals. In other words, entrepreneurs will naturally tend to be overconfident as rational individuals stay away from risky entrepreneurial activities (De Meza and Southey, 1996; Van den Steen, 2004). In fact, Busenitz and Barney (1997) document that overconfidence is a key trait that differentiates entrepreneurs from managers in large organizations. Therefore, the fact that several researchers have investigated the role of overconfidence in the investment decisions of entrepreneurial firms is not surprising.

Cooper, Woo, and Dunkelberg (1988) find that entrepreneurs assess their own chances for success to be higher than those of their peers. For example, they report that 35 percent of the entrepreneurs in their sample attach a 100 percent probability to the event that their new venture will succeed even though over half the ventures end up failing. Similarly, the majority of high technology industry entrepreneurs surveyed by Corman, Perles, and Vancini (1988) perceive no risk in their prospect for success. In a multinational survey of entrepreneurs, Koellinger, Minniti, and Schade (2007) find that countries in which entrepreneurs exhibit a high degree of overconfidence show more startup activity but a higher failure rate.

Firms also tend to make large mistakes when they decide to enter a new market. Davis (1985) reports that firms systematically overrun their budget for new projects, that 80 percent of new firms overestimate their eventual market share, and that these tendencies are worse in high technology industries. In an experimental study, Camerer and Lovallo (1999) document a "reference group neglect"

effect, in which agents fail to properly take their competition into account when they assess their prospects for success in a new market. That is, the tendency of individuals to overestimate their skills relative to those of their peers (e.g., Svenson, 1981) can be particularly detrimental when these individuals must compete with their peers.

At the product level, Simon and Houghton (2003) interview 55 managers of small firms in the computer industry that are on the verge of launching a new product. Using content analysis to estimate each manager's overconfidence about the eventual success of the product, they find that managers with greater overconfidence introduce more pioneering (i.e., riskier) products and tend to fail more often. Similarly, other studies document that managerial overconfidence leads to plant expansion (Nutt, 1993) and to innovation (Staw, 1991).

Costs, Planning, and the Escalation of Commitment

Managerial overconfidence and optimism do not lead to overinvestment only through inflated cash flows. Another channel of overinvestment that originates in these biases is the tendency for managers to underestimate the costs of projects as well as their time to completion (Kidd, 1970; Hall, 1982; Lovallo and Kahneman, 2003). As Buehler, Griffin, and Ross (1994, 2002) document and discuss, individuals display a systematic downward bias when they predict the completion time of a task. For managers, this planning fallacy reduces realized project and firm value for two reasons. First, project costs are higher because some of these costs are directly proportional to completion time (e.g., labor). Second, the delayed completion means that the positive cash flows coming from the project's operations are also delayed, and so their discounted value is less than initially anticipated by the manager.

A related phenomenon that greatly affects the cost and thus the profitability of projects is the escalation of commitment to which managers often subject their firms. Just as most individuals have a tendency toward escalation in their private endeavors (Staw, 1976; Teger, 1980; Arkes and Blumer, 1985), managers of firms tend to let their commitment escalate in negotiations (Bazerman and Neale, 1992), to throw good money after bad (Garland, 1990; Ross and Staw, 1993), and to make suboptimal decisions in real option scenarios (Denison, 2009). This failure to ignore sunk costs is illustrated in a particularly vivid example by Ross and Staw who document the Long Island Lighting Company's decision to build and operate the Shoreham Nuclear power plant for a projected cost of $75 million, a project abandoned 23 years later after $5 billion had been sunk into it. The authors attribute this behavior to the decision makers' initial overconfidence and to a self-serving bias by which they attribute negative outcomes to outside forces, justifying the non-revision of their cash flow forecasts going forward.

An aspect of optimism in project planning that has yet to make its way into behavioral corporate finance is the possibility that the bias leads to a self-fulfilling prophecy (e.g., Sherman, 1980). By setting optimistic goals and completion deadlines for their projects, managers intrinsically commit themselves and their teams to extract more value from these projects than they would otherwise (e.g., Heath, Larrick, and Wu, 1999). In other words, their dedication to making the project meet expectations gets them closer to these expectations even if they do not meet them.

FACTORS AFFECTING THE IMPACT OF MANAGERIAL BIASES

This section reviews some of the factors that help mitigate the effects of behavioral biases on capital budgeting. The interaction of learning, hurdle rates, and contractual incentives with overconfidence and investment is discussed.

Learning and the Attribution Bias

In theory, managers should eventually learn from the outcomes of their investment decisions and appropriately adjust their beliefs about their ability to process information. If this were the case, managers' expectations should become better calibrated over time, and, as a result, they should make fewer investment mistakes. For example, Koellinger, Minniti, and Schade (2007) document that nascent entrepreneurs tend to be more overconfident in their skills than are established entrepreneurs. However, this does not seem to always be the case. First, the feedback that managers get about their investment decisions is often imprecise and can take a long time to arrive. Second, because managers infrequently make important investment decisions, they rarely receive quality feedback. Third, the psychology literature documents that the process of learning about one's own ability is often plagued by an attribution bias in which people overestimate (underestimate) the degree to which they are responsible for past successes (failures). As Hastorf, Schneider, and Polefka (1970, p. 73) write, "We are prone to attribute success to our own dispositions and failure to external forces" (see also Miller and Ross, 1975; Langer and Roth, 1975; Zuckerman, 1979).

The model of capital budgeting set forth in this chapter can easily accommodate the possibility that managers learn about their ability over time as they observe the outcomes of earlier investment decisions. The multi-period version of the model, in which the manager makes a sequence of one-period investment decisions, is similar to Gervais and Odean's (2001) model about the self-attribution bias of investors. As they show, the slow, infrequent, and imprecise feedback that managers receive about their investment decisions leads them to become overconfident and to stay that way for extended periods of time. This is in fact the outcome originally anticipated by Knight (1921, p. 231): "A dependable estimate of ability can only come from a considerable number of trials. . . . And in business management no two instances, perhaps, are ever very closely alike, in any objective, describable sense." As such, convergence to correctly calibrated beliefs is unlikely to occur in the corporate arena and long-lasting overconfidence is likely to follow early success.

The predictions associated with this learning behavior essentially map the overconfidence dynamics into policies that the manager is likely to follow over time given a sequence of outcomes. For capital budgeting, the overconfidence prompted by the success of past investment decisions should lead the manager to make similar decisions in the future. Again, the corporate acquisition market has so far provided the best opportunity to test this theory. In fact, Roll (1986, p. 206) writes: "One would expect a higher level of hubris and thus more aggressive pursuit of a target in firms that had experienced recent good times." This is precisely the main empirical finding in papers by Doukas and Petmezas (2007) and Billett and Qian (2008). Specifically, both sets of authors document that CEOs who make a

successful acquisition are more likely to follow it with acquisitions that negatively affect their firm's stock price. That is, early acquisition success boosts the CEO's confidence to the point that he starts conforming to Roll's (1986) hubris hypothesis in subsequent acquisitions. This is also consistent with the work of Moeller et al. (2005) who find that large-loss deals (i.e., deals that lose in excess of $1 billion) tend to happen to firms that have been successful with their previous acquisitions.

The possibility that the success of past decisions leads executives to subsequently make similar but perhaps irrational decisions is not limited to corporate acquisitions. For example, Tyler and Steensma (1998) document that top executives tend to be overly attracted by strategic alliances when they perceive such alliances to have benefited their firm in the past. Similarly, in their study of French entrepreneurs, Landier and Thesmar (2009) document that serial entrepreneurs tend to be more consistently optimistic and attribute the result to a self-attribution bias. Finally, in their study of the effects of overconfidence on corporate policies, Ben-David et al. (2008) document that CFOs are more confident about their estimates of future market returns when past returns are high. That is, CFOs seem to gain confidence as the overall economy, not just their firm, is doing well.

Hurdle Rates

As discussed in this chapter, the literature on the effects of overconfidence and optimism on capital budgeting points to the tendency of managers to overestimate project cash flows. This leads to overinvestment, especially if firms do not adopt any control mechanisms aimed at trimming estimated cash flows. A natural instrument to counterbalance the inflated cash flows resulting from the behavioral biases of decision makers is the discount rate that they use to calculate NPVs. More specifically, the prescription of an inflated discount rate to calculate a project's NPV should serve to reduce the effect of the manager's bias on his cash flow estimates.

Given the prevalence of managerial overconfidence, seeing that firms use hurdle rates that often substantially exceed their cost of capital objectively calculated using standard techniques is not surprising. For example, in their surveys of capital budgeting techniques, Schall, Sundem, and Geijsbeek (1978), Gitman and Mercurio (1982), Poterba and Summers (1995), and Meier and Tarhan (2007) all report that the hurdle rates used by companies appear abnormally high. As Dobbs (2009) argues, a related practice that effectively curbs excessive optimism in cash flow forecasting is the provision of incentives that make managers focus on the short-term profitability of projects. As Stein (1989, 1996) shows, financing concerns force managers to adopt a more myopic investment strategy through the adoption of higher discount rates that reduce the weight of long-term cash flows in investment decisions. This short-term focus is also consistent with Graham and Harvey's (2001) survey evidence that the payback period rule, which ignores cash flows beyond the payback period, is the third-most frequently used capital budgeting method and that small firms use it as much as the NPV rule.

Contractual Incentives

The model of capital budgeting introduced earlier treats the firm and its manager as the same. That is, the underlying assumption is that the manager benevolently

performs his duties to maximize the total value of the firm. Following the seminal work of Ross (1973), Jensen and Meckling (1976), and Holmström (1979), the last three decades have seen a proliferation of papers incorporating a systematic treatment of agency theory into the decision process of firms, as originally suggested by Berle and Means (1932). In this literature, contracts are designed in such a way that they provide the agent (i.e., the manager) with the incentives to act in the best interest of the principal (i.e., the firm or its shareholders). Traditionally, the misalignment of incentives is due to moral hazard and asymmetric information problems. In recent years, this theory of contracts and incentives has been extended to account for the behavioral traits of managers and the impact they have on agency problems.

The work of Goel and Thakor (2008) and Gervais et al. (2010) captures the point of this literature. In these papers, a firm's risk-neutral shareholders hire a risk-averse manager to make investment decisions on their behalf. Two main sets of results are established. First, the manager's overconfidence serves to reduce the moral hazard that his risk aversion creates (Jensen and Meckling, 1976; Treynor and Black, 1976). That is, the manager's risk aversion makes his investment decisions overly cautious, but his overconfidence provides a naturally offsetting force by making the manager think that his information and skill allow him to control risk better than he really can. In this context, both papers establish the result that some overconfidence is beneficial, but too much of it leads to overinvestment that is detrimental. The second main result follows from this observation and from optimal risk-sharing arrangements. When contractual incentives must come with a transfer of risk from the risk-neutral firm to the risk-averse manager, they are cheaper and more efficient if the manager can commit to an investment strategy that is as close to first-best as possible. This is precisely what overconfidence achieves; the biased manager naturally follows an investment policy that is more in line with the shareholders' objective, and so compensation arrangements can be more efficient.

In related papers, Adrian and Westerfield (2009) and Giat, Hackman, and Subramanian (2010) analyze dynamic principal-agent models in which the beliefs of the principal about project payoffs differ from those of the agent. The former paper establishes that, when the agent is more optimistic than the principal, equilibrium contracts lead to increased effort, incentives, investment, and output. The latter paper adds the possibility that the principal and agent learn about the project's eventual payoff over time. The authors characterize the situations in which investment is expected to increase (when the agent is moderately optimistic compared to the principal) or decrease (when the agent is highly optimistic compared to the principal) over time. Finally, using a calibration of their model on data from pharmaceutical R&D projects, Giat et al. establish that managerial optimism is an important determinant of these firms' investment decisions and value.

At this point, there is little to no empirical evidence about the interaction of contractual incentives, managerial overconfidence, and investment decisions. For example, although Ben-David et al. (2008) find that overconfident CFOs receive a larger fraction of their compensation through stock options, they do not investigate how these variables jointly affect firms' investment policies. Similarly, Brown and Sarma (2007) document that CEO overconfidence and CEO compensation separately affect the frequency of a firm's corporate acquisitions, but they do not

investigate how these two explanatory variables interact. As Gervais et al. (2010) argue, in equilibrium, contractual arrangements between firms and top executives should adjust to reflect the effects of behavioral traits. The fact that researchers have uncovered a positive correlation between the overconfidence of managers and the aggressiveness of their investment policies seems to indicate that contracts are either suboptimal or too sticky, or alternatively that managerial overconfidence is valuable elsewhere in the firm's organization.

SUMMARY AND CONCLUSIONS

People tend to be overconfident in that they overestimate the precision of their information and their ability to control risk. Firm managers are especially prone to such a bias, as their overconfidence endogenously leads them to decision-making roles and proves to be difficult to learn away in an environment with infrequent and imprecise feedback. In capital budgeting situations, overconfident managers tend to overinvest. As the existing empirical literature shows, overconfidence leads managers to invest free cash flows more rapidly, to initiate more mergers, to start more new firms and invest in more novel projects, and to stick with an unprofitable investment policy for too long. Learning, inflated hurdle rates, and contractual incentives can reduce the investment distortions that result from managerial overconfidence but do not appear sufficient to eliminate them.

The literature on the impact of managerial biases on capital budgeting is still relatively young. Most of the progress on directly linking proper measures of executive overconfidence to their firm's investment policy has been made in the last five to ten years. In this author's view, the fact that managerial traits seem to systematically and persistently correlate with the investment policies of firms is still somewhat of a puzzle in need of more research. In addition to a deeper exploration of the interaction between contractual incentives, overconfidence, and investment policy, a productive direction is to study the entire set of trade-offs that overconfidence brings to an organization. That is, the overaggressive investment policy that comes with managerial overconfidence could be the cost for larger benefits elsewhere in the firm. For example, recent work on the leadership role of overconfident agents by Gervais and Goldstein (2007) and Bolton, Brunnermeier, and Veldkamp (2008) seems to indicate that overconfidence is valuable for the internal workings of firms. In the same vein, models by Bernardo and Welch (2001), Englmaier (2006), Chu (2007), and Gervais et al. (2010) show that overconfidence can increase efficiency, the likelihood of survival, and economic growth. In this light, the overall *NPV* of overconfidence in firms is possibly positive, despite the capital budgeting mistakes that it prompts.

DISCUSSION QUESTIONS

1. Why are managers of firms likely to be overconfident when they make capital budgeting decisions?
2. Explain why managerial overconfidence and optimism both lead to overinvestment in a capital budgeting context.
3. What empirical methods have researchers used to measure managerial overconfidence?

4. Explain how to test for the effect of managerial overconfidence on the sensitivity of a firm's investments to cash flow and discuss the likely result.
5. Explain how managerial overconfidence can be efficient when the firm provides contractual incentives to its manager.

REFERENCES

Adrian, Tobias, and Mark M. Westerfield. 2009. Disagreement and learning in a dynamic contracting model. *Review of Financial Studies* 22:10, 3873–906.

Agrawal, Anup, Jeffrey F. Jaffe, and Gershon N. Mandelker. 1992. The post-merger performance of acquiring firms: A re-examination of an anomaly. *Journal of Finance* 47:4, 1605–21.

Alpert, Marc, and Howard Raiffa. 1982. A progress report on the training of probability assessors. In *Judgment under uncertainty: Heuristics and biases*, (eds.) Daniel Kahneman, Paul Slovic, and Amos Tversky, 294–305. Cambridge: Cambridge University Press.

Andrade, Gregor, Mark Mitchell, and Erik Stafford. 2001. New evidence and perspectives on mergers. *Journal of Economic Perspectives* 15:2, 103–20.

Arkes, Hal R., and Catherine Blumer. 1985. The psychology of sunk cost. *Organizational behavior and human decision processes* 35:1, 124–40.

Asquith, Paul. 1983. Merger bids, uncertainty, and stockholder returns. *Journal of Financial Economics* 11:1-4, 51–83.

Baker, Malcolm, Richard S. Ruback, and Jeffrey Wurgler. 2007. Behavioral corporate finance. In *Handbook of corporate finance: Empirical corporate finance*, (ed.) B. Espen Eckbo, 145–88. Amsterdam: North-Holland.

Bazerman, Max, and Margaret Neale. 1992. Nonrational escalation of commitment in negotiation. *European Management Journal* 10: 2, 163–8.

Ben-David, Itzhak, John R. Graham, and Campbell R. Harvey. 2008. Managerial overconfidence and corporate policies. Working Paper, Duke University.

Berkovitch, Elazar, and M. P. Narayanan. 1993. Motives for takeovers: An empirical investigation. *Journal of Financial and Quantitative Analysis* 28:3, 347–62.

Berle, Adolph, and Gardiner Means. 1932. *The modern corporation and private property*. New York: Macmillan.

Bernardo, Antonio E., and Ivo Welch. 2001. On the evolution of overconfidence and entrepreneurs. *Journal of Economics and Management Strategy* 10:3, 301–30.

Billett, Matthew T., and Yiming Qian. 2008. Are overconfident CEOs born or made? Evidence of self-attribution bias from frequent acquirers. *Management Science* 54:6, 1037–51.

Bolton, Patrick, Markus K. Brunnermeier, and Laura Veldkamp. 2008. Leadership, coordination and mission-driven management. Working Paper, Columbia University.

Bradley, Michael, Anand Desai, and E. Han Kim. 1988. Synergistic gains from corporate acquisitions and their division between the stockholders of target and acquiring firms. *Journal of Financial Economics* 21:1, 3–40.

Brehmer, Berndt. 1980. In one word: Not from experience. *Acta Psychologica* 45:1-3, 223–41.

Brown, Rayna, and Neal Sarma. 2007. CEO overconfidence, CEO dominance and corporate acquisitions. *Journal of Economics and Business* 59:5, 358–79.

Buehler, Roger, Dale Griffin, and Michael Ross. 1994. Exploring the "planning fallacy": Why people underestimate their task completion times. *Journal of Personality and Social Psychology* 67:3, 366–81.

Buehler, Roger, Dale Griffin, and Michael Ross. 2002. Inside the planning fallacy: The causes and consequences of optimistic time predictions. In *Judgment under uncertainty: Heuristics and biases*, (eds.) Daniel Kahneman, Paul Slovic, and Amos Tversky, 250–70. Cambridge: Cambridge University Press.

Busenitz, Lowell W., and Jay B. Barney. 1997. Differences between entrepreneurs and managers in large organizations: Biases and heuristics in strategic decision-making. *Journal of Business Venturing* 12:1, 9–30.

Camerer, Colin, and Dan Lovallo. 1999. Overconfidence and excess entry: An experimental approach. *American Economic Review* 89:1, 306–18.

Campbell, T. Colin, Shane A. Johnson, Jessica Rutherford, and Brooke W. Stanley. 2009. CEO confidence and forced turnover. Working Paper, Texas A&M University.

Cassar, Gavin, and Brian Gibson. 2007. Forecast rationality in small firms. *Journal of Small Business Management* 45:3, 283–302.

Chu, Angus C. 2007. Confidence-enhanced economic growth. *B. E. Journal of Macroeconomics* 7:1, 1–18.

Cooper, Arnold C., Carolyn Y. Woo, and William C. Dunkelberg. 1988. Entrepreneurs' perceived chances for success. *Journal of Business Venturing* 3:2, 97–108.

Corman, Joel, Benjamin Perles, and Paula Vancini. 1988. Motivational factors influencing high-technology entrepreneurship. *Journal of Small Business Management* 26:1, 36–42.

Croci, Ettore, Dimitris Petmezas, and Evangelos Vagenas-Nanos. 2009. Managerial overconfidence in high and low valuation markets and gains to acquisitions. Working Paper, University of Surrey.

Cyert, Richard M., and James G. March. 1963. *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice-Hall.

Daniel, Kent D., David Hirshleifer, and Avanidhar Subrahmanyam. 1998. Investor psychology and security market under- and overreactions. *Journal of Finance* 53:6, 1839–85.

Davis, David. 1985. New projects: Beware of false economies. *Harvard Business Review* 63:2, 95–101.

Dean, Joel. 1951. *Capital budgeting*. New York: Columbia University Press.

De Meza, David, and Clive Southey. 1996. The borrower's curse: Optimism, finance and entrepreneurship. *Economic Journal* 106:435, 375–86.

Denison, Christine A. 2009. Options and escalation of commitment: A behavioral analysis of capital investment decisions. *Accounting Review* 84:1, 133–55.

Dobbs, Ian M. 2009. How bad can short termism be? A study of the consequences of high hurdle discount rates and low payback thresholds. *Management Accounting Research* 20:2, 117–28.

Dodd, Peter. 1980. Merger proposals, management discretion and stockholder wealth. *Journal of Financial Economics* 8:2, 105–37.

Doukas, John A., and Dimitris Petmezas. 2007. Acquisitions, overconfident managers and self-attribution bias. *European Financial Management* 13:3, 531–77.

Eger, Carol Ellen. 1983. An empirical test of the redistribution effect in pure exchange mergers. *Journal of Financial and Quantitative Analysis* 18:4, 547–72.

Einhorn, Hillel J., and Robin M. Hogarth. 1978. Confidence in judgment: Persistence of the illusion of validity. *Psychological Review* 85:5, 395–416.

Englmaier, Florian. 2006. A strategic rationale for having overconfident managers. Working Paper, Harvard University.

Fama, Eugene F. 1970. Efficient capital markets: A review of theory and empirical work. *Journal of Finance* 25:2, 383–417.

Fazzari, Steven, M., R. Glenn Hubbard, and Bruce C. Petersen. 1988. Financing constraints and corporate investment. *Brookings Papers on Economic Activity* 1, 141–95.

Fischhoff, Baruch, Paul Slovic, and Sarah Lichtenstein. 1977. Knowing with certainty: The appropriateness of extreme confidence. *Journal of Experimental Psychology* 3:4, 552–64.

Garland, Howard. 1990. Throwing good money after bad: The effect of sunk costs on the decision to escalate commitment to an ongoing project. *Journal of Applied Psychology* 75:6, 728–31.

Gervais, Simon, and Itay Goldstein. 2007. The positive effects of biased self-perceptions in firms. *Review of Finance* 11:3, 453–96.
Gervais, Simon, J. B. Heaton, and Terrance Odean. 2010. Overconfidence, compensation contracts, and capital budgeting. Working Paper, Duke University.
Gervais, Simon, and Terrance Odean. 2001. Learning to be overconfident. *Review of Financial Studies* 14:1, 1–27.
Giat, Yahel, Steve Hackman, and Ajay Subramanian. 2010. Investment under uncertainty, heterogeneous beliefs and agency conflicts. *Review of Financial Studies* 23:4, 1360–1404.
Gitman, Lawrence J., and Vincent A. Mercurio. 1982. Cost of capital techniques used by major U.S. firms: Survey and analysis of Fortune's 1000. *Financial Management* 11:4, 21–9.
Glaser, Markus, Philipp Schäfers, and Martin Weber. 2008. Managerial optimism and corporate investment: Is the CEO alone responsible for the relation? Working Paper, Universität Mannheim.
Goel, Anand M., and Anjan Thakor. 2008. Overconfidence, CEO selection and corporate governance. *Journal of Finance* 63:6, 2737–84.
Graham, John R., and Campbell R. Harvey. 2001. The theory and practice of corporate finance: Evidence from the field. *Journal of Financial Economics* 60:2-3, 187–243.
Hall, Peter. 1982. *Great planning disasters*. Berkeley, CA: University of California Press.
Hastorf, Albert H., David J. Schneider, and Judith Polefka. 1970. *Person perception*. Reading, MA: Addison-Wesley.
Hayward, Mathew L. A., and Donald C. Hambrick. 1997. Explaining the premiums paid for large acquisitions: Evidence of CEO hubris. *Administrative Science Quarterly* 42:1, 103–27.
Heath, Chip, Richard P. Larrick, and George Wu. 1999. Goals as reference points. *Cognitive Psychology* 38:1, 79–109.
Heaton, J. B. 2002. Managerial optimism and corporate finance. *Financial Management* 31:2, 33–45.
Holmström, Bengt. 1979. Moral hazard and observability. *Bell Journal of Economics* 10:1, 74–91.
Hubbard, R. Glenn. 1998. Capital-market imperfections and investment. *Journal of Economic Literature* 36:1, 193–225.
Ito, T. 1990. Foreign exchange rate expectations: Micro survey data. *American Economic Review* 80:3, 434–49.
Jensen, Michael C. 1986. Agency costs of free cash flow, corporate finance, and takeovers. *American Economic Review* 76:2, 323–9.
Jensen, Michael C., and William H. Meckling. 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics* 3:4, 305–60.
Jensen, Michael C., and Richard S. Ruback. 1983. The market for corporate control: The scientific evidence. *Journal of Financial Economics* 11:1-4, 5–50.
Kahneman, Daniel, and Dan Lovallo. 1993. Timid choices and bold forecasts: A cognitive perspective on risk taking. *Management Science* 39:1, 17–31.
Kaplan, Steven N., and Luigi Zingales. 1997. Do investment-cash flow sensitivities provide useful measures of financing constraints? *Quarterly Journal of Economics* 112:1, 169–215.
Katona, George. 1946. Psychological analysis of business decisions and expectations. *American Economic Review* 36:1, 44–62.
Keynes, John Maynard. 1936. *The general theory of employment, interest and money*. London: Macmillan.
Kidd, John B. 1970. The utilization of subjective probabilities in production planning. *Acta Psychologica* 34, 338–47.
Knight, Frank H. 1921. *Risk, uncertainty and profits*. Boston, MA: Houghton Mifflin Company.
Koellinger, Philipp, Maria Minniti, and Christian Schade. 2007. I think I can, I think I can: Overconfidence and entrepreneurial behavior. *Journal of Economic Psychology* 28:4, 502–27.

Kunda, Ziva. 1987. Motivated inference: Self-serving generation and evaluation of causal theories. *Journal of Personality and Social Psychology* 53:4, 636–47.

Landier, Augustin, and David Thesmar. 2009. Financial contracting with optimistic entrepreneurs. *Review of Financial Studies* 22:1, 117–50.

Langer, Ellen, and Jane Roth. 1975. Heads I win, tails it's chance: The illusion of control as a function of the sequence of outcomes in a purely chance task. *Journal of Personality and Social Psychology* 32:6, 951–5.

Larrick, Richard P., Katherine A. Burson, and Jack B. Soll. 2007. Social comparison and confidence: When thinking you're better than average predicts overconfidence (and when it does not). *Organizational Behavior and Human Decision Processes* 102:1, 76–94.

Larwood, Laurie, and William Whittaker. 1977. Managerial myopia: Self-serving biases in organizational planning. *Journal of Applied Psychology* 62:2, 194–8.

Lin, Yueh-Hsiang, Shing-Yang Hu, and Ming-Shen Chen. 2005. Managerial optimism and corporate investment: Some empirical evidence from Taiwan. *Pacific-Basin Finance Journal* 13:5, 523–46.

Liu, Yue, and Richard Taffler. 2008. Damned out of their own mouths: CEO overconfidence in M&A decision making and its impact on firm performance. Working Paper, University of Edinburgh.

Lovallo, Dan, and Daniel Kahneman. 2003. Delusions of success: How optimism undermines executives' decisions. *Harvard Business Review* 81:7, 56–63.

Malmendier, Ulrike, and Geoffrey Tate. 2005a. CEO overconfidence and corporate investment. *Journal of Finance* 60:6, 2661–700.

Malmendier, Ulrike, and Geoffrey Tate. 2005b. Does overconfidence affect corporate investment? CEO overconfidence measures revisited. *European Financial Management* 11:5, 649–59.

Malmendier, Ulrike, and Geoffrey Tate. 2008. Who makes acquisitions? CEO overconfidence and the market's reaction. *Journal of Financial Economics* 89:1, 20–43.

March, James G., and Zur Shapira. 1987. Managerial perspectives on risk and risk taking. *Management Science* 33:11, 1404–18.

March, James G., and Herbert A. Simon. 1958. *Organizations*. Cambridge, MA: John Wiley & Sons, Inc.

Margolis, Julius. 1958. The analysis of the firm: Rationalism, conventionalism, and behaviorism. *Journal of Business* 31:3, 187–99.

Meier, Iwan, and Vefa Tarhan. 2007. Corporate investment decision practices and the hurdle rate premium puzzle. Working Paper, HEC Montréal.

Miller, Dale, and Michael Ross. 1975. Self-serving biases in attribution of causality: Fact or fiction? *Psychological Bulletin* 82:2, 213–25.

Modigliani, Franco, and Merton H. Miller. 1958. The cost of capital, corporation finance, and the theory of investment. *American Economic Review* 48:3, 261–97.

Moeller, Sara B., Frederik P. Schlingemann, and René M. Stulz. 2005. Wealth destruction on a massive scale? A study of acquiring-firm returns in the recent merger wave. *Journal of Finance* 60:2, 757–82.

Neale, Margaret A., and Max H. Bazerman. 1990. *Cognition and rationality in negotiation*. New York: The Free Press.

Nisbett, Richard E., and Lee Ross. 1980. *Human inference: Strategies and shortcomings of social judgment*. Englewood Cliffs, NJ: Prentice Hall.

Nutt, Paul C. 1993. Flexible decision styles and the choices of top executives. *Journal of Management Studies* 30:5, 695–721.

Pigou, Arthur C. 1926. *Industrial fluctuations*. London: Macmillan.

Poterba, James M., and Lawrence H. Summers. 1995. A CEO survey of U.S. companies' time horizons and hurdle rates. *Sloan Management Review* 37:1, 43–53.

Ravenscraft, David J., and F. M. Scherer. 1987. Life after takeover. *Journal of Industrial Economics* 36:2, 147–56.

Roll, Richard. 1986. The hubris hypothesis of corporate takeovers. *Journal of Business* 59:2, 197–216.

Ross, Stephen A. 1973. The economic theory of agency: The principal's problem. *American Economic Review* 63:2, 134–9.

Ross, Jerry, and Barry M. Staw. 1993. Organizational escalation and exit: Lessons from the Shoreham nuclear power plant. *Academy of Management Journal* 36:4, 701–32.

Rovenpor, Janet L. 1993. The relationship between four personal characteristics of chief executive officers (CEOs) and company merger and acquisition activity (MAA). *Journal of Business and Psychology* 8:1, 27–55.

Russo, J. Edward, and Paul J. H. Schoemaker. 1992. Managing overconfidence. *Sloan Management Review* 33:2, 7–17.

Sautner, Zacharias, and Martin Weber. 2009. How do managers behave in stock option plans? Clinical evidence from exercise and survey data. *Journal of Financial Research* 32:2, 123–55.

Schall, Lawrence D., Gary L. Sundem, and William R. Geijsbeek. 1978. Survey and analysis of capital budgeting methods. *Journal of Finance* 33:1, 281–7.

Sherman, Steven J. 1980. On the self-erasing nature of errors of prediction. *Journal of Personality and Social Psychology* 39:2, 211–21.

Simon, Herbert A. 1955. A behavioral model of rational choice. *Quarterly Journal of Economics* 69:1, 99–118.

Simon, Herbert A. 1959. Theories of decision-making in economics and behavioral science. *American Economic Review* 49: 3, 253–83.

Simon, Mark, and Susan M. Houghton. 2003. The relationship between overconfidence and the introduction of risky products: Evidence from a field study. *Academy of Management Journal* 46:2, 139–49.

Smith, Adam. 1776. *The wealth of nations*. London: Methuen & Co., Ltd. (Cited from Bantam Classic edition, 2003.)

Staël von Holstein, Carl-Axel S. 1972. Probabilistic forecasting: An experiment related to the stock market. *Organizational Behavior and Human Performance* 8:1, 139–58.

Staw, Barry M. 1976. Knee-deep in the big muddy: A study of escalating commitment to a chosen course of action. *Organizational Behavior and Human Performance* 16:1, 27–44.

Staw, Barry M. 1991. Dressing up like an organization: When psychological theories can explain organizational action. *Journal of Management* 17:4, 805–19.

Stein, Jeremy C. 1989. Efficient capital markets, inefficient firms: A model of myopic corporate behavior. *Quarterly Journal of Economics* 104:4, 655–69.

Stein, Jeremy C. 1996. Rational capital budgeting in an irrational world. *Journal of Business* 69:4, 429–55.

Stein, Jeremy C. 2003. Agency, information and corporate investment. In *Handbook of the economics of finance*, (eds.) George M. Constantinides, Milton Harris, and René M. Stulz, 111–63. Amsterdam: North-Holland.

Svenson, Ola. 1981. Are we all less risky and more skillful than our fellow drivers? *Acta Psychologica* 47:2, 143–8.

Teger, Allan I. 1980. *Too much invested to quit*. New York: Pergamon Press.

Tobin, James. 1969. A general equilibrium approach to monetary theory. *Journal of Money, Credit and Banking* 1:1, 15–29.

Treynor, Jack L., and Fischer Black. 1976. Corporate investment decisions. In *Modern developments in financial management*, (ed.) Stewart C. Myers, 310–27. New York: Praeger.

Tyler, Beverly B., and H. Kevin Steensma. 1998. The effects of executives' experiences and perceptions on their assessment of potential technological alliances. *Strategic Management Journal* 19:10, 939–65.

Van den Steen, Eric. 2004. Rational overoptimism (and other biases). *American Economic Review* 94:4, 1141–51.

Wagenaar, Willem A., and Gideon B. Keren, 1986. Does the expert know? The reliability of predictions and confidence ratings of experts. In *Intelligent decision support in process environments*, (eds.) Erik Hollnagel, Giuseppe Mancini, and David D. Woods, 87–107. Berlin: Springer.

Weinstein, Neil D. 1980. Unrealistic optimism about future life events. *Journal of Personality and Social Psychology* 39:5, 806–20.

Xia, Xinping, and Hongbo Pan. 2006. The dynamics of corporate takeovers based on managerial overconfidence. *Journal of American Academy of Business* 10:1, 378–86.

Zuckerman, Miron. 1979. Attribution of success and failure revisited, or: The motivational bias is alive and well in attribution theory. *Journal of Personality* 47:2, 245–87.

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CHAPTER 23

Dividend Policy Decisions

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INTRODUCTION

Although firms have been distributing dividends to their shareholders for four centuries (Baskin, 1988), the motivation for this corporate policy is under debate in the academic community. In an early paper, Black (1976, p. 5) coined the term the "dividends puzzle" to illustrate the poor understanding of dividend payment policy: "The harder we look at the dividend picture, the more it seems like a puzzle, with pieces that just don't fit together." Over the years, dozens of theories have attempted to explain the dividends phenomenon with no consensus reached. Many of the theories view agents as rational, and dividends either serve as an efficient way to resolve agency problems or as a signaling device to mitigate information asymmetry problems. Allen and Michaely (2003), Frankfurter and Wood (2006), Baker (2009), and DeAngelo, DeAngelo, and Skinner (2009) provide excellent reviews of these theories and the related empirical facts. After reviewing the literature, Allen and Michaely (2003) and Frankfurter and Wood (2006) conclude that theories based on agency or signaling are not consistent with the empirical evidence and that the question of why firms distribute dividends remains a puzzle. DeAngelo et al., however, reach a different conclusion and argue that asymmetric information could provide an explanation for the dividends phenomenon.

This chapter reviews the main stylized facts about dividends and examines the behavioral theories that attempt to explain the evidence. Given the focus on the behavioral perspective, this chapter reexamines and reclassifies some of the empirical facts that previous researchers have used to support rational theories. As such, it does not replace the many surveys written about dividends over the years (e.g., Allen and Michaely, 2003; DeAngelo et al., 2009). Rather, this chapter tries to assess whether the empirical evidence is consistent with a departure from rational behavior on the part of investors or managers.

The role of behavioral finance in explaining the existence of dividends is debated as a matter of academic dispute. Miller (1986) presents a traditional argument against behavioral finance by contending that behavioral theories may be able to explain the micro-behavior of agents, but that rational theories should suffice to explain the aggregate behavior of firms. Frankfurter and Lane (1992) and Frankfurter and Wood (2006) emphasize the normative aspects of dividend payments

and call for an alternative theory, based on behavioral and social aspects, to explain dividend policy.

The chapter is organized as follows: It begins by listing the known empirical facts about dividends that research has discovered over the years. Then the chapter describes two sets of behavior-based explanations. The first set includes explanations that are descriptive in nature and combine the stylized facts into a description of corporate policy and investor behavior. The second set of theories offers motivations as to why investors seek dividends and why managers pay them. This chapter ends with a summary and conclusions.

THE DIVIDENDS PUZZLE: STYLIZED FACTS

Wide agreement exists on the empirical stylized facts about dividends. The following list of facts has been compiled from the empirical papers reviewed in this chapter including work by Allen and Michaely (2003) and DeAngelo et al. (2009).

- Dividends have been the primary payout method for four centuries.
- Dividends are primarily paid by established firms. Dividend payers tend to be large, well-established, and stable firms with low idiosyncratic risk.
- Dividends have been a popular method to distribute cash to investors, but, in recent years, an increasing number of firms have used repurchases as a distribution method. The proportion of dividend-paying firms has been declining since the 1960s (Fama and French, 2001), although it has picked up in recent years (Julio and Ikenberry, 2004).
- Dividends tend to be sticky and smoothed over time. Dividend volatility is far lower than the volatility of stock prices or earnings.
- Dividends are an inefficient way to distribute cash to individual shareholders, relative to share repurchases, because dividends are subject to double taxation. Until the passage of the Jobs and Growth Tax Relief Reconciliation Act of 2003 in the United States, dividend income for individuals had been taxed more heavily than capital gains. Yet, individual investors receive a large fraction of dividends paid by corporations.
- Investors consider dividend initiation and increases (omissions) as good (bad) news. A stock's price reacts positively to dividend initiation and to dividend increase announcements. The price reaction to dividend omissions is particularly negative.
- Because managers view dividend distribution as a sticky decision, which is costly to reverse, they are cautious about initiating dividend payments and even more cautious about omitting them.

Many papers have tried to provide rational explanations for why firms distribute dividends and why investors like them. Allen and Michaely (2003) summarize the economic determinants of dividend payments for rational agents: taxes, signaling to mitigate asymmetric information, incomplete contracts (agency), transaction costs, or institutional investors. The tax argument suggests that firms should minimize dividend payments due to the high tax burden on individuals. In signaling theory, managers use dividends as a costly signal for their private

information (e.g., Bhattacharya, 1979). According to agency theory, the persistent distribution of cash out of the firm disciplines managers and reduces the extent of agency costs (e.g., Easterbrook, 1984). Dividends may be an optimal way to reduce transaction costs to shareholders in managing their funds. For example, dividends may be valuable to shareholders if it is costly for them to finance their consumption by selling shares. Finally, firms may pay out dividends to attract institutional investors. Since legal restrictions (e.g., prudent man rule as discussed in Brav and Heaton, 1997) make dividends appealing to institutional investors, then distributing dividends might be an appropriate way to encourage such investment.

Whether rational theories can explain dividend policy is still under discussion. Allen and Michaely (2003) argue that rational theories have low explanatory power, but DeAngelo et al. (2009) claim that dividend distribution could be an efficient device in mitigating information asymmetry problems. To illustrate this academic debate, Benartzi, Michaely, and Thaler (1997), Grullon, Michaely, and Swaminathan (2002), and Grullon, Michaely, Benartzi, and Thaler (2005) all find that dividend changes do not predict future earnings growth or improvement in operating performance, contradicting signaling theory. In contrast, Denis, Denis, and Sarin (1994) and Guay and Harford (2000) find support for the idea that dividends convey information about future investments. Frankfurter and McGoun (2000) argue that the search for a rational explanation for dividends is an example of thought contagion in the field of economics. They claim that there is little doubt that dividends appeared in financial markets to help investors value common stocks. In the last four decades, economists strove for a rational explanation for the dividends phenomenon that fitted into the dominant contemporary paradigm of mathematical economics and the doctrine of rational behavior.

The first set of explanations for dividends that are covered in this chapter is descriptive in nature. The dividend clientele explanation suggests that some investors prefer dividends over capital gains. This conjecture is based on the observation that certain types of investors are more likely to invest in dividend-paying firms. Alternately, the life-cycle explanation suggests that paying dividends is a part of the maturing stage in a firm's life. While these theories describe the firms paying dividends and the characteristics of the investors who receive them, they do not provide much insight into the reasons firms pay dividends or why investors prefer them.

The second set of explanations attempts to explain the "why" question. Several behavioral theories see market inefficiency (investor sentiment), investor biases, and managerial biases as the key drivers of dividend payments. The catering theory of dividends suggests that firms initiate dividends when investors value dividend-paying firms more highly. The bird-in-hand, self-control, and mental accounting theories motivate dividend payment by arguing that investors favor dividends because of behavioral biases (lack of understanding, regret avoidance, and narrow framing, respectively). There is also some mixed empirical evidence about the link between managerial bias and dividend payout. Some studies find that optimistic or overconfident managers are less likely to pay out dividends, while others argue that managers will too quickly commit to paying dividends based on private signals. Finally, two theories suggest that dividends are a result of social processes in the population of firms and investors. One theory argues that,

among the population of mature firms, dividends became a social norm, that is, an action without a purpose. The second proposes that although dividends do not convey information about the future (as the empirical literature broadly shows), investors put pressure on firms to pay them because they are traditionally used as a valuation tool.

On balance, although behavioral finance may explain many aspects of dividend paying, the question of why firms pay dividends remains open. A review of the literature suggests strong empirical support for the life-cycle theory, as many authors find that mature firms with stable cash flows begin to distribute dividends. Nevertheless, this theory does not explain why mature firms choose to distribute dividends and not repurchase shares. Promising research directions involve social norms and investor demand for dividends for valuation purposes.

DESCRIPTIVE THEORIES OF DIVIDENDS

Several studies document that dividends are more likely to appear in one segment in the market more than in others. While these studies describe the landscape of dividend paying in the economy, they often provide little motivation to why firms pay dividends.

Clientele Theories

This line of thinking suggests that investors may have different reasons for favoring dividends as a result of institutional features such as regulatory requirements or tax differentials, or from behavioral preference. In particular, Shefrin and Thaler (1988) argue that investors' personal life-cycle considerations determine the predilection for dividends: Older investors favor dividend-paying stocks because they substitute for a regular employment income.

Several studies find supporting evidence for dividend clientele among institutional investors. Allen et al. (2000) present a model in which dividends attract institutional investors because they are taxed less than retail investors, which in turn imposes a better governance structure. Brav and Heaton (1997) identify a preference to dividend payouts using the prudent man rules that require certain types of institutional investors to hold mature, and thus dividend-paying firms. Dhaliwal, Erickson, and Trezevant (1999) and Seida (2001) find empirical evidence that supports the existence of tax-based clientele for dividends. Pérez-González (2003) presents evidence that investors' tax status affects firm dividend policy. Hotchkiss and Lawrence (2002) find complementary evidence that firm returns are higher following dividends announcements for firms with institutional investors who favor dividends. Furthermore, based on a managerial survey, Brav, Graham, Harvey, and Michaely (2005) report that managers consider their investor preferences toward dividends when making dividend-related decisions.

Other studies fail to find support for the clientele hypothesis among institutional investors. Grinstein and Michaely (2005) do not find supporting evidence for the clientele theory. They investigate whether institutional investors do indeed favor dividend-paying firms and find that institutions avoid investing in nonpaying firms, but nevertheless favor firms that pay low dividends over high ones. In a recent paper, Barclay, Holderness, and Sheehan (2009) investigate whether

corporations that have the lowest dividend tax bracket favor dividends. In a contradiction of previous findings, they find that corporate shareholders do not induce firms to pay dividends, but rather are concerned with improving the firms' operating business. Brav et al. (2005) conduct a comprehensive survey of 384 managers and interview another 23 firms. Their goal is to reconcile managerial views with common academic theories of dividends. According to their survey, managers are skeptical about the relation between dividends and investor clientele and believe that institutional investors are indifferent to dividend decisions.

Researchers also find evidence for dividend clientele's existence among retail investors. Using data about retail investors' portfolio holdings, Graham and Kumar (2006) find that older and low-income retail investors tend to hold a larger fraction of dividend-paying stocks than other investors do. The authors argue that older investors' preference for dividends results from their desire for income, and that low-income investors have an advantageous tax status that makes dividends preferable. The authors also find that these classes of investors purchase dividend-paying stocks after dividend announcements, in keeping with the behavioral attention hypothesis that news attracts investors' attention (Lee, 1992; Barber and Odean, 2008). In addition, Rantapuska (2008) uses Finnish investor-level trading data to find that tax status is a major determinant in the holding and trading of dividend-paying stocks: Investors with a preferable tax status with respect to dividends tend to buy dividend-paying stocks before the ex-day and to sell after the ex-day. Conversely, Michaely (1991), using aggregate data, finds no evidence for the effects of trading by long-term retail investors around ex-dates following the 1986 Tax Reform Act. According to Becker, Ivkovic, and Weisbenner (2007), firms are more likely to distribute dividends if they are located in geographical areas where investors tend to hold shares of local firms and if the investor base is older. This evidence lends further support to the dividend clientele hypothesis and the relationship between investor preference and firm payout policy.

Firm Life Cycle

Another vein of the literature ties dividend payout to firms' life cycle. In particular, numerous papers observe that firms that pay dividends tend to be more mature and less volatile. According to Grullon et al. (2002), firms that increase (decrease) dividends experience a future decline (increase) in their profitability. According to these authors, firms that exhaust their investment opportunities increase their dividends, and thus dividends indicate firm maturity rather than signaling future profitability.

Several papers highlight the link between dividends and idiosyncratic risk. Venkatesh (1989) reports that idiosyncratic risk and the informational content of earnings decline following dividend initiation. Fink, Fink, Grullon, and Weston (2006) document that dividend-paying firms have lower idiosyncratic volatility. Bradley, Capozza, and Seguin (1998) and Chay and Suh (2008) explain the link between dividends and volatility in selection: Only firms with low cash-flow uncertainty feel comfortable in committing to paying dividends, an attitude consistent with the conservative managerial views in Lintner (1956) and Brav et al. (2005). Hoberg and Prabhala (2008) determine that the disappearance of dividends (Fama and French, 2001) is associated with an increase in idiosyncratic risk.

Supporting the view that the decline in idiosyncratic risk is related to firm maturity, studies find that idiosyncratic risk is negatively correlated with the firm governance index (Ferreira and Laux, 2007) and firm age (Fink et al., 2006). DeAngelo, DeAngelo, and Stulz (2006) and Denis and Osobov (2008) also find supporting evidence for the life-cycle theory: Firms are more likely to pay out dividends when their equity is earned through operations, rather than contributed by investors. Von Eije and Megginson (2007) perform similar tests for firms in the European Union but without finding evidence that firms are more likely to pay dividends out of earned rather than contributed capital.

Among the theories surveyed in this chapter, researchers broadly agree on firm life-cycle theory. To some extent this theory negates the rational theories that attempt to explain dividends as mitigating information asymmetries because information asymmetry problems are actually weaker in mature firms. Despite the evidence in support of this theory, it is insufficient to resolve the fundamental question of why mature firms opt to distribute dividends rather than repurchase stocks.

BEHAVIORAL BIASES AS EXPLANATIONS FOR DIVIDENDS

A set of papers links behavioral biases directly to dividends. In particular, these papers propose that firms pay dividends in order to lower the perceived costs or to enhance the perceived value by irrational investors or managers.

Investor Sentiment and the Catering Theory of Dividends

As the demand for dividends by investors varies over time (Baker and Wurgler, 2004b), one possibility is that investor demand reflects time-varying risk preferences or "sentiment." Specifically, in low-sentiment periods (e.g., recessions) investors may prefer "safer" dividend-paying stocks, while in good times (e.g., booms) investors prefer "riskier" stocks that invest their earnings rather than distribute them.

Long (1978) finds evidence supporting the hypothesis that investors' demand for dividends varies over time. He investigates the share price time-series of the Citizens Utility Company. The company has two classes of shares. One class pays cash dividends, while the other pays stock dividends. The classes are otherwise virtually identical. Based on rational asset pricing models, prices of the dividend-paying shares should be lower because the investors holding them pay higher taxes due to dividend income, relative to investors who hold the other class of shares and who are exposed only to the lower capital gains tax. Long notices, however, that the market places a premium on dividends relative to capital gains. This observation contradicts not only the Miller and Modigliani (1961) theorem, but also simple arbitrage theory (Jensen, 1978). Gemmill (2005) finds similar evidence for U.K. split-capital mutual funds in which dividend-paying shares traded at different prices than shares that did not pay dividends.

As some investors have a preference for cash payouts in dividend form, firms may simply cater to these preferences. Baker and Wurgler (2004a) consider a theory

of dividend catering in which firms accommodate the dynamic preferences of investors with respect to dividends. In their model, investors' demand for dividends varies over time, and firms respond to this demand. Thus, non-payer firms initiate dividend payouts when investor demand for dividends is high, and dividend-paying firms tend to omit dividend payments more frequently when investors do not appreciate dividends. The authors identify investor demand in several ways. First, they use Long's (1978) finding concerning the price premium that dividend-paying shares have over nonpaying shares. Second, the authors compute the "market premium of dividends": the difference in market valuations (market-to-book) between dividend-paying and non–dividend-paying stocks. Baker and Wurgler find that both time-series correlate positively with the annual time-series of the number of firms that initiate dividend payments. Li and Lie (2006) report similar findings regarding changes in dividend amounts.

Baker and Wurgler (2004b) use their catering argument to explain the fact that dividends disappear over time, as originally documented by Fama and French (2001). They argue that the disappearance of dividends is in accordance with a decline in the market dividend premium. Ferris, Sen, and Yui (2006) offer supporting evidence for the relationship between the dividend premium and the time-series of the number of dividend payers in the United Kingdom. In later papers, Baker and Wurgler use the dividend premium time-series as a proxy for investment sentiment (e.g., Baker, Wurgler, and Yuan, 2009).

Several studies find evidence contradicting the catering hypothesis. DeAngelo et al. (2009) analyze the recent trends in dividends and report that dividends did not disappear, but have become more concentrated. They find that the number of dividend payers declined because small dividend payers stopped paying them. However, firms that paid large dividends in the past have increased their current payout. Denis and Osobov (2008) present similar findings for firms in Canada, the United Kingdom, Germany, France, and Japan. Von Eije and Megginson (2007) find that the proportion of dividend-paying firms in the European Union declined toward the turn of the millennium, but they do not find supporting evidence that the catering hypothesis explains this phenomenon. DeAngelo et al. (2009) show that overall, the volume of dividends increased over time in almost a monotonic trend; they argue that investor demand is not a likely explanation of this trend. Hoberg and Prabhala (2009) determine that proxies for investor fads cannot explain the cross-section of dividend-paying firms after controlling for proxies of risk.

The idea of firms' catering to investors is not new. In particular, many studies find evidence supporting the hypothesis that firms respond to investor demand across a variety of firm policies. For example, Lee, Shleifer, and Thaler (1991) show that new closed-end funds are started when the discount of closed-end funds share prices is low relative to the underlying net asset value (NAV) and when investor sentiment is high (measured as the premium on small stocks). Similarly, Dong, Hirshleifer, Richardson, and Teoh (2006), Ben-David and Roulstone (2009), and others find evidence consistent with the hypothesis that firms initiate mergers and acquisitions in response to overvaluation of their own stock. Barberis and Thaler (2003) and Baker, Ruback, and Wurgler (2007) provide a further review of studies in this subfield.

Theories of Investor Biases

Several theories based on investor psychological biases have been proposed to explain why investors like dividends.

Bird-in-Hand Theory

The bird-in-hand argument suggests that investors need to realize wealth in order to consume and therefore have a preference for cash dividends over capital gains. This argument was first formally put forth by Gordon (1959) and Lintner (1962) but was theoretically contested by Miller and Modigliani (1961). Miller and Modigliani's seminal paper shows that capital gains and dividends substitute for each other. Also, investors could produce their "home-made dividends" by selling stock if they chose to do so.

Self-Control

Thaler and Shefrin (1981) and Shefrin and Statman (1984) propose that investors favor dividends as a self-control mechanism. Without dividends, investors would be tempted to sell stocks and use the proceeds for consumption, and they might sell more stock than they originally intended. In this explanation, dividends help investors to pace consumption and avoid later regret from their own overconsumption. Black (1990) subscribes to the view that investors like dividends because they like the idea of readily available wealth that spares them from consuming out of their capital.

Mental Accounting

Shefrin and Statman (1984) also suggest that investors may prefer dividends because they derive less utility from one big gain (e.g., a large capital gain) than from a series of small gains (e.g., a small capital gain and a dividend). They base their argument on prospect theory (Kahneman and Tversky, 1979). According to the theory, people evaluate profits in isolation of their overall wealth (narrow framing), and their utility function is concave in the area of gains and convex in the area of losses. Further, the slope of the utility function is greater near the origin. Thus, a big gain that is divided into several small gains provides more pleasure to investors and fuels investors' demand for dividends.

To demonstrate the process, suppose a firm gains 10 percent over a year. Barberis and Thaler (2003) also provide an illustration of this idea. If investors have prospect-theory preferences, then they would derive more utility from such a gain if it is split, for example, to a dividend of 3 percent and a capital gain of 7 percent. The same applies for losses. For a person with prospect-theory preferences, a 10 percent loss would hurt less if it is separated into a 3 percent gain (dividend) and a 13 percent loss.

Theories of Managerial Biases

Several studies link managerial biases and dividends by employing the Malmendier and Tate (2005) proxies for optimism. Chief executive officers (CEOs) are considered optimistic about their firms' cash flows ("overconfident" is the term they use) if they do not diversify their portfolio holdings by selling executive

options or if they commend themselves in the press. Cordeiro (2009) finds support for the hypothesis that managers who are optimistic about their firms' cash flows are less likely to pay dividends, and Deshmukh, Goel, and Howe (2009) document that the level of payout (dividend yield) is lower for optimistic managers. The intuition behind the test is that managers with a buoyant belief in their firm's future prefer to invest cash in firm projects rather than pay it out to investors. Bouwman (2009) uses the same proxy for optimism and presents evidence consistent with the hypothesis that managers who are optimistic about their future earnings distribute larger dividends. She finds that, controlling for earnings surprise and for dividend changes, the market reacts more strongly to dividend changes announced by optimistic managers. This evidence is consistent with the hypothesis that optimistic managers overestimate their private signal about the future profitability of their firms.

In another study of managerial overconfidence, Ben-David, Graham, and Harvey (2009), find no evidence that overconfident chief financial officers (CFOs) are less likely to pay dividends. In their study, they measure overconfidence as the stock market volatility perceived by managers. The authors collect managers' one-year forecasts for the S&P 500 together with confidence intervals for the forecasts. The study finds that managers who are more confident about their forecasts (i.e., have narrow confidence intervals) also implement aggressive corporate policies including high investments and high leverage.

Deshmukh et al. (2009) control for selection in the announcements of dividend changes and find that the market reaction to dividend increases by optimistic CEOs is less positive than the response to announcements by less optimistic CEOs. Dividend payouts by biased managers can be self-regulating in the sense that if dividends are too high due to optimism about future earnings, then lower-than-expected realizations of future earnings might force biased managers to reduce their dividends. In practice, dividend payout is almost never of sufficient magnitude to become a constraining or disciplining factor (DeAngelo, DeAngelo, and Skinner, 1996).

THE INERTIA-BASED EXPLANATION FOR DIVIDENDS

One explanation of the dividends phenomenon is that firms pay out dividends out because they have always paid dividends, i.e., dividend paying persists due to inertia. This section discusses this possibility, starting from the origins of dividends through their use by investors.

Dividends as a Valuation Yardstick

The original purpose of dividends, four centuries ago, was to make equity look like debt, providing investors with a tangible return and a way to calculate the value of shares (Baskin, 1988; Frankfurter and Wood, 1997). Dividend yields make stocks comparable to each other, just as bond yields make bonds comparable to each other. By construction, dividend yield is a similar value measure to earnings-to-price, that is, comparing flow (dividends) to stock (price, which is the equal of discounted

dividends). As dividends became a common means of payout, paying dividends could have plausibly become a social norm, putting pressure on managers to conform to it (Frankfurter and Wood, 1997).

Investors often use statistics such as ratios to evaluate investments. For example, investors may compare firms' asset turnover (sales-to-assets) ratios, price-earnings ratios, market-to-book, so they can determine which company is undervalued and which might be overvalued. Practitioners commonly hold the view that dividend yield (annual per share dividends scaled by the share price) is a yardstick for valuation, that is, an indicator of value (Graham, Dodd, and Cottle, 1934; Gordon, 1959; Baskin, 1988).

Frankfurter and McGoun (2000) discuss the role dividends played in the nineteenth-century railroad industry (based on Ripley, 1915; Cleveland and Powell, 1912; Withers, 1915; Dewing, 1921; Morgan and Thomas, 1969). Using the dividends paid by firms, investors could calculate the value of shares without concerning themselves too much with the accounting practices used to calculate earnings. Hence, firms and investors treated dividends on shares like coupons on debt. In the case of the nineteenth-century railroad firms, these firms paid stable dividends even in years in which they did not have positive earnings. In addition, the pressure to distribute dividends was an effective mechanism for preventing accounting manipulations on the part of managers.

Empirical evidence seems to support the valuation-as-yardstick concept. First, casual observation shows that analysts often employ terms like "attractive dividend yield" to describe undervalued stocks. This is consistent with dividend yield being a measure of value. Second, Brennan, Chordia, and Subrahmanyam (1998) present empirical support to this conjecture by finding that dividend yield can be used as an alternative factor in an asset pricing model. Third, Graham and Kumar (2006) offer evidence that could be interpreted as investors using dividend yield as a measure of value. Consistent with the idea that retail investors are value investors in general (Barber and Odean, 2000), Graham and Kumar find that retail investors prefer to hold high versus low dividend-yield stocks. Finally, Ben-David, Glushkov, and Moussawi (2010) document that hedge funds require stronger mispricing signals from non–dividend-paying firms before purchase.

Although both the valuation yardstick hypothesis and the catering hypothesis argue that firms distribute dividends to satisfy investor demand, there is a crucial difference between the two theories. According to the catering hypothesis, firms initiate dividends when dividend-paying firms are more appreciated by investors and omit paying dividends when they are discounted in the marketplace. Conversely, the valuation yardstick hypothesis proposes that firms manage their dividends in order to help investors value their stream of cash flows and make them comparable to other firms, often within the same industry.

One prediction that follows from the yardstick valuation hypothesis is that firms time their dividend initiation to periods when they are relatively undervalued by investors; they omit dividends when they are relatively overvalued. Michaely, Thaler, and Womack (1995) find evidence consistent with this conjecture. In studying dividend initiations and omissions between 1964 and 1988, they observe that firms initiating dividends outperform the market portfolio in the year after the announcement, while firms omitting dividends underperform this benchmark. Again, while the catering hypothesis considers systematic mispricing

of dividend-paying firms, the valuation yardstick hypothesis focuses on idiosyncratic misvaluation. Denis, Denis, and Sarin (1994) find that analysts revise their earnings forecasts following dividend changes, potentially showing that such changes convey information to the market.

Another prediction is that dividend changes are correlated within industries. If investors use the same dividend yield to price firms within an industry and if firms are interested in having high valuations, a change in dividend payout by one firm is expected to be followed with payout changes in the same direction by peer firms. Firth (1996) presents empirical evidence about the relation between dividend changes in intra-industry performance that can be interpreted as supporting this hypothesis.

In order to be a useful tool for valuation based on models such as the Gordon (1959, 1962) model, firms should smooth their dividend payouts. Michaely and Roberts (2007) find that private firms in the United Kingdom smooth dividends less than large firms do. They further report that public firms pay higher dividends and are more sensitive to investment opportunities. Leary and Michaely (2008) explore the determinants of dividend smoothing. They find that "cash cows," which are larger firms, those with tangible assets, and firms with low price volatility, tend to smooth dividends more, as do firms with a larger fraction of institutional ownership and a high payout.

Are Dividends a Useful Tool for Valuation?

Given that investors use dividends for guidance in valuation, investigating whether dividends contain useful information about firms' future cash flows is important. According to signaling theories, dividend distribution serves as a signaling device for the management's quality and commitment level (Miller and Modigliani, 1961; Bhattacharya, 1979; Miller and Rock, 1985; John and Williams, 1985). In other words, firms commit to pay dividends in order to credibly signal to investors private information about their bright future.

Signaling theories may prove correct if dividend yield is correlated with the extent to which firms are over- or undervalued. Several studies have attempted to answer this question with largely inconclusive results. While early studies uncover no evidence that dividend initiation, omission, and changes convey information about future cash flows, some later studies find support for this hypothesis. Benartzi et al. (1997), Grullon et al. (2002), and Grullon et al. (2005) find no relation between dividend changes and future earnings or operating performance.

DeAngelo et al. (1996) examine the dividend policy of firms with high past growth of earnings. They find that these firms tend to increase their dividends when they are in a period of earnings growth. However, dividend increases do not forecast earnings growth. The authors argue that one explanation for the dividends could be optimism about future earnings, which is in the spirit of Jensen's (1993) corporate culture optimism argument. Also, they find that dividends are sufficiently low for the investigated corporation so as to not pose a binding constraint on cash flow usage. Nissim and Ziv (2001) find that dividend changes convey information about future changes in earnings beyond market and accounting data. Denis et al. (1994) also report that firms increase their capital expenditure following dividend increases.

Overall, what do these studies show? The balance of studies shows that although dividend initiation does not predict changes in operating performance, it could convey information about firm undervaluation.

Are Dividends a Social Norm?

Investors' affection for dividends and the observed stickiness of dividends raise the question of whether dividends have become a social norm (Frankfurter and Lane, 1992; Frankfurter and Wood, 2006). The idea behind such a hypothesis is that dividends might have had an initial use in, for example, mitigating information asymmetry problems., Over the course of time, however, dividend paying evolved into a custom that is difficult to question and hard to resist.

Baskin (1988) reviews the historical development of firms in the United Kingdom and the United States and observes that pressure on behalf of investors turned dividend paying into a hard-to-evade norm. Surveys of managers also provide evidence in support of this hypothesis. In an early survey, Lintner (1956) qualitatively explores the dividend policy of 28 corporations over seven years (1947 to 1953) in personal interviews with their managers. He makes several important observations. First, he notes that managers consider the amount of payout relative to the benchmark of the existing rate of dividends paid by their firm, rather than independent of this rate, which the theory of the time had predicted. Hence, inertia and conservatism about the ability to maintain the dividend rate in the future governed dividend decisions. Second, the interviewees believe that distributing dividends at a high rate was their fiduciary duty. In other words, they view dividend distribution as a benefit to shareholders. Third, the prime drivers of dividend amounts are long-term earnings. Managers believe that dividends should be a smoothed function of earnings and believe that investors view it similarly.

Brav et al. (2005) conduct a comprehensive survey of executives in order to learn their view on the purpose of dividends. The results of the survey show no support for rational theories of signaling, agency, or the clientele hypothesis. Conversely, the results of the survey are consistent with a social explanation for dividends—managers report that their firms distribute dividends due to inertia and because ending the payout would result in a negative market reaction.

Proving that a corporate policy is a social norm is generally difficult because this requires disproving any economic reasons for the policy at the same time. In particular, an empirical work that attempts to show that dividends are socially normative needs to control for other reasons for dividend payouts. Benartzi et al. (2009), provide an example of behavioral work that attempts to identify norms, which argues that inertia and social norms drive the stability of new issue share prices at around $20 for the whole of the twentieth century.

SUMMARY AND CONCLUSIONS

The chapter surveys the main behavioral theories proposed to explain why firms distribute dividends and why investors appreciate dividends in spite of dividends' inefficiency as a means of paying out cash. Several theories explain the determinants of paying dividends. On the demand side, the clientele explanation suggests that some groups of investors prefer dividends. On the supply side, the life-cycle

explanation proposes that steady and mature firms are more likely to distribute dividends. On the time-series aspect, the catering theory suggests that firms respond to time-varying demand by investors.

Several theories attempt to explain why investors like dividends. Theories of behavioral biases suggest that dividends are an efficient way to consume capital gains and avoid the mental costs associated with selling stock. Social-based theories propose that dividends became a signal of firm stability and a tool for valuation to many investors, and thus there is a demand for dividends by investors and pressure on firms to distribute them.

Across the different theories surveyed in this chapter, there is a broad consensus among researchers about the life-cycle theory; many studies find that mature firms are more likely to pay dividends. In general, these are large firms with low investment opportunities, stable cash flows, good governance, and low idiosyncratic risk. Nevertheless, this theory is descriptive in nature rather than having an economic rationale because it fails to explain *why* firms distribute dividends.

The puzzle of why investors like dividends and why firms distribute them remains unresolved. Despite the compelling behavioral theories, the empirical debate is unsettled. Additionally, several of the behavioral explanations for investors' demand lack any empirical evidence and thus are difficult to assess. One of the promising directions of research is the question of whether dividends became a social norm in the corporate world and whether investors use them as a yardstick for valuation. While these theories were proposed decades ago and are consistent with some empirical facts, they need to be established by additional empirical evidence.

DISCUSSION QUESTIONS

1. What is the fundamental problem with descriptive theories such as the dividend clientele and the life cycle theory?
2. What is the empirical challenge in testing whether dividends are a social norm?
3. Can theories of managerial biases explain the dividends puzzle?
4. What is the empirical difficulty in testing the "bird-in-hand," "self-control," and "mental accounting" theories?
5. Can the "valuation yardstick" hypothesis be valid even if dividends do not have predictive power about future returns?

REFERENCES

Allen, Franklin, Antonio E. Bernardo, and Ivo Welch. 2000. A theory of dividends based on tax clienteles. *Journal of Finance* 55:6, 2499–536.

Allen, Franklin, and Roni Michaely. 2003. Payout policy. In *Handbook of the economics of finance*, (eds.) George M. Constantinides, Milton Harris, and René M. Stulz, Volume 1, 337–429. Amsterdam: North-Holland.

Baker, Kent (ed.). 2009. *Dividends and dividend policy*. Hoboken, NJ: John Wiley & Sons, Inc.

Baker, Malcolm, Richard S. Ruback, and Jeffrey Wurgler. 2007. Behavioral corporate finance: A survey. In *Handbook of corporate finance: Empirical corporate finance*, (ed.) B. Espen Eckbo, Volume 1, 146–88. Amsterdam: North-Holland.

Baker, Malcolm, and Jeffrey Wurgler. 2004a. A catering theory of dividends. *Journal of Finance* 59:3, 1125–65.

Baker, Malcolm, and Jeffrey Wurgler. 2004b. Appearing and disappearing dividends: The link to catering incentives. *Journal of Financial Economics* 73, 271–88.

Baker, Malcolm, Jeffrey Wurgler, and Yu Yuan. 2009. Global, local, and contagious investor sentiment. Working Paper, Harvard Business School.

Barber, Brad M., and Terrance Odean. 2000. Trading is hazardous to your wealth: The common stock investment performance of individual investors. *Journal of Finance* 55:2, 773–806.

Barber, Brad M., and Terrance Odean. 2008. All that glitters: The effect of attention and news on the buying behavior of individual and institutional investors. *Review of Financial Studies* 21:2, 785–818.

Barberis, Nicolas, and Richard Thaler. 2003. A survey of behavioral finance. In *Handbook of the economics of finance*, (eds.) George M. Constantinides, Milton Harris, and René M. Stulz, Volume 1, 1053–128. Amsterdam: North-Holland.

Barclay, Michael J., Clifford G. Holderness, and Dennis P. Sheehan. 2009. Dividends and corporate shareholders. *Review of Financial Studies* 22:6, 2423–455.

Baskin, Jonathan Barron. 1988. The development of corporate financial markets in Britain and the United States, 1600–1914: Overcoming asymmetric information. *Business History Review* 62:2, 199–237.

Becker, Bo, Zoran Ivkovic, and Scott Weisbenner. 2007. Local dividend clienteles. Working Paper, Harvard Business School, University of Illinois at Urbana-Champaign, and Michigan State University.

Ben-David, Itzhak, Denys Glushkov, and Rabih Moussawi. 2010. Direct evidence for the behavior of hedge funds when arbitrage is costly. Working Paper, The Ohio State University.

Ben-David, Itzhak, John R. Graham, and Campbell R. Harvey. 2009. Managerial overconfidence and corporate policies. Working Paper, Duke University and Ohio State University.

Ben-David, Itzhak, and Darren Roulstone. 2009. Why do small stock acquirers underperform in the long-term? Working Paper, The Ohio State University.

Benartzi, Shlomo, Roni Michaely, and Richard H. Thaler. 1997. Do changes in dividends signal the future or the past? *Journal of Finance* 52:3, 1007–43.

Benartzi, Shlomo, Roni Michaely, Richard H. Thaler, and William C. Weld. 2009. The nominal price puzzle. *Journal of Economic Perspectives* 23:2, 121–42.

Bhattacharya, Sudipto. 1979. Imperfect information, dividend policy, and "the bird in the hand" fallacy. *Bell Journal of Economics* 10:1, 259–70.

Black, Fischer. 1976. The dividend puzzle. *Journal of Portfolio Management* 2:2, 5–8.

Black, Fischer. 1990. Why firms pay dividends. *Financial Analysts Journal* 46:3, 5.

Bouwman, Christa. 2009. Managerial optimism and the market's reaction to dividend changes. Working Paper, Case Western University.

Bradley, Michael, Dennis R. Capozza, and Paul J. Seguin. 1998. Dividend policy and cash-flow uncertainty. *Real Estate Economics* 26:4, 555–80.

Brav, Alon, John R. Graham, Campbell R. Harvey, and Roni Michaely. 2005. Payout policy in the 21st century. *Journal of Financial Economics* 77:3, 483–527.

Brav, Alon, and James B. Heaton. 1997. The economic effects of prudent man laws: Empirical evidence from stock ownership dynamics. Working Paper, Duke University.

Brennan, Michael J., Tarun Chordia, and Avanidhar Subrahmanyam. 1998. Alternative factor specifications, security characteristics, and the cross-section of expected stock returns. *Journal of Financial Economics* 49:3, 345–73.

Chay, Jong-Bom, and Jungwan Suh. 2008. Payout policy and cash-flow uncertainty. *Journal of Financial Economics* 93:1, 88–107.

Cleveland, Fredrick A., and Fred Wilbur Powell. 1912. *Railroad finance*. New York: D. Appleton and Company.

Cordeiro, Leonardo. 2009. Managerial overconfidence and dividend policy. Working Paper, London Business School.

DeAngelo, Harry, Linda DeAngelo, and Douglas Skinner. 1996. Reversal of fortune, dividend signaling and the disappearance of sustained earnings growth. *Journal of Financial Economics* 40:3, 341–71.

DeAngelo, Harry, Linda DeAngelo, and Douglas Skinner. 2009. Corporate payout policy. *Foundations and Trends in Finance* 3:2-3, 95–287.

DeAngelo, Harry, Linda DeAngelo, and René Stulz. 2006. Dividend policy and the earned/contributed capital mix: A test of the lifecycle theory. *Journal of Financial Economics* 81:2, 227–54.

Denis, David J., Diane K. Denis, and Atulya Sarin. 1994. The information content of dividend changes: Cash flow signaling, overinvestment, and dividend clienteles. *Journal of Financial and Quantitative Analysis* 29:4, 567–87.

Denis, David J., and Igor Osobov. 2008. Why do firms pay dividends? International evidence on the determinants of dividend policy. *Journal of Financial Economics* 89:1, 62–82.

Deshmukh, Sanjay, Anand M. Goel, and Keith M. Howe. 2009. CEO overconfidence and dividend policy: Theory and evidence. Working Paper, DePaul University.

Dewing, Arthur S. 1921. *The financial policy of corporations: Volume I, corporate securities*. New York: Ronald Press Company.

Dong, Ming, David A. Hirshleifer, Scott A. Richardson, and Siew Hong Teoh. 2006. Does investor misvaluation drive the takeover market? *Journal of Finance* 61:2, 725–62.

Dhaliwal, Dan, Merle Erickson, and Robert Trezevant. 1999. A test of the theory of tax clienteles for dividend policies. *National Tax Journal* 52:2, 179–94.

Easterbrook, Frank H. 1984. Two agency-cost explanations of dividends. *American Economic Review* 74:4, 650–59.

Fama, Eugene F., and Kenneth R. French. 2001. Disappearing dividends: Changing firm characteristics or lower propensity to pay? *Journal of Financial Economics* 60:1, 3–43.

Ferreira, Miguel A., and Paul A. Laux. 2007. Corporate governance, idiosyncratic risk, and information flow. *Journal of Finance* 62:2, 951–89.

Ferris, Stephen P., Nilanjan Sen, and Ho Pei Yui. 2006. God save the queen and her dividends: Corporate payouts in the UK. *Journal of Business* 79:3, 1149.

Fink, Jason, Kristin E. Fink, Gustavo Grullon, and James P. Weston. 2006. Firm age and fluctuations in idiosyncratic risk. Working Paper, James Madison University and Rice University.

Firth, Michael. 1996. Dividend changes, abnormal returns, and intra-industry firm valuations. *Journal of Financial and Quantitative Analysis* 31:2, 189–211.

Frankfurter, George M., and William R. Lane. 1992. The rationality of dividends. *International Review of Financial Analysis* 1:2, 115–30.

Frankfurter, George M., and Elton G. McGoun. 2000. Thought contagion and financial economics: The dividend puzzle as a case study. Journal of Psychology & Financial Markets 1:2, 145–53.

Frankfurter, George M., and Bob G. Wood. 1997. The evolution of corporate dividend policy. *Journal of Financial Education* 23:1, 16–32.

Frankfurter, George M., and Bob G. Wood. 2006. *Dividend policy: Theory and practice*. London: Academic Press.

Gemmill, Gordon. 2005. Catering for dividends by stripping mutual-fund portfolios. Working Paper, Warwick Business School.

Gordon, Myron J. 1959. Dividends, earnings and stock prices. *Review of Economics and Statistics* 41:2, 99–105.

Gordon, Myron J. 1962. *The investment, financing, and valuation of the corporation*. Homewood, IL: Richard D. Irwin.

Graham, Benjamin, David L. Dodd, and Sidney Cottle. 1934. *Security analysis: Principles and technique*. New York: McGraw-Hill.

Graham, John R., and Alok Kumar. 2006. Do dividend clienteles exist? Evidence on dividend preferences of retail investors. *Journal of Finance* 61:3, 1305–36.

Grinstein, Yaniv, and Roni Michaely. 2005. Institutional holdings and payout policy. *Journal of Finance* 60:3, 1389–426.

Grullon, Gustavo, Roni Michaely, Shlomo Benartzi, and Richard H. Thaler. 2005. Dividend changes do not signal changes in future profitability. *Journal of Business* 78:5, 1659–82.

Grullon, Gustavo, Roni Michaely, and Bhaskaran Swaminathan. 2002. Are dividend changes a sign of firm maturity? *Journal of Business* 75:3, 387–424.

Guay, Wayne, and Jarrad Harford. 2000. The cash-flow permanence and information content of dividend increases versus repurchases. *Journal of Financial Economics* 57:3, 385–415.

Hoberg, Gerard, and Nagpurnanand R. Prabhala. 2009. Disappearing dividends, catering, and risk. *Review of Financial Studies* 22:1, 79–116.

Hotchkiss, Edith S., and Stephen Lawrence. 2002. Empirical evidence on the existence of dividend clienteles. Working Paper, Boston College.

Jensen, Michael C. 1978. Some anomalous evidence regarding market efficiency. *Journal of Financial Economics* 6:2/3, 95–101.

Jensen, Michael C. 1993. The modern industrial revolution, exit, and the failure of internal control systems. *Journal of Finance* 48:3, 831–80.

John, Kose, and Joseph Williams. 1985. Dividends, dilution and taxes: A signaling equilibrium. *Journal of Finance* 40:4, 1053–70.

Julio, Brandon, and David L. Ikenberry. 2004. Reappearing dividends. *Journal of Applied Corporate Finance* 16:4, 89–100.

Kahneman, Daniel, and Amos Tversky. 1979. Prospect theory: An analysis of decision under risk. *Econometrica* 47:2, 263–91.

Leary, Mark T., and Roni Michaely. 2008. Why do firms smooth dividends? Working Paper, Cornell University.

Lee, Charles M. C. 1992. Earnings news and small traders: An intraday analysis. *Journal of Accounting and Economics* 15:2-3, 265–302.

Lee, Charles M. C., Andrei Shleifer, and Richard Thaler. 1991. Investor sentiment and the closed-end fund puzzle. *Journal of Finance* 46:1, 75–109.

Li, Wei, and Erik Lie. 2006. Dividend changes and catering incentives. *Journal of Financial Economics* 80:2, 293–308.

Lintner, John. 1956. Distribution of incomes of corporations among dividends, retained earnings and taxes. *American Economic Review* 46:2, 97–113.

Lintner, John. 1962. Dividends, earnings, leverage, stock prices and supply of capital to corporations. *Review of Economics and Statistics* 44:3, 243–69.

Long, John B., Jr. 1978. The market valuation of cash dividends: A case to consider. *Journal of Financial Economics* 6:2-3, 235–64.

Malmendier, Ulrike, and Geoffrey Tate. 2005. CEO overconfidence and corporate investment. *Journal of Finance* 60:6, 2661–700.

Michaely, Roni. 1991. Ex-dividend day stock price behavior: The case of the 1986 tax reform act. *Journal of Finance* 46:3, 845–59.

Michaely, Roni, and Michael R. Roberts. 2007. Corporate dividend policies: Lessons from private firms. Working Paper, Cornell University and Wharton School of the University of Pennsylvania.

Michaely, Roni, Richard H. Thaler, and Kent L. Womack. 1995. Price reactions to dividend initiations and omissions: Overreaction or drift? *Journal of Finance* 50:2, 573–608.

Miller, Merton. 1986. Behavioral rationality in finance. *Journal of Business* 59:4, S451–68.

Miller, Merton, and Franco Modigliani. 1961. Dividend policy, growth and the valuation of shares. *Journal of Business* 34:4, 411–33.
Miller, Merton, and Kevin Rock. 1985. Dividend policy under asymmetric information. *Journal of Finance* 40:4, 1031–51.
Morgan, E. Victor, and William Arthur Thomas. 1969. *The London Stock Exchange*. New York: St. Martin's Press.
Nissim, Doron, and Amir Ziv. 2001. Dividend changes and future profitability. *Journal of Finance* 55:6, 2111–133.
Pérez-González, Francisco. 2003. Large shareholders and dividends: Evidence from U.S. tax reforms. Working Paper, Stanford Graduate School of Business.
Rantapuska, Elias. 2008. Ex-dividend day trading: Who, how, and why? Evidence from the Finnish market. *Journal of Financial Economics* 88:2, 355–74.
Ripley, William Z. 1915. *Railroads: Finance and organization*. New York: Longmans, Green, and Co.
Seida, Jim A. 2001. Evidence of tax-clientele-related trading following dividend increases. *Journal of the American Taxation Association* 23:1, 1–21.
Shefrin, Hersh M., and Meir Statman. 1984. Explaining investor preference for cash dividends. *Journal of Financial Economics* 13:2, 253−82.
Shefrin, Hersh M., and Richard H. Thaler. 1988. The behavioral life-cycle hypothesis. *Economic Inquiry* 26:4, 609–43.
Thaler, Richard H., and Hersh M. Shefrin. 1981. An economic theory of self-control. *Journal of Political Economy* 89:2, 392–406.
Von Eije, Henk, and William L. Megginson. 2007. Dividend policy in the European Union. Working Paper, University of Groningen and University of Oklahoma.
Venkatesh, P. C. 1989. The impact of dividend initiation on the information content of earnings announcements and returns volatility. *Journal of Business* 62:2, 175–97.
Withers, Harley. 1915. *Stocks and shares*. New York: E. P. Dutton and Company.

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CHAPTER 24

Loyalty, Agency Conflicts, and Corporate Governance

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INTRODUCTION

A behavioral perspective on agency requires considering both insufficiently and excessively loyal agents. Wherever human beings are organized into hierarchies—command economies, governments, armies, or corporations—principals, at the top of the hierarchy, make decisions, and agents, in lower positions, obey orders or not. To promote obedience, agents often have a duty of loyalty to principals. Thus, cadres, soldiers and bureaucrats must obey commissars, sergeants, and presidents; and chief executive officers (CEOs) must obey shareholders, the legal owners of a corporation.

Problems of agency in social psychology concern excessively loyal agents, while those in mainstream finance concern insufficiently loyal agents. The purpose of this chapter is to reconcile these two approaches and to assess the implications of that reconciliation for financial economics.

Agency in Economics

The archetypical agency problem in economics features a CEO who maximizes her utility rather than her shareholders' wealth. Jensen and Meckling (1976) posit an entrepreneur, initially owning her firm entirely, contemplating an initial public offering (IPO) to sell some shares to public investors, retaining the rest, and staying on as CEO. The CEO can divert corporate resources to augment her utility by purchasing unnecessary Lear jets, hiring unqualified cronies, advancing personal political agendas, or funding pet charities. Before the IPO, she bears the full cost of such things; but afterwards public shareholders share their costs. A rationally self-interested CEO therefore diverts more corporate funds after the IPO than before. Public shareholders anticipate this governance problem and correspondingly devalue the shares.

In other hierarchies, command and control mechanisms limit agents' freedom of action. Disloyal peasants or soldiers risk quartering; disloyal bureaucrats risk

prosecution. Monitoring and control costs limit these mechanisms' effectiveness so agency problems are mitigated, not eliminated. Corporations and the economic institutions surrounding them provide analogous mechanisms: transparency, board oversight, independent audits, independent directors, and the like. These mechanisms are costly to design, monitor, and enforce, and are employed to the extent that their benefits outweigh their costs. Their costs plus the remaining depression in firm valuation equals what Jensen and Meckling (1976) call *agency costs*. Most of the agency literature in finance evaluates the effectiveness of such "loyalty enhancing" mechanisms in mitigating agency costs, as evidenced by corporate valuations (Shleifer and Vishny, 1997).

Agency in Social Psychology

Similar terminology arises in social psychology. Milgram (1974) defines an *agentic shift* where one individual subordinates her actions to the judgment of another and sees excessive loyalty as the problem. For example, social welfare would have been enhanced were Nazi guards less faithful agents of their Führer. The *agency problem* here is that the guards obeyed orders they should have defied: "I was only obeying orders" was not a defense at Nuremburg. The agency cost here is the loss due to that excessive loyalty—the loss due to the holocaust.

Thus, social psychology might see agency problems in directors' excessive loyalty to a CEO, rather than the CEO's insufficient loyalty to shareholders (Morck, 2008). For example, an agentic shift might lead directors to support a CEO's obviously misguided merger plan. Here too, firm value falls (Morck, Shleifer, and Vishny, 1990; Moeller, Schlingemann, and Stulz, 2005), and countermeasures are possible: directors might meet without the CEO or solicit an independent evaluation of the merger. However, these are "loyalty blocking" mechanisms, not "loyalty enhancing" mechanisms.

Generalized Agency Problems

Generalizing the term *agent* to include anyone from whom loyalty is expected and *principal* to encompass anyone to whom loyalty is due, a generalized agency problem entails an agent exhibiting non-optimal loyalty to the principal—too little or too much. This covers the self-interested agent of corporate finance and the blindly loyal agent of social psychology. The key insight for financial economists is that behavioral considerations permit welfare losses from insufficient *or* excessive loyalty, and much of what follows draws from Morck (2008).

This chapter has the following organization: The next section describes fundamental experimental results in social psychology that motivate a more general view of agency problems that also concedes excessively loyal agents. Alternative explanations for these results are considered, and reasons excessive loyalty best fits the facts are set forth. Experimental evidence showing that rival authority figures and dissenting peers counteract excessive loyalty is then surveyed, and examples from other fields are used to show how institutions can evolve to constrain excessive loyalty. The penultimate section recasts standard agency problems in

corporate finance with backlighting from social psychology, and the final section summarizes conclusions and implications.

AGENCY PROBLEMS GENERALIZED

Agency theory in social psychology derives from experiments by Milgram (1963, 1974) and replicated extensively thereafter (Blass, 2004). Milgram, noting senior Nazis' Nuremburg defense: "I was only obeying orders," recalled historians' observation that "loyalty" motivates many atrocities (Laski, 1919).

Milgram's Experiment

The experiment features a box with switches labeled "15 volts," "30 volts," and so on up to "450 volts" and wires attached to a professional actor, the "learner." A noise maker mimics high voltage buzzes. Each subject is told (falsely) that the "learner" is the subject of an experiment on how punishment stimulates learning and asked to assist by working the switches. The real subjects, paid volunteers, thus incurred a duty to Milgram, whose lab coat and Yale laboratory evoked the authority of Science. Milgram asked a series of questions and, each time the actor answered incorrectly, instructed the subject to pull a higher voltage switch, whereupon the actor feigned increasing pain. Milgram (1974, p. 4) describes the actor's script: "At 75 volts, the 'learner' grunts. At 120 volts he complains verbally; at 150 he demands to be released from the experiment. His protests continue as the shocks escalate, growing increasingly vehement and emotional. At 285 volts his response can only be described as an agonized scream."

Milgram planned to compare American to German subjects, thinking a German cultural proclivity to obedience might explain Nazi war crimes. He was astonished by a "test run" of undergraduates dutifully electrocuting perfect strangers, but dismissed this as "Yalies." But the full experiment gave similar results. Ordinary Americans obediently electrocuted strangers upon command.

Exhibit 24.1 summarizes his main results. Every subject electrocuted the "learner" through 135 volts, whereupon he demanded release. Eighty percent continued administering shocks through 285 volts, whereupon the "learner" screamed in agony. Over 60 percent obediently administer shocks through 450 volts, despite labels like "danger severe" beside the voltage figures.

Robustness

Milgram (1963, 1974) repeats the experiment varying several parameters. He finds no difference between male and female subjects. Moving the experiment from New Haven to Bridgeport has little effect. Requiring the subject to physically hold the actor down while applying the shocks reduced obedience only marginally.

Numerous researchers, including this author, have replicated Milgram's results. A substantial majority of subjects obediently administer maximal shocks across countries, including Germany (Miller, 1986) and a wide range of subject pools and experimental designs (Merritt and Helmreich, 1996; Tarnow, 2000; Blass, 1998, 2000, 2004).

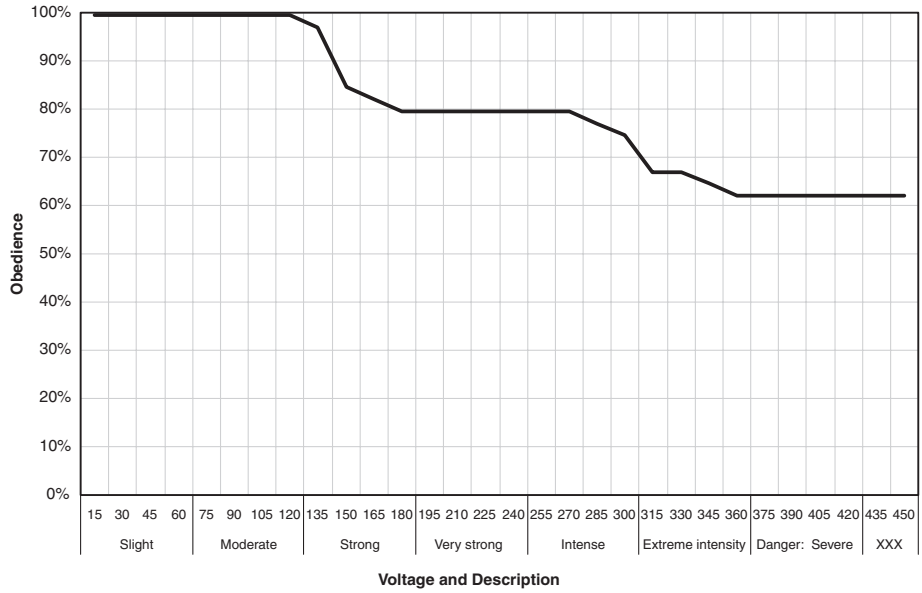

Exhibit 24.1 Obedience Rates, Baseline Milgram Experiment
Note: The vertical axis displays the fraction of subjects who apply electric shocks, with voltages plotted on the horizontal axis, to perfect strangers when so ordered by a psychologist. Based on data in Milgram (1974).

Responding to concerns Milgram's subjects complied because they sensed the actor was acting, Sheridan and King (1972) use actual shocks to a puppy. Twenty of their 26 subjects fully comply—6 of 13 males and all 13 females, though some of the latter exhibit distress (Blass, 1998, 2004).

Most recently, Burger (2009) reproduces Milgram's finding, stopping at 150V (Packer, 2008) and excluding anxious subjects—with both alterations designed to avoid causing subjects lasting psychological harm—a major criticism of Milgram's experiments (Baumrind, 1964; Kaufmann, 1967; Fischer, 1968; Mixon, 1972). Milgram's follow-up interviews suggest this discomfort afflicted his peers more than his subjects. As Burger (2009, p. 2) notes, "The vast majority of participants not only were glad they had participated in the study but said they had learned something important from their participation and believed that psychologists should conduct more studies of this type in the future." Nonetheless, university ethics reviews no longer permit full replications (Elms, 1995), apparently in response to social scientists' distress with Milgram's findings (Blass, 2000). Exhibit 24.2 illustrates Burger's (2009) baseline findings.

These replications are buttressed by "natural experiments"—in which people, acting as agents, engage in obviously cruel or inappropriate behavior. Loyal soldiers shoot strangers and loyal bomber pilots incinerate cities when so ordered.

ALTERNATIVE EXPLANATIONS

Given this robustness, the generality of Milgram's (1963, 1974) findings as a description of human nature is beyond doubt. Psychological and economic explanations

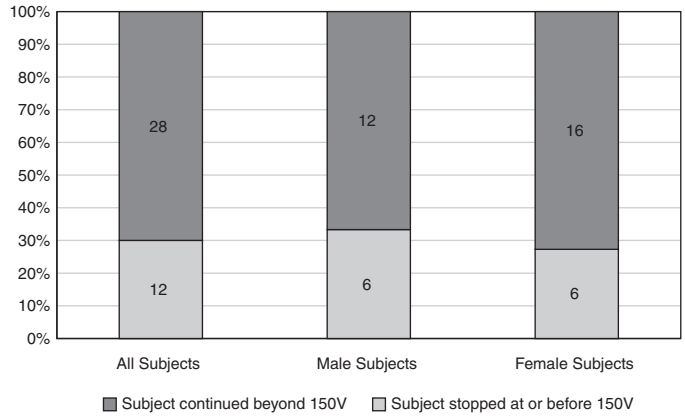

Exhibit 24.2 Replicating the Baseline Milgram Experiment

Note: The most recent replication terminated the experiment once a subject obeyed instructions to administer a shock above 150V. Results for the 30 subjects are consistent across the 18 males and 22 females in the sample. Based on data in Burger (2009).

are needed. Milgram (1974) posits an agentic shift: People suspend their autonomy and literally become agents of another, experiencing a psychological pleasure of "being loyal" to a legitimate authority that occludes personal ethical responsibility. Milgram's preferred explanation follows, and then alternatives are reviewed.

Milgram's Theory of the Agentic Shift

Milgram, appalled by his findings, never repeated his experiment in Germany. He concluded instead that humans have an innate loyalty response—an urge to obey authority (Blass, 2004).

Milgram (1974) suggests this has a genetic basis. Animals that hunt in packs, such as wolves, sort themselves into hierarchies. De Waal (2005) describes hierarchical social structures under alpha males among chimpanzees and alpha females among bonobos. Early hominids obeying alpha males (or females) perhaps survived charging mastodons better than otherwise similar loners. Thus, an agentic shift, like other *a priori* irrational behavioral decision-making shortcuts, might enhance individual or group survival (Bernardo and Welch, 2001). Certainly, this accords with Hobbes's (1651) proposal that organized tyranny trumps independent savagery. "Loyalty" evoking psychological well-being explains much of the misery and atrocity overlaying human history, but perhaps also our survival.

In follow-up interviews, Milgram's subjects explained that they "gave their word" or felt a duty of "loyalty" (Blass, 2004). Many indicated they were "doing what was expected of them." When Milgram (1974, p. 7) solicited a "moral judgment," they "unfailingly see disobedience as proper." Asked why they behaved otherwise, they cited politeness, the inviolability of one's word, the awkwardness of conflict, engulfment in the technical details of the experiment, and so on.

But the most universal response was the virtue of loyalty. Milgram (1974, p. 188) despairs that "virtues of loyalty, discipline, and self-sacrifice that we value so highly in the individual are the very properties that create destructive engines

of war and bind men to malevolent systems of authority." Because other biological drives generate similarly deep emotions, a neurological basis seems plausible. Milgram (p. 8) concludes his typical subject did not abandon moral reasoning, but "instead, it acquires a radically different focus. He does not respond with a moral sentiment to the actions he performs. Rather, his moral concern now shifts to a consideration of how well he is living up to the expectations that the authority has of him."

This is the essence of Milgram's agentic shift. The subject switches from the teleological (consequences-based) decision-making framework familiar to economists to a deontological (duty-based) framework. Right and wrong are reframed as doing or failing to do one's duty. Philosophy has long weighed duties as guiding ethics (Broad, 1930). Milgram (1963, 1974) provides empirical support for deontological considerations affecting human decisions, and that this need not induce behavior the people ex post consider teleologically ethical.

Milgram (1974, pp. 145–146) argues that this agentic shift is a previously unrecognized fundamental component of human nature; and that "the most far-reaching consequence of the agentic shift is that a man feels responsibility to the authority directing him, but feels no responsibility for the content of the actions that the authority prescribes." In economics jargon, people forsake rationally weighing consequences because "being loyal" makes them feel good. This behavioral bias might be modeled as a deontological reflex, an instinct to do one's duty, or a deontological component of utility, *a* utility of loyalty.

Sadism

One common alternative explanation, that Milgram revealed a fundamental sadistic impulse in his subject, triggers many social scientists' discomfort (Blass, 2000). This perhaps reflects a conflation of Milgram's work with the contemporaneous Stanford prison experiments (Haney, Banks, and Zimbardo, 1973), in which students in a mock prison played either "prisoners" or "guards." Within days, the "guards" inflicted rapidly escalating cruelty on increasingly cowering "prisoners."

The prison experiment elicited cruelty by the "guards" in the absence of an authority figure. After the experimenters sought (unsuccessfully) to restrain this behavior by imposing their authority, they terminated the experiment abruptly. Thus, while both experiments expose a surprising situational flexibility to ethical constraints and unflattering aspects of human nature, whether they expose the same ignominy is far from clear.

Subsequent variations of Milgram's experiment reinforce his rejection of an innate sadistic impulse. Martin, Chapman, and Spillane (1976) modified his experimental design by directing their subjects, secondary school boys, to raise a noise generator to levels indicating "a 50 percent risk" of permanent hearing loss. Because the subjects were closer to the noise generator than the actor feigning pain, they clearly risked greater damage. The near alignment of their findings to Milgram's precludes sadism as a general explanation. Still, some subjects' disobedience suggests heterogeneity in personality traits such as empathy, and some follow-up work underscores this (Blass, 1991). However, Burger (2009) finds subjects' "empathy" scores and propensities to administer shocks uncorrelated.

Conformity

North (1990) defines *economic institutions* as constraints on people's self-interested behavior. Laws and regulations are clearly economic institutions, but so are social norms (Smith, 1759), and their importance is experimentally verified (Cialdini, Kallgren, and Reno, 1991; Cialdini, 1998). People leave tips at places they will never revisit, surrender seats on buses, and deal honestly with strangers—all because doing otherwise violates social norms.

The social psychology literature shows that people tend to go along with the group. Asch (1951) asked his subjects to compare the lengths of different lines. If others in the room volubly agreed on an obviously false comparison, most subjects concurred. Asch concluded that people are remarkably prone to accept a "group consensus"—even one rigged to be obviously wrong. But Milgram's baseline subjects were not in groups. If their compliance reflects "conformity," the distinction from "obedience" seems semantic.

Changing Prospects

Another alternative stresses Milgram's small (15V) voltage increments (Gilbert, 1981). This evokes the salesman's "foot-in-the-door effect": slowly escalating a subject's commitment modifies behavior (Cialdini and Goldstein, 2004). This effect appears to derive from subjects' need for consistency—refusing to administer a 315V shock is difficult after administering a 300V shock—or changing self-perception—administering successively higher voltages causes the subject to recast herself as a person who faithfully follows instructions (Burger, 2009).

This class of explanations relates to Kahneman and Tversky (2000), who find that decisions depend critically on how options are "framed." Thus, gradually increasing the voltages changes the baseline against which subjects judge severity. Subjects would not administer a 450V shock immediately. Whether they could be induced to do so by successive reframing remains untested.

Information Cascades

Yet another alternative stresses subjects' perception of Milgram's superior knowledge (Morelli, 1983) and the experiment's academic setting, signaling legitimacy. Analogous information asymmetry underpins the literature on rational herding and information cascades (Banerjee, 1992; Bikhchandaqni, Hirshleifer, and Welch, 1992). If information is costly, the strategy of following another who appears informed can pay. Specifically, if the cost of information exceeds that of occasionally mistakenly following an uninformed actor, ignorance is rational. Thus, people tend to presume that crowded restaurants have better food and praise oeuvres of abstraction lauded by art critics. Such information cascades are readily triggered in laboratory subjects (Anderson and Holt, 1997). From this perspective, Milgram's subjects inferred he was informed and rationally avoided the costs of ascertaining electricity's effect on human physiology or the experiment's academic merits.

The importance of information cascades in finance remains unclear. Alevy, Haigh, and List (2007) find professional options traders markedly less prone to information cascades than students. By contrast, Drehmann, Oechssler, and Roider

(2002) report no significant difference between experts at an international consulting firm and ordinary subjects. Consistent with information cascades, Amihud. Hauser, and Kirsh (2003) find Israeli initial public offering (IPO) subscriptions either massively oversubscribed or pitifully undersubscribed. Consistent with Gul and Lundholm's (1995) prediction of waves of similar decisions as uninformed actors free-ride on apparent fresh information, Rao, Greve, and Davis (2001) find financial analysts initiating and discontinuing coverage en masse. Evidence of information cascades is found in hiring (Kübler and Weizsäcker, 2003), artistic success (Crossland and Smith, 2002) and perhaps cinema hits (De Vany and Walls, 1996; De Vany and Lee, 2001).

Milgram (1983) counters that erroneous presumptions of superior information characterize many instances of profoundly costly excess loyalty. In economists' parlance, excessive obedience has negative externalities: Interrogators waterboarding prisoners may think their leaders have superior information, but the social cost of this mistaken presumption likely exceeds the interrogators' costs of becoming informed. Likewise, corporate directors' liability from loyally approving a misbegotten merger likely exceeds their costs of double-checking the CEOs figures. In short, socially excessive loyalty from information cascades is, nonetheless, excessive.

But rationality amid information cascades seems inadequate given the full evidence. The danger of high voltage electricity is widely appreciated, and the experiment's stated purpose—seeing if people learn faster when punished for mistakes—is obviously not a life-and-death matter. Moreover, Martin et al.'s (1976) subjects knew they risked their own hearing, yet continued increasing noise blasts. An innate obedience reflex seems more consistent with such findings.

VOICE AND LOYALTY: DISENGAGING THE AGENTIC SHIFT

Corporate, government, and other hierarchies populate modern economies. Perhaps deriving utility from loyalty helped our ancestors survive and still inoculates hierarchies against self-interested agents, lowering the monitoring and control costs neoclassical economics casts against them.

Clearly, the immunity is incomplete. Agency problems of insufficient loyalty are theoretically compelling and empirically verified imposing large costs in a wide range of important settings.

The evidence above suggests, however, that excessively loyal agents might also impose important economic and social costs. The finance literature sees insufficient agentic loyalty augmented by institutions: laws, regulations, accounting standards, social norms and the like. Perhaps excessive agentic loyalty is likewise deterred by institutions. Therefore, ascertaining what modulates the loyalty response is important.

Bias Awareness

Gergen (1973, p. 313) posits that informing people about their behavioral biases might restore rationality. Despite extensive publicity accorded Milgram's

experiments in the 1960s and 1970s, Schurz (1985) detects no time trend in subsequent replications. Proponents of "education as liberation" from behavioral bias may underestimate its tenacity. Still, ethics committees ended Milgram experiments in the 1980s, and knowledge of them faded. Thus, recent replications such as Burger (2009) need not falsify the hypothesis.

Proximity

In variants of his experiment where Milgram's subjects physically held the actor's hands to electrodes, compliance declines slightly, so closer proximity to a victim may reduce loyalty to authority. Where Milgram (1974) left the lab, directing the experiment by telephone, obedience drops by two-thirds—and several subjects who continued administering shocks surreptitiously lowered their voltages. Some even lied about the voltages. When the experimenter reentered the lab, such disobedience ended.

Milgram (1974, p. 62) concludes that "subjects seemed able to resist the experimenter far better when they did not have to confront him face to face ... The physical presence of an authority figure was an important force." Remarkably, proximity to the authority ordering abuses appears far more important than proximity to the victim.

Directors meet the CEO regularly, but public shareholders are remote. If the same logic applies, mandating that directors meet without the CEO might remove the authority from the room and reverse the agentic shift more effectively than reminders about duties to shareholders.

DISSENTING PEERS

Although most variants of the Milgram experiment elicit similar levels of obedience, a few do not. One experiment features "dissenting peers"—another actor who reads the questions aloud and a third who declares the "electrocuted" first actor's answers right or wrong—who object and walk out, one at 150 volts and the second at 210 volts. Exhibit 24.3 shows the fraction of subjects who continue administering shocks dropping sharply when these "peers" voice "dissent." Milgram (1974, p. 118) notes that "the effects of peer rebellion are very impressive in undercutting the experimenter's authority."

In the most recent Milgram's experiment variants, Burger (2009, p. 8) includes a "dissenting peer" described thus: "The confederate showed no signs of hesitation until hearing the learner's 'ugh!' after pressing the 75-volt switch. At that point, the confederate paused for a few seconds before continuing. After pressing the 90-volt switch and hearing another 'ugh!,' the confederate glanced at the experimenter and said, "I don't know about this." The experimenter responded with his initial prod, "Please continue." The confederate paused a few seconds, then said, "I don't think I can do this," and pushed his or her chair a few inches back from the table. The experimenter then asked the real subject to continue the test, picking up where the other teacher had left off. The confederate sat silently throughout the rest of the study and avoided making eye contact with the participant." Exhibit 24.4 summarizes the results.

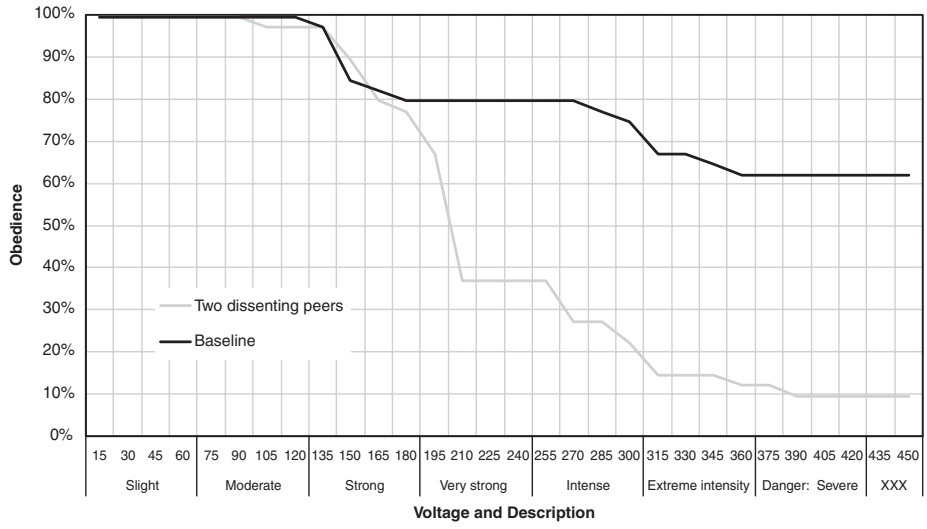

Exhibit 24.3 Obedience Rates, Dissenting Peers Variant

Note: The vertical axis displays the fraction of subjects who apply electric shocks, with voltages plotted on the horizontal axis, to perfect strangers, despite voiced concerns of two peers, when so ordered by a psychologist. Based on data in Milgram (1974).

Findings concordant with Exhibit 24.3 emerge from Asch's (1951) conformity studies. If everyone else avowed unequal lines to be of equal length, most subjects concurred. However, just one person dissenting from the incorrect consensus induced every subject to support the dissident.

Burger's (2009) failure to detect a dissenting peer effect is unexpected. He used lower voltages, eliminated subjects likely to find the experiment disturbing, and

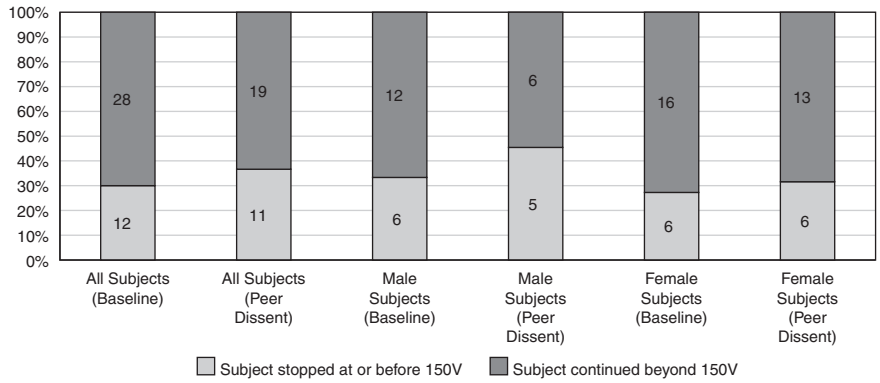

Exhibit 24.4 Replicating Peer Dissent

Note: The most recent replication of the Milgram experiment terminated the experiment once a subject obeyed instructions to administer a shock above 150V. A "peer" administers increasing shocks until the actor exhibits discomfort at 90V, whereupon the peer says, "I don't think I can do this" and the experimenter instructs the subject to take over. Results for the 40 baseline runs and 30 "peer dissent" runs are statistically indistinguishable. A lower fraction of male than female subjects comply fully in the "peer dissent" variant, but these differences are statistically insignificant. Based on data in Burger (2009).

scripted less voluble dissent. The degree of harm, selection of subjects, or volume of voiced dissent might thus modulate Milgram's "dissenting peers" effect.

"Dissenting peers" checking excessive loyalty explains repressive regimes' seemingly disproportionate zeal for suppressing dissidents and suggests institutions protecting dissidents might foster rational decision making. Democratic regimes can also succumb to "groupthink"—defined as a psychological predisposition to conform to group expectations—and pursue clearly wrongheaded "consensus" policies: Japan's Pearl Harbor attack, Kennedy's Bay of Pigs fiasco, America's Vietnam misadventure, and others (Janis, 1972). While such fiascos might arise from information cascades, Janis exposes clear psychological motives—feelings of well-being from fulfilling others' expectations—and argues that dedicated critics, impartial leaders, and multiple groups analyzing issues independently could have mitigated such "groupthink." Surowiecki (2004) goes further, arguing that independence and freely voiced dissent let groups make better decisions than individuals, while suppressing dissent induces "groupthink."

The "groupthink" literature is clearly relevant to corporate finance because management teams and boards are "groups" and make important decisions (Shefrin, 2007; Bénabou, 2008). Yet, to date, groupthink has remarkably little traction—even within behavioral subfields.

RIVAL AUTHORITY FIGURES

One Milgram (1974, p. 105) experiment variant evoked a complete cessation of obedience: At 150 volts, a second psychologist "of approximately the same age and height" as Milgram began a scripted argument that higher voltage was unnecessary. Confronted with rival authority figures, Exhibit 24.5 shows, in Milgram's (p. 107) words, that "Not a single subject 'took advantage' of the opportunity to continue the shocks, and that "action was stopped dead in its tracks."

This most startling variant suggests that rival authority figures might negate subjects' loyalty impulse entirely and evoke rational decision making. This notion raises the disturbing possibility that destructive behavior by agents loyal to a misguided or criminal principal could be prevented if a rival principal voiced disagreement sufficiently sharply.

Similar situations arise in economics. Shareholder meetings can disconcertingly resemble the North Korean parliament, with board elections featuring one candidate per position and shareholders voting "yes" or abstaining (Bebchuk, 2007). Such overt absence of alternative authorities suggests institutions designed to reinforce loyalty to corporate insiders.

DISSENT AS LOYALTY

Many important institutions seem designed to evoke disloyalty. A brief tour of these helps illuminate what such institutions might look like in economics.

The Devil's Advocate

In 1587, Pope Sixtus V established the *Holy Office of the Devil's Advocate*, also called the *Promoter of the Faith*, as a senior position in the Roman Catholic hierarchy for a

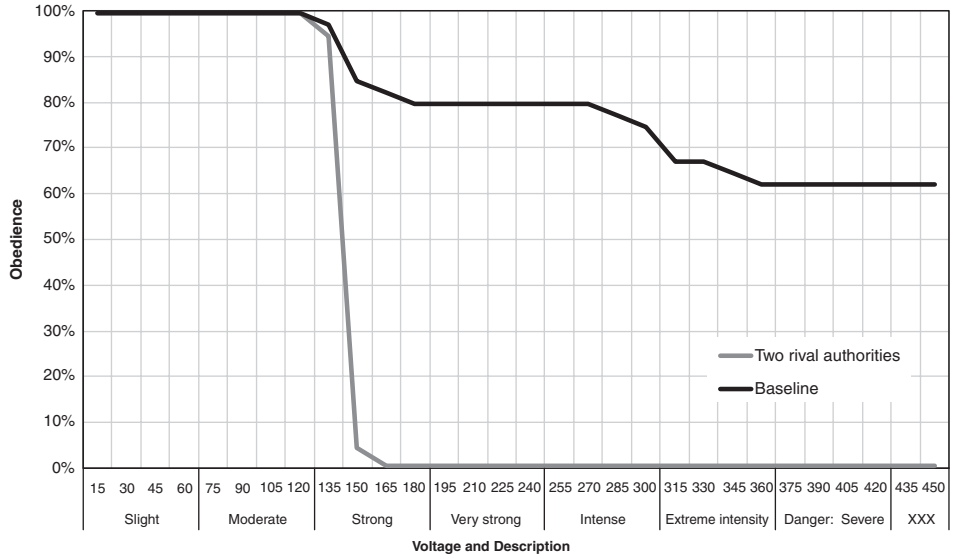

Exhibit 24.5 Obedience Rates, Disagreeing Authority Figures Variant
Note: The vertical axis displays the fraction of subjects who apply electric shocks, with voltages plotted on the horizontal axis, to perfect strangers, when two psychologists disagree about the need to complete the experiment, having been so ordered by one psychologist. Based on data in Milgram (1974).

leading canon law expert. This early Counterreformation reform sought to cleanse the Roman Church of its Renaissance practice of canonizing powerful individuals and their friends and relatives. The Devil's Advocate's duty was to challenge the character and miraculous credibility of all sainthood candidates. Like Milgram's second psychologist, the Devil's Advocate was required to vociferously criticize all proposed saints.

The Holy Office of the Devil's Advocate remained an important clerical position until abolished by John Paul II in 1983. The Polish Pope then canonized fivefold more saints than all other twentieth-century pontiffs combined, suggesting the Devil's Advocate was a substantive hindrance to sainthood.

The Common Law

Common Law, used by Britain and its ex-colonies, lets judges interpret broad legal principles. This distances judges from legislators, checking excess judicial loyalty to politicians, but risks self-interested judges abusing their discretion. In contrast, the Napoleonic Code, the basis of the French legal system, makes judges enforce minutely detailed regulations, limiting their scope for both self-interested abuse of power and independent judgment.

Glaeser and Shleifer (2002) argue that these differences reflect France's more tumultuous history exposing judges to bribes and threats from powerful litigants and thus escalating agency problems of insufficient loyalty to the nation. English judges, less subject to such pressures, were allowed more discretion. Hostettler (2006) adds that the Parliamentary victory in the English Civil War diminished

the Royal Courts, whose judges were appointed by the King and whose politicized rulings evoked widespread revulsion. This left the commanding heights of England's judiciary to its relatively independent Courts of Common Law, whose judges ruled by precedent and tradition, and owed no personal loyalty to the king. Thus, Civil Code judges, to augment insufficient loyalty to the State, decide cases by parsing a minutely intricate Code and reading off the correct judgment. Common Law judges, to check excess loyalty to the king, interpret brief codified laws with general principles such as acting like a "reasonable man" or a "prudent man."

French courts employ an inquisitorial system: The judge summons and grills witnesses, orders investigations, and actively runs his court. Once the appropriate part of the Code is found, no judgment calls arise, and no rival authorities are needed. Common Law courts, in contrast, are all about judgment calls and employ an adversary system: Rival lawyers actively undermine each other's arguments (Langbein, 2006). Confronted with rival authority figures, judges or juries, like Milgram's subjects, are forced into a rational decision-making mindset.

Common Law countries exhibit better outcomes in political corruption, financial development, and corporate ownership, financing, valuations, and dividend policies (La Porta, Lopez-de-Silanes, and Shleifer, 2008). Perhaps the judicial discretion and rational mindsets of Common Law courts resolve business disputes more efficiently; and institutions designed centuries ago to limit or enhance judges' loyalties still shape modern economies.

The Leader of Her Majesty's Loyal Opposition

The Westminster model of parliamentary democracy assigns the Leader of the Official Opposition the explicit duty of persistently criticizing the party power. This position evolved slowly after the Glorious Revolution to limit first the power of kings, and then the power of elected prime ministers (Fourd, 1964). From the eighteenth century on, Leaders of the Loyal Opposition who failed to criticize government policies sufficiently came to be seen as disloyal to the electorate (O'Gorman, 1982).

Different countries designate their leaders of the opposition differently, but this position is universal across functioning democracies. This institution, by creating a rival authority in government, may help to explain the superior public goods and services evident in democracies. A purer application of Exhibit 24.5 is hard to imagine.

PEER REVIEW

Speakers at academic economics or finance conferences must endure a subsequent critique by a *discussant*—another academic charged with exposing the speaker's errors. Researchers seeking to publish must expose their work to the merciless criticism of anonymous *referees*, also duty-bound to expose errors. Work failing either test generally fades into obscurity. Discussants and referees are designated "dissenting peers," evoking Exhibit 24.4.

Peer review is often, and perhaps rightly, criticized for inducing a conservatism bias (Samuelson and Zeckhauser, 1988) in academic journals (Editors of *Nature*, 2003). But the pace of scientific discovery hastened after peer review spread across

most disciplines in the 1960s (Benos et al., 2007), perhaps facilitated by Xeroxing (Spier, 2002). Prominent researchers may still have an easier time publishing, but big names are no longer undisputed authorities, and pharmaceuticals firms whose researchers publish more peer-reviewed articles are more productive (Cockburn and Henderson, 1998).

AGENTIC SHIFT AS A BEHAVIORAL FACTOR IN CORPORATE FINANCE

The institutions outlined above moderate loyalty to authority. Their development took centuries, even millennia, and their success remains limited. Much of the world still uncritically obeys religious, political, judicial, and academic authorities—and steadfastly avoids economic development.

Business corporations, in many ways, emulate dictatorships rather than parliamentary democracies (Bebchuk, 2007). Mace (1971) describes how CEOs cultivate directors' loyalty, keeping boards free of dissenting peers or rival authorities. This concentration of power surely reflects a historical survival advantage because alternative business organizations could have arisen. Adams, Almeida, and Ferreira (2005) show that powerful CEOs raise performance in high performing firms, but lower performance in underperforming firms. Perhaps benefits of the former outweighed the costs of the latter in the past.

But the autocratic corporation is under fire. Jensen (1993, pp. 862–63), in his American Finance Association presidential address, observes:

> *The job of the board is to hire, fire, and compensate the CEO, and to provide high-level counsel. Few boards in the past decades have done this job well in the absence of external crisis. . . . The reasons for the failure of the board are not completely understood. . . .*

Milgram (1963, 1974) provides a plausible reason: Economists see only half the problem, insufficient loyalty to shareholders; and miss the other half, excessive loyalty to top insiders. Thus, Enron's ex-Chief Financial Officer Jeffrey McMahon describes his scandal-plagued firm as "a corporate climate in which anyone who tried to challenge questionable practices of Enron's former chief financial officer, Andrew S. Fastow, faced the prospect of being reassigned or losing a bonus" (Cohan, 2002, p. 276); and Sherron Watkins, an ex-vice president at Enron, describes "a culture of intimidation in which, despite widespread knowledge of financial irregularities," no one dared question top management (Cohan, 2002, p. 277). After Enron's fall, its employees at all levels protested, "I was only doing my job" (Cohan, 2002).

The world has grown far more complex in recent decades. As a result, the benefits of concentrating decision making in the CEO's office may no longer outweigh such costs. Akerlof and Shiller (2009) see underlings loyally telling CEOs "what they want to hear," magnifying Keynes's (1936) psychologically based waves of "animal spirits" and destabilizing economies in increasingly dangerous ways. The corporate governance movement of recent decades seems determined to bring dissenting peers and rival authorities to modern business corporations, and more democratic governance does correlate with value creation (Gompers, Ishii, and Metrick, 2003).

Corporate insiders remain unconvinced and continue demanding personal loyalty (Akerlof and Yellen, 1986). Fama (1980) and Fama and Jensen (1983) argue that directors build reputations through effective monitoring. But this is no key to success if CEOs prefer "yes men" to "loose cannons" or "troublemakers" (Westphal and Stern, 2006, 2007). Corporate whistle-blowers, even those who expose serious frauds, are often rewarded with broken lives (Alford, 2000).

The evolution of economic institutions should lead toward more nuanced trade-offs between insufficient and excessive loyalty. Corporations or countries that achieve better balances should prosper more consistently, and their institutions should inspire imitation. Corporations especially seem to need an updated solution to Hollywood mogul Samuel Goldwyn's famous bluster, "I want everyone to tell me the truth—even if it costs him his job!"

VOICE AS LOYALTY

Milgram's (1974) findings on rival authorities and dissenting peers argue for boardroom analogs to Leaders of the Official Opposition and academic discussants. At present, the nature of this analog remains unclear—we do not yet know which new institutions most effectively check excessively agentic behavior while imposing the least drag on economic activity.

Regulation

Enron and other scandals of excessive obedience to misguided authority prompted corporate governance reforms such as the Sarbanes Oxley Act (SOX). This act—which forced a reorganization of the accounting industry, requires top executives to sign financial statements, and mandates internal control systems—may well be cost-ineffective (Leuz, Triantis, and Wang, 2008; Marosi and Massoud, 2007; Zhang, 2007), and soon undone (Romano, 2005). Despite hefty compliance costs, SOX did nothing to check a second round of financial sector governance scandals in 2007 and 2008.

Perhaps this is because SOX reinforces penalties on CEOs and CFOs entirely convinced of the rightness of their policies (Festinger, 1957) and unlikely to do anything differently absent overt criticism highlighting looming disaster. Hopefully, better reforms guided by behavioral finance will emerge from the current scandals.

Boards

Nonexecutive chairs and independent directors correlate with CEO departures after poor performance but not enhanced valuations (Kang and Sorensen, 1999; Hermalin and Weisbach, 2003). The finance literature stresses nonexecutive chairs and independent directors (Herman, 1981; Mace, 1971; Weisbach, 1988; Morck, Shleifer, and Vishny, 1989; Rosenstein and Wyatt, 1990) as enhancing directors' loyalty to shareholders. But viewing them as disrupting directors' loyalty to CEOs may be more useful.

Reforms motivated by this perspective might strengthen rival authorities on the board. Thus, Adams et al. (2005) argue rival insiders can check CEO power better than independent directors because they are better informed. This suggests reforms to help rival insiders usurp the CEO position when firm performance sags (Ocasio, 1994).

This perspective also suggests why previous reforms failed. Enron's CEO did not chair its board, which contained many independent directors. Yet, neither the chair nor the independent directors stood up like Milgram's second psychologist or dissenting peers. The Higgs Report (2003), a British corporate governance study, suggests why. Detailed biographies of British independent directors and nonexecutive chairs reveal most to be friends of the CEO who passed various independence tests. Moreover, CEOs can play games of tit-for-tat (Axelrod, 1984), serving as "independent" directors on each other's boards.

Disrupting excessive loyalty to the CEO suggests stronger standards of "independence" that preclude personal or family relationships, as well as financial ties, and ban cross-appointments on each other's boards. Other options include directors certifying their own independence under severe liability for misstatements; having shareholders, rather than the CEO, nominate directors (Shivdasani and Yermack, 1999); and mandating that director elections be contested. Unfortunately, little is known of the costs and benefits of such reforms.

Shareholder Meetings

Another forum where disloyalty to CEOs might improve governance is shareholder meetings. Larger shareholders, such as pension funds and insurance funds, can better monitor CEOs (Shleifer and Vishny, 1986) and can be nurtured by tax and regulatory policies (Cheffins, 2008). This envisions sophisticated fund managers denouncing underperforming CEOs and organizing proxy contests—opposition candidates to replace underperforming boards (Shleifer and Vishny, 1997). Board election procedures that facilitate this correlate with higher valuations (Bebchuk and Cohen, 2005; Faleye, 2007). Black and Coffee (1994) describe Britain's reliance on this approach.

These mechanisms also have costs. Fund managers, like CEOs, maximize their utility and this need not lead them to maximize portfolio returns (Romano, 1993). Fund managers may also be less sophisticated than commonly believed (Lakonishok, Shleifer, Thaler, and Vishny, 1992).

Takeovers

An active market for corporate control improved governance in 1980s America (Morck et al., 1989) and in Britain (Cheffins, 2008). Takeovers circumvent the whole issue of board loyalty to CEOs. Poor decisions depress share prices, putting misgoverned firms "on sale." Raiders buy these fixer-uppers and resell them—a sort of corporate gentrification.

Beginning in the late 1980s, American CEOs convinced boards to approve takeover defenses such as poison pills and staggered director elections, and to fund lobbying for state laws to obstruct takeovers. Firms more immune to takeovers have lower valuations (Gompers, Ishii, and Metrick, 2003). Failure to account for directors' loyalty to CEOs likely blunted takeovers as a governance-enhancing mechanism in America.

Behavioral Biases to Counter Behavioral Biases

Information cascades, invoked above as an alternative explanation of Milgram's (1974) results, may well be interrupted by various behavioral biases. Noth and Weber (2003) see individually irrational overconfidence inducing agents to think for themselves and stopping information cascades. Kübler and Weizsäcker (2004)

observe experimental subjects overpaying for signals and suggest this apparently irrational behavior likewise interrupts information cascades. Arya, Glover, and Mittendorf (2006) propose that noisy information can sometimes be better than clear signals. An overconfident director spending freely on information, and who is unsure of what the CEO thinks, might enhance board rationality.

SUMMARY AND CONCLUSIONS

Milgram (1974) suggests human nature includes reflexive loyalty to authority, wherein people recast themselves as agents rather than autonomous decision makers. Where this reflex disposes subordinates and boards to support CEOs advancing wrongheaded strategies, a behaviorally grounded agency problem of excessive loyalty imposes economic costs.

Because this reflex connects to morally charged concepts like loyalty, trust, and duty, this subservience is tenacious. Its moral overtone lets people behave in overtly unethical ways, yet justifies their behavior in terms of these charged concepts. Thus, managers and directors justify acquiescence to corporate fraud as loyalty, trust, and duty to a powerful CEO.

Effective reform must overcome both the standard economic agency problem of insufficient loyalty (Jensen and Meckling, 1976) and this behaviorally based agency problem of excessive loyalty. Institutions in law, politics, and academia balance these agency problems, but corporate governance focuses on insufficient loyalty to shareholders, neglecting excessive loyalty to CEOs.

Milgram (1974) finds that distant authorities, dissenting peers, and rival authorities reinitiate subjects' rational reasoning. Thus, governance reforms might emulate Westminster parliaments in designating lead independent directors or institutional investors as Leaders of the Official Opposition. They might emulate Common Law courts in eliciting constructive dissent and academic journals in soliciting independent criticisms. To date, reforms such as independent directors or chairs are uncorrelated with corporate performance. One explanation is that CEOs choose independent directors and chairs for loyalty. Another is that the behavioral impulse to loyalty is hard to overcome.

DISCUSSION QUESTIONS

1. What is meant by *agency cost* and the *agency problem* in finance? Give an example of problems this might cause.
2. What is meant by an *agentic shift* in social psychology, and what sorts of problems does this cause?
3. What is a *generalized agency problem*, and how does this concept connect with agency problems in finance and agentic shifts in social psychology?
4. How might social psychology's agentic shift be reconciled with microeconomics, which casts human behavior as utility maximization?

REFERENCES

Adams, Renée, Heitor Almeida, and Daniel Ferreira. 2005. Powerful CEOs and their impact on corporate performance. *Review of Financial Studies* 18:4, 1403–32.

Akerlof, George, and Robert Shiller. 2009. *Animal spirits: How human psychology drives the economy, and why it matters for global capitalism*. Princeton, NJ: Princeton University Press.

Akerlof, George, and Janet Yellen. 1986. *Efficiency wage models of the labor market*. San Diego, CA: Academic Press.

Alevy, Jonathan, Michael Haigh, and John List. 2007. Information cascades: Evidence from a field experiment with financial market professionals. *Journal of Finance* 62:1, 151–80.

Alford, C. Fred. 2000. *Whistleblowers: Broken lives and organizational power*. Ithaca, NY: Cornell University Press.

Amihud, Yakov, Shmuel Hauser, and Amir Kirsh. 2003. Allocations, adverse selection, and cascades in IPOs: Evidence from the Tel Aviv stock exchange. *Journal of Financial Economics* 68:1, 137–58.

Anderson, Lisa, and Charles Holt. 1997. Information cascades in the laboratory. *American Economic Review* 87:5, 847–62.

Arya, Anil, Jonathan Glover, and Brian Mittendorf. 2006. Hierarchical reporting, aggregation, and information cascades. *Managerial and Decision Economics* 27:5, 355–62.

Asch, Solomon. 1951. Effects of group pressure upon the modification and distortion of judgment. In *Groups, leadership, and men*, (ed.) Harold Guetzkow, 177-190. Pittsburgh, PA: Carnegie Press.

Axelrod, Richard. 1984. *The evolution of cooperation*. New York: Basic Books.

Banerjee, Abhijit. 1992. A simple model of herd behavior. *Quarterly Journal of Economics* 107:3, 797–817.

Baumrind, Diana. 1964. Some thoughts on ethics of research: After reading Milgram's behavioral study of obedience. *American Psychologist* 19:6, 421–3.

Bebchuk, Lucian. 2007. The myth of the shareholder franchise. *Virginia Law Review* 93:3, 675–732.

Bebchuk, Lucian, and Alma Cohen. 2005. The costs of entrenched boards. *Journal of Financial Economics* 78:2, 409–33.

Bénabou, Roland. 2008. Groupthink: Collective delusions in organizations and markets. Working Paper, Princeton University.

Benos, Dale J., Edlira Bashari, Jose M. Chaves, Amit Gaggar, Niren Kapoor, Martin LaFrance, Robert Mans, David Mayhew, Sara McGowan, Abigail Polter, Yawar Qadri, Shanta Sarfare, Kevin Schultz, Ryan Splittgerber, Jason Stephenson, Cristy Tower, R. Grace Walton, and Alexander Zotov. 2007. The ups and downs of peer review. *Advances in Physiology Education* 31:2, 145–52.

Bernardo, Antonio, and Ivo Welch. 2001. On the evolution of overconfidence and entrepreneurs. *Journal of Economics and Management Strategy* 10:3, 301–30.

Bikhchandaqni, Sahil, David Hirschleifer, and Ivo Welch. 1992. A theory of fashion, custom, and cultural change. *Journal of Political Economy* 100:5, 992–1026.

Black, Bernard, and Jack Coffee. 1994. Hail Britannia? Institutional investor behavior under limited regulation. *Michigan Law Review* 92:7, 1999–2088.

Blass, Thomas. 1991. Understanding behavior in the Milgram obedience experiment: The role of personality, situations, and their interactions. *Journal of Personality and Social Behavior* 60:3, 398–407.

Blass, Thomas. 1998. A cross cultural comparison of studies of obedience using the Milgram paradigm. Working Paper, Department of Psychology, University of Maryland.

Blass, Thomas. 2000. The Milgram paradigm after 35 years: Some things we know about obedience to authority. In *Obedience to authority—Current perspectives on the Milgram paradigm*, (ed.) Thomas Blass, 35–60. Mahwah, NJ: Lawrence Erlbaum.

Blass, Thomas. 2004. *The man who shocked the world: The life and legacy of Stanley Milgram*. New York: Basic Books.

Broad, Charlie. 1930. *Five types of ethical theory*. Orlando, FL: Harcourt, Brace and Co.

Burger, Jerry. 2009. Replicating Milgram: Would people still obey today? *American Psychologist* 64:1, 1–11.
Cheffins, Brian R. 2008. *Corporate ownership and control: British business transformed*. Oxford: Oxford University Press.
Cialdini, Robert. 1998. *Influence: The psychology of persuasion*. New York: William Morrow and Company.
Cialdini, Robert, and Noah Goldstein. 2004. Social influence: Compliance and conformity. *Annual Review of Psychology* 55:1, 591–621.
Cialdini, Robert, Carl Kallgren, and Raymond Reno. 1991. A focus theory of normative conduct. In *Advances in experimental social psychology*, (ed.) Leonard Berkowitz, Volume 24, 201–34. San Diego, CA: Academic Press.
Cockburn, Iain M., and Rebecca M Henderson. 1998. Absorptive capacity, coauthoring behavior, and the organization of research in drug discovery. *Journal of Industrial Economics* 46:2 157–83.
Cohan, John Alan. 2002. "I didn't know" and "I was only doing my job": Has corporate governance careened out of control? A case study of Enron's information myopia. *Journal of Business Ethics* 40:2, 275–99.
Crossland, Philip, and Faye Smith. 2002. Value creation in fine arts: A system dynamics model of inverse demand and information cascades. *Strategic Management Journal* 23:5, 417–34.
De Vany, Arthur, and Cassey Lee. 2001. Quality signals in information cascades and the dynamics of the distribution of motion picture box office revenues. *Journal of Economic Dynamics & Control* 25:3/4, 593–614.
De Vany, Arthur, and David Walls. 1996. Bose-Einstein dynamics and adaptive contracting in the motion picture industry. *Economic Journal* 106:439, 1493–514.
De Waal, Frans. 2005. *Our inner ape: A leading primatologist explains why we are who we are*. New York: Penguin.
Drehmann, Mathias, Jörg Oechssler, and Andreas Roider. 2002. Herding and contrarian behavior in financial markets: An internet experiment. *American Economic Review* 95:5, 1403–26.
Elms, Alan. C. 1995. Obedience in retrospect. *Journal of Social Issues* 51:3, 21–31.
Faleye, Olubunmi. 2007. Classified boards, firm value, and managerial entrenchment. *Journal of Financial Economics* 83:2, 501–29.
Fama, Eugene. 1980. Agency problems and the theory of the firm. *Journal of Political Economy* 88:2, 288–307.
Fama, Eugene, and Michael Jensen. 1983. Separation of ownership and control. *Journal of Law and Economics* 26:2, 301–25.
Festinger, Leon. 1957. *A theory of cognitive dissonance*. Stanford, CA: Stanford University Press.
Fischer, Constance T. 1968. Ethical issues in the use of human subjects. *American Psychologist* 23:7, 532–3.
Fourd, Archibald. 1964. *His majesty's opposition, 1714–1830*. Oxford: Oxford University Press.
Gergen, Kenneth J. 1973. Social psychology as history. *Journal of Personality and Social Psychology* 26:2, 309–20.
Gilbert, Steven. 1981. Another look at the Milgram obedience studies: The role of a graduated series of shocks. *Personality and Social Psychology Bulletin* 7:4, 690–5.
Glaeser, Edward, and Andrei Shleifer. 2002. Legal origins. *Quarterly Journal of Economics* 117:4, 1193–229.
Gompers, Paul, Joy Ishii, and Andrew Metrick. 2003. Corporate governance and equity prices. *Quarterly Journal of Economics* 118:1, 107–55.
Gul, Faruk, and Russell Lundholm. 1995. Endogenous timing and the clustering of agents' decisions. *Journal of Political Economy* 103:5, 1039–66.

Haney, Craig, Curtis Banks, and Philip G. Zimbardo. 1973. Study of prisoners and guards in a simulated prison. *Naval Research Reviews* 9:1, 1–17.

Hermalin, Benjamin, and Michael Weisbach. 2003. Boards of directors as an endogenously determined institution: A survey of the economic literature. *Economic Policy Review—Federal Reserve Bank of New York* 9:1, 7–26.

Herman, Edward. 1981. *Corporate control. Corporate power*. Cambridge: Cambridge University Press.

Higgs, Derek. 2003. *The Higgs report: Review of the role and effectiveness of non-executive directors*. London: United Kingdom Department of Trade and Industry.

Hobbes, Thomas. 1651. *Leviathan, or the matter, forme, and power of a commonwealth ecclesiasticall and civil*. London: Andrew Crooke.

Hostettler, John. 2006. *Fighting for justice: The history and origins of adversary trial*. Hampshire: Waterside Press.

Janis, Irving. 1972. *Victims of groupthink: A psychological study of policy decisions and fiascoes*. Boston, MA: Houghton-Mifflin.

Jensen, Michael. 1986. Agency costs of free cash flow. *American Economic Review* 76:2, 323–9.

Jensen, Michael. 1993. The modern industrial revolution, exit and the failure of internal control systems. *Journal of Finance* 48:3, 831–80.

Jensen, Michael, and William Meckling. 1976. Theory of the firm: Managerial behavior, Agency costs and ownership structure. *Journal of Financial Economics* 3:4, 305–60.

Kahneman, Daniel, and Amos Tversky. 2000. *Choices, values, and frames*. Cambridge: University Press.

Kang, David, and Aage Sorensen. 1999. Ownership organization and firm performance. *Annual Review of Sociology* 25:1, 121–44.

Kaufmann, Harry. 1967. The price of obedience and the price of knowledge. *American Psychologist* 22:4, 321–2.

Keynes, John Maynard. 1936. *The general theory of employment, interest and money*. London: Macmillan.

Kübler, Dorothea, and Georg Weizsäcker. 2003. Information cascades in the labor market. *Journal of Economics* 80:3, 211–29.

Kübler, Dorothea, and Georg Weizsäcker. 2004. Limited depth of reasoning and failure of cascade formation in the laboratory. *Review of Economic Studies* 71:2, 425–41.

La Porta, Rafael, Florencio Lopez-de-Silanes, and Andrei Shleifer. 2008. The economic consequences of legal origins. *Journal of Economic Literature* 46:2, 285–332.

Lakonishok, Josef, Andrei Shleifer, Richard Thaler, and Robert Vishny. 1992. The structure and performance of the money management industry. *Brookings papers on economic activity* 1, 339–92.

Langbein, John. 2006. *The origins of adversary criminal trial.* Oxford: Oxford University Press.

Laski, Harold J. 1919. The dangers of obedience. *Harper's Monthly Magazin*e 159:June, 1–10.

Leuz, Christian, Alexander Triantis, and Tracy Wang. 2008. Why do firms go dark? Causes and economic consequences of voluntary SEC deregistrations. *Journal of Accounting and Economics* 45:2-3, 181–208.

Mace, Myles. 1971. *Directors: Myth and reality*. Boston, MA: Harvard Business School Press.

Marosi, András, and Nadia Massoud. 2007. Why do firms go dark? *Journal of Financial and Quantitative Analysis* 42:2, 421–42.

Martin, John, Brian Lobb, Greg Chapman, and Robert Spillane. 1976. Obedience under conditions demanding self-immolation. *Human Relation* 29:4, 345–56.

Merritt, Ashleigh C., and Robert L. Helmreich. 1996. Human factors of the flight deck: The influence of national culture. *Journal of Cross-Cultural Psychology* 27:1, 5–24.

Milgram, Stanley. 1963. Behavioral study of obedience. *Journal of Abnormal and Social Psychology* 67:4, 371–8.

Milgram, Stanley. 1974. *Obedience to authority*. New York: Harper and Row.

Milgram, Stanley. 1983. Reflections on Morelli's "Dilemma of Obedience." *Metaphilosophy*, 14:3/4, 190–4.
Miller, Arthur. 1986. *The obedience experiment: A case study of controversy in social science*. New York: Praeger.
Mixon, Don. 1972. Instead of deception. *Journal for the Theory of Social Behavior* 22:2, 145–77.
Moeller, Sara, Frederik Schlingemann, and René M. Stulz. 2005. Wealth destruction on a massive scale? A study of acquiring-firm returns in the recent merger wave. *Journal of Finance* 60:2, 757–82.
Morck, Randall. 2008. Behavioral finance in corporate governance: Economics and ethics of the devil's advocate. *Journal of Management and Governance* 12:2, 179–200.
Morck, Randall, Andrei Shleifer, and Robert Vishny. 1989. Alternative mechanisms for corporate control. *American Economic Review*. 79:4, 842–52.
Morck, Randall, Andrei Shleifer, and Robert Vishny. 1990. Do managerial objectives drive bad acquisitions? *Journal of Finance* 45:1, 31–48.
Morelli, Mario. 1983. Milgram's dilemma of obedience. *Metaphilosophy* 14:3/4, 183–9.
Nature, Editors of. 2003. Coping with peer rejection. *Nature*, 425:6959, 645.
North, Douglass. 1990. *Institutions, institutional change and economic performance*. Oxford: Oxford University Press.
Noth, Markus, and Martin Weber. 2003. Information aggregation with random ordering: Cascades and overconfidence. *Economic Journal* 113:484, 166–89.
Ocasio, William. 1994. Political dynamics and the circulation of power: CEO succession in U.S. industrial corporations, 1960–1990. *Administrative Science Quarterly* 39:2, 285–312.
O'Gorman, Frank. 1982. *The emergence of the British two-party system: 1760–1832*. London: Edward Arnold.
Packer, Dominic. 2008. Identifying systematic disobedience in Milgram's obedience experiments: A meta-analytic review. *Perspectives on Psychological Science* 3:4, 301–4.
Rao, Hayagreeva, Henrich R. Greve, and Gerald F. Davis. 2001. Fool's gold: Social proof in the initiation and abandonment of coverage by Wall Street analysts. *Administrative Science Quarterly* 46:3, 502–26.
Romano, Roberta. 1993. Public pension fund activism in corporate governance reconsidered. *Columbia Law Review* 93:4, 795–853.
Romano, Roberta. 2005. The Sarbanes-Oxley Act and the making of quack corporate governance. *Yale Law Journal* 114:7, 1521–612.
Rosenstein, Stuart, and Jeffrey Wyatt. 1990. Outside directors, board independence, and shareholder wealth. *Journal of Financial Economics* 26:2, 175–92.
Samuelson, William, and Robert Zeckhauser. 1988. Status quo bias in decision making. *Journal of Risk and Uncertainty* 11:1, 7–59.
Schurz, Grete. 1985. Experimentelle Uberprüfüng des Zusammenhangs Zwischen Persönlichkeitsmerkmalen und der Bereitschaft zum destruktiven Gehorsam gegenüber Autoritäten. *Zeitschrift für Experimentelle und Angewandte Psychologie* 32:11, 160–77.
Shefrin, Hersh, 2007. *Behavioral corporate finance*. New York: McGraw-Hill.
Sheridan, Charles, and Richard King Jr. 1972. Obedience to authority with an authentic victim. *Proceedings of the 80th Annual Convention of the American Psychological Association* 7, 165–6.
Shivdasani, Anil, and David Yermack. 1999. CEO involvement in the selection of new board members: An empirical analysis. *Journal of Finance* 54:5, 1829–53.
Shleifer, Andrei, and Robert Vishny. 1986. Large shareholders and corporate control. *Journal of Political Economy* 94:3, 461–88.
Shleifer, Andrei, and Robert Vishny. 1997. A survey of corporate governance. *Journal of Finance* 52:2, 737–84.
Smith, Adam. 1759. *The theory of moral sentiments*. London: A. Millar.
Spier, Ray. 2002. The history of the peer-review process. *Trends in Biotechnology* 20:8, 357–8.

Surowiecki, James. 2004. *The wisdom of crowds*. New York: Doubleday.
Tarnow, Eugen. 2000. Self-destructive obedience in the airplane cockpit and the concept of obedience optimization. In *Obedience to authority—Current perspectives on the Milgram paradigm*, (ed.) Thomas Blass, 111–25. Mahwah, NJ: Lawrence Erlbaum Associates.
Weisbach, Michael S. 1988. Outside directors and CEO turnover. *Journal of Financial Economics* 20:1/2, 431–60.
Westphal, James, and Ithai Stern. 2006. The other pathway to the boardroom. *Administrative Science Quarterly* 51:2, 169–204.
Westphal, James, and Ithai Stern. 2007. Flattery will get you everywhere (especially if you are a male Caucasian). *Academy of Management Journal* 50:2, 267–88.
Zhang, Ivy Xiying. 2007. Economic consequences of the Sarbanes-Oxley Act of 2002. *Journal of Accounting & Economics* 44:1/2, 74–115.

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CHAPTER 25

Initial Public Offerings

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INTRODUCTION

An initial public offering (IPO) is the firm's transition from private to public ownership. Before its IPO, the firm is held by a limited number of shareholders; after its IPO, the firm becomes widely held. The IPO is an important event in a firm's life and an interesting testing ground for financial researchers. First, it is the first time when the market puts a price on the firm's shares. Second, an IPO is a time of substantial changes in the firm's organization, ownership structure, and relation with capital markets. Helwege, Pirinsky, and Stulz (2007) provide a description of the long-term evolution of the ownership of U.S. firms following their IPO.

The literature on IPOs focuses on three "puzzles." The first puzzle involves IPO underpricing, namely the fact that in most periods and countries, IPOs exhibit highly positive average first-day returns. The next IPO enigma concerns "hot issue" markets documented in Ibbotson and Jaffe (1975) and Ritter (1984), and characterized by high variance in IPO activity and occasionally intense IPO activity concentrated in time and in a small number of industries. The boom in IPO activity in Internet-related industries at the end of the 1990s in the United States offers a good example of a "hot issue" market. The boom started in the mid-1990s and ended abruptly at the end of 2000 following the collapse of the NASDAQ stock market index.

Exhibit 25.1 presents the annual count of IPOs (left axis) and their average first-day return (right axis) in the United States between 1960 and 2008 based on Ritter's (2009a, 2009b, 2009c) web site. As Exhibit 25.1 shows, the annual number of IPOs fluctuated dramatically between 1960 and 2008. In 1974, the "coldest" of the sample years, only nine firms went public in the United States, compared to 953 in 1986, the "hottest" year in this period.

The plot of annual first-day returns shows that average first-day returns are generally positive. During 1960 to 2008, only three years exhibit negative average first-day returns (1962, 1973, and 1975). Over the entire period, first-day returns average a very sizeable 16 percent. First-day returns are also variable and occasionally reach extremely high values, such as in 1999 when the average first-day run up reached an impressive 70 percent. At the end of the 1990s, when first-day returns reached all-time highs in the United States, some specific IPOs went up in price by as much as several hundred percent. For example, on its first trading day on April 12, 1996, Yahoo's stock price increased by 154 percent, from an IPO

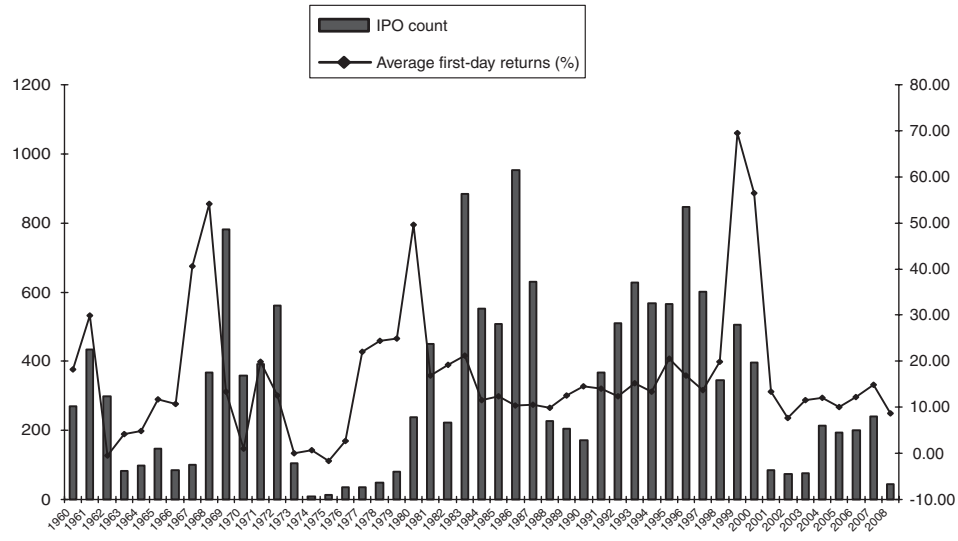

Exhibit 25.1 Annual Number and Average First-Day Return of Initial Public Offerings in the United States between January 1960 and December 2008

Note: This figure presents the annual count of IPOs (left axis) and their average first-day return (right axis) in the United States between January 1960 and December 2008. First-day returns are unadjusted percentage changes between the IPO price and the closing price at the end of the first trading day.

Source: Data from Ritter (2009a, 2009b, 2009c).

price of $13 to a closing price of $33. Ritter's (2009a, 2009b) web site provides a list of IPOs with first-day returns of at least 100 percent during 1975 to 2007, most of which occurred in 1999 and 2000.

Underpricing is a substantial cost for issuers. According to Ritter (2009c), issuers left about $569 billion on the table in the form of IPO underpricing between 1990 and 2008. An important question is why issuers agree to pay this cost. This chapter discusses several behavioral explanations that help to explain IPO underpricing, in particular when IPO underpricing reaches abnormally high levels. The chapter also focuses on understanding whether the clustering of IPOs in certain time periods or industries is better explained by economic fundamentals or investors' irrationality.

The third component of the IPO puzzle is the poor stock returns of IPO firms in the three to five years following their IPOs. Ritter (1991) provides the first large-sample academic study that documents this phenomenon. He finds that firms that went public in the United States between 1974 and 1985 underperformed various benchmarks by up to 45 percent in the next three years. He argues that IPO underperformance is the consequence of fads or "windows of opportunity" investors occasionally provide to managers, who respond by going public. Subsequent sections of this chapter provide a review of the evidence on this theory of windows of opportunity. The chapter also presents the debate on whether IPO long-run underperformance is a real phenomenon or an artifact of how long-run performance is calculated.

This chapter discusses how the behavioral approach has helped researchers explain the three components of the IPO puzzle: IPO underpricing, hot-issue

markets, and IPO long-run underperformance. Each section compares the merits of behavioral explanations to that of the rational ones and tries to provide an honest assessment of whether the behavioral approach fills the gap in understanding the IPO puzzle.

IPO UNDERPRICING

What explains IPO underpricing? As shown in the previous section, IPOs, on average, exhibit positive and sizeable first-day returns. This section begins with a brief review of the rational explanations of IPO underpricing. Next, it focuses on explanations based on the issuers' objective function and on the impact of optimistic noise traders on IPO underpricing.

Rational Explanations of IPO Underpricing

This section presents a brief overview of the main "rational" explanations of IPO underpricing. Jenkinson and Ljungqvist (2001) provide a more detailed review. Researchers have long considered high first-day returns as a direct consequence of voluntary underpricing of newly listed companies. There are many "rational" arguments offered to explain this underpricing. A sizeable proportion of these underpricing explanations rely on the idea that information asymmetries exist between two or more of the actors of an IPO, such as the issuer, its underwriters, and the investors, and that underpricing is the direct consequence of these information asymmetries. Rock (1986) argues that some investors are more informed than others, who require underpricing in order to break even on average. In Benveniste and Spindt (1989), investors are collectively more informed than underwriters and issuers, who have to pay a cost to extract this information from investors. In Allen and Faulhaber (1989), Grinblatt and Hwang (1989), and Welch (1989), the issuing firm is more informed than investors, and underpricing is a cost high-quality firms have to pay in order to signal their quality to the market. The empirical evidence generally supports the idea that firm-level information asymmetry, measured by age, size, or other firm characteristics, has a positive impact on first-day returns (Booth and Smith, 1986; Koh and Walter, 1989; Carter and Manaster, 1990). Consistent with the predictions of Benveniste and Spindt's information extraction theory, Hanley (1993) shows that underwriters only partially adjust IPO prices to reflect the information received during the IPO process.

Welch (1992) presents a model in which herd behavior leads to voluntary underpricing by issuers. Baron and Holmström (1980) and Baron (1982) attribute underpricing to agency conflicts between issuers and underwriters, who are in charge of setting the IPO price. Tinic (1988) and Lowry and Shu (2002) argue that underpricing is a way for issuers to mitigate litigation risk. Ruud (1993) claims that first-day returns are positive on average because price support by underwriters truncates the left part of the first-day returns distribution. Another strand of the literature sees underpricing as a way for the issuer to obtain the desired post-IPO ownership structure (Booth and Chua, 1996; Brennan and Franks, 1997; Stoughton and Zechner, 1998).

Collectively, these traditional explanations of IPO underpricing do a good job of explaining moderate first-day returns (10 to 15 percent). However, they do not perform as well when explaining the very high levels of IPO underpricing

observed, for example, during the dot-com bubble. Can behavioral explanations provide a better understanding of this phenomenon?

Issuers' Objective Function and IPO Underpricing

Loughran and Ritter (2002) ask why issuers do not get upset about leaving so much money on the table in the form of IPO underpricing. They base their answer on a prospect theory argument: Pre-issue shareholders do not consider wealth losses due to IPO underpricing in isolation. Rather, they consider the total wealth change relative to their pre-IPO expected wealth, and equal to the sum of two parts: (1) underpricing losses; and (2) a wealth increase equal to the number of shares pre-IPO shareholders retain multiplied by the increase in value of these retained shares relative to their pre-IPO expected value. A good estimate of the pre-IPO expected value is the midpoint of the filing range that is announced a few days before the IPO. In most cases, IPOs with high underpricing also have a high issuing price relative to the midpoint of their price range (Hanley, 1993). Therefore, pre-IPO shareholders of underpriced IPOs leave money on the table, but they typically experience considerable gains on their retained shares. In net terms, these shareholders gain overall provided that they retain enough of their pre-IPO shares and that the relative size of the IPO is not too big, which is the case in the typical IPO.

Consistent with Loughran and Ritter's (2002) explanation, Krigman, Shaw, and Womack (2001) find that firms switching underwriters between their IPO and their first seasoned equity offering (SEO) experience lower average first-day returns than those that retained their IPO underwriters for their SEOs. Krigman et al. conclude that pre-IPO shareholders are not upset by high IPO underpricing. In a more direct test of Loughran and Ritter (2002), Ljungqvist and Wilhelm (2005) construct a proxy for pre-IPO shareholder satisfaction equal to the sum of underpricing losses and perceived gains arising from differences between the midpoint of the price range and post-IPO share prices. They show that firms in which shareholders are satisfied in the sense of Loughran and Ritter are less likely to switch underwriters for their SEO.

Even though this evidence is consistent with the idea that issuers accept high levels of underpricing as long as their perceived wealth increase is large enough to offset losses due to underpricing, it does not explain why underpricing is high in the first place. Loughran and Ritter (2002) argue that underwriters who choose IPO prices voluntarily underprice IPOs for several reasons. First, in the spirit of Baron (1982), share placement is easier when the offering is underpriced. Second, IPO underpricing occurs because underwriters get indirect benefits from heavy underpricing. Underwriters' compensation has two components: a direct fee that is equal to 7 percent for a large fraction of IPOs (Chen and Ritter, 2000); and indirect fees underwriters obtain from rent-seeking clients who return a fraction of their short-term gains on underpriced IPOs to underwriters. These kickbacks can take the form of increased trading commissions (Reuter, 2006; Nimalendran, Ritter, and Zhang, 2007) around the allocation of "hot" IPOs.

Other authors argue that IPO first-day returns are high because maximizing their offering price is not the only goal of pre-IPO shareholders. Loughran and Ritter (2004) argue that the dramatic change observed in average IPO first-day returns in the 1990s comes from a change in the issuers' objective function. They

claim that during this period, issuers increasingly focused on receiving analyst coverage for their stock and were willing to leave more money on the table to obtain extra analyst coverage. According to Loughran and Ritter, the reason for this change in the issuers' objective is that analyst coverage was necessary to support the high stock valuations observed in the 1990s. The empirical evidence is largely consistent with the argument that issuers perceive analyst coverage as crucial. Cliff and Denis (2004) find that IPO underpricing is positively related to the analyst coverage received by the firm, in particular during the bubble period. They conclude that firms purchase analyst coverage with underpricing. Krigman et al. (2001) survey chief executive officers (CEOs) and chief financial officers (CFOs), and find that the main reason they switch underwriters between their IPO and their SEO is to obtain better analyst coverage.

Optimistic Investors and IPO Underpricing

Another strand of the literature focuses on the impact of optimistic investors on IPOs. Miller (1977) argues that in a world with divergence of opinion between investors and short-sale constraints, optimists will set the price of financial assets. Building on Miller's argument, Derrien (2005) and Ljungqvist, Nanda, and Singh (2006) construct models in which optimistic investors affect IPO prices and post-IPO returns. In both models, sentiment investors are willing to overpay for the firm's shares at the time of the IPO. This leads to high IPO price and poor long-run performance of IPO stocks. The two models also need to explain another feature of hot IPO markets, namely, high first-day returns. To explain this phenomenon, both Derrien and Ljungqvist et al. assume that sentiment investors can disappear shortly after the IPO, driving the share price of the IPO firm down to its fundamental value. The consequence of this assumption is that underwriters optimally choose an IPO price that is higher than the fundamental share value, but below the price sentiment investors are willing to pay at the time of the IPO.

In Derrien (2005), the information consists of two types of signals: (1) private signals about the firm's fundamental value that the underwriter has to extract from informed investors in the spirit of Benveniste and Spindt's (1989) model; and (2) a public signal about the price sentiment investors offer for the firm's shares. The underwriter, who is in charge of choosing the IPO price, has to provide aftermarket price support, which is costly if the shares trade at a lower price than that of the IPO. Therefore, the underwriter sets an IPO price that is higher than the fundamental value per share of the firm obtained by aggregating private signals from informed investors, but lower than the price sentiment investors are willing to pay. This leads to a positive price run-up, on average, as sentiment investors purchase the firm's shares on the aftermarket.

Ljungqvist et al. (2006) reach a similar conclusion using a slightly different assumption. In their model, underwriters allocate IPO shares to rational institutional investors. These rational investors observe the demand of sentiment investors and gradually sell their shares to them. Rational investors face the risk that sentiment evaporates before they can sell off all their (overpriced) shares. To compensate IPO investors for this risk, the underwriter underprices the IPO relative to the price sentiment investors are willing to pay.

These models require a few ingredients: sentiment investors, short-sale constraints, and some institutional frictions that prevent issuers from taking full

advantage of optimistic investors. These models can explain the high first-day returns observed during hot markets and predict overpricing (relative to the fundamental value of company) of the firms that go public in hot markets. Is the empirical evidence consistent with these predictions?

One of the issues in testing this theory is to identify sentiment investors and to observe their trading behavior in IPOs. Retail traders, who are less sophisticated than institutions, are good candidates for the sentiment traders of the theory. Several studies analyze the behavior of these investors around IPOs. Derrien (2005) observes demand by retail investors in a sample of French IPOs. He shows that retail demand is highly predictable using public information available at the time of the offering (recent stock market returns), positively related to IPO prices and first-day returns, and negatively related to long-run returns. These findings suggest that strong investor sentiment (proxied by strong retail demand) leads to overpricing at the time of the IPO. Using retail trading in a forward (when-issued) market that exists in some European countries to infer retail demand, Cornelli, Goldreich, and Ljungqvist (2006) and Dorn (2009) reach similar conclusions. Cook, Kieschnik, and Van Ness (2006) show that press coverage of IPO firms also predicts, among other things, IPO prices and first-day returns. They argue that press coverage results from promotional efforts by the underwriter to attract sentiment investors to the IPO. Ofek and Richardson (2003) focus on Internet firms during the dot-com bubble and show that institutional holdings are significantly lower in Internet-related stocks than in other traded stocks at that time.

Purnanandam and Swaminathan (2004) take another empirical approach. They compare the average valuations of IPOs (at their IPO price) with those of comparable seasoned companies using a variety of valuation multiples. Based on this comparison, they show that IPOs are overvalued relative to their peers and that the most overvalued IPOs also exhibit the highest first-day returns and the worst long-term performance.

One of the predictions in Derrien (2005) and Ljungqvist et al. (2006) absent from rational IPO models is that public information about investor sentiment drives IPO prices and first-day returns. Consistent with this prediction, Loughran and Ritter (2002) and Lowry and Schwert (2004) observe a positive link between publicly observable variables such as recent market movements and first-day returns. This suggests that underwriters only partially take into account public information available at the time of the offering when they set the IPO price.

The presence of optimistic sentiment investors is one necessary ingredient for the above theory to work. Another necessary ingredient for optimistic investor models to work, that is, short-sales constraints, also seems to be present. D'avolio (2002) documents that short-sale restrictions apply predominantly to stocks that are small, illiquid, and for which divergence of opinion is high. Geczy, Musto, and Reed (2002) show that short-selling IPOs is initially difficult and relatively costly but probably not enough to discourage short-selling in case of high overvaluation.

Edwards and Hanley (2008) use data on actual short-selling activities in recent IPOs. They document that short-selling is about as prevalent in IPOs as in seasoned companies and that IPOs with the highest first-day returns are also those where short-selling is the highest. Edwards and Hanley conclude that this finding is inconsistent with models that explain IPO underpricing with short-sale constraints. Another possible interpretation is that the level of short-selling observed in IPOs

with strong first-day returns is high, but not high enough to drive the aftermarket price of these IPOs to its fundamental value. Also, these results are based on a sample of IPOs conducted during 2005–2006, while most of the evidence discussed above uses samples that include the dot-com bubble period. This suggests that investor sentiment models are valid only in the most extreme situations.

Was there anything special during the bubble period apart from strong investor sentiment? Ljungqvist and Wilhelm (2003) compare IPOs in this period with other IPOs and show that IPOs in the bubble period were characterized by lower CEO ownership and a smaller fraction of secondary shares sold than in other times. This might explain why CEOs were more willing to accept extremely high levels of underpricing during the bubble. This change in the characteristics, however, is probably not large enough to explain the extreme underpricing observed during the bubble. Another possibility is that self-selection led firms with high CEO ownership to delay their IPOs during the bubble and that selling fewer secondary shares than in previous times was the pre-IPO shareholders' optimal response to high anticipated underpricing.

WHY DO FIRMS GO PUBLIC?

This section discusses the hot issue market phenomenon, that is, the clustering of IPOs in short periods of time that typically coincide with high average first-day returns. A related and broader question is why firms choose to go public. This section also explores whether fundamental or behavioral reasons drive firms' decisions to issue equity and in particular to issue equity for the first time by going public. Broadly speaking, firms issue equity for fundamental reasons if they raise equity financing when they need cash to finance their growth. If fundamental reasons explain IPO waves, then IPO waves should correspond with periods of high economic growth for the entire economy or for a specific industry. The alternative hypothesis is that most firms decide to go public when firms in their industry are overvalued. This is what Ritter (1991) calls the "window of opportunity" hypothesis. It relies on two assumptions. First, market prices occasionally diverge from fundamental values. Second, managers know when the market is too optimistic about their firm's value and can take advantage of the mispricing of their firm by selling overvalued stocks to investors.

Empirically, attributing the decision to go public to fundamental or behavioral reasons is difficult because both growth opportunities and overvaluation are hard to measure. For instance, the market-to-book measure can serve as a gauge of how the stock market perceives a firm's future growth opportunities as well as of the firm's overvaluation in a world where market values occasionally diverge from fundamental values. Measuring investor sentiment that may cause overvaluation is also a difficult task. Baker and Wurgler (2007) discuss different ways of measuring sentiment, while their earlier work (Baker and Wurgler, 2006) proposes a measure that combines six factors thought to reflect investor sentiment. Interestingly, one of these six factors meant to correlate with investor sentiment is the number of IPOs and their average first-day return.

Researchers use several approaches to explain the determinants of a firm's choice to go public. Probably the most natural approach to understanding why firms go public is to ask firm managers. Graham and Harvey (2001) use this survey

approach. When asked whether the firm's undervaluation or overvaluation is an important factor in their decision to issue equity, 67 percent of the responding CFOs claim that it is important. The second most important factor in the firm's decision to issue equity is the firm's valuation by the market. Similarly, Brau and Fawcett (2006) survey CFOs, who claim that general market conditions are the most important choice variable in the timing of the IPO.

Another approach to understanding why firms go public consists of analyzing samples of private firms, some of which decide to go public. Lerner (1994) uses a sample of venture capital–backed companies and analyzes the decision of some to go public. He finds that the main driver of this decision seems to be the valuation of comparable listed companies. Pagano, Panetta, and Zingales (1998) use a large sample of Italian firms of which 66 go public during the period 1982 to 1992. They document that the main driver of the going-public decision is the average market-to-book ratio of listed firms in the same industry. This evidence may indicate that firms choose the stock market only when they expect to be overvalued, but may also suggest that the firms with the best growth opportunities are those that go public.

One way to disentangle these two interpretations is to analyze the operating performance of firms after their IPO. Pagano et al. (1998) find that the operating performance declines post-IPO and argue that this gives credit to the overvaluation interpretation. This finding is consistent with those of Jain and Kini (1994) and Mikkelson, Partch, and Shah (1997), who study large samples of U.S. IPOs and document a decrease in post-IPO operating performance. For example, Jain and Kini find that operating returns on assets decline by about 10 percent, on average, between the IPO minus one year and the IPO plus two years (and by about 8 percent when operating ROA is industry adjusted).

Degeorge and Zeckhauser (1993) analyze the operating performance of reverse-LBO firms and document the same pattern. Chemmanur, He, and Nandy (2007) compare post-IPO operating performance with that of comparable firms remaining private and reach the same conclusion. Degeorge and Zeckhauser as well as Chemmanur et al. also document that firms choose to go public at operating performance peaks; that is, after recent increases and before declines in operating performance. This suggests that firms decide to go public when they look the most attractive and that investors incorrectly believe that recent gains in profitability will persist in the future.

Teoh, Welch, and Wong (1998) offer another explanation for this phenomenon that is also consistent with investors incorrectly processing the information at their disposal. The authors argue that firms going public manage their earnings at the time of their IPO. Consistent with their predictions, the firms that manage their earnings the most aggressively when going public are those that exhibit the worst long-term stock performance. Pastor, Taylor, and Veronesi (2009) propose another explanation for the observed drop in profitability following IPOs. In their model, the manager's decision to go public depends on a trade-off between the costs and benefits of dispersed ownership. When the firm is privately held, the manager-owner enjoys private benefits of controls. When it is publicly held, the manager can diversify his wealth and smooth his consumption over time. The model predicts that firms decide to go public when the firm's public value is higher than its private value; that is, when the firm's expected future profitability is high. In addition,

managers should decide to go public when they observe higher-than-expected profitability. After the IPO, profitability reverts to its expected level.

Helwege and Liang (2004) use a slightly different approach. They compare firms that go public during hot versus cold markets. They find that the two subsets of firms do not differ dramatically in terms of their characteristics or industries, but they do differ in terms of their market-to-book ratios. This evidence suggests that market-wide fluctuations in stock valuations, not industry-specific innovations, drive market cycles.

Another way of assessing the relative impacts of economic fundamentals and investor sentiment on the decision to go public consists of explaining the time series variations in IPO volume with variables measuring fundamentals and investor sentiment. Loughran, Ritter, and Rydqvist (1994) use this approach and analyze the determinants of IPO volume in 15 countries. They document that the current level of the stock market explains a much larger fraction of the variation in IPO volume than does future GNP growth (at a two-year horizon). The authors conclude that issuers time their decision to go public when they can obtain high valuation for their shares. This is consistent with the findings of Lee, Shleifer, and Thaler (1991), who document that the discount on closed-end funds that they attribute to investor sentiment is strongly related to IPO volume.

Lowry (2003), who uses several measures of fundamentals and investor sentiment to explain IPO volume, obtains mixed results. Future sales growth in the economy is positively related to IPO volume, while future GDP and investment growth variables as well as a National Bureau of Economic Research (NBER) contraction next quarter dummy variable are not significantly related to IPO volume. As for sentiment measures, she finds that future stock market returns as well as recent closed-end fund discounts are negatively related to IPO volume, which supports the investor sentiment hypothesis. At the aggregate level, Baker and Wurgler (2000) show that the share of new issues, including IPOs and seasoned offerings, in the total debt and equity issues is negatively related to future market returns.

These economy-wide studies are limited by the difficulty in precisely measuring economic fundamentals of the entire economy. Perhaps a fraction of the information captured in investor sentiment measures is, in fact, information about fundamentals that is not captured properly by economy-wide measures of fundamentals like GDP growth. Derrien and Kecskés (2009) address this concern by focusing on an industry in which economic fundamentals are easy to measure, namely the oil and gas industry in Canada. They show that in this industry, the explanatory power of fundamentals in the volume of IPOs is much larger than in previous economy-wide studies, and also larger than the explanatory power of investor sentiment.

The studies discussed above show that hot-issue markets occur at times when stock valuations are high. Some attribute these high valuations to investor sentiment and IPO waves to the market-timing ability of managers. Alternatively, the link between high market valuations and IPO volume can be attributed to rational explanations. Pastor and Veronesi (2005) develop a model in which managers-owners of private firms hold an option to go public. The value of this option is high when market conditions are high. That is, when expected profitability is high, expected market returns are low or prior uncertainty is high. In Benveniste, Busaba,

and Wilhelm's (2002) model, bundling IPOs in waves allows underwriters to split information production costs (that are high for new-technology firms) between many firms, some of which might otherwise choose to remain private. Benveniste, Ljungqvist, Wilhelm, and Yu (2003) provide empirical evidence consistent with this theory.

Some empirical findings are consistent with the argument that IPO waves are not the consequence of the market-timing ability of firms that go public. Schultz and Zaman (2001) study a sample of IPOs by Internet firms in the period 1996 to 2000 and analyze the behavior of their owners. They find that their behavior is inconsistent with pre-IPO owners taking advantage of irrational investors. For instance, pre-IPO owners of these Internet firms sold relatively less of their shares in the offering than did shareholders of other IPOs. They used the cash they raised in the offering to perform acquisitions, which is consistent with the idea that pre-IPO owners used their IPO to establish their position in a nascent and competitive industry. Lowry and Schwert (2002) study the time series patterns of hot-issue markets, namely the auto-correlation of average first-day returns and the correlation between first-day returns and future IPO volume. They show that information acquisition during the IPO process explains most of these phenomena.

Overall, evidence shows that firms go public in waves when stock prices are high. Whether this pattern arises from firms taking advantage of overvaluation or optimally timing the exercise of their growth options is more controversial. There is evidence in support of both views.

THE IPO LONG-RUN PERFORMANCE DEBATE

The long-run performance of IPOs is probably the most controversial and the least understood of the three components of the IPO puzzle. It is also a phenomenon that has only relatively recently come under examination. Ritter (1991) studies a large sample of U.S. IPOs and documents that from their first-day trading price, IPO firms underperform various indices by up to 45 percent in the three years following their offering. This finding is a blatant violation of the efficient market hypothesis. If markets are efficient, the prices of recent IPOs should adjust to their fundamental value quickly. Even if naïve investors are fooled by issuers that, for instance, manipulate their earnings before going public, these investors should learn and eventually understand how to discount pre-IPO earnings. Thus, in order to explain the IPO underperformance, one has to resort to behavioral explanations.

Consistent with some of the theories discussed above such as Ljungqvist et al. (2006), the main explanation for the IPO long-run underperformance is that the market occasionally offers "windows of opportunity" to issuers, who go public when investors overvalue their stock. These theories are consistent with the three components of the IPO puzzle (high first-day returns, hot-issue markets, and IPO long-run underperformance) by virtue of the following: When (at least some) investors are ready to overpay for some or all listed firms, first-day returns of IPOs become high. This triggers a massive arrival of IPO candidates, and thus a hot-issue market. As sentiment investors realize their error, stock prices of recent IPOs drop to their fundamental values, leading to underperformance. Some of the empirical findings discussed above are consistent with this "window of opportunity" explanation. For example, Derrien (2005) documents that IPOs occurring during the

Internet bubble performed poorly in the long run. Ritter (1991) provides similar evidence. In a multiple regression setting, he finds a negative relation between IPO volume when the firm went public and its three-year post-IPO return.

There is another explanation for the long-run underperformance of IPOs: Long-run performance is not calculated properly. When the long-run performance of a sample of stocks following a corporate event is estimated, the null hypothesis of no abnormal performance is in fact a joint hypothesis: Long-run performance does not differ from zero, and the model used to calculate the "normal" long-run performance is the right one. For instance, assume one finds that IPOs underperform the NASDAQ index over a three-year period. This might be because the average IPO firm is different from the average NASDAQ firm in terms of risk. In addition to this "bad model" problem, Barber and Lyon (1997), Kothari and Warner (1997), Barber, Lyon and Tsai (1999), Brav (2000), and Loughran and Ritter (2000) analyze the statistical properties of long-run performance estimates and show that they can be subject to numerous biases.

Based on their recommendations, several studies have reconsidered the issue of the long-run underperformance of IPOs. Brav and Gompers (1997) use various long-run performance measurements, including the matching of IPO firms with comparable size and book-to-market portfolios and Fama and French (1993), three-factor regressions. In the Brav and Gompers tests, most of the long-run underperformance documented previously for IPOs disappears, except for small, non–venture-backed offerings. Using a similar approach, Brav, Geczy, and Gompers (2000) document that long-run underperformance is concentrated in the subsample of small and low book-to-market IPOs. Gompers and Lerner (2003) analyze IPOs completed in the United States between 1935 and 1972. Most of their tests show that in this period, there was no significant IPO underperformance. Moreover, unlike Ritter (1991), they fail to find any difference in performance between IPOs that occurred in hot vs. cold markets. Gompers and Lerner conclude that IPO long-run underperformance may be time-specific rather than an IPO phenomenon.

Eckbo and Norli (2005) observe that recent IPO firms are characterized by relatively high turnover and low leverage. They argue that the long-run returns of these firms are not abnormally low when considering these two additional factors. Eckbo and Norli also notice that compared to seasoned NASDAQ firms, the IPO sample contains more extremely high performers. This suggests that the observed underperformance of IPOs could be a "peso problem," that is, that because of the limited size of the IPO sample, the number of extremely high performers observed *ex post* is small relative to what investors expect. Ang, Gu, and Hochberg (2007) however, test and reject this possibility. Schultz (2003) also claims that IPO long-run returns are not abnormal based on an argument that does not require any miscalculation of long-run returns. If more firms issue equity when valuations are high, then ex post, the observed IPO volume will be high just before market drops, and long-run IPO returns will be negative when calculated in event time. Based on this argument, Schultz suggests measuring long-run IPO returns in calendar-time and confirms that IPO underperformance disappears with this methodology.

What is the current state of this issue? Even though the debate about the long-run performance of IPOs is not (and might never be) closed, a few regularities seem to emerge. Some firms (e.g., small and low book-to-market) in some time periods (e.g., the Internet bubble) do underperform various benchmarks over a horizon of

three to five years. Providing a rational explanation for this underperformance is difficult.

SUMMARY AND CONCLUSIONS

This chapter has discussed the three components of the so-called IPO puzzle (high IPO first-day returns, hot-issue markets, and negative IPO long-run returns) and how behavioral explanations can help provide a better understanding of these components. IPO underpricing is a complex phenomenon that is driven by many factors related to information asymmetries, agency issues, and institutional features of the IPO market. At times, underpricing reaches levels that are difficult to comprehend without resorting to behavioral explanations. A natural explanation is that sentiment investors occasionally drive aftermarket prices above the firm's fundamental value. During these strong sentiment periods, underwriters set IPO prices above fundamental values but below the prices sentiment investors are willing to pay. Therefore, strong-sentiment IPOs are characterized by high IPO prices but also high short-term returns and subsequent price reversals that occur when sentiment demand disappears. The empirical literature studies the behavior of retail investors in and after IPOs. It provides convincing evidence that retail investors behave like the sentiment investors of this sentiment-based theory, in particular during the dot-com bubble of the late 1990s. Whether investor sentiment is a major driver of IPO underpricing outside this period is less clear.

If firms can identify periods of high investor sentiment, for instance by observing high IPO prices and first-day returns, they can then take advantage of these windows of opportunity when offered by sentiment investors. This should lead to hot-issue markets and negative long-run underperformance, in particular for firms that go public during those hot-issue markets. The evidence on these last two components of the IPO puzzle is mixed. IPOs do cluster at market peaks, but this phenomenon is also consistent with explanations based on the argument that firms go public when they need to raise financing to exploit their growth opportunities, which are higher when the stock market is at a peak. IPO long-run underperformance is established for some firms (e.g., small, low book-to-market) in some time periods (e.g., the Internet bubble), but whether long-run underperformance is a widespread IPO phenomenon is still subject to debate.

DISCUSSION QUESTIONS

1. What are the necessary ingredients for a theory based on investor sentiment to generate high and time-varying first-day returns, hot-issue markets, and poor long-run performance of IPOs?
2. Can hot-issue markets be observed in the absence of strong demand from sentiment investors? Why or why not?
3. Since the burst of the dot-com bubble in 2001, the issuing mechanism known as bookbuilding has been under attack. Bookbuilding refers to the process of determining the price at which an IPO will be offered. An underwriter fills the book with the prices that investors indicate they are willing to pay per share. Upon closing the book, the underwriter determines the issue price by analyzing these values. Thus, this IPO mechanism leaves much discretion to underwriters in terms of pricing and allocation of the IPO shares. Its

opponents claim that bookbuilding is an unfair mechanism that gives too much decision power to underwriters. Since 1999, WR Hambrecht has conducted auctioned IPOs open to all investors in the United States. (See Degeorge, Derrien, and Womack (2010), and Lowry, Officer, and Schwert (2010) for a description of these auctions and an analysis of their performance.) Discuss the pros and cons of auctions in the presence of sentiment investors.

4. Should retail investors be excluded from IPO participation? Why or why not?

REFERENCES

Allen, Franklin, and Gerald F. Faulhaber. 1989. Signalling by underpricing in the IPO market. *Journal of Financial Economics* 23:2, 303–23.

Ang, Andrew, Li Gu, and Yael Hochberg. 2007. Is IPO underperformance a peso problem? *Journal of Financial and Quantitative Analysis* 42:3, 565–94.

Baker, Malcolm, and Jeffrey Wurgler. 2000. The equity share in new issues and aggregate stock returns. *Journal of Finance* 55:5, 2219–57.

Baker, Malcolm, and Jeffrey Wurgler. 2006. Investor sentiment and the cross-section of stock returns. *Journal of Finance* 61:4, 1645–80.

Baker, Malcolm, and Jeffrey Wurgler. 2007. Investor sentiment in the stock market. *Journal of Economic Perspectives* 21:2, 129–51.

Barber, Brad M., and John D. Lyon. 1997. Detecting long-run abnormal stock returns: The empirical power and specification of test statistics. *Journal of Financial Economics* 43:3, 341–72.

Barber, Brad M., John D. Lyon, and Chih-Ling Tsai. 1999. Improved methods for tests of long-run abnormal stock returns. *Journal of Finance* 54:1, 165–201.

Baron, David P. 1982. A model of the demand for investment banking advising and distribution services for new issues. *Journal of Finance* 37:4, 955–76.

Baron, David P., and Bengt Holmström. 1980. The investment banking contract for new issues under asymmetric information: Delegation and the incentive problem. *Journal of Finance* 35:5, 1115–38.

Benveniste, Lawrence M., Walid Y. Busaba, and William J. Wilhelm Jr. 2002. Information externalities and the role of underwriters in primary equity markets. *Journal of Financial Intermediation* 11:1, 61–86.

Benveniste, Lawrence M., Alexander Ljungqvist, William J. Wilhelm Jr., and Xiaoyun Yu. 2003. Evidence of information spillovers in the production of investment banking services. *Journal of Finance* 58:2, 577–608.

Benveniste, Lawrence M., and Paul A. Spindt. 1989. How investment bankers determine the offer price and allocation of new issues. *Journal of Financial Economics* 24:2, 343–61.

Booth, James R., and Lena Chua. 1996. Ownership dispersion, costly information and IPO underpricing. *Journal of Financial Economics* 41:2, 291–310.

Booth, James R., and Richard L. Smith II. 1986. Capital raising, underwriting, and the certification hypothesis. *Journal of Financial Economics* 15:2, 261–81.

Brau, James C., and Stanley E. Fawcett. 2006 Initial public offerings: An analysis of theory and practice. *Journal of Finance* 61:1, 399–436.

Brav, Alon. 2000. Inference in long-horizon event studies: A Bayesian approach with application to initial public offerings. *Journal of Finance* 55:5, 1979–2016.

Brav, Alon, Christopher Geczy, and Paul A. Gompers. 2000. Is the abnormal return following equity issuances anomalous? *Journal of Financial Economics* 56:2, 209–49.

Brav, Alon, and Paul A. Gompers. 1997. Myth or reality? The long-run underperformance of initial public offerings: Evidence from venture and nonventure capital-backed companies. *Journal of Finance* 52:5, 1791–821.

Brennan, Michael J., and Julian Franks. 1997. Underpricing, ownership and control in initial public offerings of equity securities in the UK. *Journal of Financial Economics* 45:3, 391–413.
Carter, Richard, and Steven Manaster. 1990. Initial public offerings and underwriter reputation. *Journal of Finance* 45:4, 1045–67.
Chemmanur, Thomas, Shan He, and Debarshi Nandy. 2007. The going public decision and the product market. Working Paper, Boston College.
Chen, Hsuan-Chi, and Jay R. Ritter. 2000. The seven percent solution. *Journal of Finance* 55:3, 1105–31.
Cliff, Michael T., and David J. Denis. 2004. Do initial public offerings purchase analyst coverage with underpricing? *Journal of Finance* 59:6, 2871–901.
Cook, Douglas O., Robert Kieschnick, and Robert A. Van Ness. 2006. On the marketing of IPOs. *Journal of Financial Economics* 82:1, 35–61.
Cornelli, Francesca, David Goldreich, and Alexander Ljungqvist. 2006. Investor sentiment and pre-IPO markets. *Journal of Finance* 61:3, 1187–216.
D'avolio, Gene. 2002. The market for borrowing stock. *Journal of Financial Economics* 66:2, 271–306.
Degeorge, François, François Derrien, and Kent L. Womack. 2010. Auctioned IPOs: The U.S. evidence. *Journal of Financial Economics*, forthcoming.
Degeorge, François, and Richard Zeckhauser. 1993. The reverse LBO decision and firm performance: Theory and evidence. *Journal of Finance* 48:4, 1323–48.
Derrien, François. 2005. IPO pricing in "hot" market conditions: Who leaves money on the table? *Journal of Finance* 60:1, 487–521.
Derrien, François, and Ambrus Kecskés. 2009. How much does investor sentiment really matter for security issuance activity? *European Financial Management* 15:4, 787–813.
Dorn, Daniel. 2009. Does sentiment drive the retail demand for IPOs? *Journal of Financial and Quantitative Analysis* 44:1, 85–108.
Eckbo, B. Espen, and Oyvind Norli. 2005. Liquidity risk, leverage and long-run IPO returns. *Journal of Corporate Finance* 11:1, 1–35.
Edwards, Amy K., and Kathleen Weiss Hanley. 2008. Short selling in initial public offerings. Working Paper, U.S. Securities and Exchange Commission.
Fama, Eugene F., and Kenneth R. French. 1993. Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics* 33:1, 3–56.
Geczy, Christopher C., David K. Musto, and Adam V. Reed. 2002. Stocks are special too: An analysis of the equity lending market. *Journal of Financial Economics* 66:2, 241–69.
Gompers, Paul A., and Josh Lerner. 2003. The really long-run performance of initial public offerings: The pre-Nasdaq evidence. *Journal of Finance* 58:4, 1355–92.
Graham, John, and Campbell Harvey. 2001. The theory and practice of corporate finance: Evidence from the field. *Journal of Financial Economics* 60:2, 187–243.
Grinblatt, Mark, and Chuan Y. Hwang. 1989. Signalling and the pricing of new issues. *Journal of Finance* 44:1, 393–420.
Hanley, Kathleen. 1993. The underpricing of initial public offerings and the partial adjustment phenomenon. *Journal of Financial Economics* 34:2, 231–50.
Helwege, Jean, and Nellie Liang. 2004. Initial public offerings in hot and cold markets. *Journal of Financial and quantitative Analysis* 39:3, 541–69.
Helwege, Jean, Christo Pirinsky, and René M. Stulz. 2007. Why do firms become widely held? An analysis of the dynamics of corporate ownership. *Journal of Finance* 62:3, 995–1028.
Ibbotson, Roger G., and Jeffrey F. Jaffe. 1975. Hot issue markets. *Journal of Finance* 30:4, 1027–42.
Jain, Bharat A., and Omesh Kini. 1994. The post-issue operating performance of IPO firms. *Journal of Finance* 49:5, 1699–726.
Jenkinson, Tim J., and Alexander Ljungqvist. 2001. *Going public: The theory and evidence on how companies raise equity finance*, 2nd ed. Oxford and New York: Oxford University Press.

Koh, Francis, and Terry Walter. 1989. A direct test of Rock's model of the pricing of unseasoned issues. *Journal of Financial Economics* 23:2, 251–72.
Kothari, S. P., and Jerold B. Warner. 1997. Measuring long-horizon security price performance. *Journal of Financial Economics* 43:3, 301–39.
Krigman, Laurie, Wayne H. Shaw, and Kent L. Womack. 2001. Why do firms switch underwriters? *Journal of Financial Economics* 60:2, 245–84.
Lee, Charles M. C., Andrei Shleifer, and Richard H. Thaler. 1991. Investor sentiment and the closed-end fund puzzle. *Journal of Finance* 46:1, 75–109.
Lerner, Joshua. 1994. Venture capitalists and the decision to go public. *Journal of Financial Economics* 35:3, 293–316.
Ljungqvist, Alexander, Vikram Nanda, and Radjeep Singh. 2006. Hot markets, investor sentiment, and IPO pricing. *Journal of Business* 79:4, 1667–702.
Ljungqvist, Alexander, and William J. Wilhelm Jr. 2003. IPO pricing in the dot-com bubble. *Journal of Finance* 58:2, 723–52.
Ljungqvist, Alexander, and William J. Wilhelm Jr. 2005. Does prospect theory explain IPO market behavior? *Journal of Finance* 60:4, 1759–90.
Loughran, Tim, and Jay R. Ritter. 2000. Uniformly least powerful tests of market efficiency. *Journal of Financial Economics* 55:3, 361–89.
Loughran, Tim, and Jay R. Ritter. 2002. Why don't issuers get upset about leaving money on the table in IPOs? *Review of Financial Studies* 15:2, 413–43.
Loughran, Tim, and Jay R. Ritter. 2004. Why has IPO underpricing changed over time? *Financial Management* 33:3, 5–37.
Loughran, Tim, Jay R. Ritter, and Kristian Rydqvist. 1994. Initial public offerings: International insights. *Pacific-Basin Finance Journal* 2:2/3, 165–99.
Lowry, Michelle. 2003. Why does IPO volume fluctuate so much? *Journal of Financial Economics* 67:1, 3–40.
Lowry, Michelle, Micah S. Officer, and G. William Schwert. 2010. The variability of IPO initial returns. *Journal of Finance* 65:1, 425–465.
Lowry, Michelle, and G. William Schwert. 2002. IPO market cycles: Bubbles or sequential learning? *Journal of Finance* 57:3, 1171–98.
Lowry, Michelle, and G. William Schwert. 2004. Is the IPO pricing process efficient? *Journal of Financial Economics* 71:1, 3–26.
Lowry, Michelle, and Susan Shu. 2002. Litigation risk and IPO underpricing. *Journal of Financial Economics* 65:3, 309–35.
Mikkelson, Wayne H., M. Megan Partch, and Kshitij Shah. 1997. Ownership and operating performance of companies that go public. *Journal of Financial Economics* 44:3, 281–307.
Miller, Edward M. 1977. Risk, uncertainty, and divergence of opinion. *Journal of Finance* 32:4, 1151–68.
Nimalendran, M., Jay R. Ritter, and Donghang Zhang. 2007. Do today's trades affect tomorrow's IPO allocations? *Journal of Financial Economics* 84:1, 87–109.
Ofek, Eli, and Matthew Richardson. 2003. DotCom mania: The rise and fall of internet stock prices. *Journal of Finance* 58:3, 1113–37.
Pagano, Marco, Fabio Panetta, and Luigi Zingales. 1998. Why do firms go public? An empirical analysis. *Journal of Finance* 53:1, 27–64.
Pastor, Lubos, and Pietro Veronesi. 2005. Rational IPO waves. Journal of Finance 60:4, 1713–57.
Pastor, Lubos, Lucian Taylor, and Pietro Veronesi. 2009. Entrepreneurial learning, the IPO decision, and the post-IPO drop in firm profitability. *Review of Financial Studies* 22:8, 3005–3046.
Purnanandam, Amiyatosh K., and Bhaskaran Swaminathan. 2004. Are IPOs really underpriced? *Review of Financial Studies* 17:3, 811–48.
Reuter, Jonathan. 2006. Are IPO allocations for sale? Evidence from mutual funds. *Journal of Finance* 61:5, 2289–324.

Ritter, Jay R. 1984. The "hot issue" market of 1980. *Journal of Business* 57:2, 215–40.
Ritter, Jay R. 1991. The long-run performance of initial public offerings. *Journal of Finance* 46:1, 3–27.
Ritter, Jay R. 2009a. Available at http://bear.cba.ufl.edu/ritter/ipodata.htm. Contains data on IPO counts and first-day returns in the United States.
Ritter, Jay R. 2009b. Available at http://bear.cba.ufl.edu/ritter/Runup7507.htm. Contains a list of U.S. IPOs with first-day returns of 100 percent or more in the period 1975–2000.
Ritter, Jay R. 2009c. Available at http://bear.cba.ufl.edu/ritter/IPOs2008Factoids.htm. Contains data on U.S. IPO in the period 1990–2008.
Rock, Kevin. 1986. Why new issues are underpriced. *Journal of Financial Economics* 15:1, 187–212.
Ruud, Judith S. 1993. Underwriter price support and the IPO underpricing puzzle. *Journal of Financial Economics* 34:2, 135–51.
Schultz, Paul. 2003. Pseudo market timing and the long-run underperformance of IPOs. *Journal of Finance* 58:2, 483–518.
Schultz, Paul, and Mir Zaman. 2001. Do the individuals closest to internet firms believe they are overvalued? *Journal of Financial Economics* 59:3, 347–81.
Stoughton, Neal M., and Josef Zechner. 1998. IPO mechanisms, monitoring and ownership structure. *Journal of Financial Economics* 49:1, 45–78.
Teoh, Siew Hong, Ivo Welch, and T. J. Wong. 1998. Earnings management and the long-run market performance of initial public offerings. *Journal of Finance* 53:6, 1935–74.
Tinic, Seha M. 1988. Anatomy of initial public offerings of common stock. *Journal of Finance* 43:4, 789–822.
Welch, Ivo. 1989. Seasoned offerings, imitation costs, and the underpricing of initial public offerings. *Journal of Finance* 44:1, 421–49.
Welch, Ivo. 1992. Sequential sales, learning and cascades. *Journal of Finance* 47:2, 695–732.

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CHAPTER 26

Mergers and Acquisitions

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INTRODUCTION

The idea that stock market valuations affect mergers and acquisitions (M&A) activity is not new. Nelson (1959) observes that merger activity concentrates during times of high stock valuations when the means of payment is generally stock. Brealey and Myers (2000) discuss an earnings-per-share bootstrap game, allegedly popular during the conglomerate merger boom of the 1960s. Nevertheless, the view that stock market misvaluation drives the takeover market has traditionally had a low profile among academics (Andrade, Mitchell, and Stafford, 2001; Holmstrom, and Kaplan, 2001).

Shleifer and Vishny (2003) propose a theory of M&As in which rational managers operate in inefficient markets to exploit the misvaluation. Although their model makes the extreme assumption that mergers are purely driven by stock market misvaluation and that no real synergies exist between the combining firms, it appears to unify many of the empirical findings about takeover activity and characteristics. Consequently, the publication of the model opened a floodgate of research that focuses on the effects of market misvaluation on takeovers.

In addition, researchers have also turned to the effects of managerial behavioral biases on acquisitions. A growing literature shows that managerial personal traits such as overconfidence affect acquisition decisions. Also, the prospect theory of Tversky and Kahneman (1974) has gained traction in M&A research.

As Baker, Ruback, and Wurgler (2007) discuss, research in behavioral M&As can be broadly classified into two approaches. The first approach, as represented by Shleifer and Vishny (2003), assumes that managers are rational and markets are inefficient. The second approach takes the opposite extreme and assumes irrational managers operating in efficient markets.

The chapter has the following organization. The next five sections review the literature of the first approach. The survey starts with the Shleifer and Vishny (2003) model because it helps to motivate the logics and intuitions of misvaluation-driven acquisitions. Then the relation between bidder and target misvaluation and takeover characteristics is reviewed. The evidence broadly supports the misvaluation hypothesis. Yet much of the evidence is potentially consistent with the

Note: The author thanks David Hirshleifer for his helpful comments.

alternative—the Q hypothesis, which is based upon the neoclassical theory of acquisitions, so a comparison of the two theories is provided. This section also reviews the incentive effects derived from the difference in bidder and target managerial horizons. The next section reviews the empirical findings about the long-run bidder stock performance. The following section focuses on the aggregate market or sector level takeover activities and merger waves. After reviewing the effects of investor misvaluation on acquisitions between public firms, a section covers valuation effects on acquisitions involving unlisted firms. Lastly, a section summarizes the literature on the second approach—the effect of managerial behavioral biases on the M&A process. The last section concludes.

THE SHLEIFER AND VISHNY MODEL

The Shleifer and Vishny (2003) model (hereafter the SV model) illustrates the basic framework and intuition of how stock market inefficiencies affect takeover activities. The model assumes that financial markets are inefficient and some firms are valued incorrectly. In contrast, managers are fully rational, understand what firms are misvalued and by how much, and take advantage of the inefficiencies through mergers. These assumptions differ from Roll's (1986) hubris hypothesis of takeovers as reviewed in a later section.

Suppose that the bidder and the target have K_1 and K units of capital, respectively. Both firms are publicly traded, and the current market valuations per unit are Q_1 and Q, respectively, where $Q_1 > Q$. If the two firms merge, the short-run market valuation of the combined equity per unit of capital is S, so that the market value of the combined firms is $S(K + K_1)$. S reflects the market's "perceived synergy," which in this model is just a story that makes investors believe that there is reason to combine the firms. The long-run value of all assets is q per unit of capital. This assumption implies that there are no real synergies from the merger.

Investors believe the market is efficient, with market beliefs specified by Q, Q_1, and S. Also, the model ignores any signaling effects of takeover announcement—the announcement along with the choice of cash versus stock payment conveys no information about firm valuations (e.g., Myers and Majluf, 1984). In contrast, managers are perfectly rational and informed. They know that Q, Q_1, and S reflect short-run misvaluation of the firms' assets and that all asset valuations converge to q in the long run. Finally, suppose the bidder pays a price P per unit of target capital. The key results of the model are:

- The combined short-run market value gain of the acquisition is $S(K + K_1) - K_1 Q_1 - KQ$, the short-run effect on target value is $(P - Q)K$, and the effect on bidder value is $(S - P)K + (S - Q_1)K_1$.
- The combined long-run value effects on the bidder and the target are zero. In a cash merger, the long-run effect on target value is $K(P - q)$, and the effect on bidder value is $K(q - P)$.
- In a stock merger, the long-run effect on bidder value is $q\ K\ (1 - P/S)$, and the effect on target value is $q\ K\ (P/S - 1)$.

The model has a rich set of implications and predictions. Below are some of the main predictions of the model:

- The way for bidders to profit in a stock offer is to use overvalued equity to acquire less overvalued target assets. Therefore, bidders in stock mergers should be overvalued and are expected to exhibit signs of overvaluation.
- Why do target managers rationally accept overvalued bidder equity? There can be two related reasons. First, if $Q < P < S$, then target shareholders gain in the short run because of the premium paid to their shares, but lose in the long run because the premium does not fully compensate target relative undervaluation. So, target managers with short horizons can profit by selling the shares they obtain in the exchange. Second, target managers profit by cashing out of their illiquid stock and option holdings, and may also receive side payments from the bidder.
- The way for bidders to profit in a cash offer is to acquire undervalued target assets. Therefore, targets in cash acquisitions should be undervalued.
- Because bidders in stock offers tend to be overvalued, bidders are expected to have low long-run returns. However, the bidder still gains from the merger if the bid premium is less than the valuation advantage over the target (i.e., if $P < S$).
- Because target firms in cash offers tend to be undervalued, if the offer premium is lower than the intrinsic value of the target (when $P < q$), target management's resistance to takeover bids is in the best interest of target shareholders.
- At the aggregate market or industry levels, overvaluation encourages firms to acquire other less overvalued firms. Therefore, acquisitions, especially for stock, are more likely when market or sector valuations are high and when the dispersion of valuations is high across firms.
- When market or sector valuations are low, waves of cash takeovers of undervalued assets are possible. As discussed in a later section, there are reasons to believe that the effect of overvaluation on acquisitions is stronger than the effect of undervaluation.

The next three sections discuss the evidence regarding these predictions. Some studies make various modifications and extensions to the SV model. For example, because the model ignores the signaling effect of the merger announcement and because the perceived synergy S is difficult to measure ex ante, the model does not have a clearly testable prediction about short-run announcement effects. Incorporating the signaling effect can lead to predictions about the announcement-period bidder and target returns, as is done in Dong, Hirshleifer, Richardson, and Teoh (2006).

HOW DO BIDDER AND TARGET VALUATIONS AFFECT OFFER CHARACTERISTICS?

This section reviews the empirical evidence related to possible effects of market valuations and cross-sectional takeover characteristics. Much of the discussion in the next three subsections follows Dong et al. (2006), who test two theories of takeovers: the misvaluation hypothesis, which is based upon the SV theory with intuitive extensions, and the Q hypothesis, which is based upon Brainard and

Tobin's (1968) Q theory of investment with extensions along the lines of agency theory.

As discussed in Shleifer and Vishny (2003) and Dong et al. (2006), the misvaluation hypothesis of takeovers holds that fully informed rational managers operate in inefficient markets, and bidder and target misvaluation affects takeover characteristics. Rhodes-Kropf and Viswanathan (2004) use a somewhat different argument from SV to derive an alternative model in which stock market misvaluation affects merger activity. In their model, misvaluation has a market or sector-wide component in addition to a firm-specific component, but managers are less than fully informed; they cannot distinguish the source of the misvaluation. Target managers rationally accept merger offers when market valuation is high because of the positive correlation between valuations and synergies. The Rhodes-Kropf and Viswanathan model and the SV model have similar empirical predictions. One feature of the Rhodes-Kropf and Viswanathan approach is that it does not need the assumption that target managers have short horizons. As discussed below, the empirical evidence of short-horizon managers is strong.

An alternative theory, which is referred to as the Q hypothesis of takeovers, combines the neoclassical theory of synergy-driven acquisitions with agency theories. The neoclassical theory, expressed in studies such as Martin (1996), Mitchell and Mulherin (1996), and Jovanovic and Rousseau (2002) maintains that the M&A process efficiently redeploys target assets. Agency considerations, discussed by Lang, Stulz, and Walkling (1989), Morck, Shleifer, and Vishny (1990), and Servaes (1991), lead to takeovers that aim to eliminate wasteful target behavior. The Q hypothesis, however, allows broader cases where agency problems exist between managers and shareholders (e.g., Jensen, 1986).

A challenge for distinguishing between the misvaluation and the Q hypotheses is that both hypotheses share several implications on offer characteristics. The next three subsections provide empirical evidence with interpretations under each hypothesis. Exhibit 26.1 summarizes the evidence. The fourth and fifth subsections offer evidence about the incentives and horizons of bidder and target managers and further evidence of bidder overvaluation.

Bidder-Target Relative Valuations

In the studies surveyed below, authors use different measures of misvaluation including the P/E ratio, Tobin's Q (or market-to-book asset ratio), and price-to-book equity ratio (P/B or M/B). In addition to P/B, Dong et al. (2006) and Ang and Cheng (2006) use the ratio of price to residual-income-model value (P/V), based on Ohlson's (1995) valuation model (for implementation see Lee, Myers, and Swaminathan, 1999). Finally, Rhodes-Kropf, Robinson, and Viswanathan (2005) apply a regression approach to decompose the market-to-book ratio into components related to misvaluation and to growth options.

The first stylized fact is that bidder valuation is, on average, higher than target valuation (Result 1). The study of bidder and target valuations starts at least as early as Gort (1969), who finds that acquirers on average have higher P/E ratios than their targets in a small sample of completed takeovers in the 1950s. Andrade et al. (2001) find that 66 percent of bidders have higher Tobin's Q ratios than their targets

Exhibit 26.1 Summary of the Relation between Bidder and Target Valuations and Offer Characteristics

Finding	Study	Interpretation under Misvaluation Hypothesis	Interpretation under Q Hypothesis
1. Bidder valuation is higher than target valuation.	Gort (1969), Andrade, Mitchell, and Stafford (2001), Jovanovic and Rousseau (2002), Rhodes-Kropf, Robinson, and Viswanathan (2005), Dong, Hirshleifer, Richardson, and Teoh (2006), Ang and Cheng (2006)	Overvalued stock bidders gain from acquiring less overvalued targets. Cash bidders also gain from acquiring undervalued targets.	High firm valuation indicates good growth opportunities and management quality. Synergies are created when high Q bidders acquire low Q targets.
2. Bidder-target difference in valuations is greater among equity than among cash offers.	Dong, Hirshleifer, Richardson, and Teoh (2006)	A profitable equity offer requires the bidder to be overvalued relative to the target, while a profitable cash offer only requires the target to be undervalued.	Potential takeover gains are larger in friendly stock mergers than in hostile cash tender offers.
3. Equity offers are associated with higher bidder and target valuations than cash offers.	Martin (1996), Rau and Vermaelen (1998), Rhodes-Kropf, Robinson, and Viswanathan (2005), Dong, Hirshleifer, Richardson, and Teoh/(2006), Ang and Cheng (2006)	Overvalued bidders prefer to use equity as cheap currency to acquire target assets. The bidder can use cash to expedite the deal when an undervalued target is resistant to the bid. The more overvalued the target, the stronger the incentive of the bidder to use equity to share part of target overvaluation.	High Q bidders with good growth opportunities should reduce leverage by issuing equity. High valuation of targets with more uncertainty encourages bidders to use equity to share the risk in valuation.

(Continued)

Exhibit 26.1 *(Continued)*

Finding	Study	Interpretation under Misvaluation Hypothesis	Interpretation under Q Hypothesis
4. Lower target valuation is associated with a more combative offer and lower probability of offer success.	Schwert (2000), Dong, Hirshleifer, Richardson, and Teoh (2006)	Undervalued targets oppose bids that are below true target value, thereby reducing the probability of success. Target managers with overvalued equity are more willing to cash out.	Managers of poorly run, low Q targets oppose takeover bids to avoid being fired.
5. Lower target valuation is associated with a higher bid premium and higher target announcement return.	Walkling and Edmister (1985), Lang, Stulz, and Walkling (1989), Dong, Hirshleifer, Richardson, and Teoh (2006)	Greater undervaluation increases the target's incentive to fight for a higher bid premium. The higher bid premium and the correction of preexisting undervaluation lead to a higher announcement return of undervalued target.	There is greater room to improve a poorly run target, so the bidder can afford to pay a higher premium for a low Q target.
6. Higher bidder valuation is associated with higher bid premium and higher target announcement return, especially among stock bids.	Dong, Hirshleifer, Richardson, and Teoh (2006)	Overvalued bidders either find raising capital easier to make a high bid, or can afford to make a high bid using an overvalued currency. Targets in equity offers require a higher premium to discount the overvalued bidder equity.	High Q bidders are able to create greater value from an acquisition, and can share some of the gains with target shareholders in the form of a higher premium. (This does not explain the greater strength of the effect among equity than among cash bids.)
7a. Higher bidder valuation is associated with higher bidder announcement return (before 1990).	Lang, Stulz, and Walkling (1989), Servaes (1991)	Inconsistent with the misvaluation hypothesis	Well-run bidders can generate greater gains from acquiring poorly run targets.
7b. Higher bidder valuation is associated with lower bidder announcement return (after 1990).	Dong, Hirshleifer, Richardson, and Teoh (2006)	The market tends to believe that overvalued bidders pay too much. The bidder announcement return tends to correct bidder preexisting mispricing.	Inconsistent with the Q hypothesis

during 1973 to 1998. Jovanovic and Rousseau (2002) show that average bidder Q is higher than average target Q all across time. These findings are confirmed by Rhodes-Kropf et al. (2005), Dong et al. (2006), and Ang and Cheng (2006), whose samples include both the cash takeover wave of the 1980s and the friendly stock merger wave of the 1990s and the turn of the millennium.

Result 1 is consistent with both the misvaluation and the Q hypotheses. Under the misvaluation hypothesis, overvalued stock bidders gain from acquiring less overvalued targets. Overvaluation also enables bidders to raise capital to make cash offers, and cash bidders profit from acquiring undervalued targets. Under the Q hypothesis, high Q firms should have good growth opportunities and management quality, and more synergies are created when high Q bidders acquire low Q targets.

Dong et al. (2006) find that the bidder-target valuation differential is greater among equity than among cash offers (Result 2). An interpretation under the misvaluation hypothesis is that in stock offers, the only way for bidders to profit is to acquire undervalued or less overvalued targets, while in cash offers, bidders gain as long as their targets are undervalued. Under the Q hypothesis, potential takeover gains are larger in friendly stock mergers than in hostile cash tender offers, leading to a greater bidder-target valuation spread in stock mergers.

Several studies find that bidders in stock offers have higher valuations than bidders in cash offers, and targets also have higher valuations in stock offers than in cash offers (Result 3). Martin (1996) provides a Q theory interpretation—high Q bidders with good growth opportunities should reduce leverage by issuing equity. High target valuation encourages the bidder to use equity to share the risk in valuating target assets (Hansen, 1987). Under the misvaluation hypothesis, overvalued bidders prefer to use equity as cheap currency to acquire target assets. In addition, the bidder can use cash to expedite the deal when an undervalued target is resistant to the bid. Finally, the more overvalued the target, the stronger the incentive of the bidder to use equity to share part of target overvaluation.

Target Valuation and Takeover Characteristics

Dong et al. (2006) find that lower target valuation is associated with a more combative offer, a higher probability of a tender offer, and a lower probability of offer success (Result 4). Schwert (2000) provides similar findings using an earlier sample. Under the misvaluation hypothesis, undervalued targets should oppose bids that are below true target value, increasing the probability that the offer is a hostile tender offer, and decreasing the probability of offer success. On the other hand, target managers with overvalued shares are more willing to cash out to relatively more overvalued equity offers. An interpretation under the Q hypothesis is that managers of poorly run, low valuation targets are more likely to oppose takeover bids to avoid being fired.

Result 5—that lower target valuation is associated with a higher bid premium and higher target announcement return—is consistent with the early findings of Walkling and Edmister (1985) and Lang et al. (1989) and confirmed by Dong et al. (2006) in a more recent sample. Under the misvaluation hypothesis, greater

undervaluation increases the target's incentive to fight for a higher bid premium. The higher bid premium and the correction of preexisting undervaluation lead to higher announcement-period return of the undervalued target. Under the Q hypothesis, there is greater room to improve a poorly run target, so the bidder can afford to pay a higher premium for a low Q target.

Bidder Valuation and Takeover Characteristics

The finding that higher bidder valuation is associated with higher bid premium and higher target announcement return (Result 6) is consistent with the misvaluation hypothesis. Overvalued bidders can more easily raise capital to make a high bid or can afford to make a high bid using an overvalued currency. Furthermore, targets in equity offers require a higher premium to discount the overvalued bidder equity. This argument explains why this effect is stronger in stock offers. Under the Q hypothesis, high Q bidders can create greater value from an acquisition and share the gains with target shareholders in the form of a higher premium. Still, the Q hypothesis does not explain the greater strength of the effect among equity than among cash bids.

The relation between bidder valuations and bidder announcement returns helps to distinguish the misvaluation hypothesis from the Q hypothesis. Under the Q hypothesis, offers by high valuation bidders should generate greater total gains from the takeover and therefore higher bidder returns. This is what Lang et al. (1989) and Servaes (1991) find using takeovers before 1990 (Result 7a). Under the misvaluation hypothesis, the market should react negatively to equity offers because it overvalues the equity of the bidder more than the equity of the target, and therefore overestimates the true cost of the bid. Alternatively, regardless of the payment method, if the offer triggers more careful valuations of the bidder, the price of an overvalued bidder will tend to correct downward (see similar announcement effects in Skinner and Sloan, 2002; Ali, Hwang, and Trombley, 2003; discussion on stand-alone values in Bhagat, Dong, Hirshleifer, and Noah, 2005; and more broad discussion in Hirshleifer, 2001). The finding that announcement-period returns are significantly lower for overvalued bidders (Result 7b) is therefore supportive of the misvaluation hypothesis. (A later section provides evidence of poor long-run performance of high valuation bidders, especially for bidders in the late 1990s.)

Overall, the evidence is broadly supportive of both hypotheses. Dong et al. (2006) show that the evidence for the Q hypothesis is stronger in the 1980s than in the 1990s. The evidence for the misvaluation hypothesis is stronger in the latter period, supporting the notion that takeovers of the 1980s often involved agency problems and real efficiencies, whereas post-1990 takeovers are frequently driven by market misvaluation.

Incentives and Horizons of Target and Bidder Managers

Hartzell, Ofek, and Yermack (2004) study a sample of transactions between 1995 and 1997 and provide evidence that target chief executive officers (CEOs) negotiate large cash payments in the form of special bonuses or increased golden parachutes.

These payments make target CEOs more willing to give up executive positions in the acquiring firms and accept lower bid premia. These findings are consistent with the view that target CEOs often have short horizons and accept more cash payments up front in lieu of long-run involvement in the bidding firms. The finding of Gaspar, Massa, and Matos (2005) that firms with short-term shareholders are more likely to receive an acquisition bid but get a lower premium is also consistent with the interpretation that target shareholders with short horizons cash out by accepting a lower premium.

Cai and Vijh (2007) observe that target and bidder CEOs' stock and options holdings are illiquid, and acquisitions provide a channel for target CEOs to cash out and remove their illiquidity discount, or the difference between the with-acquisition unrestricted value and the without-acquisition executive value of their holdings. Also, bidder CEOs' illiquidity discount creates an incentive to use overvalued equity to buy a relatively undervalued target in order to improve the long-run value of bidder CEOs' holdings. Among all firms during 1993 to 2001, CEOs with higher holdings (illiquidity discount) are more likely to make acquisitions (get acquired). In 250 completed acquisitions, target CEOs with a higher illiquidity discount accept a lower premium, are less resistant to the bid, and leave more often after acquisition. By contrast, bidder CEOs with higher holdings pay a higher premium, expedite the process, and make diversifying acquisitions using stock payments.

These findings support the SV argument that target managers have short horizons and use takeovers as an opportunity to cash out, at least based on the sample after 1993. The evidence of Cai and Vijh (2007) is also consistent with the SV prediction that the bidder uses overvalued equity to acquire a less overvalued target to improve its own long-run value.

Other Evidence of Bidder Overvaluation

Erickson and Wang (1999) find signs of bidder firm earnings management before making equity offers. Gu and Lev (2008), who study acquisitions driven by equity overvaluation, find that such deals frequently trigger large goodwill write-offs by the acquirer in the years after the acquisition is completed, suggesting that many deals are triggered by bidder overvaluation. Song (2007) shows that bidder insider selling activities dramatically increase before making takeover offers (regardless of the form of payment) during the "hot market" period of 1997 to 2000. Furthermore, several studies document that the post-merger long-run abnormal returns are generally low compared to their matched firms (Loughran and Vijh, 1997; Rau and Vamaelen, 1998; Agrawal and Jaffe, 2000). Their findings are all broadly consistent with the SV prediction that bidder overvaluation drives takeover decisions.

Why do bidders make equity bids to relatively undervalued targets rather than issuing overvalued equity? Baker, Coval, and Stein (2007) offer a theory based on the inertia of investors; many investors follow the path of least resistance to passively accept and hold the acquirer's shares even when they would not have bought the same shares from a seasoned equity offer. This theory helps to explain the empirical finding of Fama and French (2005) that the amount of equity raised in mergers is roughly 40 times that raised in seasoned equity offerings.

DO BIDDERS BENEFIT FROM MARKET-DRIVEN ACQUISITIONS IN THE LONG RUN?

In the SV model, short-run and long-run effects of the acquisition can be different for both the bidder and the target. Evidence suggests that self-serving target CEOs act for their personal wealth gains. Considerable controversy exists about whether bidder shareholders gain from acquisitions in the long run.

The first issue in long-run return studies is that the outcomes are often sensitive to the empirical method, the treatment of cross-event return correlations (Barber and Lyon, 1997; Fama, 1998; Mitchell and Stafford, 2000; Loughran and Ritter, 2000), and sample period. Loughran and Vijh (1997), Rau and Vermaelen (1998), and Agrawal and Jaffe (2000) document that the bidder abnormal stock returns in the three- or five-year period following the acquisition is negative for stock mergers, especially for low book-to-market glamour bidders, and positive for cash tender offers, based on samples before 1992. Yet, Mitchell and Stafford argue that this conclusion is sensitive to how cross-event abnormal return correlations are treated. Bouwman, Fuller, and Nain (2009) also find that the event-time buy-and-hold approach and the calendar-time regression approach may yield different conclusions about the abnormal bidder performance.

Bouwman et al. (2009) document that cash bidders outperform their control portfolios in the 1980s and have negative long-run performance in the 1990s. Song (2007) provides a related finding; bidder insiders sell their shares before both cash and stock offers in the hot market period of 1997 to 2000, suggesting that even cash bidders in the late 1990s are overvalued. However, there is some consensus that long-run bidder stock performance in the late 1990s is negative based on the event-time buy-and-hold abnormal returns (Moeller, Schlingemann, and Stulz, 2005; Song, 2007; Bouwman et al., 2009; Savor and Lu, 2009; Fu, Lin, and Officer, 2010).

The second difficulty in assessing the long-run effects of M&A on bidder returns is the calculation of the bidder's "without-acquisition" benchmark return—the return of the bidder in the absence of the acquisition. Typically, researchers use the return of reference firms or portfolios matched on characteristics such as size and book-to-market as the benchmark return. To the extent that these characteristics do not fully match the degree of misvaluation of the bidder and the matching firms, the abnormal returns are measured with noise.

Therefore, finding that researchers often disagree on the long-run effects of takeovers on bidder value is not surprising. Ang and Cheng (2006) find that stock bidders outperform their size and book-to-market matched firms in the three years following the acquisition. This finding is consistent with the conclusion of Cai and Vijh (2007) that bidder CEOs act to maximize the long-run shareholder value. On the other hand, Moeller et al. (2005), Song (2007), and Fu et al. (2010) document that the most overvalued bidders significantly underperform in the years following the acquisition. This is in line with the Jensen (2005) argument that stock overvaluation encourages firms to make value-destroying investments in an effort to sustain the overvaluation. Harford and Li (2007) offer further evidence for why bidder CEOs may prefer takeovers to organic investments. They show that bidder CEOs are, on average, better off due to new stock and option grants following takeovers and their wealth gains are greater than if they undertake capital expenditures.

As pointed out by Shleifer and Vishny (2003), stock bidders are expected to underperform because they tend to be overvalued. Savor and Lu (2009) provide a way of circumventing this endogeneity problem by examining a sample of takeovers that failed for exogenous reasons. They find that bidders of failed stock acquisitions have significantly lower long-run stock returns than bidders of successful stock offers. Treating the unsuccessful bidders as a proxy for how the successful ones would have performed without the takeovers, Savor and Lu conclude that stock acquisition creates value for long-term shareholders. They also find that the announcement effect of failed stock mergers is positive on bidder returns, which is inconsistent with the Q hypothesis. Under the neoclassical view of mergers, cancellation of value-enhancing mergers should have a negative effect on bidder returns.

Even if bidders do not gain from some takeovers, it is not necessarily evidence against the SV model. After all, Shleifer and Vishny (2003) specify the condition for the bidder to gain in the long run (i.e., $P < S$). Just as agency considerations can be incorporated into the neoclassical theory of synergy-driven mergers, agency problems can be accommodated in the SV model of market-driven acquisitions—some CEOs work for their shareholders, whereas others act for their personal gains (Jensen, 2005; Harford and Li, 2007).

Finally, Massa and Zhang (2009) find that the bidder can preserve high market valuation by acquiring a more popular target. Using a measure of stock popularity constructed from mutual fund flows data, they find that in such "cosmetic mergers," bidders acquiring more popular targets tend to outperform non-merger matching firms in the 6 to 36 months after the acquisition. Their finding is in the spirit of Shleifer and Vishny (2003)—albeit from a somewhat different angle—that managers may engage in mergers that benefit bidder valuation without necessarily creating real synergies.

DOES MARKET MISVALUATION DRIVE MERGER WAVES?

The empirical evidence of whether aggregate market misvaluation drives merger waves is controversial for several reasons. First, the aggregate market or industry-level data of merger waves are much fewer than the cross-sectional transactions data. Second, researchers have some discretion in the classification of merger waves and market valuation levels. Third, aggregate level misvaluation may be correlated with macroeconomic or sector-wide forces.

According to Shleifer and Vishny (1993), the empirical pattern of historical merger waves is consistent with their model predictions. As Nelson (1959) observes, merger activity concentrates during times of high market valuation when the means of payment is generally stock. Moreover, the recent three merger waves mesh well with their model. In the 1960s conglomerate merge wave, bidders acquired relatively undervalued target assets in different industries using stock payments, possibly because the dispersion of valuation is greater cross-industry than within-industry. In the bust-up takeovers of the 1980s, bidders snapped up undervalued targets using cash after periods of miserable market performance. In the massive merger wave of the 1990s, particularly the second half, overvalued

bidders acquired less overvalued targets, even within the same industry, often by paying with stock.

Using a long time series of takeover sample, Verter (2003) provides more systematic evidence that merger volume increases with aggregate market valuation as well as dispersion in valuation, and periods of high levels of stock acquisitions are followed by low market returns.

Two studies offer further support for the hypothesis that aggregate market valuations affect merger activity. Baker, Foley, and Wurgler (2009) examine how source and host country stock market valuations affect the flow of foreign direct investment (FDI). They find that FDI flows are positively related to source-country market valuations, particularly the "mispricing component" of valuations that negatively predicts future market returns, and particularly in the presence of capital account restrictions that limit other channels of cross-country arbitrage. The results suggest that the source country acquires host-country assets using cheap financing. Lamont and Stein (2006) find that corporate acquisitions and equity issuances are substantially more sensitive to aggregate market valuations than to firm-level valuations. To the extent that aggregate market movements reflect more of non-fundamental factors than do firm-specific price fluctuations (Campbell, 1991; Vuolteenaho, 2002), this evidence is consistent with the idea that aggregate misvaluation affects corporate takeover behavior.

On the other hand, Harford (2005) provides evidence that economic, regulatory, and technological shocks drive industry merger waves, but only when there is sufficient overall capital liquidity. Once the liquidity component is included, market-timing variables have little power to predict merger waves. One force that may mitigate the apparent power of market timing is that during low market valuation periods such as the 1980s, low market valuations could drive cash acquisitions. Conversely, during high valuation periods such as the late 1990s, high market valuation may also lead to some cash offers, particularly to unlisted targets. Using Harford's definition of merger waves, Rhodes-Kropf et al. (2005) find that even in industries that have experienced economic shocks, most bidders rank among the highest misvaluation quintile. This is consistent with the interpretation that market timing at least partially drives merger activity.

Bouwman et al. (2009) study the characteristics of takeovers occurring during high versus low market valuation periods. They find that poor long-run returns follow high valuation takeovers even though they are associated with high announcement returns. The authors conclude that the long-run bidder underperformance following high valuation takeovers is consistent with managerial herding and inconsistent with market timing. The differences in conclusion between this paper and others may arise from a few factors mentioned above, including the classification of high and low market valuation periods.

On the whole, the evidence suggests a strong possibility that market misvaluation affects aggregate merger activity, though other economic forces are also likely drivers of merger waves. In the SV model, both over- and undervaluations of the stock market may generate opportunities of acquisitions that are beneficial to the bidder (Predictions 6 and 7). The empirical evidence appears to suggest, however, that the effect of overvaluation on takeover activity is stronger than the effect of undervaluation (Verter, 2003; Lamont and Stein, 2006; Baker et al., 2009). There is also a similar pattern in the cross-sectional effects (Results 2 and 6). There can be several

explanations for this pattern. First, the bidder can more easily raise financing, especially equity financing, in an overvalued market. Second, undervaluation-driven cash offers are likely to encounter target resistance and lower success rates. Third, the incentive effects related to CEO stock and option holdings are likely to be greater in an overvalued market.

ACQUISITIONS INVOLVING UNLISTED FIRMS

As discussed, the SV model applies to transactions between public firms. When both firms' shares are traded, bidder and target stock valuations have the greatest impact on takeovers—overvalued bidders acquire relatively undervalued targets with stock, and regardless of bidder valuation, bidders profit by acquiring undervalued targets with cash. Consistent with this model, stock bidders have lower announcement returns than cash bidders in public-public transactions (e.g., Travlos, 1987; Brown and Ryngaert, 1991; Fuller, Netter, and Stegemoller, 2002; Moeller, Schlingemann, and Stulz, 2004; Dong et al., 2006).

In takeovers of unlisted target firms, the means of payment conveys different information about valuations from the case of public acquisitions. Several papers document positive returns to acquirers of private or subsidiary targets, even in stock acquisitions. Fuller et al. (2002) find positive announcement abnormal returns in a sample of repeat bidders when they acquire unlisted targets. Moeller et al. (2004) find the same in a general U.S. sample, as do Faccio, McConnell, and Stolin (2006) in a non-U.S. sample. Chang (1998) argues that in the acquisition of private targets, the positive bidder announcement returns in equity offers are related to monitoring activities by target shareholders when they become blockholders of the bidder. Yet, Officer (2007) provides evidence that unlisted targets are often sold at discounts. Subsidiaries of distressed parents (such as those with negative 12-month abnormal returns leading up to the sale) are sold at deep discounts, suggesting target undervaluation. Fuller et al. find that, in contrast to the public acquisitions, acquisitions of private or subsidiary targets are associated with positive bidder announcement returns that generally increase with the target-bidder relative size, consistent with the view that unlisted targets are sold at bargain prices. Given the impact of target organizational form on bidder announcement returns, caution may be required in interpreting bidder return results when public and nonpublic targets are indiscriminate (e.g., Rosen, 2006).

Cooney, Moeller, and Stegemoller (2009) offer an alternative explanation for the positive bidder wealth effect of the acquisition of private firms. In a sample of acquisitions of private firms with valuation histories (the initial valuation is the planned offer price of the later-withdrawn initial public offering), targets that are acquired for more than their prior valuation mainly drive the positive bidder announcement returns. One interpretation is that when the bidder's offer is high relative to the prior value, the target is more willing to accept the offer without aggressive bargaining for a higher offer price. Alternatively, any deviation of the bidder's expected value of the target from the prior value creates an uncertainty for the bidder that tends to cause a partial adjustment of the expected value. Both interpretations are consistent with the prospect theory of Kahneman and Tversky (1979) which posits that a reference valuation point in the past can affect the current valuation (see also Baker, Pan, and Wurgler, 2009).

Finally, when the bidding firm is unlisted, it cannot readily use overvalued equity as currency for the acquisition. Bargeron, Schlingemann, Stulz, and Zutter (2008) document that public bidders pay a much higher bid premium than do private bidders, especially when the public bidder's managerial ownership is low. Although the authors do not discuss this matter, this finding is consistent with the interpretation that the bidder can afford to pay a higher premium when the bidder has access to equity capital, especially when the equity is overvalued.

MANAGERIAL OVERCONFIDENCE, PROSPECT THEORY, AND ENVY

The papers reviewed so far generally assume that rational bidder and target managers operate in inefficient markets. Another, opposite approach of behavioral finance is to assume irrational managers operating in efficient markets. In both approaches, agency considerations may be superimposed to yield broader and more realistic predictions.

Observing that there is no clear evidence of value creation from takeovers in general, Roll (1986) proposes that bidder managers are influenced by "hubris" and are overoptimistic about deal synergies. Hietala, Kaplan, and Robinson (2003) present cases in which hubris affects takeovers. Billett and Qian (2008) argue that overconfidence is an acquired quality and increases with the number of deals a manager has completed. Aktas, De Bodt, and Roll (2007) as well as Klasa and Stegemoller (2007) offer alternative interpretations.

Malmendier and Tate (2008) document further evidence that managerial overconfidence helps to explain takeover decisions. They find that overconfident managers complete more acquisitions, especially when they have access to internal financing and when the merger is diversifying. The market reacts negatively when overconfident CEOs make the bids. The authors recognize that the effect of manager overconfidence does not exclude the effect of bidder and target misvaluation. Cai and Vijh (2007) also report that their results are robust after controlling for CEO overconfidence.

Evidence of managerial overconfidence in the takeover market fits in the broader framework that managerial personal traits affect corporate activities. Bertrand and Schoar (2003) show that manager fixed effects matter for a wide range of corporate decisions including M&A and diversification. Graham, Harvey, and Puri (2008) document that personal traits such as risk aversion and optimism are related to corporate policies, and the matching of managerial traits and the kinds of firms helps to explain the persistence of firm behavior.

Baker et al. (2009) show that the combining firms use the target's 52-week high stock price as a reference point in setting bid price. In a large sample of takeover bids to public target firms, a clustering of bid prices centers on the 52-week high. Bidders who bid with this price experience negative announcement effects when the current target prices are well below their 52-week highs, indicating investors view such bids as overpaying. On the other hand, bids that are above the target's 52-week highs are much more likely to be accepted. These findings are vivid evidence that

market participants use reference points in making strategic decisions, consistent with the prospect theory of Tversky and Kahneman (1974) and Kahneman and Tversky (1979).

Goel and Thakor (2009) propose a theory in which bidder CEOs' envy causes merger waves. Because CEO compensation increases with the firm's size and acquisitions lead to larger firm size, envy can cause merger waves even in the absence of real economic shocks or market misvaluation. The model predicts (with empirical confirmation) that earlier acquisitions in a merger wave display higher synergies, involve smaller targets, and are associated with higher executive compensation gains, than later acquisitions. The model also makes several other predictions. It does not, however, address some other stylized facts reviewed in the third section, such as the relative valuations of the bidder and the target, and the relation between these valuations and offer characteristics.

SUMMARY AND CONCLUSIONS

The studies surveyed in this chapter suggest that both the irrational investor and the irrational manager approaches to M&As provide fresh insights beyond the Q theory. These behavioral approaches have received considerable empirical support. In particular, the irrational investors approach helps to unite many of the findings about the relative bidder and target valuations, offer characteristics, managerial horizons, long-run bidder performance, and merger waves. Because both managers and investors are likely to be imperfectly rational, combining both approaches should expand the realm of behavioral models about acquisitions.

Of course, neoclassical and other rational theories have their own degree of validity. There are sometimes real efficiency gains from takeover transactions (e.g., Maksimovic and Phillips, 2001; Shleifer and Vishny, 2003; Bhagat et al., 2005). The finding that the evidence for the misvaluation hypothesis is stronger for the 1990s than for the 1980s sample also suggests that multiple forces drive the takeover market. By incorporating other significant forces such as synergies and agency considerations into the behavioral framework, new theories and empirical insights may be generated to better understand the M&A process.

DISCUSSION QUESTIONS

1. In the Shleifer and Vishny (2003) model, overvalued bidders use equity to buy relatively undervalued targets. Why do target firms agree to accept overvalued bidder stock? What is the empirical evidence?
2. What are the challenges in M&A research that tries to distinguish the misvaluation hypothesis from the Q hypothesis? What empirical evidence helps to revolve this issue?
3. Summarize the reasons overvalued firms make merger bids to less overvalued targets. Do stock market–driven acquisitions benefit the bidders in the long run?
4. What are some of the challenges in testing theories about merger waves? What is the evidence that stock market valuations drive merger waves?
5. What are the differences in the theory of stock market–driven acquisitions when applied to public-to-public firms as opposed to deals involving unlisted target firms?

REFERENCES

Agrawal, Anup, and Jeffrey F. Jaffe. 2000. The post-merger performance puzzle. In *Advances in mergers and acquisitions*, (eds.) Cary Cooper and Alan Gregory, Volume 1, 7–41. Amsterdam: Elsevier.

Aktas, Nihat, Eric De Bodt, and Richard W. Roll. 2007. Corporate serial acquisitions: An empirical test of the learning hypothesis. Working Paper, University of California, Los Angeles.

Ali, Ashiq, Lee-Seok Hwang, and Mark A. Trombley. 2003. Residual-income-based valuation predicts future stock returns: Evidence on mispricing versus risk explanations. *Accounting Review* 78:2, 377–96.

Andrade, Gregor, Mark L. Mitchell, and Erik Stafford. 2001. New evidence and perspectives on mergers. *Journal of Economic Perspectives* 15:2, 103–20.

Ang, James S., and Yingmei Cheng. 2006. Direct evidence on the market-driven acquisitions theory. *Journal of Financial Research* 29:2, 199–216.

Baker, Malcolm P., Joshua Coval, and Jeremy C. Stein. 2007. Corporate financing decisions when investors take the path of least resistance. *Journal of Financial Economics* 84:2, 341–72.

Baker, Malcolm P., C. Fritz Foley, and Jeffrey A Wurgler. 2009. Multinationals as arbitrageurs: The effect of stock market valuations on foreign direct investment. *Review of Financial Studies* 22:1, 337–69.

Baker, Malcolm P., Xin Pan, and Jeffrey Wurgler. 2009. A reference point theory of mergers and acquisitions. Working Paper 15551, National Bureau of Economic Research.

Baker, Malcolm P., Richard Ruback, and Jeffrey Wurgler. 2007. Behavioral corporate finance: A survey. In *Handbook of corporate finance: Empirical corporate finance*, (ed.) B. Espen Eckbo, Volume 1, 145–86. North Holland: Elsevier.

Barber, Brad M., and John D. Lyon. 1997. Detecting long-run abnormal stock returns: The empirical power and specification of test statistics. *Journal of Financial Economics* 43:3, 341–72.

Bargeron, Leonce L., Frederik P. Schlingemann, René M. Stulz, and Chad J. Zutter. 2008. Why do private acquirers pay so little compared to public acquirers? *Journal of Financial Economics* 89:3, 375–90.

Bertrand, Marianne, and Antoinette Schoar. 2003. Managing with style: The effect of managers on firm policies. *Quarterly Journal of Economics* 118:4, 1169–208.

Bhagat, Sanjai, Ming Dong, David Hirshleifer, and Robert Noah. 2005. Do tender offers create value? New methods and evidence. *Journal of Financial Economics* 76:1, 3–60.

Billett, Matthew T., and Yiming Qian. 2008. Are overconfident CEOs born or made? Evidence of self-attribution bias from frequent acquirers. *Management Science* 54:6, 1037–51.

Bouwman, Christa, Kathleen Fuller, and Amrita Nain. 2009. Market valuation and acquisition quality: Empirical evidence. *Review of Financial Studies* 22:2, 633–79.

Brainard, William C., and James Tobin. 1968. Pitfalls in financial model building. *American Economic Review: Papers and Proceedings* 58:2, 99–122.

Brealey, Richard A., and Stewart C. Myers. 2000. *Principles of corporate finance*. New York: McGraw-Hill.

Brown, David T., and Michael D. Ryngaert. 1991. The mode of acquisition in takeovers: Taxes and asymmetric information. *Journal of Finance* 46:2, 653–69.

Cai, Jie, and Anand M. Vijh. 2007. Incentive effects of stock and option holdings of target and acquirer CEOs. *Journal of Finance* 62:4, 1891–933.

Campbell, John Y. 1991. A variance decomposition for stock returns. *Economic Journal* 101:405, 157–79.

Chang, Saeyoung. 1998. Takeovers of privately held targets, methods of payment, and bidder returns. *Journal of Finance* 53:2, 773–84.

Cooney, John W., Thomas Moeller, and Mike Stegemoller. 2009. The underpricing of private targets. *Journal of Financial Economics* 93:1, 51–66.
Dong, Ming, David Hirshleifer, Scott Richardson, and Siew Hong Teoh. 2006. Does investor misvaluation drive the takeover market? *Journal of Finance* 61:2, 725–62.
Erickson, Merle, and Shiing-wu Wang. 1999. Earnings management by acquiring firms in stock for stock acquisitions. *Journal of Accounting and Economics* 27:2, 149–76.
Faccio, Mara, John McConnell, and David Stolin. 2006. Returns to acquirers of listed and unlisted targets. *Journal of Financial and Quantitative Analysis* 41:1, 197–220.
Fama, Eugene F. 1998. Market efficiency, long-term returns and behavioral finance. *Journal of Financial Economics* 49:3, 283–306.
Fama, Eugene F., and Kenneth R. French. 2005. Financing decisions: Who issues stock? *Journal of Financial Economics* 76:3, 549–82.
Fu, Fangjian, Leming Lin, and Micah S. Officer. 2010. Acquisitions driven by stock overvaluation: Are they good deals? Working Paper, Loyola Marymount University.
Fuller, Kathleen, Jeffry Netter, and Mike Stegemoller. 2002. What do returns to acquiring firms tell us? Evidence from firms that make many acquisitions. *Journal of Finance* 57:4, 1763–93.
Gaspar, Jose-Miguel, Massimo Massa, and Pedro Matos. 2005. Shareholder investment horizons and the market for corporate control. *Journal of Financial Economics* 76:1, 135–65.
Goel, Anand, and Anjan V. Thakor. 2009. Do envious CEOs cause merger waves? *Review of Financial Studies*, forthcoming.
Gort, Michael. 1969. An economic disturbance theory of mergers. *Quarterly Journal of Economics* 83:4, 624–42.
Graham, John, Campbell Harvey, and Manju Puri. 2008. Managerial attitudes and corporate actions. Working Paper, Duke University.
Gu, Feng, and Baruch Itamar Lev. 2008. Overpriced shares, ill-advised acquisitions, and goodwill impairment. Working Paper, SUNY-Buffalo and New York University.
Hansen, Robert G. 1987. A theory of the choice of exchange medium in mergers and acquisitions. *Journal of Business* 60:1, 75–95.
Harford, Jarrad. 2005. What drives merger waves? *Journal of Financial Economics* 77:3, 529–60.
Harford, Jarrad, and Kai Li. 2007. Decoupling CEO wealth and firm performance: The case of acquiring CEOs. *Journal of Finance* 62:2, 917–49.
Hartzell, Jay, Eli Ofek, and David Yermack. 2004. What's in it for me? CEOs whose firms are acquired. *Review of Financial Studies* 17:1, 37–61.
Hietala, Pekka, Steven N. Kaplan, and David T. Robinson. 2003. What is the price of hubris? Using takeover battles to infer overpayments and synergies. *Financial Management* 32:3, 1–32.
Hirshleifer, David. 2001. Investor psychology and asset pricing. *Journal of Finance* 56:4, 1533–97.
Holmstrom, Bengt R., and Steven N. Kaplan. 2001. Corporate governance and merger activity in the U.S.: Making sense of the 1980s and 1990s. *Journal of Economic Perspectives* 15:2, 121–44.
Jensen, Michael C. 1986. Agency costs of free cash flow, corporate finance, and takeovers. *American Economic Review* 76:2, 323–9.
Jensen, Michael C. 2005. Agency costs of overvalued equity. *Financial Management* 34:1, 5–19.
Jovanovic, Boyan, and Peter L. Rousseau. 2002. The Q-theory of mergers. *American Economic Review* 92:2, 198–204.
Kahneman, Daniel, and Amos Tversky. 1979. Prospect theory: An analysis of decision under risk. *Econometrica* 47:2, 263–91.
Klasa, Sandy, and Mike Stegemoller. 2007. Takeover activity as a response to time-varying changes in investment opportunity sets: Evidence from takeover sequences. *Financial Management* 36:2, 19–43.

Lamont, Owen A., and Jeremy C. Stein. 2006. Investor sentiment and corporate finance: Micro and macro. *American Economic Review* 96:2, 147–51.

Lang, Larry H. P., René Stulz, and Ralph A. Walkling. 1989. Managerial performance, Tobin's Q, and the gains from successful tender offers. *Journal of Financial Economics* 24:1, 137–54.

Lee, Charles M. C., James Myers, and Bhaskaran Swaminathan. 1999. What is the intrinsic value of the Dow? *Journal of Finance* 54:5, 1693–741.

Loughran, Tim, and Jay Ritter. 2000. Uniformly least powerful tests of market efficiency. *Journal of Financial Economics* 55:3, 361–89.

Loughran, Tim, and Anand M. Vijh. 1997. Do long-term shareholders benefit from corporate acquisitions? *Journal of Finance* 52:5, 1765–90.

Maksimovic, Vojislav, and Gordon Phillips. 2001. The market for corporate assets: Who engages in mergers and asset sales and are there efficiency gains? *Journal of Finance* 56:6, 2019–65.

Malmendier, Ulrike, and Geoffrey Tate. 2008. Who makes acquisitions? CEO overconfidence and the market's reaction. *Journal of Financial Economics* 89:1, 20–43.

Martin, Kenneth J. 1996. The method of payment in corporate acquisitions, investment opportunities, and management ownership. *Journal of Finance* 51:4, 1227–46.

Massa, Massimo, and Lei Zhang. 2009. Cosmetic mergers: The effect of style investing on the market for corporate control. *Journal of Financial Economics* 93:3, 400–27.

Mitchell, Mark, and Harold J. Mulherin. 1996. The impact of industry shocks on takeover and restructuring activity. *Journal of Financial Economics* 41:2, 193–229.

Mitchell, Mark, and Erik Stafford. 2000. Managerial decisions and long-term stock price performance. *Journal of Business* 73:3, 287–329.

Moeller, Sara B., Frederik P. Schlingemann, and René M. Stulz. 2004. Firm size and the gains from acquisitions. *Journal of Financial Economics* 73:2, 201–28.

Moeller, Sara B., Frederik P. Schlingemann, and René M. Stulz. 2005. Wealth destruction on a massive scale? A study of acquiring-firm returns in the recent merger wave. *Journal of Finance* 60:2, 757–82.

Morck, Randall, Andrei Shleifer, and Robert W. Vishny. 1990. Do managerial objectives drive bad acquisitions? *Journal of Finance* 45:1, 31–48.

Myers, Stewart C., and Nicholas S. Majluf. 1984. Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics* 13:2, 187–221.

Nelson, Ralph. 1959. Merger movements in the American industry. New York: NBER.

Officer, Micah S. 2007. The price of corporate liquidity: Acquisition discounts for unlisted targets. *Journal of Financial Economics* 83:3, 571–98.

Ohlson, James A. 1995. Earnings, book values, and dividends in equity valuation. *Contemporary Accounting Research* 11:2, 661–87.

Rau, P. Raghavendra, and Theo Vermaelen. 1998. Glamour, value and the post-acquisition performance of acquiring firms. *Journal of Financial Economics* 49:2, 223–53.

Rhodes-Kropf, Matthew, David T. Robinson, and S. Viswanathan. 2005. Valuation waves and merger activity: The empirical evidence. *Journal of Financial Economics* 77:3, 561–603.

Rhodes-Kropf, Matthew, and S. Viswanathan. 2004. Market valuation and merger waves. *Journal of Finance* 59:6, 2685–718.

Roll, Richard. 1986. The hubris hypothesis of corporate takeovers. *Journal of Business* 59:2, 197–216.

Rosen, Richard J. 2006. Merger momentum and investor sentiment: The stock market reaction to merger announcements. *Journal of Business* 79:2, 987–1017.

Savor, Pavel G., and Qi Lu. 2009. Do stock mergers create value for acquirers? *Journal of Finance* 64:3, 1061–97.

Schwert, G. William. 2000. Hostility in takeovers: In the eyes of the beholder? *Journal of Finance* 55:6, 2599–640.

Servaes, Henri. 1991. Tobin's Q and the gains from takeovers. *Journal of Finance* 46:1, 409–19.
Shleifer, Andrei, and Robert W. Vishny. 2003. Stock market–driven acquisitions. *Journal of Financial Economics* 70:3, 295–311.
Skinner, Douglas J., and Richard G. Sloan. 2002. Earnings surprises, growth expectations, and stock returns *or* don't let an earnings torpedo sink your portfolio. *Review of Accounting Studies* 7:2-3, 289–312.
Song, Weihong. 2007. Does overvaluation lead to bad mergers? Working Paper, American Finance Association, 2007 Annual Meeting.
Travlos, Nickolaos G. 1987. Corporate takeover bids, methods of payment, and bidding firms' stock returns. *Journal of Finance* 42:4, 943–63.
Tversky, Amos, and Daniel Kahneman. 1974. Judgment under uncertainty: Heuristics and biases. *Science* 185:4157, 1124–30.
Verter, Geoffrey. 2003. Timing merger waves. Working Paper, Harvard University.
Vuolteenaho, Tuomo. 2002. What drives firm-level stock returns? *Journal of Finance* 57:1, 233–64.
Walkling, Ralph A., and Robert O. Edmister. 1985. Determinants of tender offer premiums. *Financial Analysts Journal* 41:1, 27–37.

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PART V

Investor Behavior

CHAPTER 27

Trust Behavior: The Essential Foundation of Securities Markets

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INTRODUCTION

Burt Ross graduated from Harvard University in 1965. After working several years as a stockbroker, he ran for and was elected mayor of Fort Lee, New Jersey. Then Ross turned to commercial real estate. In 2003, he decided to sell some of his buildings and invest the proceeds, which amounted to more than $5 million. Ross thought he was prepared for retirement. He believed so until December 11, 2008, when he learned that his nest egg, which he had invested almost entirely in funds managed by the now infamous Ponzi schemer Bernard Madoff, was gone (Pulliam, 2008).

Ross had never met Madoff. He invested in Madoff's funds on the advice of a friend. When he received account statements showing hefty gains, he believed them. Although he was puzzled by how Madoff managed to make money even when the market was declining, he never questioned the source of the gains or worried about how they were earned.

With the benefit of hindsight, one might say Ross was foolish to entrust his nest egg to Madoff. Yet to understand how modern securities markets work, it is important to understand such "foolishness" is the rule, not the exception, in investing behavior. Very few people make more than a cursory investigation of the individuals and institutions (investment advisors, mutual funds, pension funds) to which they entrust their savings. Indeed, most people often do not know exactly where their savings are invested. Ross invested on faith, as do most investors. Faith—or more accurately, trust—is the foundation on which successful public securities markets are built.

This chapter seeks to explore the role that investor trust plays in securities markets by examining what can be learned about trust from behavioral experiments. The chapter begins by arguing that investor trust provides the foundation for thriving securities markets. It explores the nature and meaning of trust before turning to the experimental evidence on trust and especially the results of a type of experiment called a "trust game." Trust game experiments prove that trust is

a surprisingly common behavior. They also demonstrate, however, that trust depends on expectations of trustworthiness, and that trust that is abused tends to disappear. The chapter concludes by considering the implications of these findings for regulating modern securities markets.

THE MYTH OF THE RATIONAL EXPECTATIONS INVESTOR

Understanding why trust is essential to thriving securities markets starts with asking a basic question: Why do investors think they will make money purchasing corporate stocks and bonds? Why do they not believe instead that their money will be stolen or squandered by unethical brokers, corrupt investment advisors, larcenous mutual fund managers, and greedy corporate officers and directors?

To the economist or finance theorist who favors "rational expectations" analysis, most investing is puzzling behavior. The notion of rational expectations provides the foundation for game theory and many other areas of economic analysis. It assumes that investors are cool, calculating, and purely self-interested actors. More important, rational expectations assumes that investors believe that *other* people—including corporate managers and investment professionals like Madoff—are cool, calculating, and purely self-interested actors. Rational choice accordingly predicts that the business of investing should be much like the business of playing chess. A rational investor should assume corporate insiders and investment professionals will steal from him or her whenever they see a chance to do so, just as a rational chess player should assume his or her opponent will take the queen if given the opportunity.

As a matter of logic, this means that the vast majority of individuals who invest in securities markets today cannot be rational expectation investors. An investor who expects corporate managers and investment professionals to lie, cheat, steal, and shirk their duty, while at the same time demanding proof that they are adequately constrained from doing these things, would find investing such an onerous process that it would not be worth the trouble. Except perhaps for the very largest portfolios, the information costs involved in such a process are simply too burdensome.

Imagine, for example, a person is contemplating acquiring a modest and diversified portfolio of corporate securities through an investment advisor like Madoff. Before investing, the person would need to investigate the many people at Madoff's firm who would be in a position to steal from him or her. These include Madoff, his secretary and assistants, and indeed almost anyone else in the firm. A rational choice investor would have to establish that each and every one of these presumably larcenous individuals was adequately deterred from stealing and adequately incentivized to avoid shirking. This means a rational choice investor would have to familiarize himself or herself not only with securities law and the rules of investment advisor regulations (as well as the procedures and punishments involved in applying those rules), but also would have to know all the details of the firm's employment contracts and compliance systems. To return to the chess analogy, just as a rational expectations chess player would not move his

or her queen to an open space on a chessboard without making absolutely sure the other player could not take it, a rational expectations investor would not entrust his or her money to an investment manager until absolutely certain it could not be stolen.

Investigating the investment firm is only the first step. Assuming the investment firm used the invested funds to buy corporate stocks and bonds, the rational expectations investor must also assume that the companies that issued the stocks and bonds are filled with unethical and opportunistic agents—directors, officers, and employees—who would leap at the chance to shirk or commit fraud. Thus, the investor would have to investigate not only all the individuals at all the companies in which funds are invested, but also would need to investigate corporate law, securities law, and the employment contracts and compliance systems employed in all of those companies.

One could argue that a rational expectations investor might not need this sort of omniscience to invest because he or she could rely on auditing firms, ratings agencies, the Securities Exchange Commission (SEC), and other "gatekeepers" and regulators to monitor investment advisors and the insiders at the companies in which he or she invests. But this argument only moves the problem back a step. Why should a rational expectations investor assume that the gatekeepers and the regulators have the proper incentives and constraints to do their jobs, if he or she does not take the time to actually research the gatekeepers' and the regulators' incentives and constraints?

Accordingly, a rational expectations investor would have to do an enormous amount of investigative work simply before concluding his or her money would not be stolen. And, of course, assuring oneself that one's money will not be stolen is only the starting point in evaluating an investment. The rational expectations investor must then take on the additional task of figuring out whether the fund or security in question is in fact a good investment. Thus, the phrase "rational expectations investor" borders on an oxymoron. A rational expectations investor would work himself or herself into exhaustion continuously gathering, verifying, and analyzing information before feeling safe enough to invest in the securities markets. Stuffing money under his or her mattress would be the better and far less stressful retirement strategy.

Logic accordingly suggests that the vast majority of individuals who invest in public securities markets cannot be "rational expectations" investors. For further evidence, consider some simple introspection. An investor might ask the following question: "What sort of research did I undertake, what sorts of investigation have I done, and what sorts of objective evidence do I have to prove the funds I invested are still there?" Most likely the primary reason the investor believes in his or her investment is the file drawer full of quarterly statements from strangers that state the money is still there. Yet a dedicated fraudster such as Madoff could simply mail bogus quarterly statements with the right sets of numbers to convince the investor that the investment still exists. Nevertheless, most investors believe in the existence of their investments on the basis of such quarterly statements.

Why do people believe in their investments? They believe because they are not, in fact, "rational expectations" investors who expect to be defrauded. To the contrary, most are "trusting investors."

THE "TRUSTING INVESTOR"

In drawing the distinction between rational expectations investors and trusting investors, note that trusting investors are not irrational in the everyday sense of that word. Rather, they do not always adopt the rational expectations investor's assumption that other people always behave in a cold, calculating, unethical, purely self-interested fashion. Trusting investors are willing to believe that at least some people, and possibly some institutions, are "trustworthy." In other words, they are willing to believe—often on the basis of minimal investigation—that certain people and institutions will refrain from exploiting their trust, even when they do not know with certainty what prevents such exploitation.

The behavior called "trust" accordingly can be thought of as having three basic characteristics. First, trust means knowingly making oneself vulnerable to another. Without vulnerability, there is no trust. Second, trust requires knowing that the person to whom one becomes vulnerable could gain from exploiting that vulnerability. Third, trust requires the belief that the person to whom one becomes vulnerable will not, despite the temptations of self-interest, actually take that advantage. In other words, people expect the person being trusted to refrain from exploiting vulnerability, even though he or she could (Blair and Stout, 2001).

This means that trust behavior is consistent with pure self-interest on the part of the person doing the trusting, the "trustor." But the trustor must believe that the person being trusted—the "trustee"—is *not* driven solely by self-interest. To employ the language of social science, the trustor believes the trustee is, at least to some extent, "other-regarding" (cares about others) rather than purely "self-regarding" (cares only about self).

To some, especially to those trained in economics, the idea that a complex and enormous economic institution such as a securities market might be based on a widespread belief in others' trustworthiness may come as something of a shock. This idea, however, enjoys substantial and growing empirical support. In recent years, the phenomenon of trust has attracted the attention of psychologists, economists, sociologists, political scientists, and legal scholars. There is now a large literature, both theoretical and empirical, exploring the phenomenon of trust. This chapter focuses on a section of that literature that uses a research methodology known as "experimental gaming."

TRUST, INVESTMENT, AND THE "TRUST GAME"

Experimental gaming goes by various names including experimental psychology, behavioral economics, and experimental economics. Whatever label one prefers, the basic technique is the same. Rather than formulate some abstract theory about how people should behave (rational self-interest being an abstract theory), researchers put people into laboratory-controlled situations, ask them to play an experimental "game," and observe how they *really* behave.

Researchers have used this technique to study a number of odd aspects of human behavior. One is trust. In recent decades researchers around the globe have run hundreds of versions of a particular experimental game expressly designed to test whether and under what circumstances human subjects will place trust in others (Johnson and Mislin, 2008). This game is called the "trust game." Interestingly,

it is also sometimes called the "investment game" (Berg, Dickhaut, and McCabe, 1995).

In a typical trust game experiment, each subject is given a certain amount of money (say, $10.00). The subjects are then divided into pairs. One member of each pair is assigned to play the role of the "trustor" and is told that he has a choice to make: He can keep all of his money, or he can choose to deliver some or all of it to the other member of the pair, dubbed the "trustee." Both subjects are told that if the trustor delivers any money to the trustee, the amount of money that is delivered ("invested") will be tripled. Both subjects are also told that if the trustor chooses to send any money to the trustee—that is, to invest with the trustee—the trustee will then be faced with her own choice. She can either keep all of the tripled funds for herself or she can choose to send some or all of those funds back to the trustor.

How subjects who adhere to the rules of rational expectations theory would play the trust game is quite clear. The trustor would refuse to invest any funds with the trustee because the trustor would know that if he did so, a rational and purely self-regarding trustee would never send any money back. This is not, however, the way real people play a trust game.

In real life, people often choose to trust others, and trusted individuals often chose to act in a trustworthy manner. This was seen in one of the first published accounts of a trust game experiment, the 1995 study by Berg et al. (1995). Out of 32 pairs of subjects, 30 trustors chose to trust (that is, to send at least some of their money to the trustee). The majority of trustees then responded by behaving trustworthily. Twenty-four trustees sent back at least some of the funds they had received and most sent back more than they had originally received from the trustor, thus ensuring that both parties profited from the trustor's "investment."

Trust in Securities Markets

These sorts of results, which have been reliably replicated in many studies, demonstrate that real people do not approach life as if it were a game of chess in which the other player will relentlessly try to take every advantage. To the contrary, real people are ready to trust and make themselves vulnerable to others with the expectation of restrained self-interest and trustworthy behavior. Although this is inconsistent with "rational expectations," it is quite rational. As the trust game demonstrates, both sides profit when trust is reciprocated by trustworthiness. Thus, as long as people sometimes are trustworthy—and as the trust game also illustrates, an empirical fact is that real people often are trustworthy—it is also rational sometimes to trust.

This observation has some important implications for the understanding of the investment process. In particular, it implies that trust may be an essential ingredient for a successful public securities market. As already observed, logic alone suggests that modern securities markets could not possibly have reached their present size and scope if most investors were "rational expectations" investors. Introspection also (at least for those people whose primary evidence of savings is a file of papers) suggests trust behavior underlies most investment. Researchers are starting to produce more formal evidence as well. Guiso, Sapienza, and Zingales (2008) conclude that individuals' willingness to trust is directly linked to their investment behavior. Individuals who show more trust in others, as evidenced by

their response to the question "Would you say most people can be trusted or that you have to be very careful in dealing people?" are also significantly more likely to buy stocks.

If investment in modern securities markets is indeed based primarily on trust rather than rational expectations, another question seems appropriate: Why and under what circumstances are people willing to trust? Although much work remains to be done on this complex question, the experimental gaming literature offers at least two important lessons. First, many people are strongly inclined to trust others, even strangers, even in novel situations, and even with little or no investigation. The second lesson is that this willingness to trust is neither irrational nor unlimited. It is based on the rational calculation that other people are in fact likely to prove trustworthy. Trust disappears when it is taken advantage of, so that exchange no longer works to the benefit of both trustor and trustee but benefits the trustee alone.

Lesson One from the Trust Game: The Prevalence of Trust

One of the most remarkable observations about trust from the trust game is the level of trust that people possess. Most people, of course, would be expected to trust their friends and family. But the data from experimental gaming suggest the willingness to trust others runs much deeper than this. In a typical trust game experiment, for example, the subjects are strangers. Nevertheless, as seen in the original study by Berg et al. (1995), trust behavior seems to be the rule more than the exception.

This is true even when researchers ensure that the players in a trust game interact anonymously, via computer stations or the exchange of worksheets. Some studies have even gone so far as to interject random variable treatments into players' returns from trust games so as to reassure subjects that their decisions will remain undecipherable by both the other subjects in the game and the researchers themselves. This double-blind protocol does not change the results (Johnson and Mislin, 2008). Most people still choose to trust other people.

Indeed, most people not only trust other people; they trust things. In one particularly interesting experiment, subjects were asked to play a variation on the trust game known as a "social dilemma" game. In a trust game, one subject is first asked to trust, and the other is then asked to act trustworthily. In a social dilemma, all subjects simultaneously decide whether they want to "invest" in a common pool the researchers promise to multiply and then redistribute to the subjects in equal shares, without regard for initial contribution. A social dilemma thus requires subjects to decide simultaneously whether or not they want both to trust and to behave trustworthily. What makes this particular social dilemma experiment interesting is not that the subjects are asked to play a social dilemma—there may be even more social dilemma studies than trust game experiments—but the fact that the subjects are asked to play the game not only with other humans, but also with different kinds of computers. Trust is still the order of the day. Kiesler, Waters, and Sproull (1996) show that most human subjects (about 90 percent) displayed the same sort of cooperative, trusting behavior when playing the game with a standard beige-box computer that they showed toward human partners. Interestingly, though, far fewer subjects (only about 40 percent) were willing to

trust a "deceptive" computer that spoke with a synthesized voice and displayed a human face on its monitor.

These results suggest that most people are willing to trust not only familiar people but also strangers and even nonhuman actors such as computers or possibly an institution such as a corporation or "the market." Yet while trust is common, it is not invariable. People place trust in some individuals but not in others (for example, in one's family doctor but not in the quack who treats one's brother-in-law). They trust some companies and institutions but not others (e.g., the poison control center, but not the local car dealership; the straightforward computer, but not the computer that tries to imitate a human). This leads to a second important lesson observed from trust game experiments: The willingness to trust a particular person or institution seems to depend to a large degree on past experience.

Lesson Two from the Trust Game: The Importance of History

One of the most important findings from the trust game literature is that trust depends in significant part on "history effects" (Berg et al., 1995). In the trust game, for example, most players approach the game with a predisposition to trust. However, when players are asked to play repeatedly with each other, trust behavior declines when trustors find that some of their fellow players are behaving in an untrustworthy fashion (Fehr, 2009). Similarly, in a variation on the trust game called the "gift exchange" game, researchers find that players assigned the role of trustor are far more willing to trust individuals who have proven themselves trustworthy in prior games.

A similar pattern has been observed in the data from social dilemma games mentioned earlier. One of the most consistent findings in social dilemma games is that when subjects play repeatedly with each other, cooperation rates (the rate of mutually trusting and trustworthy behavior) decline over time when cooperative players learn that other players are "defecting." The cooperating players then begin to defect themselves. Conversely, when subjects in a social dilemma play each other repeatedly and find trustworthy behavior, they become willing to make themselves even more vulnerable in later rounds (Stout, 2002).

Such results suggest that given a history of favorable experiences, most people are willing to make themselves surprisingly vulnerable to others, apparently believing it safe to trust. Conversely, bad experiences (i.e., experiences in which trust has been violated) make experimental subjects distrustful and unwilling to make themselves vulnerable to others. Therefore, trust apparently is learned.

This suggests another fundamental difference between rational expectations investors and trusting investors. Where the former look to "the shadow of the future," the latter care about "the shadow of the past." Put differently, a rational expectations investor expects to be exploited. Accordingly, he or she will always be forward-looking, trying, just as a chess player might, to anticipate other players' opportunistic future moves. In contrast, trusting investors look to the past. If someone or something has always behaved in a particular way in the past, trusting investors assume that that person or thing will continue to behave similarly in the future, without worrying too much about understanding what drives the behavior in question. Some economists describe this sort of backward looking focus as "adaptive expectations," to distinguish it from the "rational expectations"

approach typically applied in game theory and other branches of economic analysis. As discussed in Chapter 14, behavioral finance scholars might call this focus an extrapolation bias or representativeness bias.

Applying the Lessons of Trust to Securities Markets

These lessons from the trust game can be applied to our understanding of the investment process and modern securities markets. To begin with, the possibility that securities markets are based more on trust-based investing than rational expectations investing can help to explain some otherwise puzzling market phenomena. Consider, for example, the phenomenon of price bubbles, periods where the price of a particular type of asset (information technology stocks in the 1990s, real estate in early 2000s) rises far above what seems justified by economic fundamentals (Stout, 2002). The trusting investor model of behavior explains bubbles by suggesting that bubbles occur when investors are not paying attention to economic fundamentals at all—instead, they are paying attention to history. When the price of an asset begins rising steadily, for whatever reason, trusting investors who rely on history assume the trend will continue, without bothering to investigate whether the evidence supports their assumption. Of course, the process also works in reverse. As many unhappy investors learned in the tech stock crash of 2000 and in the real estate market during 2008–2009, if prices begin to fall after a speculative bubble has developed (due to some event such as an extraneous shock), investors are again likely to extrapolate and assume the trend will continue, withdrawing from the market en masse and "bursting" the bubble.

A second phenomenon that can be explained by taking account of trust is how sophisticated investors such as Burt Ross (the Harvard graduate, former stockbroker, and successful businessman mentioned earlier in this chapter) can be defrauded. Rational expectations investors vigilantly protect themselves from any possible exploitation, often by refusing to invest in the first place. Ross, despite his sophistication, was trusting, and trusting investors can be fooled. Because they judge from past experience more than present circumstances, investors accustomed to a regulated securities market in which fraud and malfeasance have been kept in check are likely to "trust" the market and assume it is safe to invest even in parts of the market that aren't well-regulated. Ross may have been fooled in just this fashion. Most investors who want to pay an advisor to invest their funds in a diversified stock portfolio rely on mutual funds, highly regulated investment companies subject to strict government controls that made large-scale frauds unlikely. But Ross did not invest in a mutual fund—rather, he invested in Madoff through a hedge fund, a relatively new and unregulated investment vehicle open only to wealthier "sophisticated" investors. Ross may have assumed some regulatory system existed to protect his hedge fund investment, just as a scheme exists to protect mutual fund investments, only to find out after his money was gone that his assumption was in error.

But the empirical data on trust behavior carry a third and still more vital implication for today's securities markets: Although a trusting investor such as Ross can be taken advantage of once, he will be less trusting in the aftermath. Investor trust should not be treated as inexhaustible. Trust-based investing depends on history and in particular on whether investment professionals and the securities

market as a whole have behaved in a trustworthy fashion. Unfortunately, over the past decade, American investors have witnessed innumerable financial scandals, such as those involving Enron, WorldCom, and Madoff. Worse, many have seen investment results that are, if anything, slightly worse than those they would have enjoyed had they simply put their savings under their mattress. If trust is indeed influenced by history, as the evidence suggests, investor trust can only be expected to decline. Under the mattress may indeed be where many investors are likely to put their savings in the future.

How can investor trust in the securities markets be restored? The experimental evidence offers a clear answer. Trust is not some form of masochism or irrationality. Rather, it is based on the reasonable expectation that a trusted person or institution will, in fact, behave trustworthily. If sustainable trust is desired, there first must be trustworthiness.

Building a trustworthy securities market is a big project, and a full discussion of how that can be done is beyond the scope of this chapter. For a discussion on trust in regulations, see Carlin, Dorobantu, and Viswanathan (2009). The question of why people sometimes behave in a trustworthy fashion when they could benefit by violating trust also is a complex one that various scholars have addressed at length (Blair and Stout, 2001). The data from trust game experiments offer a clear warning, however. Trust may provide the foundation for securities markets, but trustworthiness provides the foundation for trust. Remove the foundation of trustworthiness, and the market will collapse.

SUMMARY AND CONCLUSIONS

The American securities market is one of our largest and most important economic institutions. By 2007, more than 91 million individual investors held a total of more than $15 trillion in corporate bonds and equities, either directly or through pension and mutual funds (U.S. Census Bureau, 2009, Tables 1161 and 1171). This is only possible because many investors base their investments on trust. They may not necessarily trust individual securities professionals and corporate insiders to be honest and dependable, but they at least trust "the system." As a result, they are willing to buy trillions of dollars of securities even when not quite sure what they are buying or from whom they are buying.

Of course, experienced lawmakers and businesspeople, as well as experienced con artists such as Madoff, are well aware that trust is a potent force in explaining investor behavior. Academics should also incorporate this idea into their analyses. In order to truly understand how securities markets work, a more complete understanding of trust behavior is necessary.

DISCUSSION QUESTIONS

1. What are the three major characteristics of trust?
2. Is trust irrational?
3. What motivates people to trust others?
4. Could there be a securities market without trust?

REFERENCES

Berg, Joyce, John Dickhaut, and Kevin McCabe. 1995. Trust, reciprocity, and social history. *Games and Economic Behavior* 10:1, 122–42.

Blair, Margaret M., and Lynn A. Stout. 2001. Trust, trustworthiness, and the behavioral foundations of corporate law. *University of Pennsylvania Law Review* 149:6, 1735–1810.

Carlin, Bruce Ian, Florin Dorobantu, and S. Viswanathan. 2009. Public trust, the law, and financial investment. *Journal of Financial Economics* 92:3, 321–41.

Fehr, Ernst. 2009. On the economics and biology of trust. Institute for Empirical Research in Economics, University of Zurich, Working Paper No. 399.

Guiso, Luigi, Paola Sapienza, and Luigi Zingales. 2008. Trusting the stock market. *Journal of Finance* 43:6, 2557–600.

Johnson, Noel D., and Alexandra Mislin. 2008. Cultures of kindness: A meta-analysis of trust game experiments. Available at http://ssrn.com/abstract=1315325.

Kiesler, Sara, Keith Waters, and Lee Sproull. 1996. A prisoner's dilemma experiment on cooperation with people and human-like computers. *Journal of Personality and Social Psychology* 70:1, 47–65.

Pulliam, Susan. 2008. "Uncle Bernie" and his angry clients: Former mayor, millions lost, describes how he was lulled. *Wall Street Journal*, December 20, p. A1.

Stout, Lynn A. 2002. The investor confidence game. *Brooklyn Law Review* 68:2, 407–37.

U.S. Census Bureau. 2009. *2009 Statistical Abstract of the United States*.

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CHAPTER 28

Individual Investor Trading

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INTRODUCTION

The extraordinarily high degree of trading in financial markets represents major challenges to the field of finance. The New York Stock Exchange (NYSE) website indicates that the annual share turnover rate in the early 2000s on the NYSE was close to 100 percent, amounting to a total volume of about 350 billion shares per year. Using reasonable estimates of per-trade costs, this implies that the investing public voluntarily pays several billion dollars to financial intermediaries every year. International markets, especially many stock markets in Asia, witness even higher turnovers (Barber, Lee, Liu, and Odean, 2009; Feng and Seasholes, 2004) and trading costs. Such stylized facts are in stark contrast with many theoretical models in finance such as those found in Aumann (1976) and Milgrom and Stokey (1982), which argue that there should be no trading at all.

Scholars have devoted increasing research to understanding why investors, especially individual investors, trade, and the implications of individual investor trading to the financial markets. This chapter has three major objectives. First, the chapter will summarize the major motivations for individual investors' trades and provide empirical evidence testing respective hypotheses regarding trading motivations. Evidence shows that behavioral explanations are responsible for many of the interesting findings on individual investor trading.

Second, the chapter focuses on three important aspects of individual investor trading: (1) the disposition effect; (2) the tendency to trade geographically nearby stocks; and (3) individual investors' ability to learn about their investment skills over the course of the investment. Although rational predictions can explain part of each phenomenon, the extant literature largely agrees that behavioral biases are responsible for these three phenomena.

Lastly, the chapter reviews how investor trading activities affect the financial markets. Evidence shows that individual investors trade in strikingly similar fashions. Such correlated trading activities question the traditional view that individual investors are "noise traders," and that their trading activities cancel each other out, leaving no impact on the market. As a matter of fact, several recent studies present convincing evidence that trading activities by retail investors can influence asset prices not only in the concurrent period but also in future periods. In addition to

reviewing individual investors' impact on asset price formation, the chapter will also review the transaction costs and time costs incurred in individual investor trading.

The remainder of the chapter has the following organization. The first section provides an overview of the motivations for individual investor trading. The second section focuses on three major aspects of individual investor trading that have received considerable academic research, namely the disposition effect, local bias, and individual investor learning abilities. The third section provides an assessment of the implication of individual investor trading in terms of asset price formation and social welfare evaluation. The last section concludes the topic.

OVERVIEW OF INDIVIDUAL INVESTOR TRADING

The section overviews both the rational and the behavioral explanations for individual investor trading.

Rational Explanations

Under the traditional financial economics literature, there are several major rational reasons for individual investors to trade. For example, Grossman and Stiglitz (1980) argue that investors will trade when the marginal benefit of doing so is greater than or at least equal to its costs. In particular, they suggest that information, or specifically private information, should be a major motivation for investors to trade.

Of course, there are several other motivations to trade in a more realistic and dynamic market. For example, individuals may need to trade in order to rebalance their portfolios after some stock prices substantially rise or fall, thus altering portfolio weights. Trading in those stocks allows them to maintain their preferred asset allocation structure. Separately, individuals may need to liquidate part of their equity investment in order to raise needed cash for consumption purposes.

Further, if one were to believe the life cycle hypothesis of Modigliani and Brumberg (1963), one would expect rational economic agents to smooth their consumption by appropriately investing and borrowing based on expectations about lifetime income. This means that investment and trading decisions should vary depending on the life cycle of an investor. Such inter-temporal borrowing/consumption decisions should also lead to more trading activities than those predicted in a simple static model.

Finally, Hong, Kurbik, and Stein (2004) propose that social interaction may partly induce stock market participation and trading. Their model predicts that any given "social" investor finds the market more attractive when more of his peers participate. Using the Health and Retirement Study data, the authors provide strong support for their hypothesis that more social households, those households who have more social interaction with the community (i.e., go to church, talk to neighbors), are substantially more likely to participate in the stock market and hence stock trading.

TAX MOTIVATIONS

Another apparent reason for individual investor trading is tax considerations. Given that tax laws treat various components of investment returns such as interest, dividends, and capital gains differently, rational investors who face tax obligations are expected to trade so as to take advantage of the tax laws. Barber and Odean (2004) use brokerage account data and analyze the tax awareness of individual investors in the United States. They find that investors prefer to locate bonds and mutual funds in retirement accounts and realize stock losses in their taxable accounts toward year end, which supports the idea that individuals are conscious of taxes when they make investment decisions. However, Barber and Odean also find that investors trade actively in their taxable accounts, realize gains more frequently than losses, and locate a material portion of their bonds in taxable accounts, thereby hurting their after-tax returns.

Grinblatt and Keloharju (2004) find a similar level of importance for tax consideration in investment decisions from the Finnish stock market. They show that individual investors in Finland realize losses more than gains towards the end of December. Moreover, Finnish investors repurchase the same stocks recently sold. The repurchase rate depends on the magnitude of previous losses. Such a predictable trading pattern generates net tax-loss buying pressure that is negative before the turn of the year and positive afterwards. Grinblatt and Keloharju also conclude that such tax-motivated trading activities are responsible for the turn-of-the-year effect and the cross-section of stock returns around year ends.

BEHAVIORAL EXPLANATIONS

In contrast with the rational models, Odean (1998b), Gervais and Odean (2001), and Daniel, Hirshleifer, and Subrahmanyam (1998) develop theoretical models of financial markets where investors are susceptible to behavioral biases such as overconfidence and self-attribution. Investors in such models cannot accurately assess their investment skills and may become overconfident about their investment abilities over time. One attractive feature of such models is that they generate predictions that are consistent with empirical findings on excessive trading activities by individual investors.

Odean (1999) shows that the trades of many investors not only fail to cover transaction costs but also tend to lose money even before transaction costs. He finds that behavioral explanations—such as overconfidence, the disposition effect, and a misguided belief in contrarianism or momentum—are responsible for such surprising findings.

Studies by Barber and Odean (2001, 2002) provide further support for the overconfidence explanations. Specifically, Barber and Odean (2001) reveal evidence on investor profits and performance between men and women. By showing that women outperform men in their individual stock investments and by arguing that men are more confident overall about their trading abilities than women, the authors conclude that overconfidence induces more trading but hurts investment performance. In a follow-up study, Barber and Odean (2002) find that investors who choose to switch to online investing were better performers than those who choose not to go online. However, those who do decide to

switch find that their performance worsens, especially in net returns, after they trade online and indeed underperform the non-switchers. Again, the authors attribute such shifts in performance to overconfidence and the resulting imprudent trades.

Outside the United States, Grinblatt and Keloharju (2009) analyze overconfidence, sensation seeking and trading with an interesting data source that combines investors' equity trading with data from an investor's tax filings, driving record, and psychological profile. Controlling for a host of variables including wealth, income, age, number of stocks owned, marital status, and occupation, the authors find that overconfident investors and those investors most prone to sensation seeking trade more frequently. Thus, they also support the hypothesis that overconfidence is responsible for the heightened level of trading activities.

Further anomalies in individual investor trading can be traced back to other behavioral foundations such as availability and representativeness. Barber and Odean (2008) test and confirm the hypothesis that individual investors are net buyers of attention-grabbing stocks. Due to the difficulty in searching among thousands of stocks, individuals are more likely to invest in those stocks that attract their attention. In contrast, individual investors do not face the same search problem when selling because they tend to sell only stocks they already own. The authors argue that many investors consider purchasing only stocks that have first caught their attention and allude that preferences determine choices after attention has determined the choice set. Confirming these findings, Grinblatt and Keloharju (2001), among other things, find that past returns and historical price patterns, such as being at a monthly high or low, affect trading by different types of investors, with comprehensive trading records from the Finnish stock market.

Dhar, Goetzmann, Shepherd, and Zhu (2005) provide one example of how investors focus on more salient information and events available to them by studying the trading activities around stock splits. They find that a higher fraction of post-split trades are made by less sophisticated investors. Individual investors increase their aggregate buying activities following stock splits while professional investors reduce their buying activity. This behavior supports the common belief that stock splits help attract new investors and improve stock liquidity. However, given that there is virtually no new information around the ex-dates of stock splits, the events themselves and the otherwise unimportant numeraire effect (i.e., the number of shares doubles and the prices halve accordingly) apparently induce individuals to trade.

Another interesting example of the (misguided) attention is Rashes' (2001) paper on the comovement of stocks with similar ticker symbols. For one such pair of firms, there is a significant correlation between returns, volume, and volatility at short frequencies despite the low correlation in their fundamental values. This anomaly provides an example of noise traders fixating their attention on the most easily accessible but flawed information. It reveals the effect of noise traders on stock prices independent of changes in information and expectations.

In sum, the above studies suggest that factors other than traditional rational explanations are responsible for many observed trading activities in financial markets.

THREE ASPECTS OF INDIVIDUAL INVESTOR TRADING

This section overviews three major aspects of investor trading behavior: the disposition effect, local bias, and learning in investor trading.

Disposition Effect

The disposition effect, which is the tendency to hold on to losing stocks for too long while selling winning stocks too early, is arguably one of the most studied patterns of individual investing. Some 20 years ago, Shefrin and Statman (1984) uncovered an interesting pattern that demonstrated how individual investors hold different parts of their portfolios for varying periods depending on the previous performance of those stocks.

More recently, Odean (1998a) also finds evidence of a disposition effect with a large sample of individual investors from a large discount brokerage firm. In addition, Odean finds that such behavior is probably not motivated by rational reasons, as indicated by the fact that past winners do better than losers following the date of sale of stock by an individual investor, suggesting a perverse outcome to the trades. Instead, he argues that such findings are consistent with predictions from prospect theory and value gains and losses of the same magnitude differently. Nofsinger (2007) argues that realizing profits allows one to maintain self-esteem, while realizing losses causes one to implicitly admit an erroneous investment decision, and hence is avoided.

Kaustia (2004) provides another test of the disposition effect and includes the reference price effect within the context of initial public offering (IPO) markets. Because the offer price is a common purchase price, the disposition effect is clearly identifiable. Kaustia finds that volume is lower if the stock price is below the offer price and if there is a sharp upsurge in volume when the stock price surpasses the offer price for the first time. Furthermore, there is also a significant increase in volume if the stock achieves new maximum and minimum stock prices, again suggesting evidence of reference price effects. Such studies have added to the common understanding of why people trade, but a calibration of a specific model that would deliver the magnitudes of volume observed appears desirable to build a complete understanding of trading activity.

One striking aspect about extant findings on the disposition effect is how robust it is across different types of markets. For example, Weber and Camerer (1998) carry out experiments specially designed to see if subjects would exhibit disposition effects. In their laboratory experiment, subjects bought and sold shares in six risky assets. Asset prices fluctuated in each period. Contrary to Bayesian optimization, subjects did tend to sell winners and keep losers. When the shares were automatically sold after each period, the disposition effect was greatly reduced.

Outside the experiment laboratory, Heath, Huddart, and Lang (1999) confirm the disposition effect in employee option exercising in the United States. Using data on over 50,000 employees at seven corporations, they find that employees' exercise of stock options is strongly linked to the stocks' past performance. Employee exercise activity roughly doubles when the stock price exceeds the maximum price attained during the previous year. In a separate study, Genesove and Mayer (2001)

find the same pattern among household transaction of condos in Boston. They show that condominium owners subject to nominal losses set higher asking prices of 25 to 35 percent of the difference between the property's expected selling price and their original purchase price, and are less successful in selling their listed properties than other sellers.

There are an increasing number of studies that show that the disposition effect is widespread among markets outside the United States. The following provides a review of only a few of them. In a comprehensive study of trading activity using a Finnish dataset, Grinblatt and Keloharju (2001b) confirm a disposition effect. They also show that there are reference price effects, in that individuals are more likely to sell if the stock price attains a prior month high. Feng and Seasholes (2005) and Chen, Kim, Nofsinger, and Rui (2007) find the disposition effect among their sample of individual investors from China, and Shapira and Venezia (2001) find the disposition effect among a representative sample of investors at the Tel-Aviv stock exchange

Despite the fact that the disposition effect is widely documented at the market level, Dhar and Zhu (2005) find that there are considerable variations in the disposition effect at the individual investor level. They analyze the trading records of a major discount brokerage house to investigate the disposition effect and try to explain the cross-sectional difference exhibited by distinct investors. Building on the findings in experimental economics and social psychology, the authors hypothesize that differences in investor literacy about financial markets and trading frequency are in part responsible for the variation in individual disposition effect. Using demographic and socioeconomic variables as proxies for investor literacy, the paper finds empirical evidence that wealthier individuals and individuals employed in professional occupations exhibit a lower disposition effect. Consistent with experimental economics, trading frequency also tends to reduce the disposition effect.

Another finding of Dhar and Zhu (2005) is that some investors in their sample display no disposition effect and even demonstrate opposite trading patterns to the disposition effect in many cases. Such findings should motivate future studies to take a closer look at causes other than the long-standing prospect theory explanation that could be behind the disposition effect,.

Barberis and Xiong (2009) analyze the trading behavior of investors with prospect theory preferences in a theoretical setup. At least for the simplest implementation of prospect theory, the authors find that the link between these preferences and the disposition effect is not as strong as previously speculated. They show that prospect theory sometimes predicts the opposite behavior as described by the disposition effect depending on the magnitude of the gains or losses and the frequency at which investors evaluate their performance. This new exploration of the prospect theory and disposition effect brings some new perspective and has the potential of stimulating even further studies around this topic.

Local Bias

Coval and Moskowtiz (1999) uncover how U.S. institutional investors favor geographically nearby companies in their investment process. Such findings suggest that the home bias in the literature of macroeconomics (the tendency to invest in

domestic vs. international equities) is not limited to the international context but is also prevalent among domestic investment choices.

Following Coval and Moskowitz's (1999) findings on institutional investors, Zhu (2005) and Ivkovich and Weisbenner (2005) separately study individual investor tendency to invest in stocks that are geographically nearby. Zhu focuses more on the trading activities by individual investors, while Ivkovich and Weisbenner mainly study individual portfolio holdings. Although both studies confirm the local bias by showing that individuals are more likely to invest in companies closer to their home, the authors disagree with respect to what drives the local bias. Ivkovich and Weisbenner show that the local portion of an individual investor's portfolio outperforms the nonlocal portion. In contrast, Zhu fails to find significant differences in purchase transactions regardless of the distance between individual investors and the headquarters of the invested companies.

A recent paper by Seasholes and Zhu (2008) points out that the inference that individual investors are informed in their local investments, which is based on portfolio positions in Ivkovich and Weisbenner (2005), is flawed because it fails to account for the contemporaneous correlation in the cross-section of stock returns and hence inflates the statistical significance of their results. More importantly, Seasholes and Zhu find that after properly adjusting for local benchmark, the local part of individuals' portfolio underperforms the nonlocal part, hence questioning the information hypothesis in Ivkovich and Weisbenner.

Similar to the increasing evidence of the disposition effect in global markets, international studies have also generated support for the local bias in individual investor trading. Grinblatt and Keloharju (2001a) find that investors are more likely to buy, sell, and hold the stocks of Finnish firms that are located close to the investor, communicate in the investor's native tongue, and have chief executives of the same cultural background. Such an effect is less prevalent among the more investment-savvy institutions than among both households and less savvy institutions. Feng and Seasholes (2004) confirm that investors are interested in investing in nearby companies with their sample of Chinese investors. Furthermore, they find that locality matters to individuals' trading decisions in a systematic way. The buy and sell transactions by investors from the same location exhibit striking similarities. Such findings emphasize how location matters to individual investor trading and how such correlated local trading may impact asset prices.

Learning over Time

Given the increasing evidence on behavioral biases in individual investor trading, reconciling such stylized facts and the mainstream rational paradigm in financial economics literature becomes important. Under the rational paradigm, agent rationality is a classic assumption that simplifies the decision-making processes associated with constrained optimization problems, allowing economic phenomena to be analyzed with mathematical models. An important justification for this assumption is that agents are not likely to systematically make mistakes. For instance, Sargent (1993) argues that the assumption of rational expectations does not disallow for forecasting errors, but only precludes the possibility that those errors will not persistently occur on one side. While the argument is certainly appealing, it is not necessarily substantiated.

In contrast, behavioral finance theories by Gervais and Odean (2001) and Daniel, Hirshleifer, and Subrahmanyam (2001) argue that investors, especially individual investors, learn in an asymmetrical way. That is, individuals tend to credit investment success to their own information or abilities and blame investment losses on luck. If such theories indeed depict how individuals learn throughout their investment tenure, it implies that most investors are overconfident and believe they are better investors than they truly are. If this phenomenon were to pervade at the market level, one would observe "puzzles" such as excessive trading and volatilities in the equity market.

Whether and how fast individual investors learn about their abilities hence becomes an important topic in the behavioral finance literature. Nicolosi, Peng, and Zhu (2009) empirically test whether individual investors learn about their stock selection ability from their own trading experience, and consequently whether they will adjust their trading behavior accordingly. The authors find that this is indeed the case. Individuals with better previous performance are more likely to increase their future trades than individuals with disappointing performance. Nicolosi et al. find that such evidence is stronger for individuals with overall better performance than for those with worse performance. In addition, they find that although individuals respond to both previous gains and losses, they are much more responsive to previous gains (by increasing their subsequent trading intensity) than to previous losses (by decreasing their subsequent trading intensity). Hence, the authors suggest that investor learning behavior is probably more complex than any single theoretical prediction, rational or biased. Instead, individual learning activities seem to be more consistent with bounded rationality.

Seru, Shumway, and Stoffman (2009) use a large sample of individual investor records over a nine-year period from Finland and analyze how the disposition effect and trading performance change over an individual investor's life cycle. An extra year of experience decreases the disposition effect of the median investor by about 4 percent, which accounts for about 5 percent of the increase in returns earned by these investors. By controlling for survival and unobserved individual heterogeneity, the authors show that investors in aggregate learn partly by attrition, but that learning at the individual level is also important. Another important finding is that unsophisticated investors and investors who trade more learn more quickly about their abilities, and that individual investors change their trading styles over time as they gain more trading experience and understanding about their own abilities.

IMPLICATIONS OF INDIVIDUAL INVESTOR TRADING

Individual Investor Trading and Asset Prices

Traditional economics and finance literature typically assumes that investors who trade without knowledge of fundamental information (i.e., the noise traders) do not have a material impact on asset prices or market stability, as they trade in a rather atomic way and the influences that they generate cancel each other, leaving no impact on the market.

Delong, Shleifer, Summers, and Waldmann (1990a, 1990b, 1991) propose a theoretical framework to show how noise traders—those who trade upon noises instead of information—can indeed have considerable impact on financial market and asset prices. One key feature of their framework is that the noise trading can accumulate and move asset prices far from the fundamental value (overshoot) for an extended period time. Such price movement may not have fundamental support at the beginning but has the potential of changing the fundamental investors' beliefs and consequently altering their subsequent decisions.

Nofsinger and Sias (1999) document a positive correlation between changes in institutional ownership and contemporaneous relationship. That is, stocks that experience positive (negative) change in institutional ownership generate positive (negative) excess returns. While such findings are open to many possibilities, they suggest that trading activities by one class of investors can certainly exert influences on stock prices.

Barber, Odean, and Zhu (2009) analyze trading records for 66,465 households at a large discount broker and 665,533 investors at a large retail broker and find that the trading by individuals is highly correlated and surprisingly persistent. This systematic trading by individual investors is not primarily driven by passive reactions to institutional herding, by systematic changes in risk-aversion, or by taxes. Psychological biases likely contribute to the correlated trading of individuals. Barber et al. also find that biases lead investors to systematically buy stocks with strong recent performance, to refrain from selling stocks held for a loss, and to be net buyers of stocks with unusually high trading volume.

The findings of Barber, Odean, and Zhu (2009) are of particular interest to the behavioral finance literature because they build a necessary condition for individual investors to influence asset price formation in financial markets. Observing that individual investors tend to commit the same kind of behavioral biases at or around the same time, such investors conceivably do not necessarily cancel each other's actions. Instead, the actions of individual investors have the potential of aggregating. If this is the case, individual investors cannot be treated merely as noise traders but more like a giant institution in terms of their potential impact on the markets.

Kumar and Lee (2006) find evidence supporting this conjecture. They use data from the same large discount brokerage firm and find that systematic retail trading explains return comovements for stocks with high retail concentration (i.e., small-cap, value, lower institutional ownership, and lower-priced stocks), especially if these stocks are also costly to arbitrage. Macroeconomic news and analyst earnings forecast revisions do not explain these results. Collectively, the findings support a role for investor sentiment in the formation of returns. In addition, the authors find evidence that individual investor trading activities are positively related to contemporaneous stock returns. That is, the stocks that individual investors heavily bought outperform those that individual investors heavily sold during the same period of individual investor actions. Such findings lend support to the idea that individual investors and their trading activities can influence asset prices.

Several recent studies take a closer look at the relationship between individual investor trading and future, instead of contemporaneous, stock returns. Kaniel, Saar, and Titman (2008) study the dynamic relation between net individual investor trading and short-horizon returns for a large cross-section of NYSE stocks.

They report that individuals tend to buy stocks following declines in the previous month and sell following price increases. In addition, the authors document positive excess returns in the month after intense buying by individuals and negative excess returns after individuals sell, which is distinct from the previous findings that past return or volume positively predict future returns. Kaniel et al. suggest that the study's findings are consistent with the notion that risk-averse individuals provide liquidity to meet institutional demand for immediacy.

The papers by Barber et al. (2009) and Hvidkjaer (2008) show that the imbalance in individual investor trading can indeed predict the cross-section of future stock returns over an extended period of time. Barber et al. investigate the relationship between individual investor trading activities using a large discount brokerage firm and also use market-level data from the Trade and Quotes (TAQ) and Institute for the Study of Security Markets (ISSM) transaction data over the period 1983 to 2001. The authors document striking similarity between the observed trading imbalance from the brokerage firm data and that of the small-sized trades at the market level from the TAQ/ISSM data. Such findings confirm previous conjecture that trade size is a reasonable proxy for the trading of individual investors.

Consistent with their earlier study, Barber et al. (2009) also find that the order imbalance based on TAQ/ISSM data indicates strong similarity among individual trading. Individual investors predominantly buy (sell) the same stocks as each other at the same time. In addition, individual investors predominantly buy (sell) the same stocks one week (month) as they did the previous week (month). More importantly, the authors documents that the imbalance between purchases and sales of each stock by individual investors *positively* forecasts cross-sectional stock returns the subsequent week or month, but *negatively* forecasts cross-sectional stock returns over longer periods, such as a year. Such results are particularly strong among stocks that are actively traded by individual investors and those that are difficult to arbitrage. The authors argue that their findings are closely related to the literature of noise trading framework.

In another related paper, Hvidkjaer (2008) documents the same pattern between individual trade imbalances and future stock returns in the cross-section. Furthermore, Hvidkjaer provides evidence that the predictability of individual trade imbalance is very robust independent of various horizons in evaluating small-trade imbalance and the predictability can last up to three years among small stocks and stocks with dominating small-sized trades.

Welfare Evaluation of Individual Investor Trading

Trading Losses and Costs

In addition to their influence on asset pricing, scholars and regulators are also interested in the welfare implications of individual investor trading. Questions such as whether individual investors obtain (abnormal) returns or should engage in active trading have received increasing attention.

Extant evidence suggests that individual trading seems to hurt the individual's financial wealth. Most existing studies fail to find evidence that individuals obtain excess returns than simply following buy-and-hold strategies of index funds. Consistent with several other papers relying on the same data source, Coval, Hirshleifer, and Shumway (2005) find that about 5 percent of individual investors

manage to obtain abnormal returns over a market index when risk exposures are properly controlled. Put a different way, the majority of individual investors cannot beat the market.

Using the same data, Barber and Odean (2001) conclude that trading activities pose significant costs to individual investors who invest in common stocks. They find that their sample investors from a large U.S. discount brokerage firm obtain lower net returns if they trade more. Specifically, the highest trading investors earn an annual return of 11.4 percent, compared to the market return of 17.9 percent. Their finding that individual investors who trade more obtain lower net returns carries an important message for regulators and brokerage firms regarding the merits of encouraging individual trading. Of particular importance is that trading commissions and transactions costs have decreased considerably since their study, largely due to technological development and increasing competition. Nevertheless, the key message of the study is that individual investors are overconfident about their own investment skills and consequently trade upon noise as opposed to true information, resulting in unprofitable trades and wasted transaction costs.

Using a complete trading history of all investors in Taiwan, Barber, Dean, and Zhu (2007) find that individual investor trading activities are not well founded and do not achieve particularly impressive returns. They show that the aggregate portfolio of individuals suffers an annual performance penalty of 3.8 percentage points. Individual investor losses are equivalent to 2.2 percent of Taiwan's gross domestic product or 2.8 percent of the total personal income. Interestingly, they find that the trades hurting individual investors the most are those about which individual investors are most aggressive. In contrast, institutions enjoy an annual performance boost of 1.5 percentage points and both the aggressive and passive trades of institutions are profitable. This study not only puts a number to the considerable losses that individual investors face at the national level, but also provides a few specific clues (such as behavioral biases and demand for liquidity) as to why individuals obtain such disappointing performance.

Related to Barber et al. (2007), Grinblatt and Keloharju (2000) conduct an important investigation regarding what motivates different types of investors to trade. Using a unique dataset from Finland that comprehensively covers all types of investors in the market, the study analyzes how past returns determine the propensity to buy and sell for different investor classes and investors of different sophistication. The authors find that foreign investors tend to be momentum investors, buying past winning stocks and selling past losers. Domestic investors, especially individual investors, tend to behave in the opposite manner, buying past losing stocks and selling past winning stocks. Consistent with Barber et al., Grinblatt and Keloharju find that the portfolios of foreign investors seem to outperform the portfolios of individual investors even after controlling for behavior differences. Putting the above evidence from U.S. and foreign financial markets together, the extant research confirms that individual trading hurts individual investors' financial well-being.

Individual Trading and Cost of Time

Researchers have not fully investigated one aspect of costs related to individual investor trading. In addition to the costs that individuals pay to execute their

trades, they have to spend time conducting research for their trading activities. Despite the findings that individuals do not necessarily carefully process relevant information before trading, they probably spend time attempting to glean useful information *ex ante*. Individual households could reasonably substitute the time that they spend on research and trading for some other valuable activities in life such as career development and family responsibilities.

Zhu (2007) studies this topic by looking at the adoption of mutual fund investment by households with different levels of cost of their time. The study draws similar conclusions from two distinct sources, the Survey of Consumer Finances (SCF) and data on portfolio choice and trading from a large discount brokerage firm. With the SCF data, Zhu finds that households with higher cost of time are both more likely to invest in mutual funds and to invest a greater fraction of their portfolios through mutual funds. Households with greater professional engagement invest a higher fraction of their portfolios in mutual funds. Ceteris paribus, a household making $10,000 more in annual income or a household head working in a professional occupation invests 7 and 9 percent more in mutual funds. Because such investors have greater professional responsibilities and a busier schedule, the findings support Zhu's hypothesis that households with greater cost of time are less likely to engage in direct stock trading.

Also consistent with this hypothesis, Zhu (2007) finds that households in which the household head is married or lives with a spouse/partner, or owns their primary residences, invest 6 and 15 percent more respectively in mutual funds among all equity investments. Such households are busier with domestic activities and hence have less time for direct investment. This finding lends support to the hypothesis that investors with higher shadow cost of time (i.e., busier households because of job responsibilities or family activities) are more likely to invest in mutual funds.

Finally, Zhu (2007) finds that households that have more/less leisure time tend to invest less/more in mutual funds. Households in which household heads are retired invest 19 percent less in mutual funds, while households in which both adults are full-time employed invest 12 percent more, providing further evidence that the cost of time influences household choice between direct and indirect investment in equities.

The analyses using data from a large discount brokerage firm confirm the findings from the Survey of Consumer Finances. In addition, such supplemental analyses confirm that households with higher costs of time are indeed less likely to trade common equities and turn over their portfolios less frequently.

SUMMARY AND CONCLUSIONS

This chapter summarizes extant research on individual investor trading activities. As the chapter suggests, rational theory cannot easily explain a large portion of individual investor trading activities.

Individual behavioral patterns, on the other hand, seem to provide more probable explanations for many findings of individual investor trading. Although many trading patterns of individuals seem to jeopardize their financial well-being, some studies such as Calvet, Campbell, and Sodini (2007) suggest that the overall welfare loss from individuals' behavioral biases may indeed be limited. Although the

question of whether individuals suffer considerably from their trading activity remains open, more studies seem to confirm that their trading activities carry important weight to asset price formation. Therefore, unlike the traditional wisdom that assumes individual investors to be insignificant noise traders, future studies in finance and economics have to take individual investors more seriously and devote more attention to individual investors' trading activities.

DISCUSSION QUESTIONS

1. List and explain the major puzzles related to individual investor trading.
2. Discuss the major psychological reasons for biases in individual investor trading.
3. Explain whether individual investors can beat the market in their trading.
4. Identify and discuss the costs to individual investor trading.

REFERENCES

Aumann, Robert. J. 1976. Agreeing to disagree. *Annals of Statistics* 4:6, 1236–9.

Barber, Brad M., Yi-Tsung Lee, Yu-Jane Liu, and Terrance Odean. 2009. Who loses from trade? Evidence from Taiwan. *Review of Financial Studies* 22:2, 609–32.

Barber, Brad M., and Terrance Odean. 2000. Trading is hazardous to your wealth: The common stock investment performance of individual investors. *Journal of Finance* 55:2, 773–806.

Barber, Brad M., and Terrance Odean. 2001. Boys will be boys: Gender, overconfidence, and common stock investment. *Quarterly Journal of Economics* 116:1, 261–92.

Barber, Brad M., and Terrence Odean. 2002. Online investors: Do the slow die first? *Review of Financial Studies* 15:2, 455–87.

Barber, Brad M., and Terrance Odean. 2004. Are individual investors tax savvy? Evidence from retail and discount brokerage accounts. *Journal of Public Economics* 88:1-2, 419–42.

Barber, Brad M., and Terrance Odean. 2008. All that glitters: The effect of attention and news on the buying behavior of individual and institutional investors. *Review of Financial Studies* 21:2, 785–818.

Barber, Brad M., Terrance Odean, and Ning Zhu. 2007. Systematic noise. *Journal of Financial Markets*, forthcoming.

Barber, Brad M., Terrance Odean, and Ning Zhu. 2009. Do retail trades move the market? *Review of Financial Studies* 22:1, 151–86.

Barberis, Nicholas, and Wei Xiong. 2009. What drives the disposition effect? An analysis of a long-standing preference-based explanation. *Journal of Finance* 64:2, 751–84.

Calvet, Laurent, John Campbell, and Paolo Sodini. 2007. Down or out: Assessing the welfare cost of household investment mistakes. *Journal of Political Economy* 115:5, 707–47.

Chen, Gong-meng, Kenneth Kim, John Nofsinger, and Oliver Rui. 2007. Trading performance, disposition effect, overconfidence, representativeness bias, and experience of emerging market investors. *Journal of Behavioral Decision Making* 20:4, 425–51.

Coval, Joshua, and Tobias J. Moskowitz. 1999. Home bias at home. *Journal of Finance*, 54:6, 2045–73.

Coval, Joshua, David Hirshleifer, and Tyler Shumway. 2005. Can individual investors beat the market? Working Paper, Harvard University.

Daniel, Kent D., David Hirshleifer, and Avanidhar Subrahmanyam. 1998. Investor psychology and security market under- and over-reactions. *Journal of Finance* 53:6, 1839–86.

Daniel, Kent D., David Hirshleifer, and Avanidhar Subrahmanyam. 2001. Overconfidence, arbitrage, and equilibrium asset pricing. *Journal of Finance* 56:3, 921–65.

DeLong, J. Bradford, Andrei Shleifer, Lawrence H. Summers, and Robert J. Waldmann. 1990a. Noise trader risk in financial markets. *Journal of Political Economy* 98:4, 703–38.

DeLong, J. Bradford, Andrei Shleifer, Lawrence Summers, and Robert J. Waldmann. 1990b. Positive feedback investment strategies and destabilizing rational speculation. *Journal of Finance* 45:2, 375–95.

DeLong, J. Bradford, Andrei Shleifer, Lawrence Summers, and Robert J. Waldmann. 1991. The survival of noise traders in financial markets. *Journal of Business* 64:1, 1–20.

Dhar, Ravi, William Goetzmann, Shane Shepherd, and Ning Zhu. 2005. The impact of clientele change: Evidence from stock splits. Working Paper, Yale University and University of California.

Dhar, Ravi, and Ning Zhu. 2005. Up close and personal: An individual level analysis of the disposition effect. *Management Science* 52:5, 726–40.

Feng, Lei, and Mark Seasholes. 2004. Correlated trading and location. *Journal of Finance* 59:5, 2117–44.

Feng, Lei, and Mark Seasholes. 2005. Do investor sophistication and trading experience eliminate behavioral biases in finance markets? *Review of Finance* 9:3, 305–51.

Genesove, David, and Chris Mayer. 2001. Loss aversion and seller behavior: Evidence from the housing market. *Quarterly Journal of Economics* 116:4, 1233–60.

Gervais, Simon, and Terrance Odean. 2001. Learning to be overconfident. *Review of Financial Studies* 14:1, 1–27.

Grinblatt, Mark, and Matti Keloharju. 2000. The investment behavior and performance of various investor types: A study of Finland's unique data. *Journal of Financial Economics* 55:1, 43–67.

Grinblatt, Mark, and Matti Keloharju. 2001a. How distance, language, and culture influence stockholdings and trades. *Journal of Finance* 56:3, 1053–73.

Grinblatt, Mark, and Matti Keloharju. 2001b. What makes investors trade? *Journal of Finance* 56:2, 589–616.

Grinblatt, Mark, and Matti Keloharju. 2004. Tax-loss trading and wash sales. *Journal of Financial Economics* 71:1, 51–76.

Grinblatt, Mark, and Matti Keloharju. 2009. Sensation seeking, overconfidence, and trading activities. *Journal of Finance* 64:2, 549–78.

Grossman, Stanford, and Joseph Stiglitz. 1980. On the impossibility of informationally efficient markets. *American Economic Review* 70:3, 393–408.

Heath, Chip, Steven Huddart, and Mark Lang. 1999. Psychological factors and stock option exercise. *Quarterly Journal of Economics* 114:2, 601–27.

Hong, Harrison, Jeffrey Kurbik, and Jeremy Stein. 2004. Social interaction and stock market participation. *Journal of Finance* 54:1, 137–63.

Hvidkjaer, Soeren. 2008. Small trades and the cross-section of stock returns. *Review of Financial Studies* 21:3, 1123–51.

Ivkovich, Zoran, and Scott J. Weisbenner. 2005. Local does as local is: Information content of the geography of individual investors' common stock investments. *Journal of Finance* 60:1, 267–306.

Kaniel, Ron, Gideon Saar, and Sheridan Titman. 2008. Individual investor trading and stock returns. *Journal of Finance* 63:1, 273–310.

Kaustia, Markku. 2004. Market-wide impact of the disposition effect: Evidence from IPO trading volume. *Journal of Financial Markets* 7:2, 207–35.

Kumar, Alok, and Charles M. C. Lee. 2006. Retail investor sentiment and return comovements. *Journal of Finance* 61:5, 2451–86.

Milgrom, Paul, and Nancy Stokey. 1982. Information, trade, and common knowledge. *Journal of Economic Theory* 26:1, 17–27.

Modigliani, Franco, and Richard Brumberg. 1963. The "life cycle" hypothesis of saving: Aggregate implications and tests. *American Economic Review* 53:1, 55–84.

Nicolosi, Gina, Liang Peng, and Ning Zhu. 2009. Do individual investors learn from their trading experience? *Journal of Financial Markets* 12:2, 317–36.
Nofsinger, John. 2007. *The psychology of investing* (3rd ed.). New York: Prentice Hall.
Nofsinger, John, and Richard Sias. 1999. Herding and feedback trading by institutional and individual investors. *Journal of Finance* 54:6 2263–95.
Odean, Terrance. 1998a. Are investors reluctant to realize their losses? *Journal of Finance* 53:5, 1775–98.
Odean, Terrance. 1998b. Volume, volatility, price, and profit when all traders are above average. *Journal of Finance* 53:6, 1887–934.
Odean, Terrance. 1999. Do investors trade too much? *American Economic Review* 89:5, 1279–98.
Rashes, Michael. 2001. Massively confused investors making conspicuously ignorant choices (MCI-MCIC). *Journal of Finance* 56:5, 1911–27.
Sargent, Thomas. 1993. *Bounded rationality in macroeconomics*. New York: Oxford University Press.
Seasholes, Mark, and Ning Zhu. 2008. Is there information in the local portfolio choices of individuals? Working Paper, University of California.
Seru, Amit, Tyler Shumway, and Noah Stoffman. 2009. Learning by trading. *Review of Finance Studies*, forthcoming.
Shapira, Zur, and Itzhak Venezia. 2001. Patterns of behavior of professionally managed and independent investors. *Journal of Banking and Finance* 25:8, 1573–87.
Shefrin, Hersh, and Meir Statman. 1984. The disposition to sell winners too early and ride losers too long: Theory and evidence. *Journal of Finance* 40:3, 777–90.
Weber, Martin, and Colin Camerer. 1998. The disposition effect in securities trading: An experimental analysis. *Journal of Economic Behavior and Organization* 33:2, 167–84.
Zhu, Ning. 2005. The local bias of individual investors. Working Paper, University of California, Davis.
Zhu, Ning. 2007. Search costs and household choice between direct and delegated portfolio management. Working Paper, University of California, Davis.

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CHAPTER 29

Individual Investor Portfolios

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INTRODUCTION

Modern portfolio theory traces its origin to Markowitz (1952a) and is founded on the assumption that an investor's objective is described by the expected utility (EU) function. This assumption has strong normative implications for optimal portfolios with two principal results standing out. The first result, known as the portfolio separation theorem, asserts that all investors select the same well-diversified risky portfolio and choose the total optimal portfolio between this risky portfolio and the risk-free asset according to the investor's risk tolerance. The second result is that regardless of risk aversion, an investor should always hold some investment in the optimal risky portfolio as long as it has a positive expected risk premium. These two principles have shaped the research and practice of portfolio choice finance. Financial advisors routinely suggest diversification within and across asset classes, and diversification provides a theoretical basis for the existence of the mutual funds industry. The majority of academic research assumes optimality of diversification and focuses on the asset allocation decisions across portfolios representing different asset classes.

This chapter has two objectives. The first objective is to present empirical evidence that many individual investors do not conform with the above two normative prescriptions. Based on the Survey of Consumer Finances, the chapter documents that numerous households do not participate in the stock market, including some investors who have substantial savings. Furthermore, many investors are not fully diversified and hold a mixture of diversified equity funds and substantial investments in only a few different stocks. The evidence presented shows that these deviations are widespread and persistent, and imply significant efficiency loss or irrational bias in the context of the standard model. An argument is made that these deviations cannot be solely a result of mistakes or biases.

The second objective is to demonstrate that the observed portfolios are consistent with optimal choice under the alternative assumptions about the objective function. Rank-dependent expected utility (RDEU) (Quiggin, 1982; Yaari, 1987) and cumulative prospect theory (CPT) (Tversky and Kahneman, 1992) are used to demonstrate that optimal portfolio choice under these utilities is consistent with empirical observations for reasonable parameterizations of the models. Researchers designed these utility functions to explain behavior observed in

laboratory experiments inconsistent with EU. Explaining portfolio choice with these utility models provides important nonexperimental support and suggests that the choice patterns observed in the labs extend to real-life financial decisions.

Many empirical studies document deviations of individual portfolios from standard normative prescriptions. Blume and Friend (1975) were probably the first to highlight portfolio concentration, followed by Kelly (1995) and more recently by Goetzmann and Kumar (2008). These studies show that the typical individual equity portfolio is invested in stocks of one to three different companies. In addition, Polkovnichenko (2005) shows the co-existence of diversified and undiversified segments in portfolios of many households and the persistence of poor diversification over time. A study of Swedish data by Calvet, Campbell, and Sodini (2007) corroborates the main results for the United States, although Swedish households have somewhat better diversification and wider participation in equity markets as compared to their U.S. peers.

To explain undiversified portfolios, most papers in the existing literature take one of two routes. The first is to appeal to various psychological biases such as familiarity or overconfidence. The second is to introduce informational costs or other constraints. For example, Benartzi and Thaler (2001) and Choi, Laibson, Madrian, and Metrick (2006) argue in favor of implicit investment advice in the investment options offered in retirement plans. Huberman (2001) and Grinblatt and Keloharju (2001) provide support for familiarity bias. Odean (1999), Barber and Odean (2001), and Goetzmann and Kumar (2008) argue that portfolio choice observed in brokerage accounts is consistent with overconfidence. Merton (1987) presents a model with information collection costs, where investors are unaware of some of the investment options and thus fail to diversify properly. While biases may influence portfolio decisions in some circumstances, quantitatively evaluating this effect is difficult. An advantage of the preference-based approach presented in this chapter is that it offers testable quantitative predictions.

Two recent papers undertake a new approach to show that in the presence of leverage restrictions, the portfolio separation theorem may break down. Liu (2008) demonstrates that when investors are required to maintain consumption above a certain level, a multilayer optimal portfolio is implied. The first layer consists of a riskless security that ensures minimum consumption. Then, an investor allocates the remaining funds until reaching a certain threshold in a risky asset with the highest expected return. As wealth gets higher, the investor adds more risky assets with lower expected returns, and portfolios may gradually become more diversified. This portfolio structure emerges as under the EU, the expected return has a first-order effect on utility while risk (variance) has only a second-order effect. The leverage restriction implies that if one cannot use the efficient portfolio to achieve a desired level of expected return, holding an undiversified asset with a higher expected return may be beneficial to the investor.

In another paper, Roche, Tompaides, and Yang (2009) consider the role of human wealth. They show that when investors cannot borrow against human capital and invest efficiently, they may tilt portfolios toward the asset with the highest expected return, as the bulk of the total wealth is constrained to earn a relatively low expected return. Despite different motivations, both Liu (2008) and Roche et al. highlight a conceptually similar and important tradeoff. When part of the total wealth is constrained in a low-return asset and leverage is restricted, the

investor may sacrifice portfolio efficiency for a higher expected return. A limitation of the leverage restriction explanation of under-diversification is that it cannot explain the widely observed co-existence of diversified and undiversified segments in individual portfolios.

Limited stock market participation has also received considerable attention in empirical and theoretical literature. Mankiw and Zeldes (1991) were the first to document that less than 25 percent of the U.S. population invested in stocks in 1989, far from the 100 percent assumed in standard economic theory. They also evaluated the impact of limited participation on the equity premium. Subsequently, a large literature explored the reasons behind limited stock market participation and the implications for portfolio selection, savings, and aggregate economic activity. One frequent tactic in this literature is to introduce a fixed cost of stock market participation. To explain nonparticipation, the required one-time cost is found to be roughly 5 percent of the annual household income (Gomes and Michaelides, 2005; Paiella, 2007). This cost can explain nonparticipation in the case of most poor households but not of wealthy ones. A preference-based explanation, on the other hand, applies equally to poor and wealthy households. When a utility function has a property of the first-order risk aversion, it implies that an individual may avoid risky investments with positive risk premium (Segal and Spivak, 1990). Several authors recently introduced first-order risk aversion in portfolio selection problems. For example, Ang, Bekaert, and Liu (2005) use the disappointment aversion utility (Gul, 1991), and Epstein and Schneider (2007) use the recursive multiple-prior utility (Epstein and Schneider, 2003). These first-order risk averse utilities, in general, do not imply undiversified portfolios. On the other hand, the utility functions with rank-dependent decision weights are also first-order risk averse and have the ability to rationalize both diversification and limited stock market participation under different parameterizations.

The theoretical literature on the co-existence of risk averse and risk-taking behavior traces its origins to Friedman and Savage (1948). They introduced a convex segment in the utility function to explain joint demand for insurance and gambling. Following their paper, other authors also proposed non-axiomatic utilities to accommodate variation in risk attitude; for example, Roy's (1952) safety-first theory and Markowitz's (1952b) customary wealth theory. Subsequent research by Telser (1955), Pyle and Turnovsky (1970), Arzac (1974), Bawa (1978), and Arzac and Bawa (1977) explores the applications of these theories to portfolio selection. Benartzi and Thaler (1995), Barberis and Hung (2001), Barberis, Huang, and Santos (2001), and Gomes (2005) applied prospect theory in portfolio choice and asset pricing. For tractability reasons, rank-dependent probability weighting is not considered by these authors. Barberis and Huang (2008) and Levy and Levy (2004) analyze static equilibrium models with full-featured cumulative prospect theory. Shefrin and Statman (2000) develop a behavioral portfolio theory by combining Roy's safety-first theory and rank-dependent decision weights. Polkovnichenko (2005) first explored the application of RDEU and prospect theory for portfolio choice outlined in this chapter. Chapman and Polkovnichenko (2009) analyze the interaction of agents with heterogeneous preferences in general equilibrium, using a number of first-order risk averse utilities, including RDEU. Epstein and Zin (1990) apply RDEU in a dynamic model with a representative consumer to address the equity premium puzzle.

The remainder of the chapter consists of the following four sections. The first section provides a review of empirical evidence on diversification and participation. The second section evaluates welfare losses and biases implied by the observed portfolios under the standard assumptions. The third section presents simulations of optimal portfolio choice with rank-dependent utilities. The last section concludes with a review of future challenges for research on individual portfolio choice.

STOCK MARKET PARTICIPATION AND PORTFOLIO DIVERSIFICATION: EMPIRICAL EVIDENCE

Limited stock market participation and under-diversification of equity portfolios are among the most commonly observed patterns in individual portfolios. Many low-cost financial products allow individuals to invest in the stock market and make diversification accessible even to an unsophisticated investor. Despite this, the data on individual portfolios routinely show that these phenomena persist across time periods, countries, and different datasets. To demonstrate the relevant stylized facts, this chapter considers the most recent data available for the United States, which comes from the 2004 Survey of Consumer Finances (SCF) available from the Board of Governors of the Federal Reserve. Two previous SCF datasets from 1998 and 2001 complement this survey.

To present the data, households are divided into four groups by the amount of liquid financial assets *FA*. The financial assets include checking, savings, money market accounts, CDs, publicly traded equities, mutual funds, bonds (government and corporate), annuities and trusts, and pension assets in accounts, which permit either withdrawal and/or use of the assets as collateral. The groups' thresholds are defined as follows: (1) $\$0 < FA \leq \$10{,}000$; (2) $\$10{,}000 < FA \leq \$100{,}000$; (3) $\$100{,}000 < FA \leq \$1$ million; (4) $FA > \$1$ million. In addition to wealth cohorts, households are classified as stockholders if they have equity investments through mutual funds and pension plans or own stocks directly. The direct stockholders are a subset of stockholders who own stocks of individual companies. Exhibit 29.1 shows median values of liquid financial assets held by stockholders and non-stockholders in each wealth group. Stockholders, on average, accumulate considerably more financial assets, except in the most wealthy group. The difference in financial assets across stockholders and non-stockholders is more pronounced for the less wealthy groups.

The fraction of the population holding equities either directly or through mutual funds and pension plans has been steadily growing. After the collapse of the technology bubble in 2001–2002, there has been some reduction of stock market participation, primarily among the least wealthy group. This change may be attributed to portfolio liquidations during a recession or to portfolio rebalancing. Interestingly, the fraction of direct stockholders in the population declined by less than the overall fraction of stockholders, which may be attributed to higher risk tolerance among direct stockholders.

Two important observations can be inferred from Exhibit 29.1. The first is that limited stock market participation is consistently observed among all wealth groups. Textbook portfolio models imply that all individuals, regardless of risk

Exhibit 29.1 Financial Wealth and Distribution of Households by Stockholding Status

Note: A household is classified as a stockholder if it owns equity directly in mutual funds, pension plans, or IRAs.

	Financial Assets (Medians, $)		Households (% of population)		
SCF year and cohort	**Non-stockholders**	**Stockholders**	**All**	**Stockholders**	**Direct Stockholders**
1998					
$0 < FA ≤ $10K	776	4,212	41.9	10.1	1.9
$10K < FA ≤ $100K	25,868	34,294	33.5	24.0	8.1
$100K < FA ≤ $1M	243,754	288,543	14.6	13.3	8.1
$1M < FA	1,752,793	1,865,099	1.4	1.4	1.2
All	1,656	41,463	91.4	48.9	19.2
2001					
$0 < FA ≤ $10K	1,200	6,000	41.4	11.1	2.4
$10K < FA ≤ $100K	36,500	53,200	31.8	23.1	7.5
$100K < FA ≤ $1M	271,000	327,800	17.5	16.0	9.9
$1M < FA	4,056,200	2,787,000	1.7	1.7	1.4
All	1,490	69,650	92.4	52.0	21.2
2004					
$0 < FA ≤ $10K	1,100	6,800	43.1	9.4	2.0
$10K < FA ≤ $100K	38,000	60,330	30.3	23.0	8.0
$100K < FA ≤ $1M	224,500	352,000	17.4	16.2	9.4
$1M < FA	5,265,000	2,861,000	1.7	1.6	1.2
All	1,200	84,500	92.6	50.3	20.7

Source: Data from the Survey of Consumer Finances.

aversion, should maintain some exposure to risky assets with positive risk premium. Therefore, explaining limited participation requires assuming a fixed cost from information collection or other frictions (see, for example, Gomes and Michaelides, 2005; Paiella, 2007). However, the data suggest that this explanation is incomplete. While most non-stockholders are concentrated among the poor, there is a sizable and stable group of wealthy households who avoid equities. Most households in higher wealth brackets already have established investment accounts in financial institutions, and for these households the cost of reallocation of a portfolio to equities is negligible. Thus, this behavior appears anomalous even when assuming above-average risk aversion and some participation costs. On the other hand, portfolio models based on preferences with first-order risk aversion can account for this behavior.

Another observation from Exhibit 29.1 is that in each wealth cohort there are numerous households investing directly in individual stocks. In the past, high mutual fund fees and transaction costs could have justified investing directly in an under-diversified portfolio. However, some index exchange traded funds (ETFs) that appeared in the past two decades have expense ratios under 20 basis points (and even under 10 basis points), making an unconvincing case for holding individual stocks solely due to mutual fund expenses. Despite the proliferation of these

financial products allowing for a high level of diversification, the fraction of households buying stocks directly remains steady over time. This behavior is contrary to the standard normative prescription that investors should allocate wealth across a well-diversified risky portfolio and a riskless security according to individual risk tolerance. While some portfolio inefficiency can be due to the cost of attaining a diversified portfolio, the persistence of under-diversification over time suggests that this explanation is incomplete. An important related issue is the significance of allocations to direct equity, both within the portfolios of risky securities and in overall financial assets.

The SCF data provide the total values of directly held stocks in household portfolios, without breaking down allocations across each stock, and reports the number of different companies in which the household owns stock directly. Exhibit 29.2 shows the fractions of directly held stocks relative to total equity and to financial assets. If a household does not own stocks directly, these fractions are set to a missing value and are not reported in the summary statistics. This is done to avoid masking the extent of under-diversification among direct equity investors. Direct equity is a substantial portion of equity portfolios and overall financial assets. The median fractions of directly held equity range from 26 percent to 100 percent of an equity portfolio and from 12 percent to 34 percent of total financial assets. These fractions declined across all wealth groups between 2001 and 2004 due to the stock market decline during this period. With the exception of the most wealthy cohort, typical direct equity portfolios are allocated across one to four different companies. While the SCF data limitations do not allow construction of detailed portfolio concentration measures, the observations from other datasets for households with brokerage accounts suggest that direct equity portfolio concentration can be substantial (Goetzmann and Kumar, 2008; Kumar, 2009).

An interesting observation from Exhibit 29.2 is that directly held equity is often combined with diversified investments in funds. This pattern is inconsistent with classical portfolio theory, at least under the assumptions that households, on average, correctly evaluate the expected returns and risk of individual stocks. Under some alternative assumptions, however, investors may directly hold stocks because they are biased or overconfident and think erroneously that directly held portfolios have substantial "alpha." While this is certainly a possibility, the biases have to be large in order to generate the observed portfolios, to be persistent over time, and to be impervious to learning to survive market downturns. There is also empirical evidence that something other than biases and ignorance (mistakes) may be behind the decisions to hold stocks directly.

Polkovnichenko (2005) investigates how several demographic factors, wealth, and risk attitude affect direct equity allocations. The results, consistent across all waves of the SCF data, strongly suggest that households recognize the higher risk of directly owned stocks and knowingly invest in them. This evidence points toward a preference-based explanation of the observed behavior. One other interesting observation related to portfolio allocations in direct equity is that the portfolio fraction of direct equity is non-monotone in wealth. The median fraction of directly held equity (both in equity portfolio and in total financial wealth) is the highest for the least wealthy group; it declines for cohorts with financial assets under

Exhibit 29.2 Equities in Household Portfolios

Note: This table reports median values. Financial assets and cohort subdivision are defined in the text. The medians are computed conditional on owning a nonzero amount of a particular type of equity, direct or indirect.

	Direct Investor Portfolios		Equity Relative to Financial Assets		
SCF Year and Cohort	**Direct Fraction in All Equity**	**Number of stocks**	**All Equity**	**Indirect**	**Direct**
1998					
$0 < FA \leq $10K	1.00	1	0.45	0.43	0.33
$10K < FA \leq $100K	0.50	2	0.54	0.47	0.19
$100K < FA \leq $1M	0.39	4	0.60	0.44	0.18
$1M < FA	0.51	15	0.70	0.39	0.33
All	0.49	2	0.53	0.46	0.21
2001					
$0 < FA \leq $10K	1.00	1	0.46	0.43	0.34
$10K < FA \leq $100K	0.41	2	0.54	0.49	0.17
$100K < FA \leq $1M	0.29	4	0.66	0.49	0.15
$1M < FA	0.50	14	0.70	0.33	0.26
All	0.40	3	0.57	0.48	0.18
2004					
$0 < FA \leq $10K	1.00	1	0.42	0.37	0.33
$10K < FA \leq $100K	0.38	2	0.47	0.42	0.13
$100K < FA \leq $1M	0.26	4	0.55	0.43	0.12
$1M < FA	0.46	15	0.59	0.34	0.22
All	0.37	3	0.49	0.42	0.14

Source: Data from the Survey of Consumer Finances.

$1 million and rises afterward. This pattern is persistent over time and is present in all earlier SCF data as well.

HOW LARGE ARE THE OBSERVED INEFFICIENCIES IN PORTFOLIO DIVERSIFICATION?

This section quantifies the inefficiency in diversification using the standard portfolio model. Two dimensions are considered to measure the extent of deviations. First, mean-variance analysis is used to quantify certainty equivalent loss due to portfolio inefficiency and investigate how this loss is distributed across households. Second, the deviations from rational belief assumptions are evaluated, which can potentially deliver the observed portfolio allocations. The evidence shows large portfolio inefficiencies from the perspective of the standard model, and significant biases are required to induce inefficient portfolio allocation. Based on this analysis and existing empirical evidence, the conclusion is that investment mistakes due to ignorance or biases are unlikely to account for the persistent under-diversification in the data.

Mean-Variance Metric

In the standard mean-variance setting, undiversified portfolios are inefficient and carry a welfare cost. Using simulations, Brennan and Torous (1999) show that this cost may be significant and that it is much larger than the loss associated with suboptimal asset allocation. Meulbroek (2005) also shows that investing in employer stock in 401(k) plans is associated with substantial portfolio efficiency and welfare losses. Calvet et al. (2007) investigate welfare loss using Swedish data and find that the losses range from negligible to substantial, both in terms of percentage loss and absolute dollar loss.

To quantify the loss from suboptimal diversification, consider an investor who divides wealth between risky assets and a risk-free asset to maximize the standard mean-variance preferences. The investor's indifference curves are given by

$$r_{CE} = Er - \frac{\gamma}{2}\sigma_r^2$$

where r_{CE} is the certainty equivalent return, γ is the coefficient of risk aversion, Er is the expected return on total portfolio, and σ_r^2 is the variance of this return. If the investor's risky portfolio R is inefficient and an efficient portfolio D with a higher Sharpe ratio is available, the switch from the optimal portfolio using R to the one using D results in the increase of the certainty equivalent given by:

$$\Delta r_{CE} = \frac{\alpha_R \sigma_R}{2S_R}[S_D^2 - S_R^2] \tag{29.1}$$

where α_R is the observed fraction of the total portfolio invested in the risky portfolio R, σ_R is the standard deviation of the risky portfolio, and S_R and S_D are the Sharpe ratios of the risky and diversified efficient portfolios respectively. This certainty equivalent loss is given in percentage of the total wealth, but it can also be expressed relative to the equity portion only as

$$\Delta r_{CEE} = \Delta r_{CE}/\alpha_R$$

Note that Δr_{CEE} measures a hypothetical equity fund expense ratio that would be equivalent to the efficiency loss. Both measures are computed from the 2004 SCF data under some imputation assumptions.

The diversified equity is assumed to have the expected return of $Er_m = 8\%$ and the standard deviation of return $\sigma_m = 18\%$ per year, approximately the same as a broad U.S. market index. The non-equity part of the portfolios is assumed to earn the risk-free rate $r_f = 1\%$. Individual stocks are assumed to have the same expected return as diversified investments but with the standard deviation $\sigma_s = 45\%$ per year. The covariances of any individual stock with any other stock and with the diversified equities held through funds are assumed to be the same and equal to $\sigma_m^2 = 0.0324$. Another assumption is that directly held equities, except the employer stock, are equally weighted. The portfolio weights for the employer stock are computed from the actual stock values reported in the data. The results are

Exhibit 29.3 Imputed Welfare Costs of Suboptimal Diversification

Note: Estimates are based on a mean-variance framework. Imputation assumptions are discussed in the text. Δr_{CE} and Δr_{CEE} are the certainty equivalent return gains from diversification as a percent of the total financial assets and the equity portfolio, respectively. Dollar loss is computed by multiplying Δr_{CE} by the value of household financial assets.

	Δr_{CE} Percentile			Δr_{CEE} Percentile			Dollar Loss Percentile		
Financial Assets	**25**	**50**	**75**	**25**	**50**	**75**	**25**	**50**	**75**
\$0 < FA ≤ \$10K	1.04	2.73	7.20	3.80	9.19	18.38	55	143	368
\$10K < FA ≤ \$100K	0.05	0.44	2.01	0.15	1.31	5.67	36	301	1057
\$100K < FA ≤ \$1M	0.02	0.11	0.45	0.03	0.22	1.16	75	472	2097
\$1M ≤ FA	0.03	0.11	0.48	0.06	0.22	0.91	821	4018	15887

Source: Data from the Survey of Consumer Finances, 2004.

similar when investors who have employer stock are excluded. The assumption of equal weights overstates the diversification if portfolios are concentrated, as they typically are in the more detailed data (Blume and Friend, 1975; Goetzmann and Kumar, 2008; Kumar, 2009).

Exhibit 29.3 shows the medians and quartiles for each cohort. The percentage loss from under-diversification varies significantly with wealth. As anticipated from the previous discussion, portfolios of richer investors are better diversified and, on average, show relatively small loss. For the two richest cohorts the median loss is about 0.1 percent of total financial assets. Expressed relative to the equity portfolio only, the median loss in each of the top two cohorts is 0.22 percent. However, the upper quartile losses in these cohorts exceed 0.9 percent and 1.16 percent of the equity portfolio value. The losses are considerably more significant in the two lower wealth cohorts with the median losses of 2.7 percent and 0.44 percent of the total financial assets and 9.9 percent and 1.3 percent of the equity portfolio value. In dollar terms the median losses in the two lower wealth cohorts are \$143 and \$301, respectively. The losses in the tails of the two least wealthy cohorts are very large. The upper quartile loss for the least wealthy cohort is 18.0 percent and 5.7 percent for the second cohort. For these two cohorts, the losses considerably exceed the potential fund fees if the households were using well-diversified funds instead of individual stocks.

These numbers suggest that for the majority of households in the lower wealth groups and for the non-negligible fraction in the wealthier cohorts, portfolio diversification is far from the optimum based on standard mean-variance metric. Undoubtedly, some households make poor investment decisions in error. However, the persistence of under-diversification, even in the aftermath of stock market decline when the dangers of portfolio concentration should be particularly apparent, suggests that mistakes or ignorance cannot give a complete account for the observed portfolios. Combined with the fact that diversification choices are typically found to be related to demographic variables that proxy for risk attitude, the empirical evidence suggests that individual risk preferences are an important factor in diversification decisions.

Biases and Diversification

There are several potentially important psychological phenomena that may result in undiversified portfolios. Most commonly referenced in connection with diversification are biases due to familiarity and overconfidence. This section quantifies the extent to which an individual should be biased in order to hold an undiversified portfolio while maintaining the assumption of expected utility.

To simplify the exposition, the investor is assumed to have access to two assets: a well-diversified market index and an undiversified portfolio or stock with the same expected returns. The assumption of equal returns does not affect the conclusions as biases about risk can be equivalently restated as biases about expected returns. Let subscript I denote the index and subscript S denote the undiversified portfolio (stock) when writing the expected returns (ER) and the standard deviations (σ) of the assets. Also let β_S be the beta of the stock relative to the index according to the individual's beliefs. The utility function of the investor is assumed to be given by a second-order approximation to a general expected utility as, for example, in Kraus and Litzenberger (1976):

$$U = u(ER_p) + \frac{u''(ER_p)}{2}\sigma_p^2 \tag{29.2}$$

where ER_p and σ_p are the expected return and the standard deviation of return of the portfolio p and $u(\cdot)$ is a strictly increasing and twice differentiable utility function. Denote the fraction invested in the market index as α. Then, since the expected returns are the same for the stock and index, the first-order condition is given by:

$$\frac{u''(ER_p)}{2}\frac{\partial \sigma_p^2}{\partial \alpha} = 0 \tag{29.3}$$

Assuming $u''(ER_p) \neq 0$ we can express the optimal fraction invested in the index as:

$$\alpha^* = \frac{\sigma_S^2 - \beta_S\sigma_I^2}{\sigma_I^2 + \sigma_S^2 - 2\beta_S\sigma_I^2} = \frac{v - \beta_S}{1 + v - 2\beta_S} \tag{29.4}$$

where $v = \frac{\sigma_S^2}{\sigma_I^2}$. Note from the above formula that to achieve a non-zero allocation to stock ($\alpha^* < 1$), the investor must believe $\beta_S < 1$ regardless of the value of the variance ratio v. This contradicts single-index CAPM, which implies that $\beta_S = 1$ because the expected returns of stock and index are assumed to be equal. When $\alpha^* \neq 0.5$, the bias in beta can be expressed as follows:

$$1 - \beta_S = (v - 1)\frac{1 - \alpha^*}{2\alpha^* - 1} \tag{29.5}$$

To quantify this bias, suppose that the investor reasonably estimates that

$$v = \frac{0.36^2}{0.18^2} = 4$$

Then to achieve 20 percent allocation to stock and 80 percent to index the investor must believe that $\beta_S = 0$ and all risk premium of the stock is due to alpha. Even if the investor believes that the stock is not significantly more risky than the index, say $v = 2$, the required beta for the same allocation is still substantially biased at $\frac{2}{3}$, implying that $\frac{1}{3}$ of the risk premium for the stock is due to alpha.

There are certain substantial challenges with the interpretation of portfolio diversification as a result of investor biases and ignorance (mistakes). First, the biases and mistakes would have to be very persistent and not eliminated over time through learning. This is especially puzzling during stock market downturns when pitfalls of under-diversification are exposed. Biases may play a significant role in the increase of direct stockholding during the euphoria of market upturns, but some investors remain remarkably "loyal" to under-diversification regardless of stock market phases.

Second, if biases are due to the misunderstanding of risk, they fail to account for why more educated and wealthy investors scale down but do not completely eliminate under-diversified segments of their portfolios (Polkovnichenko 2005). Finally, as shown in Calvet et al. (2007) for Swedish data and in Polkovnichenko for SCF data, the "aggressiveness" of under-diversification is related to several demographic variables potentially linked to risk attitude, such as household size (number of dependents), entrepreneurship status, and self-reported willingness to take financial risks. If under-diversification is a result of mistakes, the rationale is not clear about why these statistically significant patterns emerge. Given these facts, what seems more plausible is that under-diversified investors are making a conscious and informed choice to bet on high but unlikely returns from a few stocks in their portfolios. The next section demonstrates that such behavior is consistent with rank-dependent models of preferences.

RANK-DEPENDENT PREFERENCES AND PORTFOLIO CHOICE

This section reviews rank-dependent preferences and shows that portfolio choice implied by these utilities can generate under-diversification and nonparticipation in the stock market. Two models are used here: rank-dependent expected utility (RDEU) (Quiggin, 1982; Yaari, 1987) and cumulative prospect theory (CPT) (Tversky and Kahneman, 1992). Both utilities use nonlinear decision-weighting functions but CPT adds the distinction between loss and gain outcomes.

Consider first the RDEU, a simpler model with a structure similar to expected utility. Let $i = 1, \ldots, N$ index possible wealth outcomes w_i ordered from lowest to highest. Every outcome is assigned a decision weight π_i. The RDEU function is given by:

$$V_{RDEU} = \sum_{i=1}^{N} \pi_i u(w_i) \tag{29.6}$$

where $u(\cdot)$ is the outcome utility. The simulations below use power utility $u(w) = \frac{w^{1-\alpha}}{1-\alpha}$, $\alpha > 0$. The decision weights w_i are constructed using a strictly increasing

function $Q(\cdot) : [0, 1] \to [0, 1]$, s.t. $Q(0) = 0$ and $Q(1) = 1$, defined on the cumulative probability of outcomes P_i as follows:

$$w_i = Q(P_i) - Q(P_{i-1}) \quad i = 1, \ldots, N, w_0 = 0, w_N = 1 \tag{29.7}$$

When $Q(P) = P$, RDEU coincides with expected utility. The shape of Q determines individual risk attitude, and experimental evidence points to an inverse S-shape function. For example, Tversky and Kahneman (1992) and Wu and Gonzalez (1996) use the following specification:

$$Q(P) = \frac{P^\gamma}{(P^\gamma + (1-P)^\gamma)^{\frac{1}{\gamma}}}, 0 < \gamma \leq 1 \tag{29.8}$$

This weighting function overweights the outcomes in the tails of the distribution relative to their objective probabilities. This implies risk averse behavior with respect to unfavorable outcomes while simultaneously making more desirable the outcomes with high but unlikely payoffs. To see this more readily, note that a decision weight can be expressed as:

$$w_i = \frac{Q(P_i) - Q(P_{i-1})}{P_i - P_{i-1}}(P_i - P_{i-1}) = \frac{Q(P_i) - Q(P_{i-1})}{P_i - P_{i-1}} p_i \approx Q'(P_i) p_i \tag{29.9}$$

where p_i is the objective probability of event i. Thus, if $Q'(P_i) > 1$ the decision weight exceeds the objective probability and vice-versa. For the inverse S-shape weighting function, the derivative is higher than 1 in the tails of the distribution.

The above weighting function is used in the CPT model but with an additional distinction for gains and losses. Prospect theory assumes that value function depends on gain or loss $x = w - w_0$ relative to a reference point w_0:

$$v(x) = \begin{cases} x^\alpha, & if\, x \geq 0 \\ -\lambda(-x)^\beta, & if\, x < 0 \end{cases} \tag{29.10}$$

where $\lambda > 1$ captures loss aversion, that is, the tendency to emphasize losses more than gains. In the simulations, the reference point is selected to be equal to the initial wealth increased by the risk-free return. The assumption about the reference point is important for CPT, as discussed later. Tversky and Kahneman (1992) estimated the parameters for this value function to be $\alpha = \beta = 0.88$, and $\lambda = 2.25$. The term λ is fixed at its estimated value while varying α and weighting function parameter γ in the simulations below. The combined value function is a weighted average over all possible gains (+) and losses (−):

$$V_{CPT} = \sum_{i \in gains} \pi_i^+ v(x_i) + \sum_{i \in losses} \pi_i^- v(x_i) \tag{29.11}$$

where the weights are defined *separately* for gains and losses as

$$\pi_i^\pm = Q(\bar{P}_i) - Q(\bar{P}_{i^*})$$

where $\bar{P}_i$ is the probability of all outcomes at least as good (bad) as i and $\bar{P}_{i^*}$ is the probability of all outcomes i^* that are strictly better (worse) than i. Note that each set of decision weights for gains and losses adds up to 1.

The optimal portfolio allocation is computed by simulating lognormal return distributions for a stock and an index fund. Assuming a one-year horizon, the expected log return on the stock and the index is set equal to $\mu = 8$ percent. A risk-free asset available to the investor is assumed to earn 2 percent. The index log return standard deviation is set to $\sigma_I = 18$ percent and the simulated return is equal to

$$r_I = e^{\mu+\sigma_I z_0 - \frac{\sigma_I^2}{2}},\ z_0 : N(0,1) \quad \text{(i.i.d.)}.$$

The stock return is simulated by adding an idiosyncratic component σ_e to the index return as follows:

$$r_S = e^{\mu+\sigma_I z_0+\sigma_e z_1 - \frac{\sigma_I^2+\sigma_e^2}{2}},\ z_1 : N(0,1) \quad \text{(i.i.d.)}.$$

Both simulations are using the same draw of z_0. The simulations are computed for the following values of idiosyncratic volatility $\sigma_e \in \{\sigma_I, 2\sigma_I, 3\sigma_I, 4\sigma_I\}$ and results are reported only for the endpoints of this range. Therefore, for each set of utility parameters, the reported results provide bounds obtained in simulations.

A wide range of utility parameters considered included experimental estimates from studies by Camerer and Ho (1994), Tversky and Kahneman (1992), and Wu and Gonzales (1996). These parameter ranges for RDEU are $\gamma \in [0.2,1]$ and $\alpha \in [0,3]$. Exhibit 29.4 shows optimal portfolio shares for various RDEU parameters for the cases of low-and high-volatility stock. When $\gamma = 1$ the RDEU coincides with expected utility, and the optimal portfolio involves only the index and risk-free asset. For lower values of γ, portfolios become more aggressively under-diversified, and stock is substituted for the index fund. The substitution is gradual when stock volatility is high and is more rapid for low-volatility stock. The low-volatility stock is intrinsically more diversified and serves as a substitute for the index fund. For a range of γ below 0.8 to 0.6, there is a substantial investment in stock. In the range of γ between 0.6 and 0.4, there are portfolios that include both the fund and stock. The investment in the risk-free asset naturally rises with the curvature of the utility α. Interestingly, for lower values of γ there is also a larger investment in the risk-free asset, suggesting that the effect of emphasizing the probabilities of tail events dominates in the left tail when the outcome utility is concave.

Exhibit 29.5 shows the optimal portfolios for CPT. The values of γ are chosen from the same range as for RDEU, and α is chosen from [0,1]. For a wide range of parameters there is no demand for low-volatility stock in the investor's portfolio. Only when an investor is close to risk neutral ($\alpha = 1$) is there some demand for stock for low values of γ. Also, in the case of low-volatility stock, there are some parameter values for which an investor does not hold risky assets. These are parameters for which the risk-free asset share of the portfolio reaches 1. In the case of high-volatility stock, the demand is more pronounced because high outlier returns are attractive to the investor. For the values estimated by Tversky and Kahneman (1992) $\gamma \in [0.6,0.7]$ and $\alpha = 0.88$, the portfolio share of high-volatility

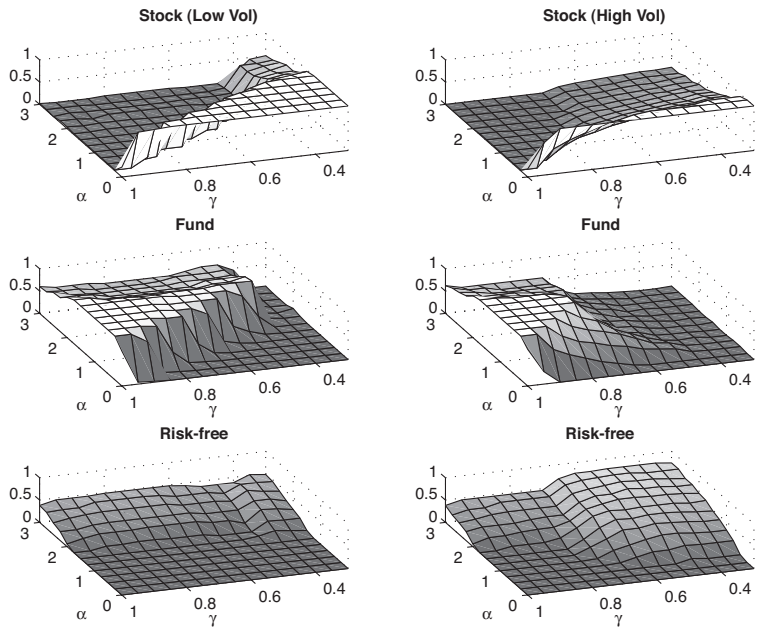

Exhibit 29.4 Optimal Portfolio Allocations for Various Parameters of the Rank-Dependent Expected Utility

Note: The figure shows optimal portfolio shares obtained in simulations. Portfolios consist of a single stock (high and low volatility), a diversified index, and a risk-free asset. The returns of the risky assets are simulated using lognormal distributions.

stock is about 20 percent to 40 percent. For these parameter values, the intermediate values of idiosyncratic volatility result in a range of portfolio shares of the stock from 0 (low-volatility simulation) to 40 percent (high-volatility simulation). Note also that the fund share of the portfolio is relatively small when parameters are close to the range estimated by Tversky and Kahneman. However, fund allocation rises significantly as utility curvature increases (lower α) and as the weighting function approaches linearity (higher γ).

The results for CPT and RDEU demonstrate that under-diversified portfolios emerge as plausible outcomes of maximizing the objective with rank-dependent decision weights. The decision-weighting function overweights the probabilities of high returns and makes undiversified assets attractive to the investor. Both RDEU and CPT are also capable of generating limited stock market participation under a variety of reasonable assumptions. For CPT the key issue in generating nonparticipation is related to the reference point. The results above are reported for cases where the reference point is set to initial wealth grossed up by the risk-free rate. A sensible alternative is to choose initial wealth as a reference. In this case, portfolios become more conservative, and there is a wider range of parameters that generates no participation in the stock market both for the cases of high- and low-volatility stocks. This is due to the loss aversion of CPT investors. The value function is convex to the left of the reference point and is more steeply sloped than on the gains side. As the reference point becomes higher, the convexity in the loss

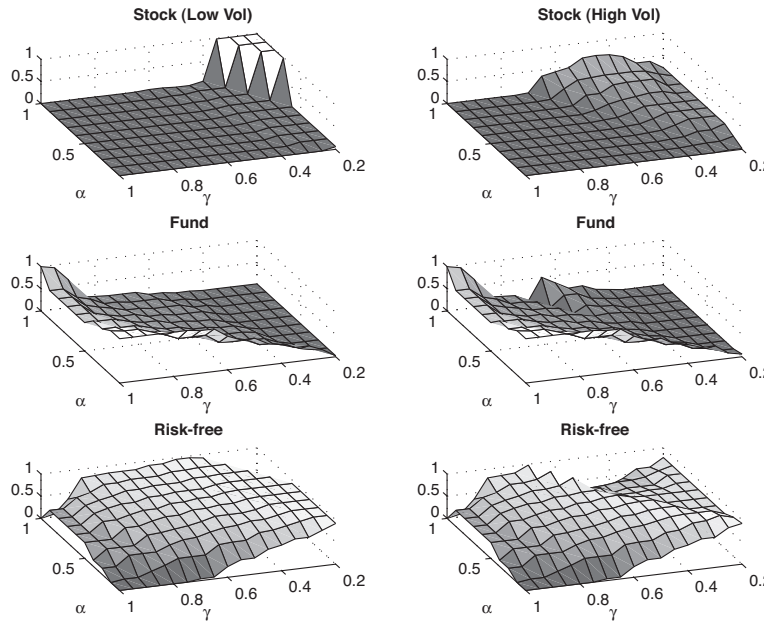

Exhibit 29.5 Optimal Portfolio Allocations for Various Parameters of the Cumulative Prospect Theory

Note: The figure shows optimal portfolio shares obtained in simulations. Portfolios consist of a single stock (high and low volatility), a diversified index, and a risk-free asset. The returns of the risky assets are simulated using lognormal distributions.

area provides incentives to invest in riskier portfolios to escape losses. Thus, CPT investors with a sufficiently low reference point may choose to stay out of the stock market. On the contrary, investors who fall short of their reference point would take aggressive actions to catch up.

In the simulations with RDEU using the inverse S-shape weighting function, there was no parameter combination when portfolios were invested only in the risk-free asset. Even when the curvature of the utility α exceeds 3, the highest value shown in Exhibit 29.5, optimal portfolios still contain some risky assets. However, RDEU belongs to the class of first-order risk averse utilities, which generally implies that some less risk tolerant investors may avoid risky investments with insufficiently high risk premiums. The inverse S-shape weighting function implies this type of behavior by emphasizing probabilities of events in the left tail of the distribution, but it also emphasizes the right tail. This effect counteracts the desire to abandon stocks. Lognormal distributions used in the simulations have positive skewness, and on balance RDEU implies positive investment in stocks. If the weighting function is such that it emphasizes only the left tail, for example $Q(P) = P^{\phi}$, $0 < \phi < 1$, for some lower values of ϕ investors would choose to abandon stocks. One could also consider a negatively skewed distribution with an inverse S-shape weighting function. Presumably, for sufficiently negatively skewed distribution, the overweighting of probabilities in the left tail would dominate the overweighting in the right tail. This, however, can only explain why investors

avoid stocks with negatively skewed returns. To generate robust nonparticipation in the stock market, one still has to consider alternative weighting functions.

In summary, the simulations demonstrate that both RDEU and CPT, under suitable parameterizations, imply under-diversification with the co-existence of diversified and undiversified segments in the portfolios. They may also imply nonparticipation in the stock market even without market frictions. Since both utilities are homothetic, these implications do not depend on wealth but rather on the return distributions of available assets and preference parameters.

SUMMARY AND CONCLUSIONS

A standard expected utility assumption has strong implications for optimal individual portfolio choice. This chapter revisits two such implications: participation in markets for risky assets and diversification. The data suggest that large numbers of investors significantly deviate from the behavior prescribed by the standard model. On the other hand, relaxing the expected utility assumption in line with some experimental evidence by introducing rank-dependent decision weights considerably improves the ability of the model to predict a wider range of observed portfolios for plausible parameterizations.

The applications of rank-dependent utilities to portfolio selection can be advanced in several directions. In general, the portfolio separation theorem does not hold for utilities with rank-dependent weights. Holding a well-diversified portfolio is no longer optimal for all preference parameters, and some exposure to idiosyncratic risk may be desirable. The vast majority of literature on individual portfolio selection uses the two-fund separation theorem to simplify the problem by considering only portfolio allocation between risky and riskless assets. The implications of the model change once the value function assumption is relaxed and assets with idiosyncratic risk are made available on the menu of choices. Shefrin and Statman (2000) consider optimal portfolios under the assumptions of complete markets using Roy's (1952) safety-first model with rank-dependent weights. A potential extension of this line of research would be to explore normative portfolio analysis under rank-dependent preferences with or without loss aversion using a generic menu of risky assets, not necessarily in a complete markets environment. Obtaining some general portfolio comparative statics and linking optimal portfolio policies with properties of the returns distribution and the decision-weighting functions could also be a worthwhile extension.

In addition, analyzing the dynamics of diversification and participation is also important. Empirical evidence by Calvet et al. (2006) and others indicates that portfolios tend to become less diversified with age, but this effect is mitigated by lower overall risk exposure. These results provide additional dimensions to test the model beyond the static portfolios considered in this chapter. The RDEU certainty equivalent may be integrated in a dynamic setting using the recursive utility along the lines of Epstein and Zin (1990), where this model is applied for an infinite horizon representative agent economy. The analysis of a life-cycle portfolio choice model with a possibility of investing in assets with idiosyncratic risk would provide new insights about optimal dynamics of diversification and participation. Another interesting issue for such models would be to explore the link between wealth and diversification. Since both RDEU and CPT are homothetic, both are

silent on this issue when total investor wealth is liquid. Therefore, research should also consider diversification decisions in a setting with illiquid wealth from human capital, private business, and housing.

Aggregate implications of preferences with rank dependency remains a relatively unexplored area. Only a few papers consider RDEU in a general equilibrium setting: Epstein and Zin (1990) and Chapman and Polkovnichenko (2009). Both papers analyze relatively simple models; the former is a dynamic representative agent model with two states, and the latter is a static two-agent multi-state model. All existing *dynamic* applications of CPT to asset pricing such as Barberis et al. (2001) omit rank-dependent weights for the sake of tractability. Barberis and Huang (2008) and Levy and Levy (2004) consider the full-featured applications of CPT to asset pricing in static economies. Overall, there is a mismatch between considerable knowledge accumulated in decision sciences about rank-dependent utilities and the extent of their applications to relevant problems in finance and economics. This mismatch deserves more attention in future research.

DISCUSSION QUESTIONS

1. What two main implications of the standard normative portfolio theory are not consistent with the data on individual portfolio holdings? Discuss relevant empirical evidence.
2. Why cannot various psychological biases and reasonable participation costs completely explain under-diversification and limited participation in the stock market?
3. What is the main mechanism that allows rank-dependent utility and prospect theory to predict more realistic portfolios?

REFERENCES

Ang, Andrew, Geert Bekaert, and Jun Liu. 2005. Why stocks may disappoint. *Journal of Financial Economics* 76:3, 471–508.

Arzac, Enrique R. 1974. Utility analysis of chance-constrained portfolio selection. *Journal of Financial and Quantitative Analysis* 9:6, 993–1007.

Arzac, Enrique R., and Vijay S. Bawa. 1977. Portfolio choice and equilibrium in capital markets with safety-first investors. *Journal of Financial Economics* 4:4, 277–88.

Barber, Brad, and Terrance Odean. 2001. Boys will be boys: Gender, overconfidence, and common stock investment. *Quarterly Journal of Economics* 116:1, 261–92.

Barberis, Nicholas, and Ming Huang. 2001. Mental accounting, loss aversion, and individual stock returns. *Journal of Finance* 56:4, 1247–92.

Barberis, Nicholas, and Ming Huang. 2008. Stocks as lotteries: The implications of probability weighting for security prices. *American Economic Review* 98:5, 2066–100.

Barberis, Nicholas, Ming Huang, and Tano Santos. 2001. Prospect theory and asset prices. *Quarterly Journal of Economics* 116:1, 1–53.

Bawa, Vijay S. 1978. Safety-first, stochastic dominance, and optimal portfolio choice. *Journal of Financial and Quantitative Analysis* 13:2, 255–71.

Benartzi, Shlomo, and Richard H. Thaler. 1995. Myopic loss aversion and the equity premium puzzle. *Quarterly Journal of Economics* 110:1, 73–92.

Benartzi, Shlomo, and Richard H. Thaler. 2001. Naive diversification strategies in retirement saving plans. *American Economic Review* 91:1, 79–98.

Blume, Marshall E., and Irwin Friend. 1975. The asset structure of individual portfolios and some implications for utility functions. *Journal of Finance* 30:2, 585–603.

Brennan, Michael J., and Walter N. Torous. 1999. Individual decision–making and investor welfare. *Economic Notes* 28:2, 119–143.
Calvet, Laurent E., John Y. Campbell, and Paolo Sodini. 2007. Down or out: Assessing the welfare costs of household investment mistakes. *Journal of Political Economy* 115:5, 707–47.
Camerer, Colin F., and Teck-Hua Ho. 1994. Violations of the betweenness axiom and non-linearity in probability. *Journal of Risk and Uncertainty* 8:2, 167–96.
Chapman, David, and Valery Polkovnichenko. 2009. Preferences heterogeneity and asset markets outcomes. *Journal of Finance*, forthcoming.
Choi, James J., David Laibson, Brigitte C. Madrian, and Andrew Metrick. 2006. Saving for retirement on the path of least resistance. In *Behavioral public finance: Toward a new agenda*, (eds.) Edward McCaffrey and Joel Slemrod, 304–351. New York: Russell Sage Foundation.
Epstein, Larry G., and Martin Schneider. 2003. Recursive multiple-priors. *Journal of Economic Theory* 113:1, 32–50.
Epstein, Larry G., and Martin Schneider. 2007. Learning under ambiguity. *Review of Economic Studies* 74:4, 1275–1303.
Epstein, Larry G., and Stanley E. Zin. 1990. "First-order" risk aversion and the equity premium puzzle. *Journal of Monetary Economics* 26:3, 387–407.
Friedman, Milton, and L. J. Savage. 1948. The utility analysis of choices involving risk. *Journal of Political Economy* 56:4, 279–304.
Goetzmann, William N., and Alok Kumar. 2008. Equity portfolio diversification. *Review of Finance* 12:3, 433–63.
Gomes, Francisco J. 2005. Portfolio choice and trading volume with loss-averse investors. *Journal of Business* 78:2, 675–706.
Gomes, Francisco, and Alexander Michaelides. 2005. Optimal life-cycle asset allocation: Understanding the empirical evidence. *Journal of Finance* 60:2, 869–904.
Grinblatt, Mark, and Matti Keloharju. 2001. How distance, language, and culture influence stockholdings and trades. *Journal of Finance* 56:3, 1053–73.
Gul, Faruk. 1991. A theory of disappointment aversion. *Econometrica* 59:3, 667–86.
Huberman, Gur. 2001. Familiarity breeds investment. *Review of Financial Studies* 14:3, 659–80.
Kelly, Morgan. 1995. All their eggs in one basket: Portfolio diversification of U.S. households. *Journal of Economic Behavior and Organization* 27:1, 87–96.
Kraus, Alan, and Robert Litzenberger. 1976. Skewness preferences and the valuation of risk assets. *Journal of Finance* 31:4, 1085–1100.
Kumar, Alok. 2009. Who gambles in the stock market? *Journal of Finance*, forthcoming.
Levy, Haim, and Moshe Levy. 2004. Prospect theory and mean-variance analysis. *Review of Financial Studies* 17:4, 1015–41.
Liu, Hong. 2008. Portfolio insurance and underdiversification. Working Paper, Washington University, St. Louis.
Mankiw, Gregory N., and Stephen P. Zeldes. 1991. The consumption of stockholders and nonstockholders. *Journal of Financial Economics* 29:1, 97–112.
Markowitz, Harry. 1952a. Portfolio selection. *Journal of Finance* 7:1, 77–91.
Markowitz, Harry. 1952b. The utility of wealth. *Journal of Political Economy* 60:2, 151–8.
Merton, Robert C. 1987. A simple model of capital market equilibrium with incomplete information. *Journal of Finance* 42:3, 483–510.
Meulbroek, Lisa. 2005. Company stock in pension plans: How costly is it? *Journal of Law and Economics* 48:2, 443–74.
Odean, Terrance. 1999. Do investors trade too much? *American Economic Review* 89:6, 1279–98.
Paiella, Monica. 2007. The foregone gains of incomplete portfolios. *Review of Financial Studies* 20:5, 1623–46.
Polkovnichenko, Valery. 2005. Household portfolio diversification: A case for rank-dependent preferences. *Review of Financial Studies* 18:4, 1467–502.

Pyle, David H., and Stephen J. Turnovsky. 1970. Safety-first and expected utility maximization in mean-standard deviation portfolio analysis. *Review of Economics and Statistics* 52:1, 75–81.

Quiggin, John. 1982. A theory of anticipated utility. *Journal of Economic and Behavioral Organization* 3:4, 323–43.

Roche, Hervé, Stathis Tompaidis, and Chunyu Yang. 2009. Asset selection and underdiversification with financial constraints and income: Implications for household portfolio studies. Working Paper, McCombs School of Business, University of Texas at Austin.

Roy, Andrew D. 1952. Safety first and the holding of assets. *Econometrica* 20:3, 431–49.

Segal, Uzi, and Avia Spivak. 1990. First order versus second order risk aversion. *Journal of Economic Theory* 51:1, 111–25.

Shefrin, Hersh, and Meir Statman. 2000. Behavioral portfolio theory. *Journal of Financial and Quantitative Analysis* 35:2, 127–51.

Telser, Lester. 1955. Safety first and hedging. *Review of Economic Studies* 23:1, 1–16.

Tversky, Amos, and Daniel Kahneman. 1992. Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk and Uncertainty* 5:4, 297–323.

Wu, George, and Richard Gonzalez. 1996. Curvature of the probability weighting function. *Management Science* 42:12, 1676–90.

Yaari, Menahem E. 1987. The dual theory of choice under risk. *Econometrica* 55:1, 95–115.

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CHAPTER 30

Cognitive Abilities and Financial Decisions

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INTRODUCTION

This chapter focuses on an important but previously unexplored determinant of stock investment decisions, namely, cognitive abilities. At first glance, it is clear that intelligence or cognitive abilities should be correlated with success in financial decisions. However, directly establishing this link is difficult because datasets that contain both measures of cognitive abilities and financial performance are hard to obtain. Even with rich datasets, the impact of cognitive abilities on financial decisions may be difficult to quantify because this relation is likely to be complex and multifaceted. For example, predicting whether the quality of investment decisions would improve or deteriorate with age poses numerous problems. Although older investors would accumulate greater knowledge about the fundamental principles of investing from their investment experience, their declining cognitive abilities could hinder the effective application of those principles. If the adverse effects of aging dominate the positive effects of experience, older investors' portfolios may underperform common performance benchmarks.

Similarly, whether smarter individuals would follow the normative prescriptions of portfolio theory or adopt active investment strategies *ex ante* is not entirely obvious. On the one hand, due to their greater sophistication, they may be more likely to realize that beating the market on a consistent basis would be difficult. Therefore, such individuals would choose a well-diversified portfolio and follow passive buy-and-hold strategies. But on the other hand, due to their higher sophistication levels, they may feel more competent and may also be more likely to adopt active trading strategies to beat various passive performance benchmarks.

For example, investors with higher cognitive abilities may distort their portfolios and hold concentrated portfolios, trade aggressively, or overweight local

stocks. Further, these portfolio distortions would have a positive impact on realized portfolio performance. In contrast, when individuals with lower cognitive abilities follow these types of portfolio distortions, they may not succeed and thus earn lower average performance. Therefore, by conditioning on the level of cognitive abilities, it may be possible to better quantify the performance effects of deviations from the normative prescriptions of portfolio theory.

In spite of these difficulties, a growing literature in behavioral finance has taken up the challenge and has attempted to establish the link between intelligence and portfolio decisions. The chapter begins with a review of the literature that studies the link between cognitive abilities and broad financial decisions (e.g., stock market participation). The next section examines the impact of investor intelligence on portfolio decisions following an individual's decision to participate in the stock market. Two themes are highlighted. First, we explore whether older investors make worse investment decisions due to the adverse effects of cognitive aging. Second, the effects of cognitive abilities on portfolio performance are summarized when investors do not follow the normative prescriptions of portfolio theory and distort their portfolios. In this section of the chapter, an empirical model of cognitive abilities is outlined that links various demographic characteristics to abilities. In the last section, the growing literature that examines the role of cognitive abilities in other financial settings is reviewed.

COGNITIVE ABILITIES AND BROAD FINANCIAL DECISIONS

Several recent studies show that the level of cognitive abilities affects the stock market participation decision, broad economic decisions, and financial decisions. The datasets used in these studies do not contain detailed information on the assets held in households' financial portfolios. Instead, they only provide aggregate measures of household wealth and overall portfolio positions in riskless and risky assets.

Benjamin, Brown, and Shapiro (2006) collect data from the National Longitudinal Survey of Youth 1979 (NLSY). After 1980, most NLSY respondents are administered the Armed Services Vocational Aptitude Battery (ASVAB) of tests. Based on their performance on the ASVAB tests, each respondent is assigned a percentile score, which represents their level of cognitive ability. The NLSY also includes two questions related to financial decisions. To assess the level of asset accumulation, the respondents are asked whether their net worth is negative, zero, or positive. Excluding retirement accounts, the respondents are also asked whether they directly hold financial assets. After controlling for income and family background, Benjamin et al. find a strong relationship between cognitive abilities and the likelihood of accumulating positive net assets. They also report that smart respondents tend to participate more in the stock market.

Kezdi and Willis (2003) use the 1992–2000 waves of the Health and Retirement Survey (HRS) in the United States to examine stock market participation. As part of their analysis, they calculate cognitive ability indices for the HRS households and include them in the participation regressions. They divide their cognitive indices into four groups: intellectual ability (IQ), memory (based on word recall), numeracy (based on counting back by sevens), and dementia (based on the TICS interview questions). The Telephone Interview of Cognitive Status (TICS) battery includes questions such as naming the President and Vice-President of the United

States. Their analysis shows that households with high IQ scores participate more in the stock market. Among the households not participating in the stock market at the beginning of the sample, the probability of becoming a stockholder by the end of the sample is higher for smarter investors. Further, conditional upon owning stocks at the beginning of the sample, the probability of exiting the stock market is lower for smarter investors.

McArdel, Smith, and Willis (2009) also use data from the HRS. Following the psychology literature, they combine various questions and construct indices measuring numeracy, memory recall, verbal fluency, and mental status. Similar to Kezdi and Willis (2003), the mental status questions are from the TICS. The authors show that total wealth, total financial wealth, and the fraction of financial wealth held in equity rise with the numeracy score of the respondent. For example, achieving the highest score on the numeracy index is associated with a $20,000 increase in total household wealth and about a $7,000 increase in financial wealth. They also find that households with high memory recall scores accumulate more total wealth and financial wealth.

In a recent study, Stango and Zinman (2008) focus on a particular form of numerical cognitive impairment, namely, the exponential growth bias. This bias refers to the tendency of individuals to systematically underestimate the growth or decline of exponential series when making calculations without the help of a calculator. To measure the bias, they use two questions from the 1987 Survey of Consumer Finances (SCF), which ask respondents about the repayment total of a hypothetical loan and perceived annual percentage rate of the same loan. Stango and Zinman find that the relationship between the exponential growth bias and the proportion of assets held in stocks is negative. In particular, their results imply that the bias induces about an 18 to 55 percent decrease in stock holdings. They also show that more biased households tend to borrow more and save less. Taken together, the studies that use U.S. household-level data find a strong correlation between cognitive abilities and stock market participation decisions.

Christelis, Jappelli, and Padula (2010) report similar results using data from the Survey of Health, Aging, and Retirement in Europe (SHARE), which surveys people aged 50 and older in 11 European countries. Apart from demographic and financial information, the survey includes a complete and accurate set of cognitive ability indicators measuring verbal fluency, numeracy, and memory recall. Christelis et al. find that cognitive abilities are highly correlated with direct stock market participation and total stock market participation, which includes mutual fund holdings and managed investment accounts. Conditional on the known determinants of stock market participation (e.g., age, health, marital status, income, wealth, and social activities), they report that a one-standard-deviation increase in numeracy, verbal fluency, and memory recall increases total stock market participation by 1.8 percent, 1.7 percent, and 1.3 percent, respectively. Overall, these studies demonstrate that cognitive abilities influence the decision to participate in the stock market.

DO OLDER INVESTORS MAKE BETTER INVESTMENT DECISIONS?

Due to limited data availability, few studies have examined the impact of cognitive abilities after a household enters the stock market. In this section and following

sections, two studies are summarized. In the first paper, Korniotis and Kumar (2009) investigate the investment decisions of older investors and interpret them within the framework of cognitive aging. In the second paper, Korniotis and Kumar (2008) test whether a relationship exists between cognitive abilities and three puzzling results reported in the recent literature on retail investors.

Evidence from Psychology

Korniotis and Kumar (2009) are motivated by psychological evidence, which indicates that both physical and cognitive abilities, especially memory, decline with age (e.g., Horn, 1968; Salthouse, 2000; Schroeder and Salthouse, 2004). Weakening memory slows down the information processing ability of individuals and leads to a decline in older people's ability to perceive conditional probabilities (Spaniol and Bayen, 2005). Additionally, due to a decline in attentional ability, older people get distracted easily and are unable to distinguish between relevant and irrelevant information.

The psychological evidence also indicates that people are likely to experience a decline in the level of their general intelligence as they grow older. The aging process influences general intelligence through two distinct channels. First, the general intelligence level declines with age due to the negative impact of aging on memory and attention (e.g., Lindenberger and Baltes, 1994; Baltes and Lindenberger, 1997). Second, the sensory (vision and hearing) functioning worsens with age and is associated with lower levels of intelligence. The decline in intelligence is much steeper after the age of 70 (Lindenberger and Baltes, 1997), while these adverse effects are attenuated in people's area of expertise due to frequent practicing (Masunaga and Horn, 2001).

In addition to biological and psychological factors, socioeconomic and demographic factors such as education, income, wealth, race, ethnicity, and gender can exacerbate the adverse effects of cognitive aging. For example, people who are more educated, are more resourceful (i.e., have higher income and are wealthier), and undertake intellectually stimulating jobs experience a slower decline in cognitive abilities because they are able to actively compensate for the adverse effects of aging (Baltes and Lang, 1997; Cagney and Lauderdale, 2002). In contrast, the age-related decline in cognitive abilities is steeper among older women (Shanan and Sagiv, 1982) as well as older African Americans and Hispanics (Black, 2004).

Overall, the evidence from research in psychology suggests that older people would react to new information inappropriately because they are typically slower and less effective at processing and integrating new information. As a result, old age is likely to have an adverse effect on people's ability to make effective investment decisions.

In addition to the negative channel of cognitive aging, a positive channel of experience may induce older investors to make better investment decisions. Specifically, older investors are likely to have greater investment experience and greater awareness of the fundamental principles of investing than younger investors. Their accumulated investing wisdom could help them make more efficient investment decisions. This last conjecture is motivated by the extant empirical evidence from the individual investor literature, which indicates that older investors exhibit a weaker disposition effect (Dhar and Zhu, 2006), hold less concentrated portfolios

(Goetzmann and Kumar, 2008), and exhibit a lower degree of overconfidence (Barber and Odean, 2001). Furthermore, these behavioral biases decline as investors learn and gain more experience (e.g., List, 2003; Feng and Seasholes, 2005). Older investors are also less prone to gambling-type activities in the stock market (Kumar, 2009). Taken together, the evidence from the cognitive aging and learning research indicates that aging and learning processes operate simultaneously.

Testable Hypothesis and Data Description

Motivated by this evidence, Korniotis and Kumar (2009) conjecture that older investors would accumulate greater knowledge about the fundamental principles of investing because of their greater investment experience. However, their declining cognitive abilities would hinder the effective application of those principles. If the adverse effects of aging dominate the positive effects of experience, older investors' portfolios would underperform common performance benchmarks.

Using the end-of-month portfolio holdings and trades of a sample of individual investors at a large U.S. brokerage house, Korniotis and Kumar (2009) empirically test this dual-pronged conjecture. The time period of their sample is from 1991 to 1996. There are 77,995 households in the retail database who hold common stocks and trade other securities such as mutual funds, options, and American depository receipts (ADRs). Their study focuses on the investment behavior of 62,387 investors who have traded common stocks. For a subset of households, demographic information such as age, income, wealth, occupation, marital status, and gender is available. The demographic measures such as age, income, marital status, and family size are compiled by Infobase Inc. a few months after the end of the sample period (June 1997). Further details on the investor database are available in Barber and Odean (2000).

Positive Effects of Investment Experience

Korniotis and Kumar (2009) first examine whether older investors possess greater knowledge about investing. Specifically, they focus on several important dimensions of portfolio decisions that reflect common investment "rules of thumb." To begin, they examine whether older investors are more likely to recognize the potential benefits of diversification. Next, the authors examine whether older investors trade less frequently because they realize their inability to improve performance through active trading. Last, they examine whether older investors are more likely to engage in year-end tax-loss selling, since it requires financial awareness but does not necessarily require skill.

In their first set of results, Korniotis and Kumar (2009) use the number of stocks held by an investor to proxy whether older investors are more aware of the potential benefits of diversification. They find that older and more experienced investors hold portfolios containing a greater number of stocks. In particular, both age and investment experience are significant predictors of the number of stocks held, even in the presence of various control variables.

Next, Korniotis and Kumar (2009) examine whether older investors engage in active trading. They measure trading activity with monthly portfolio turnover rates. In the analysis, the authors find that age and experience are significantly

negatively correlated with turnover rates. This evidence indicates that the trading behavior of older investors is more likely to conform to another key principle of investing, namely, less frequent trading.

Finally, Korniotis and Kumar (2009) test whether older investors exhibit a greater propensity to engage in year-end tax-loss selling. Specifically, they examine the relationship between age and the proportion of "losers" (stock investments in which an investor suffers a loss) sold in the month of December. Their analysis indicates that both older and more experienced investors are more willing to sell their losers in December.

Adverse Effects of Cognitive Aging

While older investors, especially those who are more experienced, exhibit a greater propensity to follow common investment rules of thumb, how effectively can they apply those principles? To answer this question, Korniotis and Kumar (2009) study the relation between age, investment experience, and investment skill.

Exhibit 30.1 shows the univariate relation between age and investment skill, as captured by the Daniel, Grinblatt, Titman, and Wermers (1997) characteristic-adjusted performance measure for the full sample period. Two features of the plot are noteworthy. First, the investment performance exhibits an inverted U-shape with a peak at around 42 years. The hump shape reflects the combined

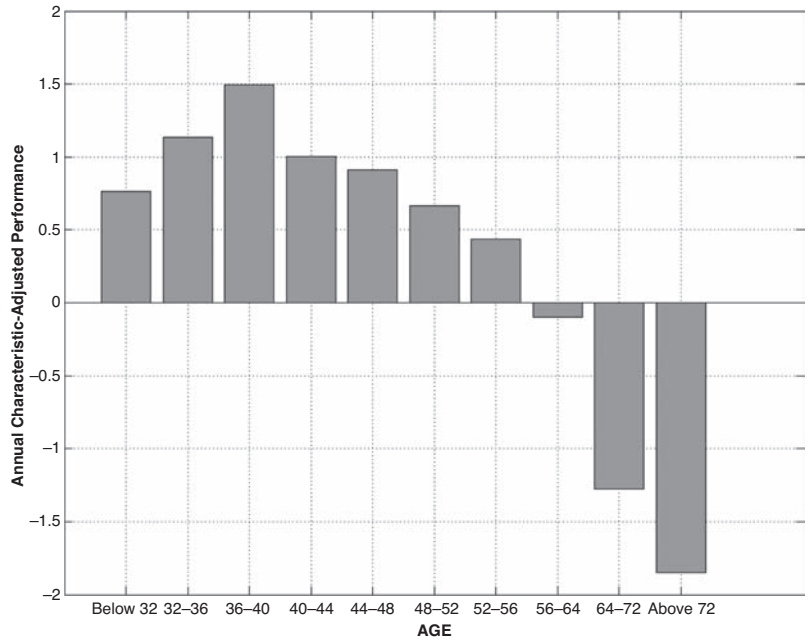

Exhibit 30.1 Investor Age and Portfolio Performance

Note: This figure shows the average risk-adjusted performance level (annualized characteristic-adjusted percentage return) of age-sorted investor groups. The sample period is from 1991 to 1996.

Source: Investor data are from a large U.S. discount brokerage house.

effects of experience and aging. This evidence is consistent with the findings in Agarwal, Driscoll, Gabaix, and Laibson (2009), who uncover a similar pattern in the borrowing rates of households in various credit markets.

Second, there is an abrupt and significant drop in investment performance around the age of 70. This nonlinear effect is consistent with the evidence from studies in psychology that document a steeper cognitive decline after the age of 70. Overall, the graphical evidence reveals that the negative effects of aging have a dramatic impact on the performance of older and more experienced investors.

Korniotis and Kumar (2009) further explore the impact of age and experience on performance by estimating "skill" regressions. In these cross-sectional regressions, a measure of investment skill is employed as the dependent variable. The authors focus on two investment skill measures: "diversification skill" (captured by monthly portfolio Sharpe ratios) and stock selection ability (captured by monthly portfolio alphas). Their conjecture is that although older investors hold portfolios with larger number of stocks, they might not possess "diversification skill" because the ability to perceive correlations accurately would decline with age. Furthermore, investors' stock selection skill could decline with age because the adverse effects of cognitive aging would influence people's ability to efficiently process new information. In contrast, both diversification skill and stock selection abilities would improve with investment experience.

The results of the skill regressions confirm that, conditional on various control variables (including investment experience), age has a negative effect on investment skill. Moreover, the regression estimates indicate that, all else equal being, a one-standard-deviation shift in the age of an investor who does not belong either to the low (bottom quintile) income, low education (bottom quintile), or ethnic minority groups would be associated with an annual, risk-adjusted performance decline of 0.61 percent. This indicates that when an investor aged 30 becomes older and crosses the retirement age of 65 (a three-standard-deviation change in age), she is likely to suffer an annual performance decline of 1.84 percent on a risk-adjusted basis.

Overall, the skill regression estimates indicate that investment skill increases with experience due to the positive effects of learning, but declines with age due to the adverse effects of cognitive aging. This decline in skill is steeper among less educated and less wealthy older investors who belong to minority groups.

COGNITIVE ABILITIES, PORTFOLIO DISTORTIONS, AND PERFORMANCE

In the second paper, Korniotis and Kumar (2008) test if cognitive abilities are related to three puzzling results established in the recent literature on retail investors. The first puzzling finding is that, contrary to the normative prescriptions of traditional portfolio theory, retail investors hold concentrated portfolios with only a few stocks (e.g., Barber and Odean, 2000). Whether certain investors hold few stocks because they are relatively unsophisticated and exhibit stronger behavioral biases is not entirely clear (Goetzmann and Kumar, 2008). Nonetheless, retail investors exhibit a preference for skewness (Mitton and Vorkink, 2007), or they are resourceful

and able to gather better information about those stocks (Ivkovich, Sialm, and Weisbenner, 2008).

Second, retail investors trade excessively and do not follow buy-and-hold strategies. Active trading could be induced by behavioral biases. For instance, overconfident investors who overestimate either the quality of their private information or their ability to interpret that information would trade excessively (Odean, 1999; Barber and Odean, 2000). Alternatively, excess trading can be due to perceived competence (Graham, Harvey, and Huang, 2009) or a desire to seek sensation (Grinblatt and Keloharju, 2009). However, aggressive trading by investors could also reflect their attempts to exploit superior, time-sensitive private information (e.g., Kyle, 1985; Holden and Subrahmanyam, 1992). In this setting, active trading could be optimal and need not be excessive.

Third, retail investors exhibit a preference for local stocks, that is, a disproportionately large proportion of their equity portfolios is invested in geographically proximate stocks. The preference for local stocks could be induced by familiarity (e.g., Huberman, 2001; Grinblatt and Keloharju, 2001) or by investors' superior information about firms located in their neighborhood (e.g., Ivkovich and Weisbenner, 2005; Massa and Simonov, 2006).

In each of these three settings, due to two conflicting explanations, there has been considerable debate in the literature about the underlying mechanisms that induce investors to hold concentrated portfolios, trade actively, and hold a disproportionate share of local stocks. Korniotis and Kumar (2008) offer a parsimonious explanation for the three puzzling findings that can accommodate both rational (information-based) and behavioral explanations. They conjecture that the investment decisions of investors with high cognitive abilities will reflect superior information, while the decisions of investors with low cognitive abilities are more likely to be induced by behavioral (or psychological) biases. Their conjecture is motivated by recent research in behavioral economics (e.g., Frederick, 2005; Benjamin et al., 2006; Dohmen, Falk, Huffman, and Sunde, 2007; Oechssler, Roider, and Schmitz, 2008), which finds that lower levels of cognitive abilities are associated with more "anomalous" preferences and stronger behavioral biases (e.g., greater level of impatience and stronger short-stakes risk aversion).

An Empirical Model of Cognitive Abilities

To test their conjecture, Korniotis and Kumar (2008) develop an empirical model of cognitive abilities by adopting the imputation method that is commonly used to link multiple datasets (Browning and Leth-Petersen, 2003). In particular, they estimate an empirical model of cognitive abilities in which a set of observable demographic variables including age are used to predict the cognitive abilities of individuals. They use a dataset that includes both direct cognitive ability measures and demographic variables. They apply this model to the brokerage dataset and obtain the cognitive ability (or smartness) proxies for the retail investors in their sample. The authors follow the imputation approach because there is no U.S. dataset available that includes both direct measures of cognitive abilities and investors' portfolio decisions.

In the empirical models, a direct measure of cognitive abilities is the dependent variable. The independent variables are the key correlates of cognitive abilities

identified in the cognitive psychology literature. Like Cagney and Lauderdale (2002), Korniotis and Kumar (2008) use age, education, income, and wealth. They extend the model of Cagney and Lauderdale with an Over-70 age dummy variable because cognitive abilities dramatically decrease after the age of 70 (Baltes and Lindenberger, 1997). Consistent with Holtzman, Rebok, Saczynski, Kouzis, Doyle, and Eaton (2004), their cognitive model includes a social network proxy. Since the level and type of social activities change with retirement, their cognitive ability model also includes a retirement dummy variable.

The final set of cognitive ability correlates includes three interaction terms using three dummy variables. They are defined as Over 70 $\times$ Low Education, Over 70 $\times$ Low Income, and High Education $\times$ High Income. The interaction terms capture the prediction that cognitive abilities are likely to be lower among older investors who are less educated and less resourceful (Baltes and Lang, 1997).

To estimate this model, Korniotis and Kumar (2008) use data from the 2005 wave of the Survey of Health, Aging, and Retirement in Europe (SHARE). The survey is administered in 11 European countries to individuals who are at least 50 years old. The SHARE data contain three direct and standardized measures of cognitive abilities (verbal ability, quantitative ability, and memory) for more than 21,000 households. These measures are constructed based on responses from a paper-based survey. The SHARE dataset also contains demographic variables such as age, income, wealth, education, gender, and a social network proxy. The social network proxy is defined as the average level of social activities undertaken by a household, which includes sports, political and community activities, and religious activities. The assumption is that people who engage in more social activities will have larger social networks.

The cognitive abilities regression estimates in Korniotis and Kumar (2008) are consistent with the psychological evidence. First, cognitive abilities decline with age and are lower for very old individuals (age $>$ 70). Abilities are also increasing with education and size of social networks. The strong positive relation between cognitive abilities and education is intuitive and consistent with the evidence from previous studies (e.g., Brown and Reynolds, 1975; Zagorsky, 2007). The authors find the coefficient estimates for wealth and income are significantly positive, although their magnitudes are weak. The relatively weak relation between cognitive abilities and income/wealth, conditional on age and education, is consistent with the previous evidence (Cagney and Lauderdale, 2002).

Overall, the cognitive abilities model estimates indicate that a few demographic characteristics can explain a significant proportion of the cross-sectional variance in people's cognitive abilities. In particular, age, education, social network, and wealth are strong correlates of cognitive abilities. Korniotis and Kumar (2008) also show that these findings are robust even when the cognitive ability regressions are estimated using U.S. data from the HRS.

Cognitive Abilities and the Three Puzzles

In their main empirical analysis, Korniotis and Kumar (2008) focus on three portfolio distortions: portfolio concentration, propensity to trade, and propensity to invest in local stocks. First, portfolio concentration is the sample period average number of stocks in the portfolio. The investors' propensity to trade is measured

by monthly portfolio turnover rates (the average of buy and sell turnover rates). The investors' propensity to invest in local stocks is captured by a local stock preference (LP) proxy, which is defined as $LP = 1 - D_{act}/D_{portf}$. In this definition, D_{act} is the average distance between an investor's location and stocks in the portfolio, while D_{portf} is the average distance between an investor's location and other characteristic-matched portfolios not held by the investor.

The authors use these three portfolio distortion measures to assess whether investors follow the normative prescriptions of the traditional portfolio theory (i.e., hold well-diversified portfolios and trade infrequently). They conjecture that when investors follow these prescriptions, having high cognitive abilities is unlikely to yield significant advantages. However, differences in cognitive abilities should significantly alter portfolio performance when investors depart from these normative prescriptions and intentionally distort their portfolios. Specifically, when investors' portfolio distortions are induced by psychological biases, the realized performance of their portfolios will underperform typical performance benchmarks. In contrast, when portfolio distortions reflect superior information, those portfolios will generate abnormal risk-adjusted returns.

To test their conjecture, Korniotis and Kumar (2008) sort investors independently using their imputed smartness estimates and the three portfolio distortion measures. For each of the three portfolio distortion measures, they compute the average portfolio performance of high (top quintile) and low (bottom quintile) cognitive abilities investor categories when the distortion level is low (bottom quintile) and high (top quintile).

They obtain the performance estimates of ability-distortion categories using characteristic adjusted stock returns (Daniel et al., 1997). Korniotis and Kumar (2008) measure the monthly characteristic-adjusted performance for each ability-distortion category and compute its time-series average to obtain the sample-period performance of the investor category. Panel A of Exhibit 30.2 shows the distortion-conditional average portfolio performance for low and high cognitive abilities investor groups computed using *gross* characteristic-adjusted returns. As shown in the figure, when portfolio distortions are low, on average, smart investors earn only 1 percent higher annualized, characteristic-adjusted returns than dumb investors. But when portfolio distortions are significant, smart investors outperform less sophisticated investors by about 6 percent.

When Korniotis and Kumar (2008) use the Barber and Odean (2000) methodology to account for trading costs and measure the distortion-conditional performance differentials using net returns, the performance levels of both high and low cognitive abilities investors decline (see Panel B of Exhibit 30.2). The positive performance of high cognitive abilities investors is significant at the 0.05 level in two cases (portfolio concentration and local preference), and it is significant at the 0.10 level when the measured distortion uses portfolio turnover. The negative performance of low cognitive abilities investors is significant at the 0.05 level in all three instances. Further, the distortion-conditional performance differentials between the high and the low cognitive abilities investor groups remain positive and significant in all three instances ($\approx$5 percent). Overall, the evidence in Exhibit 30.2 indicates that the levels of portfolio distortions and cognitive abilities jointly determine the portfolio performance. The authors confirm these sorting results using a series of multivariate cross-sectional regressions.

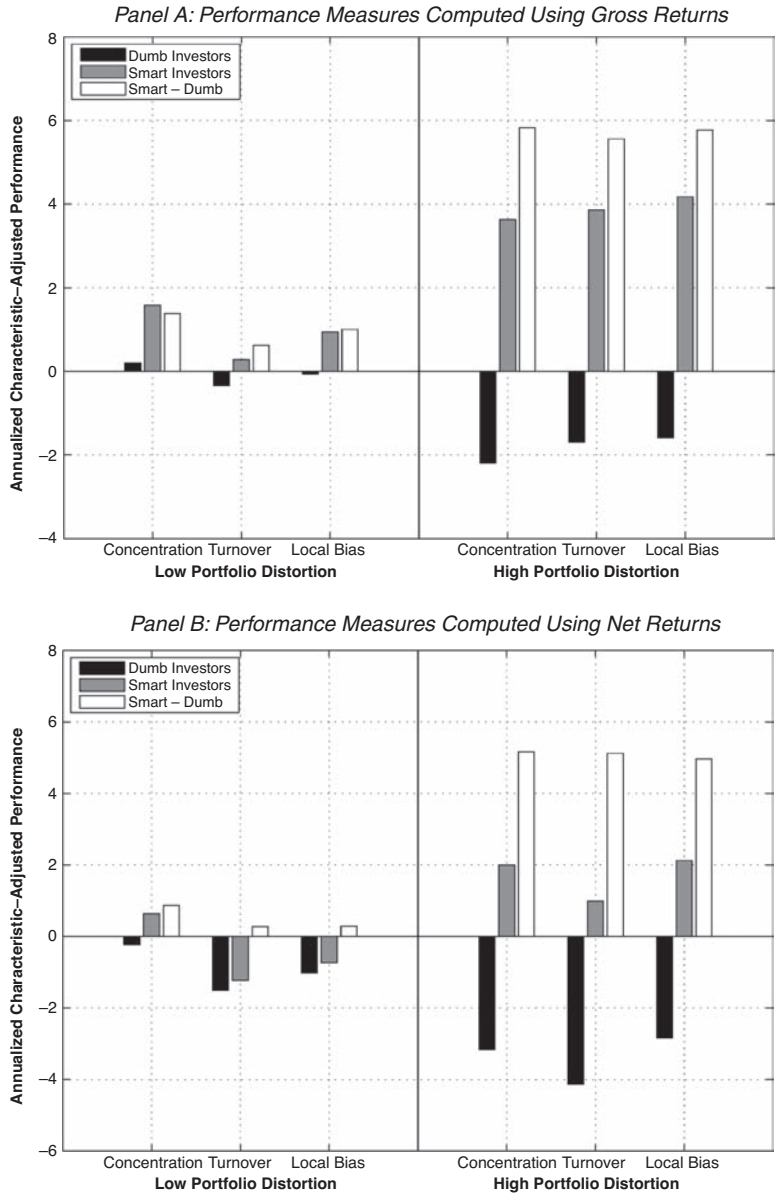

Exhibit 30.2 Cognitive Abilities, Portfolio Distortions, and Portfolio Performance

Note: This figure shows the sample-period average annualized characteristic-adjusted percentage returns of ability-distortion investor categories. Panel A (Panel B) reports performance estimates using gross (net) returns. The characteristic-adjusted returns are computed using the Daniel, Grinblatt, Titman, and Wermers (1997) method. An empirical model of cognitive abilities is used to measure investors' cognitive abilities. Investors in quintile 5 (quintile 1) are identified as high (low) cognitive abilities investors. The low and the high portfolio distortion categories are defined in an analogous manner. Three distortion measures are considered: portfolio concentration, portfolio turnover, and local stock preference.

EVIDENCE FROM FINLAND

In two related studies, Grinblatt, Keloharju, and Linnainmaa (2009a, 2009b) use a comprehensive Finnish dataset to examine whether high-IQ investors participate more in the stock market and whether they outperform low-IQ investors. Their dataset is unique because they are able to consolidate information from multiple sources. In particular, their intelligence (IQ) index comes from the Finnish Armed Forces (FAF) intelligence score data. The FAF data are collected around the age of 19 or 20 when an individual joins the military. The FAF data are then merged with data from Finnish Central Security Depository (FCSD) registry, which includes information on daily portfolios and trades of all Finnish household investors over the period 1995 to 2002.

Grinblatt et al. (2009a) use the FAF and FCSD data to show that individuals with the highest IQ scores are the most likely to participate in the stock market. Specifically, they find that conditional on the known determinants of stock market participation, the lowest IQ individuals have a participation rate that is 17.6 percentage points less than that of the highest IQ individuals. Furthermore, the IQ-participation relationship remains strong even among the most affluent individuals in their sample.

Grinblatt et al. (2009b) examine whether high-IQ investors trade on superior information. Unlike the Korniotis and Kumar (2008) analysis that computes the performance estimates for each investor, they measure the average performance of all stock bought (sold) by IQ-sorted investor groups at a particular date. They then test whether stocks purchased (sold) by high-IQ investors subsequently earn higher (lower) returns in the near future. To test this key hypothesis, they estimate stock-level Fama-MacBeth regressions in which the dependent variable is the return of a stock at day t. The set of independent variables includes the average IQ level of investors buying and selling the stock in the recent past. Their analysis shows that the high-IQ investors' stock purchases predict price increases in the following month while sales of high-IQ investors' are not systematically related to subsequent price decreases. Based on these findings they construct investor-based portfolios and report that the abnormal returns of a portfolio constructed from yesterday's purchases of the highest IQ investors outperforms the comparable portfolio of the below-average IQ investors by about 10 percent. This result is consistent with the findings in the Korniotis and Kumar study, which shows that the return differential between portfolios of stocks with high- and low-ability investor clienteles is positive and economically significant.

Grinblatt et al. (2009b) also examine whether high-IQ investors are skillful and structure their trades so that they incur low transaction costs. Their main objective is to investigate whether the transaction costs paid by high-IQ investors are lower than those paid by low-IQ investors. For this test, they integrate the Helsinki Exchanges (HEX) microstructure data to their investor-level dataset. The HEX dataset includes every order submitted to the consolidated HEX limit order book. They again estimate stock-level Fama-MacBeth regressions in which the stock returns are computed by comparing the trade's actual execution prices to the average bid and ask prices at the time of execution or a few minutes later. The authors find that the market orders of high-IQ investors face significantly lower bid-ask spreads than the market orders of below-average IQ investors. This result

complements the finding of Korniotis and Kumar (2008) that even after accounting for transaction costs, high-skill investors continue to outperform low-skill investors when portfolio distortions are high as shown in Panel B of Exhibit 30.2.

Overall, the evidence from the Grinblatt et al. (2009b) study indicates that high-IQ investors have better stock-picking abilities. High-IQ investors also appear more skillful because they incur lower transaction costs than low-IQ investors.

OTHER RELATED WORK

Thus far, the chapter has focused on the relation between cognitive abilities and investment decisions. This section summarizes studies that examine the effects of cognitive abilities in other economic settings.

In one of the early studies, Chevalier and Ellison (1999) examine the relationship between the performance of a fund and the characteristics of its manager. They use a sample of 492 managers who had sole responsibility for a fund for some part of the 1994 to 1998 period. The authors also collect biographical characteristics for these managers from Morningstar, Inc. Their evidence shows a negative relation between age and performance, even after controlling for various managerial attributes. They find this evidence puzzling and attribute it to managers' career concerns. However, their evidence is consistent with Korniotis and Kumar (2009), who argue that investment skill varies inversely with age. Chevalier and Ellison also find higher excess returns among mutual funds whose managers attended universities with higher average Scholastic Aptitude Tests (SAT) scores. Because SAT scores can proxy for IQ (Kanazawa, 2006), their results are consistent with the hypothesis that managers with more inherent abilities have better stock selection or market-timing abilities and thus can generate higher returns.

In another study, Grinblatt, Ikaheimo, and Keloharju (2008) examine the choices of mutual fund investors instead of looking at manager fund performance. Using data from Finland, they gather the scores of mutual fund investors from IQ tests. Conditioning on income and wealth, they find that the fund fees paid by high-IQ investors are not significantly lower than the fees paid by low-IQ investors. Nevertheless, the high-IQ investors seem to be more skillful because, on average, they avoid balanced funds marketed through retail networks, which tend to carry the highest fees.

In another context, Agarwal et al. (2009) look at the price people pay for financial services such as home equity loans, auto loans, and credit cards. Using proprietary data, they report that middle-aged adults borrow at lower rates and pay fewer fees than younger and older adults. Moreover, the average age of peak performance across the 10 studies is 53 years old. After considering various alternative explanations, they conclude that changes in experience and cognitive abilities across different age groups are the most plausible interpretation of their findings. The authors argue that young adults have little experience dealing with financial decisions and thus end up paying more for financial services. Older adults are also disadvantaged because of the age-related deterioration in their cognitive skills. These results from Agarwal et al. suggest that individuals with low cognitive abilities are potentially disadvantaged in making good financial decisions because they either do not know about the available financial products or do not fully understand their terms.

To further analyze consumer vulnerability, Mansfield and Pinto (2008) focus on developmentally disabled individuals, a demographic group with severe cognitive impairments. Through in-person interviews, they find that their respondents had a limited understanding of consumer credit cards. First, only 20 percent of the respondents reported that they either currently or previously owned a credit card. Second, none of the card holders they interviewed could offer a totally correct definition of a credit card. This evidence is consistent with the evidence in Suto, Clare, Holland, and Watson (2005a), who find that the financial decision-making abilities of individuals with mild intellectual disabilities are worse compared to those of their counterparts in the general population and to more able individuals. In a related study, Suto, Clare, Holland, and Watson (2005b) also conclude that a direct relationship exists between intellectual disabilities and basic financial understanding.

The impact of cognitive abilities has also been related to the winner's curse—the finding that winning bidders in various auction settings systematically overbid and lose money as a consequence. In one such study, Casari, Ham, and Kagel (2007) conduct auction experiments to study the relationship between the SAT/ACT scores of the participants and their performance in experimental settings. They find that skilled participants with high SAT/ACT scores avoided the winner's curse more than unskilled participants. The authors also document an asymmetric effect. Participants with below median SAT/ACT scores are more susceptible to the winner's curse compared to participants with high SAT/ACT scores. Their results indicate that limits exist to how much experience can compensate for low abilities because participants with low SAT/ACT scores suffer from the winner's curse even as experienced bidders.

SUMMARY AND CONCLUSIONS

This chapter examines the impact of cognitive abilities on financial decisions. The extant evidence from the behavioral finance literature demonstrates that people with high cognitive abilities are more likely to participate in the stock market. Upon participation, investors with different cognitive abilities make different decisions that result in significant performance differential across ability groups. In particular, investment skill declines with age (a key determinant of cognitive abilities), and the decline is stronger for low-income, low-education investors who cannot successfully compensate for the adverse effects of aging.

These empirical findings make several important contributions to the growing literature on household finance. First, theoretical models typically have the greatest difficulty in explaining the participation rates in the extreme age categories (e.g., Gomes and Michaelides, 2005). One conjecture is that younger investors would stay away from the stock market due to their lack of investment experience, while older investors would be less willing to participate due to a perception of declining cognitive abilities. Second, previous theoretical models have examined the aggregate effects of aging on stock market behavior (e.g., Bakshi and Chen, 1994; Poterba, 2001) through the channel of risk aversion. But age is likely to influence asset returns through an additional channel. Specifically, if older investors become aware of their declining investment skill, the perceived costs for stock market

participation would increase, and those investors would demand a higher premium for investing in the stock market.

Finally, in light of this evidence, direct stock market participation might be a suboptimal strategy for low cognitive abilities investors. Indirect investments using mutual funds and other forms of delegated investment management might be more appropriate for those investors. Similarly, while there have been attempts to privatize the social security system, Kotlikoff (1996) and Mitchell and Zeldes (1996) note that, under a fully privatized system, the welfare of households that do not make "wise" investment decisions could be adversely affected. Echoing their concerns, the papers reviewed in this chapter suggest that households with low cognitive abilities are likely to make inferior investment decisions if they are allowed to directly invest their retirement wealth in the stock market. This evidence should be taken into consideration when evaluating the merits of a fully private social security system.

DISCUSSION QUESTIONS

1. How can the confounding effects of experience and cognitive aging be incorporated into traditional portfolio choice models?
2. Is the brokerage dataset described in this chapter representative of average U.S. investors? Explain why or why not?
3. Do investors reduce their exposure to risk as they age? Discuss the research evidence.
4. The main cognitive ability model has been estimated using the SHARE dataset, which includes information on European households. Is such a model appropriate for American households? Explain why or why not.
5. The imputed smartness measure is a linear combination of demographic characteristics. If investors are sorted using each of these demographic characteristics separately, what would be the return differential between smart and dumb investors?

REFERENCES

Agarwal, Sumit, John C. Driscoll, Xavier Gabaix, and David Laibson. 2009. The age of reason: Financial decisions over the lifecycle and implications for regulation. *Brookings Papers on Economic Activity* 2009:2, 51–117.

Bakshi, Gurdip S., and Zhiwu Chen. 1994. Baby boom, population aging, and capital markets. *Journal of Business* 67:2, 165–202.

Baltes, Margaret M., and Frieder R. Lang. 1997. Everyday functioning and successful aging: The impact of resources. *Psychology and Aging* 12:3, 433–43.

Baltes, Paul B., and Ulman Lindenberger. 1997. Emergence of a powerful connection between sensory and cognitive functions across the adult life span: A new window to the study of cognitive aging? *Psychology and Aging* 12:1, 12–21.

Barber, Brad M., and Terrance Odean. 2000. Trading is hazardous to your wealth: The common stock investment performance of individual investors. *Journal of Finance* 55:2, 773–806.

Barber, Brad M., and Terrance Odean. 2001. Boys will be boys: Gender, overconfidence, and common stock investment. *Quarterly Journal of Economics* 116:1, 261–92.

Benjamin, Daniel J., Sebastian A. Brown, and Jesse M. Shapiro. 2006. Who is "behavioral"? Cognitive ability and anomalous preferences. Working Paper, University of Chicago and Harvard University.

Black, Sheila. 2004. Cognitive functioning among African American older adults. *African American Research Perspectives* 10:1, 106–18.

Brown, William W., and Morgan O. Reynolds. 1975. A model of IQ, occupation, and earnings. *American Economic Review* 65:5, 1002–7.

Browning, Martin, and Soren Leth-Petersen. 2003. Imputing consumption from income and wealth information. *Economic Journal* 113:488, F282–301.

Cagney, Kathleen A., and Diane S. Lauderdale. 2002. Education, wealth, and cognitive function in later life. *Journal of Gerontology* 57B:2, 163–72.

Casari, Marco, John Ham, and John Kagel. 2007. Selection bias, demographic effects, and ability effects in common value auction experiments. *American Economic Review* 97:4, 1278–304.

Chevalier, Judith, and Glenn Ellison. 1999. Are some mutual fund managers better than others? Cross-sectional patterns in behavior and performance. *Journal of Finance* 54:3, 875–99.

Christelis, Dimitris, Tullio Jappelli, and Mario Padula. 2010. Cognitive abilities and portfolio choice. *European Economic Review* 54, 19–39.

Daniel, Kent D., Mark Grinblatt, Sheridan Titman, and Russell Wermers, 1997. Measuring mutual fund performance with characteristic-based benchmarks. *Journal of Finance* 52:3, 1035–58.

Dhar, Ravi, and Ning Zhu. 2006. Up close and personal: An individual level analysis of the disposition effect. *Management Science* 52:5, 726–40.

Dohmen, Thomas, Armin Falk, David Huffman, and Uwe Sunde. 2007. Are risk aversion and impatience related to cognitive ability? IZA Discussion Paper No. 2735.

Feng, Lei, and Mark S. Seasholes. 2005. Do investor sophistication and trading experience eliminate behavioral biases in financial markets? *Review of Finance* 9:3, 305–51.

Frederick, Shane. 2005. Cognitive reflection and decision making. *Journal of Economic Perspectives* 19:4, 2542.

Goetzmann, William N., and Alok Kumar. 2008. Equity portfolio diversification. *Review of Finance* 12:3, 433–63.

Gomes, Francisco, and Alexander Michaelides. 2005. Optimal life-cycle asset allocation: Understanding the empirical evidence. *Journal of Finance* 60:2, 869–904.

Graham, John R., Campbell R. Harvey, and Hai Huang. 2009. Investor competence, trading frequency, and home bias. *Management Science* 55:7, 1094–106.

Grinblatt, Mark, Seppo Ikaheimo, and Matti Keloharju. 2008. Are mutual fund fees competitive? What IQ-related behavior tells us. Working Paper, UCLA Anderson School of Management.

Grinblatt, Mark, and Matti Keloharju. 2001. How distance, language, and culture influence stockholdings and trades. *Journal of Finance* 56:3, 1053–73.

Grinblatt, Mark, and Matti Keloharju. 2009. Sensation seeking, overconfidence, and trading activity. *Journal of Finance* 64:2, 549–78.

Grinblatt, Mark, Matti Keloharju, and Juhani Linnainmaa. 2009a. IQ and stock market participation. Chicago Booth Research Paper No. 09-27.

Grinblatt, Mark, Matti Keloharju, and Juhani Linnainmaa. 2009b. Do smart investors outperform dumb investors? Chicago Booth Research Paper No. 09-33.

Holden, Craig W., and Avanidhar Subrahmanyam. 1992. Long-lived private information and imperfect competition. *Journal of Finance* 47:1, 247–70.

Holtzman, Ronald E., George W. Rebok, Jane S. Saczynski, Anthony C. Kouzis, Kathryn Wilcox Doyle, and William W. Eaton. 2004. Social network characteristics and cognition in middle-aged and older adults. *Journal of Gerontology: Psychological Sciences* 59B:6, 278–84.

Horn, John L. 1968. Organization of abilities and the development of intelligence. *Psychological Review* 75:3, 242–59.

Huberman, Gur. 2001. Familiarity breeds investment. *Review of Financial Studies* 14:3, 659–80.

Ivkovich, Zoran, Clemens Sialm, and Scott Weisbenner. 2008. Portfolio concentration and the performance of individual investors. *Journal of Financial and Quantitative Analysis* 43:3, 613–56.

Ivkovich, Zoran, and Scott Weisbenner. 2005. Local does as local is: Information content of the geography of individual investors' common stock investments. *Journal of Finance* 60:1, 267–306.

Kanazawa, Satoshi. 2006. IQ and the wealth of states. *Intelligence* 34:6, 593–600.

Kezdi, Gabor, and Robert Willis. 2003. Who becomes a stockholder? Expectations, subjective uncertainty, and asset allocation. Working Paper 2003-039, University of Michigan Retirement Research Center.

Korniotis, George M., and Alok Kumar. 2008. Do portfolio distortions reflect superior information or psychological biases? Working Paper, University of Texas at Austin.

Korniotis, George M., and Alok Kumar. 2009. Do older investors make better investment decisions? *Review of Economics and Statistics*, forthcoming.

Kotlikoff, Laurence J. 1996. Privatizing social security at home and abroad. *American Economic Review* 86:2, 368–72.

Kumar, Alok. 2009. Who gambles in the stock market? *Journal of Finance* 64:4, 1889–933.

Kyle, Albert S. 1985. Continuous auctions and insider trading. *Econometrica* 53:6, 1315–35.

Lindenberger, Ulman, and Paul B. Baltes. 1994. Sensory functioning and intelligence in old age: A strong connection. *Psychology and Aging* 9:3, 339–55.

Lindenberger, Ulman, and Paul B. Baltes. 1997. Intellectual functioning in old and very old age: Cross-sectional results from the Berlin aging study. *Psychology and Aging* 12:3, 410–32.

List, John A. 2003. Does market experience eliminate market anomalies? *Quarterly Journal of Economics* 118:1, 41–71.

Mansfield, Phylis M., and Mary Beth Pinto. 2008. Consumer vulnerability and credit card knowledge among developmentally disabled citizens. *Journal of Consumer Affairs* 42:3, 425–38.

Massa, Massimo, and Andrei Simonov. 2006. Hedging, familiarity and portfolio choice. *Review of Financial Studies* 19:2, 633–85.

Masunaga, Hiromi, and John Horn. 2001. Expertise and age-related changes in components of intelligence. *Psychology and Aging* 16:2, 293–311.

McArdel, John J., James P. Smith, and Robert Willis. 2009. Cognition and economic outcomes in the health and retirement survey. IZA Discussion Paper Series, No. 4269.

Mitchell, Olivia S., and Stephen P. Zeldes. 1996. Social security privatization: A structure for analysis. *American Economic Review* 86:2, 363–67.

Mitton, Todd, and Keith Vorkink, 2007. Equilibrium under-diversification and the preference for skewness. *Review of Financial Studies* 20:4, 1255–88.

Odean, Terrance. 1999. Do investors trade too much? *American Economic Review* 89:5, 1279–98.

Oechssler, Jörg, Andreas Roider, and Patrick W. Schmitz. 2008. Cognitive abilities and behavioral biases. IZA Discussion Paper No. 3481.

Poterba, James M. 2001. Demographic structure and asset returns. *Review of Economics and Statistics* 83:4, 565–84.

Salthouse, Timothy A. 2000. Aging and measures of processing speed. *Biological Psychology* 54:1-3, 35–54.

Schroeder, David H., and Timothy A. Salthouse. 2004. Age-related effects on cognition between 20 and 50 years of age. *Personality and Individual Differences* 36:2, 393–404.

Shanan, J., and R. Sagiv. 1982. Sex differences in intellectual performance during middle age. *Human Development* 25:1, 24–33.

Spaniol, Julia, and Ute J. Bayen. 2005. Aging and conditional probability judgments: A global matching approach. *Psychology and Aging* 20:11, 165–81.

Stango, Victor, and Jonathan Zinman. 2008. Exponential growth bias and household finance. *Journal of Finance*, forthcoming.

Suto, W. M. I., Isabel Clare, Anthony Holland, and Peter Watson. 2005a. Capacity to make financial decisions among people with mild intellectual disabilities. *Journal of Intellectual Disability Research* 49, 199–209.

Suto, W. M. I., Isabel Clare, Anthony Holland, and Peter Watson. 2005b. The relationships among three factors affecting the financial decision-making abilities of adults with mild intellectual disabilities. *Journal of Intellectual Disability Research*, 49:3, 210–17.

Zagorsky, Jay L. 2007. Do you have to be smart to be rich? The impact of IQ on wealth, income and financial distress. *Intelligence* 35:5, 489–501.

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CHAPTER 31

Pension Participant Behavior

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INTRODUCTION

Over the past 25 years, the United States has witnessed a dramatic shift in pension coverage (for an overview, see Poterba, Venti, and Wise, 2008). For years, Social Security and defined benefit plans provided many employees guaranteed support in retirement. In both cases, difficult savings and investment decisions were not the responsibility of the participants. Today, the landscape has changed dramatically. While policy makers debate serious concerns about the long-term solvency of the Social Security system, defined contribution plans have become the most common pension offering. From the employer's perspective, this change is beneficial because defined contribution plans are less expensive to administer and shift the portfolio risk entirely to the employee. From the employee's perspective, defined contribution plans offer portability but also involve the personal responsibility of making critical savings decisions. For many, these new and challenging financial decisions are overwhelming and further complicated by a lack of financial literacy, interest, and time. One unintended consequence of this shift is that it has provided academics a rich context for investigating behavioral finance theories. Over the past 10 years, this growing area of research has enhanced our understanding of the psychology of investing, provided substantial support for various theories, and led to significant changes in retirement plan design that have improved overall savings outcomes. The purpose of this chapter is to summarize the most significant findings in this area that relate to behavioral finance and highlight the successful plan design changes that have resulted.

This chapter contains six main sections. The first five sections address the behavioral aspects of five important financial decisions investors must make in their retirement plans: (1) whether to participate in the plan, (2) how much to periodically contribute, (3) where to allocate assets, (4) when to rebalance allocations, and (5) how to handle the sum they have accumulated once they retire. The final section discusses how financial literacy and lack of interest may contribute to the influence of biases and heuristics in these decisions.

THE PARTICIPATION DECISION

When employers first introduced defined contribution plans, employees typically joined their retirement plan under a voluntary enrollment arrangement. This meant

they had to consciously "opt-in" to participate. Early studies largely focused on rational explanations for nonparticipation. Often studies used either 401(k) administrative data or survey evidence to investigate the role of plan features and individual characteristics. Researchers often found that plan design elements—such as employer matches and individual characteristics like age, salary, ethnicity, and job tenure—mattered for participation rates. Munnell, Sundén, and Taylor (2001/2002) provide a concise survey of this early work. By the late 1990s, a growing interest in behavioral reasons for nonparticipation was emerging that led to research evidence supporting several behavioral biases. Today, the retirement savings decision is clearly a function of a complex set of factors. In addition to rational explanations for nonparticipation, behavioral biases can play an important role.

A popular Madrian and Shea (2001) study led to widespread changes in plan design. The authors analyze one 401(k) plan transitioning from a voluntary (opt-in) enrollment arrangement to an automatic (opt-out) enrollment arrangement. According to rational-choice theory, this change in enrollment method should have no effect on participation levels if individuals have well-defined preferences because a person will always optimize and select the best option (Johnson and Goldstein, 2003). Contrary to this expectation, the authors find participation levels for employees at similar points in job tenure increase significantly when automatic enrollment is introduced, from 37 percent to 86 percent. In addition, participation rates between demographic groups equalize. The authors are careful in their analysis and make sure that none of the economic characteristics such as the vesting schedule, number of investment options, access to loans, and level of employer matching change during the study. As a result, their findings strongly point to behavioral explanations. Madrian and Shea provide a thorough summary of several behavioral theories that explain their findings and highlight procrastination, in particular, as a very likely cause.

So what causes individuals to procrastinate when making important decisions about their long-run financial well-being? At first this might seem puzzling, but the complexity of these decisions and their high stakes are the very reasons individuals most likely delay decision making. O'Donoghue and Rabin's (2001) model predicts that an individual's tendency to procrastinate increases the more important the goal and the more options that are available. In addition, the perceived complexity of the decision is further complicated by the well-documented lack of interest and knowledge of finance among workers that is discussed in the last section of this chapter.

Procrastination may also be influenced by how aware individuals are of their own self-control problems. Time-inconsistent behavior, such as neglecting to save for retirement, can result when individuals' lack of self-control causes them to pursue immediate gratification over long-term benefits (Thaler and Shefrin, 1981). O'Donoghue and Rabin's (2001) model suggests that the more ignorant individuals are regarding their own self-control, the more likely they are to procrastinate. Laibson (1997) and Diamond and Koszegi (2003) provide additional research on time-inconsistent behavior and retirement that focuses specifically on hyperbolic and quasi-hyperbolic discounting.

Madrian and Shea (2001) also suggest that the status quo bias may influence their findings. The status quo bias is the tendency for individuals to do nothing or

maintain their current or previous decision. In Samuelson and Zeckhauser's (1988) experimental testing of this phenomenon, they find that subjects are significantly influenced by the status quo even if they do not recognize a bias. According to these authors, rational reasons including transaction costs (such as information search costs) and uncertainty, as well as cognitive misperceptions (such as loss aversion and anchoring), can all lead to the status quo bias. They also mention that psychological commitments such as regret avoidance can play a role. Obviously, each of these factors could come into play in retirement decision making. Therefore, the different participation rates that Madrian and Shea find are also consistent with this theory.

The number of choices the individual must make also contributes to nonparticipation. As mentioned earlier, O'Donoghue and Rabin's (2001) model predicts that additional choices can increase the probability of procrastination. In the case of 401(k) plans, if the individual chooses to participate, he or she then faces several additional decisions such as how much to save and how to allocate his or her portfolio across a variety of investment options. This may lead to what is called choice overload.

Iyengar and Lepper (2000) test the choice overload theory in an innovative study using consumer goods in field and laboratory experiments. In one experiment, they present supermarket shoppers with either a display of 24 exotic jams (extensive choice condition) or six exotic jams (limited choice condition). While they find more people are drawn to the extensive choice display (60 percent versus 40 percent), the individuals who view the limited choice display are actually more likely to purchase the jams than those who view the extensive choice set (30 percent versus 3 percent). Thus, Iyengar and Lepper conclude that too much choice can be demotivating.

To test the influence of the number of fund choices on retirement plan participation, Sethi-Iyengar, Huberman, and Jiang (2004) use 401(k) administrative data provided by Vanguard. They find that the probability of participation decreases as the number of funds in the investment menu increases. Their analysis suggests that for every 10 funds added to an investment menu, the probability of participation decreases by 1.5 to 2 percent.

Beyond plan features, peer effects may also influence participation. Survey studies by Lusardi and Mitchell (2006) and van Rooij, Lusardi and Alessie (2007) report that a high percentage of respondents consult with family and friends when making financial decisions. In a study of employees at a university offering a tax-deferred account, Duflo and Saez (2002) find evidence of peer effects in their analysis of participation rates and investment decisions. Using an administrative dataset, they find that when participation rates increase by 1 percent in a department, the probability of an individual participating in that department increases by 0.2 percent.

In a separate paper, Duflo and Saez (2003) study the role of social interactions by conducting a field study in which they invite individuals who do not participate in their university retirement plan to attend a benefits fair that encourages enrollment. They promise the invitees a $20 reward for attending. The authors draw these "treated" individuals from a random subset of departments to estimate the role of social interaction effects. The results show that the treatment significantly affects the attendance at the benefits meeting. The treated individuals are five times more

likely to attend the benefits meeting versus the control sample. In addition, Duflo and Saez note a significant spillover social effect. Individuals not given invitations but working in a department with treated individuals are three times as likely to attend the fair versus their controls in departments without invited employees. The treatment also affects plan participation rates. Treated departments report higher participation rates. Interestingly, whether an individual receives an invitation letter does not influence participation: What matters is whether the individual is in a treated department. Duflo and Saez's results suggest that small financial rewards and/or peer effects can significantly influence important decisions like retirement savings.

Trust may also influence participation. Research suggests that a lack of trust in financial institutions can influence general financial behavior, specifically among lower socioeconomic households. For example, studies by Szykman, Rahtz, Plater, and Goodwin (2005) and Bertrand, Mullainathan, and Shafir (2006) show that poor individuals consciously avoid doing business with financial institutions due to their lack of trust in them. In addition, Guiso, Sapienza, and Zingales (2008) find that lack of trust may explain why some individuals do not invest in the stock market.

To explore the role of trust in 401(k) participation, Agnew, Szykman, Utkus, and Young (2009) use a dataset that combines survey data with administrative data from three plans, two featuring automatic enrollment and one with voluntary enrollment. They find lack of trust in financial institutions lowers the probability of participating in an automatic enrollment plan. For a married male with average demographic characteristics based on the data sample, a low level of trust corresponds to a 15 percent lower probability of participation.

Taken together, the research described above suggests that non-economic or behavioral motivations can influence participation. Proponents of Thaler and Sunstein's philosophy of libertarian paternalism would argue that private and public institutions have a responsibility to help guide people toward welfare-promoting choices without eliminating freedom of choice (Thaler and Sunstein, 2003; Sunstein and Thaler, 2003). Recent and significant changes in plan design and enrollment techniques in retirement plans suggest that many plan sponsors are acting consistently with this philosophy.

The most notable change in retirement plans is the widespread adoption of automatic enrollment. At the time of Madrian and Shea's (2001) study, this feature was still relatively uncommon but in 2007 the Profit Sharing/401(k) Council of America estimated that 53 percent of large plans automatically enrolled participants (Wray, 2009). This change in plan design has led to a significant increase in participation rates. While the trend toward automatic enrollment continues, some company sponsors remain resistant to this change and prefer the voluntary enrollment approach. Fortunately for these plan sponsors, a growing understanding of behavioral finance has led to some new approaches that work with voluntary schemes. While the three alternatives discussed below are successful, none increase participation to the level of automatic enrollment.

Active choice is an alternative method that institutes a deadline to require workers to decide whether to participate. Without default options, workers must make explicit decisions related to contribution rates and allocations. Under active choice, Carroll, Choi, Laibson, Madrian, and Metrick (2009) find that enrollment

after three months is 28 percent higher compared to a voluntary arrangement. They also demonstrate that if individuals are likely to procrastinate and have heterogeneous optimal savings rates, then this method is socially optimal.

A second approach uses social marketing to promote participation. Lusardi, Keller, and Keller (2008) employ surveys, focus groups, and in-depth interviews to identify three barriers to savings by participants. Considering these obstacles, they devise a planning aid that helps at-risk, new employees overcome self-control issues. Thirty days after the first intervention, they find the participation rate tripled compared to the control group.

Finally, Choi, Laibson, and Madrian (2009) study a program instituted by Hewitt Associations called Quick Enrollment™. This enrollment method reduces the complexity of the decision by requiring employees to consider only two choices between nonparticipation and participation with contribution rate and asset allocation defaults. They find that quick enrollment triples 401(k) participation rates after three months for new employees and increases participation by previously hired workers by 10 to 20 percent. However, the authors find evidence of a default bias associated with the contribution rate and asset allocations.

CONTRIBUTION LEVELS

Once the employee is enrolled in the plan, there are still several important decisions remaining. For those who have been voluntarily enrolled, he or she must now decide how much of his or her paycheck to contribute to the plan. Research shows that contribution rates often cluster around several points. Benartzi and Thaler (2007) explain that this is evidence that individuals may be using different savings heuristics. They describe several heuristics based on these commonly found clusterings, including a "multiple-of-five heuristic," a "maximum contribution heuristic," and an "employer match heuristic."

In contrast to the voluntarily enrolled participants, automatically enrolled participants are not required to choose a contribution rate because a default rate is available. In the case of automatically enrolled participants, researchers commonly observe a strong default bias with the contribution rates anchored to the default. Highlighting the influence of the default bias, Choi, Laibson, Madrian, and Metrick (2004) report that 80 percent of automatically enrolled participants in their study accept both the default savings rate and the default investment fund. Consistent with the status quo bias and inertia, they find that three years later, over half of these participants maintain these default options. Given that plan providers often set the default contribution rate very low, this has become one of the few downsides of the trend toward automatic enrollment (Nessmith, Utkus, and Young, 2007).

Once the individual sets or accepts a contribution level, Choi, Laibson, Madrian, and Metrick (2009) find that a naïve reinforcement learning heuristic may lead to subsequent changes in the contribution level. According to this heuristic, individuals increase weights on strategies with which they have personally experienced success even when future success is not logically related to past experience. Using administrative data, the authors find that investors who have positive savings outcomes in their 401(k) plans (either high average returns and/or low variance returns) increase their savings rates more than others with different experiences.

In an effort to increase contribution levels, especially as automatic enrollment has caused many to anchor at low rates, several plans have implemented a new feature that takes advantage of information learned about investors' psychology. Engineered by Thaler and Bernatzi (2004), the Save More Tomorrow Plan™ (SMarT) takes into account the self-control problems. As a result, the program requires employees to commit far in advance to increases in contribution rates. This "future lock-in" is known to overcome participants' problems with self-control and is effective in enabling individuals to select what they "should" do over what they "want" to do (Rogers and Bazerman, 2008). The SMarT program also mitigates feelings of loss by timing the contribution rate increases with future raises. Inertia works to the participants' advantage because a suboptimal decision is to change once the initial decision to enroll in the program is made. That said, consistent with libertarian paternalism, employees may opt out of the program at any time.

The results from the first implementation of the program show dramatic increases in savings for SMarT participants. In addition, as status quo bias theory would predict, few people drop out. After the fourth pay raise, SMarT participants contribute on average 13.6 percent to the plan. This compares to an 8.8 percent contribution rate for those who instead consulted with an advisor. The contrast is even more dramatic when comparing contribution rates with those who opt not to see the financial consultant (6.2 percent) or decline participation in the SMarT plan (5.9 percent).

ASSET ALLOCATION DECISIONS

Once the individual decides on or accepts a contribution rate, he or she must decide how to allocate the portfolio. This can be challenging because research suggests that individuals may not have well-defined portfolio preferences (Benartzi and Thaler, 2002). Not surprisingly, as with participation and contribution rate decisions, defaults appear to have an influence (Choi, Laibson, Madrian, and Metrick, 2002, 2004). As mentioned earlier, Choi, et al. (2004) report that in their study, 80 percent of automatically enrolled participants accept the default investment fund. Similarly, in an analysis of 50 retirement plans, Nessmith et al. (2007) find that new hires in automatic enrollment plans are three times as likely to put all of their contributions in the default investment fund compared to new hires in voluntary plans. They also find that 51 percent of individuals remain in the plan default after two years.

While the influence of defaults is obviously powerful, evidence suggests that the default bias can be overcome through committed and sustained efforts to encourage active choice. One of the most interesting examples of this is the Swedish pension system. Under the Swedish pension scheme, individuals may invest in up to five funds out of a menu of over 400 fund choices. In 2000, the first year of the plan, the Swedish government undertook a large advertising campaign to increase public awareness of options. In the first year of the system, a large percentage of citizens made an active fund allocation choice (67 percent). As a result, the initial appearance was that Swedish investors were far less susceptible to the default bias than U.S. investors (Engstrom and Westerberg, 2003). However, by 2003, the advertising level had decreased, and 91.6 percent of new participants chose the

default fund (Cronqvist and Thaler, 2004), demonstrating that the default bias is not limited to U.S. investors and cannot be overcome without sustained efforts.

In addition to the default bias, other behavioral biases can influence allocations. Company stock investment provides an excellent case study. Given the well-known benefits of diversification, it is puzzling that investors would invest substantial amounts in one security, especially one highly correlated with their own human capital. Several studies detail the potentially large welfare costs associated with company stock investment (Muelbroek, 2002; Poterba, 2003; Even and Macpherson, 2008). Despite these costs, participants still concentrate their portfolios in company stock, and recent research suggests that behavioral biases may be to blame.

For example, Huberman (2001) suggests that a familiarity bias may influence an investment choice. He asserts that some investors are not optimizing their portfolios based on risk and return but rather choosing to invest in what they know. Huberman finds evidence of this in investing patterns associated with U.S. Regional Bell Operating Companies. Along similar lines, Cohen (2009) suggests that loyalty may come into play. He finds that employees of stand-alone firms invest 10 percent more in company stock than employees in conglomerates.

Benartzi (2001) suggests that there may also be an endorsement effect when the employer restricts the employer match to company stock. Brown, Liang, and Weisbenner (2006) provide more information about why employers might provide matching contributions in company stock. Contrary to rational expectations, Benartzi finds that when the employer match is in company stock participants allocate *more* of their own contributions to this security (18 percent versus 29 percent). He theorizes that employees are interpreting the company stock match as implicit investment advice. Using pooled cross sections of data, Brown, Liang, and Weisbenner (2007) find similar evidence. However, when they control for firm-level fixed effects, they find this relationship between match policy and employee contributions to company stock disappears.

Excessive extrapolation may also affect company stock allocations. Benartzi (2001) finds that discretionary contributions to company stock with the poorest 10-year stock performance were lower than those with the best performance (10.4 percent versus 39.7 percent). Additional studies also find links between past company stock returns and company stock holdings (Choi et al., 2004; Huberman and Sengmueller, 2004; Agnew, 2006; Brown et al., 2007).

Moving beyond company stock allocation decisions, research suggests that excessive extrapolation can also be a factor in other asset choices. Returning to the Swedish pension scheme example, investors may have been using historic 5-year fund returns to aid in their fund selection process. During the first year of the program, a technology and health-care fund recorded the best 5-year fund performance out of all 456 funds. An information booklet given to all participants reported these returns. Interestingly, this fund received the largest percent of the contribution pool (4.2 percent) excluding the default fund (Cronqvist and Thaler, 2004). Unfortunately for those who selected this fund, by 2003 the Internet bubble had burst, and this fund had lost 69.5 percent of its value. This example is a cautionary tale about the potential pitfalls of using simple allocation heuristics.

Past research also suggests that the investment menu may affect asset allocations. Benartzi and Thaler (2001) find some evidence that individuals follow a naïve diversification strategy called the "$1/n$ heuristic." Based on this rule of

thumb, investors divide their contributions equally among the n choices available. Depending on the fund menu, this strategy can easily result in portfolios that are inconsistent with the investors' risk preferences and lead to large *ex ante* welfare losses as documented by the authors. This rule of thumb appears to become less popular as the number of fund choices increases. Huberman and Jiang (2006) find that for a menu with a large number of funds, individuals follow a slightly different heuristic, which they refer to as the "conditional $1/n$ rule." Agnew (2006) also finds evidence of the conditional $1/n$ rule. According to the conditional rule, participants will divide their allocations equally among the number of funds they choose. The number of funds chosen is not necessarily equal to the total number of funds offered. Huberman and Jiang (2006) point out that this may not be an irrational strategy.

Brown et al. (2007) provide further evidence of menu-driven effects. They use aggregate data and find that the number and mix of investment options significantly affects the allocation of contributions. They estimate that increasing the share of equity funds from 1/3 to 1/2 increases overall participant allocations to equity funds by 7.5 percentage points. Using individual-level administrative data, Agnew (2006) also finds evidence of mental accounting (Kahneman and Tversky, 1984; Thaler, 1985, 1999) when company stock is present. In a variation on the conditional $1/n$ heuristic, Agnew finds that individuals appear to allocate their contributions to company stock and then divide equally their remaining allocations to the other asset holdings. From these results, participants are apparently treating company stock as a separate asset class. This finding supports earlier work by Benartzi and Thaler (2001). Finally, Choi, Laibson, and Madrian (2008a) find mental accounting present when employees do not choose their own match allocation.

Once again highlighting the importance of choice architecture, Benartzi and Thaler (2007) report surprising results related to subtle changes to the investment form design. They test whether the number of lines on a fund election form can influence the number of funds in which participants invest. In an experiment using Morningstar.com, they asked participants to allocate money among eight hypothetical funds. Participants received one of two possible computer forms, one featuring four lines with a hyperlink to invest in more than four funds and one with eight lines. The number of lines did significantly influence the behavior. Only 10 percent of individuals presented with the four-line form chose more than four funds compared to 40 percent of those viewing the form with more lines. Benartzi, Peleg, and Thaler (2008) provide further discussion about choice architecture.

This research has helped plan sponsors recognize the complexity of the allocation decision and the tendency of employees to rely on simple heuristics when making allocation choices. In response, 401(k) providers have become proactive in improving plan design and introducing new products intended to simplify the process and improve savings outcomes. Target date funds (sometimes referred to as Life-Cycle funds) are a recent example of this type of new product. These funds have rapidly become a common offering in 401(k) menus since the 2006 Pension Protection Act authorized that they could be used as default options. Nessmith and Utkus (2008) estimate that participants invested $183 billion in these funds in 2007, and 81 percent of plans with auto-enrollment used them as their default. While not without controversy, these funds are theoretically an effective tool to

help individuals maintain a portfolio mix that is appropriate over the long term. One advantage of these funds is that they reduce the complexity of the allocation decision for the investor because the participant need only choose a fund with a date similar to his or her expected retirement date. Once a participant decides to invest in a target date fund, the status quo bias and inertia keep the participant's investment decision on track. Viceria (2008) provides more details about how the first generation of these products relates to academic models of asset allocation and suggests improvements for future products.

While an innovative and a seemingly error-proof solution, the way target date funds are actually used in individuals' portfolios is perplexing and suggests that individuals may not fully understand this growing asset class. Nessmith and Utkus (2008) find that just over half of target date fund investors are "pure" investors who hold only one single target date fund when these products are offered, while the remaining group represents "mixed" investors who combine target date funds with other investment options. In an analysis of a similar type of fund that is based on risk preferences, so-called lifestyle funds, Agnew (2007) finds similar "mixed" portfolio results. Of the participants in her sample, 36 percent held at least one lifestyle fund, and of that group nearly half (47 percent) invested in multiple lifestyle funds.

Whether these "mixed" portfolios are due to participants optimizing their overall portfolios or a result of naïve decision making is unclear. However, there is growing evidence that a lack of financial understanding about these new products may drive this behavior, and this is discussed later in the financial literacy section. In addition to financial literacy, Nessmith and Utkus (2008) propose several rational and behavioral explanations for the mixed portfolios including naïve diversification, inertia, and employer matching effects. Future research will need to test all these theories. However, existing evidence shows that defaults can encourage more pure "single selection" investing. Mitchell, Mottola, Utkus, and Yamaguchi (2008) find that participants are more likely to be "pure" investors when the default option is a target date fund. Once again, if individuals have well-defined preferences, the presence of a default should not matter.

With regard to company stock investment, Bernatzi and Thaler (2003) are developing a new program based on behavioral finance principles similar to their SMarT program discussed earlier. The results of this program are still to be tested.

TRADING

Once retirement participants make an asset allocation, they must then decide if and how to rebalance their portfolio over time. Unlike retail brokerage accounts, trading in 401(k) plans is characterized by extreme inertia (Odean, 1999; Ameriks and Zeldes, 2001; Madrian and Shea, 2001; Agnew, Balduzzi, and Sundén, 2003; Mitchell, Mottola, Utkus, and Yamaguchi, 2006). Agnew et al. (2003) find that, on average, investors trade only once every 3.85 years. Mitchell et al. (2006) discover that almost 80 percent of the 1.2 million workers they study do not trade over a two-year period. This behavior is consistent with the implications of models of optimal portfolio choice with realistic transaction costs (Lynch and Balduzzi, 2000). However, such behavior can be a concern if it results from procrastination.

For example, if a participant is defaulted into a fund that is inappropriate for his or her risk characteristics, the optimal action would be to trade out of the fund.

This inertia appears to persist even in times of market turmoil (Mottola and Utkus, 2009). However, evidence suggests that a very small subset of individuals may be reacting to market returns. Mottola and Utkus report spikes in the number of investors who completely abandoned equities during the months of extreme market downturns in 2008. However, the number of traders represents an extremely small proportion of the sample. This type of trading is consistent with a positive feedback strategy where investors buy assets that are increasing and sell assets that are falling. Using data from only one 401(k) plan, Agnew et al. (2003) find evidence of positive feedback trading with a one-day lag. Using a more comprehensive but aggregated dataset of retirement asset flows representing 1.5 million participants over a 5-year period, Agnew and Balduzzi (2009) find additional evidence of feedback trading within the day. Taken together this evidence is a cause for concern as it suggests that some investors may deviate from their long-run investment objectives in response to one-day market returns.

Trading in 401(k) trading plans has also been shown to be influenced by access to the Internet. Choi, Laibson, and Metrick's (2002) study finds that trading frequency after 18 months of access to Web trading nearly doubles relative to a control group of individuals without access. This finding may be a result of the fact that Web trading reduces time and other transaction costs. Mitchell et al. (2006) also discover that the most active traders use the Internet. Yamaguchi, Mitchell, Mottola, and Utkus (2006) find that active trading does not lead to higher risk-adjusted returns but passive rebalancing through balanced and life-cycle funds does. Given the documented inertia and the benefits of rebalancing, plan sponsors have introduced life-cycle funds that automatically adjust portfolio shares over time, as well as managed account services.

DISTRIBUTION PHASE

While many researchers have devoted time to studying how behavioral factors influence decisions in the accumulation phase, far fewer have studied how these influences affect how individuals make investment and consumption decisions upon retirement. For most defined contribution plans, the default is for participants to withdraw their money in a lump sum after a certain age. At this point, participants face complicated decisions. Should annuities play a role in their retirement portfolio? How should they allocate assets, and how much should they consume so that they do not run out of money?

In response to these questions, theoreticians contend that single, premium lifetime immediate annuities should play a role in retirement portfolios. However, the actual market for these products is relatively small, which is puzzling to academics whose models of rational behavior predict a much larger demand. Even when theoreticians add extensions to the basic model, such as adverse selection and bequest motives, they cannot explain the small size of the actual market. This well-known fact is commonly referred to as "The Annuity Puzzle." Brown (2008) provides a thorough and informative summary of the past theoretical and empirical literature and challenges researchers to consider behavioral explanations in the future. He offers framing, complexity, mental accounting, loss aversion, misleading

heuristics, regret aversion, and the illusion of control as possible behavioral reasons for the annuity puzzle.

One recent study by Hu and Scott (2007) explores how several behavioral theories such as cumulative prospect theory, loss aversion, and mental accounting can explain the low demand for immediate annuities. They find behavioral reasons for the popularity of guaranteed period life annuities.

Two new studies examine the role of framing in the annuity decision. Agnew, Anderson, Gerlach, and Szykman (2008) use a large scale-laboratory experiment to investigate the influence of negative message framing. They are motivated by the framing work of Tversky and Kahneman (1981) and more recent studies in the health communications literature that examine how positive and negative messages influence recommended health behaviors (Block and Keller, 1995). Agnew et al. ask participants to play a retirement game with real money where they must choose between an annuity and an investment. Before making their decision, the participants see one of three brief presentations that either (1) favor the annuity choice by emphasizing the potential losses associated with investing in the market and outliving resources, (2) favor the investment choice by emphasizing the potential loss from dying early after purchasing an annuity, or (3) favor neither choice. The presentations were factual but played on the participants' aversion to loss. Agnew et al. report a sizeable and significant influence of the message frame.

Using a different type of frame, Brown, Kling, Mullainathan, and Wrobel (2008) also find significant results related to the influence of framing on the attractiveness of annuities. They use an Internet survey to demonstrate that the demand for annuities can be influenced by whether the consumer is viewing the annuity from a narrow investment frame or a broader consumption frame. They present individuals with product choices that represent annuities and competing non-annuitized products like savings accounts. Some participants view the product choices from an investment frame where they are discussed in terms of their account values and earnings. Other participants are presented with the same products but they are discussed in a consumption frame. In this case, the discussion centers around how much the consumer can spend over time with each option. The authors find that individuals in the consumption frame prefer annuities to other non-annuitized products, and the reverse holds for the investment frame. For example, Brown et al. (2008) find that 21 percent of participants in the investment frame compared to 72 percent in the consumption frame prefer the life annuity to a savings account.

Finally, very recent working papers suggest that the decision to annuitize may also be influenced by past market returns. Using administrative data, Chalmers and Reuter (2009) and Previtero (2010) find an inverse relationship between past market returns and the probability of annuitization. Agnew, Anderson, and Szykman (2010) find similar evidence using a laboratory experiment.

These early results suggest that using behavioral finance to explain annuity demand is a promising area for future research. As more becomes known about the psychology behind this decision, there are opportunities for plan providers to devise products and programs that make annuities more attractive. However, as Brown (2008) points out, the irreversibility of the annuity decision makes this a more challenging task. For example, simple plan solutions used in the accumulation phase such as choosing optimal defaults are more difficult to implement in the case of annuities because the decision cannot be undone.

FINANCIAL LITERACY

One reason that individuals may succumb to behavioral biases is that they lack financial literacy and are subsequently overwhelmed by the decisions they face. Widespread evidence demonstrates that there is a substantial lack of financial literacy both in the United States and abroad (Lusardi and Mitchell, 2007). If people do not understand their financial choices or cannot grasp general financial concepts, they can easily make mistakes and may be more likely to fall back on simple heuristics.

This could easily be the case with investment in company stock and "mixed" target date investing. An earlier section of this chapter raised these asset allocation issues. In both cases, evidence suggests that individuals may not understand these assets. Several studies demonstrate that individuals often do not realize that investment in company stock is riskier than investing in the market (for example, Agnew and Szykman, 2005; Lusardi and Mitchell, 2008). Benartzi (2001) reports that 84 percent of the respondents in a Morningstar survey made this mistake. In addition, a recent study by Envestnet finds that 40 percent of respondents in a small survey strongly agreed or somewhat agreed that target date funds provide a guaranteed return, while 30 percent agreed that they could save less money using these vehicles and still have sufficient funds to retire (Behling, 2009). Additional studies show misunderstanding of other basic products.

Yet more than general financial literacy is important to pension participants. How well individuals understand their own plan features is also paramount. Choi, Laibson, and Madrian (2008b) find that 21 percent of participants who contribute at a rate below the match threshold knew their match rate compared to 41 percent of those above the match threshold in their sample. According to Chan and Stevens (2006), individuals who are knowledgeable about their plan features are five times more responsive to plan features than the average individual.

One issue facing plan sponsors is that efforts designed to help investors, such as simplifying investment materials or reducing plan choices, may be ineffective for the financial illiterate. For example, Agnew and Szykman (2005) use a laboratory experiment to test how the number of investment choices and information presentation influence decision making. While reducing the number of choices decreased feelings of information overload for those with above-average financial literacy, it did nothing for those with below-average literacy. They remained simply overwhelmed. Not surprisingly, individuals with below-average financial knowledge were more likely in the Agnew and Szykman study to choose the default option than those with above-average knowledge (20 percent versus 2 percent), suggesting that low literacy may make individuals more susceptible to biases.

As the shift toward defined contribution plans continues, improving financial literacy becomes increasingly important. However, evidence is mixed about the success of current educational efforts. While employer-sponsored seminars suggest that individuals have good intentions to improve savings behavior after attendance, there is growing evidence that they do not follow through with their intentions (Clark and d'Ambrosio, 2008). Choi et al. (2002) find that after one seminar nearly every worker not participating in the plan indicated his or her intention to join, but only 14 percent actually followed through. In addition, individuals do not seem to learn from the experiences of others. Choi, Laibson, and

Madrian (2005) find that even when Enron employees were losing their retirements because of investing in company stock, there was little change in company stock holdings by employees in other 401(k) plans.

Educators must also consider that individuals tend not to be interested in financial matters or financial planning, and this leads to inattention. MacFarland, Marconi, and Utkus (2004) find that at least half of their sample of retirement investors had limited interest in topics often presented in current financial education programs. Additionally, Lusardi and Mitchell (2006) discover that only 18.5 percent of their sample was able to determine how much they needed to save, develop a savings plan, and actually stick to it. In addition, individuals may not even realize that they lack financial literacy and therefore need assistance. Agnew and Szykman (2005) find that certain groups (for example, low-income individuals) have a low correlation between their own perceived knowledge and their score on a literacy test. Lusardi and Tufano (2009) find similar evidence for older individuals.

This suggests that educators must recognize psychological biases and be creative in their approach to teaching. Tufano and Schneider (2008) provide a review of existing financial literacy programs that include new and innovative approaches for low- and moderate-income families. In addition, Lusardi (2008) provides insights into improving the effectiveness of programs in the United States, and Fox, Bartholomae, and Lee (2005) present information regarding the importance of financial education evaluation.

SUMMARY AND CONCLUSIONS

The retirement research literature provides solid evidence that behavioral biases influence every financial decision related to retirement. In view of the documented lack of financial literacy and interest in retirement planning, overwhelmed investors often resort to simple heuristics. The findings in the literature clearly show that even the most subtle details in plan design influence behavior. A successful working relationship between practitioners and academics in this field has resulted in numerous plan design changes that have improved savings outcomes. While the literature in this field is now extensive, there is still more work to be done, particularly related to the distribution phase of retirement and the role of annuities. In addition, financial education programs can become more effective by incorporating what is known about behavioral biases and investor psychology. Given the increasing responsibility of individuals for their own retirement, the behavioral literature should continue to grow quickly for years to come and motivate further successful changes to plan design.

DISCUSSION QUESTIONS

1. Given participants' documented behavioral biases in retirement decision making, should plan sponsors and policy makers focus on automating plan design to avoid common mistakes made by plan participants, or work on improving financial education?
2. Until recently, there has been little behavioral research related to the distribution phase of retirement, and specifically annuities. Discuss some possible behavioral theories that might explain the annuity puzzle.

3. Investing a large portion of one's wealth in an employer's company stock is contrary to sound investment principles. Discuss some theories that might explain this questionable investment behavior.
4. Discuss three successful changes to plan design that have improved savings outcomes, and explain how they relate to behavioral finance. Are there any associated drawbacks?

REFERENCES

Agnew, Julie R. 2006. Do behavioral biases vary across individuals? Evidence from individual level 401(k) data. *Journal of Financial and Quantitative Analysis* 41:4, 939–61.

Agnew, Julie R. 2007. Personalized retirement advice and managed accounts: Who uses them and how does advice affect behavior in 401(k) plans? Working Paper, College of William and Mary.

Agnew, Julie R., Lisa Anderson, Jeff Gerlach, and Lisa Szykman. 2008. Who chooses annuities: An experimental investigation of gender, framing and defaults. *American Economic Review* 98:2, 418–22.

Agnew, Julie R., Lisa Anderson, and Lisa Szykman. 2010. An experimental study of the effect of prior market experience on annuitization and equity allocations. Working Paper, College of William and Mary.

Agnew, Julie R., and Pierluigi Balduzzi. 2009. The reluctant retirement trader: Do asset returns overcome inertia? Working Paper, College of William and Mary.

Agnew, Julie R., Pierluigi Balduzzi, and Annika Sundén. 2003. Portfolio choice and trading in a large 401(k) plan. *American Economic Review* 93:1, 193–215.

Agnew, Julie R., and Lisa R. Szykman. 2005. Asset allocation and information overload: The influence of information display, asset choice, and investor experience. *Journal of Behavioral Finance* 6:2, 57–70.

Agnew, Julie R., Lisa Szykman, Steve Utkus, and Jean Young. 2009. Literacy, trust and 401(k) savings behavior. Working Paper, Center for Retirement Research at Boston College, Boston College.

Ameriks, John, and Stephen P. Zeldes. 2001. How do household portfolio shares vary with age? Working Paper, Columbia University.

Behling, Ellie, 2009, Planadvisor website: http://www.planadviser.com/research/article.php/4285, May 6.

Benartzi, Shlomo. 2001. Excessive extrapolation and the allocation of 401(k) accounts to company stock. *Journal of Finance* 56:5, 1747–64.

Benartzi, Shlomo, Ehud Peleg, and Richard H. Thaler. 2008. Choice architecture and retirement savings plans. Working Paper, UCLA.

Benartzi, Shlomo, and Richard Thaler. 2001. Naïve diversification strategies in retirement savings plans. *American Economic Review* 91:1, 79–98.

Benartzi, Shlomo, and Richard Thaler. 2002. How much is investor autonomy worth? *Journal of Finance* 57:4, 1593–616.

Benartzi, Shlomo, and Richard Thaler. 2003. Using behavioral economics to improve diversification in 401(k) plans: Solving the company stock problem. Working Paper, UCLA.

Benartzi, Shlomo, and Richard Thaler. 2007. Heuristics and biases in retirement savings behavior. *Journal of Economic Perspectives* 21:3, 81–104.

Bertrand, Marianne, Sendhil Mullainathan, and Eldar Shafir. 2006. Behavioral economics and marketing in aid of decision making among the poor. *Journal of Public Policy and Marketing* 21:2, 8–23.

Block, Lauren, and Punam Anand Keller. 1995. When to accentuate the negative: The effects of perceived efficacy and message framing on intentions to perform a health-related behavior. *Journal of Marketing Research* 32:2, 192–203.

Brown, Jeffrey R. 2008. Understanding the role of annuities in retirement planning. In *Overcoming the saving slump: How to increase the effectiveness of financial education and savings programs*, (ed.) Annamaria Lusardi, 178–208. Chicago: University of Chicago Press.

Brown, Jeffrey R., Jeffrey R. Kling, Sendhil Mullainathan, and Marian V. Wrobel. 2008. Why don't people insure late-life consumption? A framing explanation of the under-annuitization puzzle. *American Economic Review* 98:2, 304–09.

Brown, Jeffrey R., Nellie Liang, and Scott Weisbenner. 2006. 401(k) matching contributions in company stock: Costs and benefits for firms and workers. *Journal of Public Economics* 90:6-7, 1315–346.

Brown, Jeffrey R., Nellie Liang, and Scott Weisbenner. 2007. Individual account investment options and portfolio choice: Behavioral lessons from 401 (k) plans. *Journal of Public Economics* 91:10, 1992–2013.

Carroll, Gabriel D., James Choi, David Laibson, Brigitte C. Madrian, and Andrew Metrick. 2009. Optimal defaults and active decisions. *Quarterly Journal of Economics* 124:4, forthcoming.

Chalmers, John and Jonathan Reuter. 2009. How do retirees value life annuities? Evidence from Public Employees. Working paper.

Chan, Sewin, and Ann Huff Stevens. 2006. What you don't know can't help you: Pension knowledge and retirement decision making. Working Paper, New York University.

Choi, James J., David Laibson, and Brigitte Madrian. 2005. Are empowerment and education enough? Underdiversification in 401(k) plans. *Brookings Papers on Economic Activity* 2, 151–98.

Choi, James J., David Laibson, and Brigitte Madrian. 2009. Reducing the complexity costs of 401(k) participation through Quick Enrollment™. In *Developments in the economics of aging*, (ed.) David A. Wise, 57–82. Chicago: University of Chicago Press.

Choi, James J., David Laibson, and Brigitte C. Madrian. 2008a. Mental accounting and portfolio choice: Evidence from a flypaper effect." Working Paper, Harvard University.

Choi, James J., David Laibson, and Brigitte C. Madrian. 2008b. $100 bills on the sidewalk: Suboptimal investment in 401(k) plans. Working Paper, Harvard University.

Choi, James J., David Laibson, Brigitte C. Madrian, and Andrew Metrick. 2002. Defined contribution pensions: Plan rules, participant decisions and the path of least resistance. In *Tax policy and the economy*, (ed.) James M. Poterba, 67–113. Cambridge, MA: MIT Press.

Choi, James J., David Laibson, Brigitte C. Madrian, and Andrew Metrick. 2004. For better or for worse: Default effects and 401(k) savings behavior. In *Perspectives on the economics of aging*, (ed.) David A. Wise, 81–121. Chicago: University of Chicago Press.

Choi, James J., David Laibson, Brigitte C. Madrian, and Andrew Metrick. 2009. Reinforcement learning and savings behavior. *Journal of Finance*, forthcoming.

Choi, James J., David Laibson, and Andrew Metrick. 2002. How does the internet affect trading? Evidence from investor behavior in 401(k) plans. *Journal of Financial Economics* 64:3, 397–421.

Clark, Robert, and Madeleine d'Ambrosio. 2008. Adjusting retirement goals and savings behavior: The role of financial education. In *Overcoming the saving slump: How to increase the effectiveness of financial education and savings programs*, (ed.) Annamaria Lusardi, 237–56. Chicago: University of Chicago Press.

Cohen, Lauren. 2009. Loyalty-based portfolio choice. *Review of Financial Studies* 22:3, 1213–45.

Cronqvist, Henrik, and Richard H. Thaler. 2004. Design choices in privatized social-security systems: Learning from the Swedish experience. *American Economic Review* 94:2, 424–28.

Diamond, Peter, and Botond Koszegi. 2003. Quasi-hyperbolic discounting and retirement. *Journal of Public Economics* 87:9-10, 1839–72.

Duflo, Esther, and Emmanuel Saez. 2002. Participation and investment decisions in a retirement plan: The influence of colleagues' choices. *Journal of Public Economics* 85:1, 121–48.
Duflo, Esther, and Emmanuel Saez. 2003. The role of information and social interactions in Retirement Plan Decisions: Evidence from a randomized experiment. *Quarterly Journal of Economics* 118:3, 815–42.
Engstrom, Stefan, and Anna Westerberg. 2003. Which individuals make active investment decisions in the new Swedish pension system? *Journal of Pension Economics and Finance* 2:3, 225–45.
Even, William E., and David A. Macpherson. 2008. Pension investments in employer stock. *Journal of Pension Economics and Finance* 7:1, 67–93.
Fox, Jonathan, Suzanne Bartholomae, and Jinkook Lee. 2005. Building the case for financial education. *Journal of Consumer Affairs* 39:1, 195–214.
Guiso, Luigi, Paola Sapienza, and Luigi Zingales. 2008. Trusting the stock market. *Journal of Finance* 63:6, 2557–600.
Hu, Wei-Yin, and Jason S. Scott. 2007. Behavioral obstacles to the annuity market. *Financial Analysts Journal* 63:3, 71–82.
Huberman, Gur. 2001. Familiarity breeds investment. *Review of Financial Studies* 14:3, 659–80.
Huberman, Gur, and Wei Jiang. 2006. Offering versus choice in 401(k) plans: Equity exposure and number of funds. *Journal of Finance* 61:2, 763–801.
Huberman, Gur, and Paul Sengmueller. 2004. Performance and employer stock in 401(k) plans. *Review of Finance* 8:3, 403–43.
Iyengar, Sheena S., and Mark R. Lepper. 2000. When choice is demotivating: Can one desire too much of a good thing? *Journal of Personality and Social Psychology* 79:6, 995–1006.
Johnson, Eric J., and Daniel Goldstein. 2003. Do defaults save lives? *Science* 302:5649, 1338–9.
Kahneman, Daniel, and Tversky, Amos. 1984. Choices, values and frames. *American Psychologist* 39:4, 341–50.
Laibson, David. 1997. Golden eggs and hyperbolic discounting. *Quarterly Journal of Economics* 112:2, 443–377.
Lusardi, Annamaria (ed). 2008. *Overcoming the saving slump: How to increase the effectiveness of financial education and savings programs*. Chicago: University of Chicago Press.
Lusardi, Annamaria, and Olivia S. Mitchell. 2006. Financial literacy and planning: Implications for retirement wellbeing. Pension Research Council Working Paper, PRC WP 2006-1, The Wharton School.
Lusardi, Annamaria, and Olivia S. Mitchell. 2007. Financial literacy and retirement preparedness: Evidence and implications for financial education. *Business Economics* 42:1, 35–44.
Lusardi, Annamaria, and Olivia S. Mitchell. 2008. Planning and financial literacy: How do women fare? *American Economic Review* 98:2, 413–7.
Lusardi, Annamaria, and Peter Tufano. 2009. Debt literacy, financial experiences, and overindebtedness. Working Paper, Harvard Business School.
Lusardi, Annamaria, Punam Anand Keller, and Adam M. Keller. 2008. New ways to make people save: A social marketing approach. In *Overcoming the saving slump: How to increase the effectiveness of financial education and savings programs*, (ed.) Annamaria Lusardi, 209–36. Chicago: University of Chicago Press.
Lynch, Anthony W., and Pierluigi Balduzzi. 2000. Predictability and transaction costs: The impact on rebalancing rules and behavior. *Journal of Finance* 55:5, 2285–309.
MacFarland, Donna M., Carolyn D. Marconi, and Stephen P. Utkus. 2004. "Money attitudes" and retirement plan design: One size does not fit all. In *Pension design and structure: New lessons from behavioral finance*, (eds.) Olivia S. Mitchell and Stephen P. Utkus, 97–120. New York: Oxford University Press.
Madrian, Brigitte C., and Dennis F. Shea. 2001. The power of suggestion: Inertia in 401(k) participation and savings behavior. *Quarterly Journal of Economics* 116:4, 1149–87.

Mitchell, Olivia S., Gary R. Mottola, Stephen P. Utkus, and Takeshi Yamaguchi. 2006. The inattentive participant: Portfolio trading behavior in 401(k) plans. Pension Research Council Working Paper, PRC WP 2006-5, The Wharton School.

Mitchell, Olivia S., Gary R. Mottola, Stephen P. Utkus, and Takeshi Yamaguchi. 2008. The dynamics of lifecycle investing in 401(k) plans. Pension Research Council Working Paper, PRC WP 2008-01, The Wharton School.

Mottola, Gary R., and Stephen P. Utkus. 2009. Flight to safety? Market volatility and target-date funds. *Research Note* March, 1–4.

Muelbroek, Lisa. 2002. Company stock in pension plans: How costly is it? Working Paper 02-058, Harvard Business School.

Munnell, Alicia H., Annika Sundén, and Catherine Taylor. 2001/2002. What determines 401(k) participation and contributions? *Social Security Bulletin* 64:3, 64–75.

Nessmith, William E., and Stephen P. Utkus. 2008. Target-date funds: Plan and participant adoption in 2007. Vanguard Center for Retirement Research, Volume 33.

Nessmith, William E., Stephen P. Utkus, and Jean A. Young. 2007. Measuring the effectiveness of automatic enrollment. Vanguard Center for Retirement Research, Volume 31.

Odean, Terrance. 1999. Do investors trade too much? *American Economic Review* 89:6, 1279–98.

O'Donoghue, Ted, and Matthew Rabin. 2001. Choice and procrastination. *Quarterly Journal of Economics* 116:1, 121–60.

Poterba, James M. 2003. Employer stock and retirement savings accounts. *American Economic Review* 93:2, 398–404.

Poterba, James M., Steven F. Venti, and David A. Wise. 2008. The changing landscape of pensions in the United States. In *Overcoming the saving slump: How to increase the effectiveness of financial education and savings programs*, (ed.) Annamaria Lusardi, 17–46. Chicago: University of Chicago Press.

Previtero, Alessandro. 2010. Stock market returns and annuitization. Working Paper, UCLA Anderson School of Management.

Rogers, Todd, and Max H. Bazerman. 2008. Future lock-in: Future implementation increases selection of "should" choices. *Organizational Behavior and Human Decision Process* 106:1, 1–20.

Samuelson, William, and Richard Zeckhauser. 1988. Status quo bias in decision making. *Journal of Risk and Uncertainty* 1:1, 7–59.

Sethi-Iyengar, Sheena, Gur Huberman, and Wei Jiang. 2004. How much choice is too much? Contributions to 401(k) retirement plans. In *Pension design and structure: New lessons from behavioral finance*, (eds.) Olivia S. Mitchell and Stephen P. Utkus, 83–95. Oxford University Press.

Sunstein, Cass R., and Richard H. Thaler. 2003. Libertarian paternalism is not an oxymoron. *University of Chicago Law Review* 70:4, 1159–202.

Szykman, Lisa, Don Rahtz, Michael Plater, and Greg Goodwin. 2005. Living on the edge: Financial services for the lower socio-economic strata. Working Paper, College of William and Mary.

Thaler, Richard H. 1985. Mental accounting and consumer choice. *Marketing Science* 4:3, 199–214.

Thaler, Richard H. 1999. Mental accounting matters. *Journal of Behavioral Decision Making* 12:3, 183–206.

Thaler, Richard H., and Shlomo Benartzi. 2004. Save more tomorrow: Using behavioral economics to increase employee saving. *Journal of Political Economy* 112:1, 164–87.

Thaler, Richard H., and Hersh M. Shefrin. 1981. An economic theory of self-control. *Journal of Political Economy* 89:2, 392–406.

Thaler, Richard H., and Cass R. Sunstein. 2003. Libertarian paternalism. *American Economic Review* 93:2, 175–9.

Tufano, Peter, and Daniel Schneider. 2008. Using financial innovation to support savers: From coercion to excitement. Finance Working Paper No. 08-075, Harvard Business School.

Tversky, Amos, and Daniel Kahneman. 1981. The framing of decisions and the psychology of choice. *Science* 221:4481, 453–8.

Van Rooij, Maarten, Annamaria Lusardi, and Rob Alessie. 2007. Financial literacy and stock market participation. NBER Working Paper Number 13565.

Viceria, Luis M. 2008. Life-cycle funds. In *Overcoming the saving slump: How to increase the effectiveness of financial education and savings programs*, (ed.) Annamaria Lusardi, 140–77. Chicago: University of Chicago Press.

Wray, David. 6/12/ 2009. Telephone Conversation with President of the Profit Sharing/401k Council of America. *Source of Statistics:* Annual Surveys of Profit Sharing and 401(k) Plans. The Profit Sharing/401k Council of America.

Yamaguchi, Takeshi, Olivia S. Mitchell, Gary R. Mottola, and Stephen P. Utkus. 2006. Winners and losers: 401(k) trading and portfolio performance. Pension Research Council Working Paper, PRC WP 2006-26, The Wharton School.

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CHAPTER 32

Institutional Investors

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INTRODUCTION

One of the main defenses of the efficient markets hypothesis has been the theoretically predicted role of "arbitrageurs." In particular, when prices deviate from their fundamental values in financial markets, sophisticated, well-capitalized investors are predicted to enter the market and take large positions intended to profit from the resultant discrepancy. The concept of arbitrage employed here (and more generally in discussions in behavioral finance) does not merely cover the axiomatic definition of a no-loss, sure-gain bet; it is, rather, a broader description covering any attempt to eliminate deviations between fundamental value and price. As a consequence of the actions of such intelligent, wealthy agents, the theory predicts that prices will return to fundamental value very quickly. The consequence of these agents' actions is to eliminate the anomalous behavior of prices.

While this logic is appealing in theory, many questions remain. The first and rather obvious question is: Who are these arbitrageurs in real-world financial markets? Other important questions are: Can arbitrageurs easily spot such discrepancies between price and fundamental value in the first place, especially if they are not glaring? Is anyone really well-capitalized enough to conduct such trades once they have been identified? Does the separation of ownership and control between intelligent investors and their outside financiers make theoretically predicted trading activity difficult? How do transactions costs impede the ability of arbitrageurs to do their job effectively? If arbitrageurs could benefit more from increasing mispricing in the short run, would they do so?

Most financial economists' instinctive answer to the first question would be that institutional investors play the role of the theoretical arbitrageurs in real-world financial markets. This only invites further questions because treating institutional investors as a monolithic entity masks important heterogeneity among these investors. Pension funds, mutual funds, and hedge funds clearly have different investment mandates and, as a large empirical literature attests, they have very different performance characteristics. These differences are important, and this chapter begins by exploring them in the context of the different performance characteristics of two types of institutional investors: mutual funds and hedge funds. The chapter then turns to exploring the literature on institutional investor holdings and trade data, where in contrast to the performance measurement studies,

the perspective is generally taken that analyzing the investment behavior of institutional investors as a group is instructive. The goal of the literature on holdings is primarily to understand whether institutions arbitrage apparent inefficiencies in asset markets, and whether they have a stabilizing or destabilizing influence on asset prices.

As an important aside, the complement of institutional investors is the set of individual investors, the behavior of which is discussed in other chapters of this book. There are two obvious differences between institutional investors and individuals (ignoring exceptional cases). First, the level of wealth controlled by institutional investors is per capita higher than that controlled by individual investors. Second, decisions are taken in some structured fashion by institutions, which may or may not be the case for individual investors.

This chapter begins by discussing (with a focus on more recent work) the extensive empirical evidence on the behavior of institutional investors, focusing primarily on equity asset markets. The discussion is categorized into four sub-categories that attempt to broadly capture the different approaches taken by authors. The subsequent section discusses a selective summary of theory, which focuses on a few papers that outline the incentives that institutional investors may have to behave in a destabilizing fashion. Specifically, there may be situations in which institutions can generate higher returns from destabilizing behavior than by attempting to move prices back towards fundamental value.

EMPIRICAL WORK ON INSTITUTIONAL INVESTORS

The empirical behavior of institutional investors has been extensively studied. The studies in this area can be divided into four main categories. First, a straightforward way to test the efficient markets hypothesis is to inspect the portfolio returns of groups of institutional investors, such as mutual fund or hedge fund managers, to see if they earn more than a fair compensation for risk. If they do, such evidence would suggest that markets might not be informationally efficient because agents can garner profits from exploiting these inefficiencies. Second, using publicly available datasets that are generally low frequency (i.e., quarterly or annual), academics have investigated the holdings of institutional investors. The goals of these studies have been twofold. Holdings allow another, possibly more accurate measurement of pre-fee institutional investor returns, and they also allow the investigation of whether institutions act as a stabilizing or destabilizing influence on prices (the latter, for example, might be associated with trend-following behavior by institutions). Third, more recently, researchers have used higher-frequency data to analyze institutional investors' trading behavior. Fourth, several authors examine how the behavior of flows to institutional investors affects their investment decisions.

THE RETURNS OF INSTITUTIONAL INVESTMENT MANAGERS: MUTUAL FUNDS

The literature on the investment performance of mutual fund managers is vast. Treynor (1965), Sharpe (1966), and Jensen (1968) (the latter being the precursor

to perhaps the most standard current methodology), pioneered these studies in the mid-1960s. Jensen ran a single-factor model, regressing the returns of 115 mutual funds over the period 1945 to 1964 on the contemporaneous returns on the S&P 500 composite index, using the intercept (alpha) as a measure of the fund's risk-adjusted average return. This was the first time such a methodology was systematically employed to assess the performance of investment managers. Jensen's pessimistic conclusion that gross of expenses, the funds have an average alpha of negative 40 basis points (net of expenses, this number is even lower at negative 1.1 percent) has subsequently been the subject of intense academic scrutiny and debate.

Following the initial set of studies analyzing the average performance of mutual funds, Hendricks, Patel, and Zeckhauser (1993) heralded an important shift in methodology toward understanding conditional mutual fund performance, rather than simply concentrating on unconditional performance. They are not the first authors to analyze the phenomenon of mutual fund performance persistence because Goetzmann and Ibbotson (1994) conducted a similar contemporaneous study. Yet, Hendricks et al. are among the first to identify significant evidence of performance persistence from 1974 to 1988 and to document that it is essentially a short-run phenomenon. The methodology that they use, which is now standard, is to rank funds based on their *ex-post* performance and to track the performance of these funds in an ex-post evaluation period. They find that funds with the highest (lowest) past returns over short evaluation periods continue to outperform (underperform) in the evaluation period relative to their levels of systematic risk.

In an in-depth investigation of the Hendricks et al. (1993) result, Carhart (1997) documents that the continuing outperformance and underperformance of successful and unsuccessful funds can be explained by loadings on a "momentum" factor, namely a portfolio that is long stocks with recent high past returns and short stocks with recent low returns. The sequence of these papers is instructive because in the literature on the performance of institutional investment managers, new methodologies uncovering evidence of outperformance are followed by new risk-adjustment methodologies that uncover the source of the outperformance. The next step is usually to create a financial product that mimics the newly uncovered investment strategy by investing in the factor responsible for the investment manager's outperformance.

Studies following these early mutual fund papers increasingly used sophisticated approaches and large datasets of mutual fund performance to estimate institutional investors' risk-adjusted returns. One important result of these studies, which sometimes employ complicated econometric techniques, is the discovery that some mutual funds deliver consistently superior risk-adjusted performance.

Ferson and Schadt (1996) introduced new methodology to the study of mutual funds that influenced subsequent researchers to consider the concept of conditional performance evaluation. This approach uses publicly available variables as conditioning information to model time-varying mutual fund risk exposures. In essence, Ferson and Schadt model the risk exposures of funds as time-varying and conditional on macroeconomic variables. Using their methodology on a sample of 68 mutual funds over the period 1968 to 1990, they find that the performance of the funds is broadly neutral, rather than negative as Jensen (1968) reports. Mamaysky, Spiegel, and Zhang (2008) provide the most recent manifestation of the

move to adopt models of time-varying factor exposures in mutual funds. Their model introduces a sophisticated Kalman filter–based model to uncover the unobservable factors on which time-varying factor exposures of mutual funds may depend. These authors find that using their method reveals significant timing ability in about a fifth of the total set of mutual funds in the Center for Research on Security Prices (CRSP) mutual fund database.

Another recent paper using sophisticated econometric methodology is the bootstrap analysis of Kosowski, Timmerman, Wermers, and White (2006). Using this bootstrap method, the authors attempt to distinguish luck from skill in the cross-section of all open-end mutual funds from 1975 to 2002. They find convincing evidence that the top 10 percent of mutual fund managers has statistically significant positive performance. Furthermore, the risk-adjusted performance of these managers persists, which conflicts with Carhart's (1997) evidence.

Other recent papers that arrive at similar conclusions are Bollen and Busse (2005) and Avramov and Wermers (2006). However, some contrary perspectives in recent data have been offered by Fama and French (2009) and Barras, Scaillet, and Wermers (2009), who are unable to detect evidence of performance persistence. Busse, Goyal, and Wahal (2009), using data on the managed investments of retirement plans, endowments, and foundations, also find little evidence of positive risk-adjusted performance or performance persistence.

The increasingly sophisticated techniques and new data brought to bear on the question have uncovered important new evidence of positive risk-adjusted performance in mutual funds. Yet, this must be confronted with the broad consensus in the empirical literature supporting Jensen's (1968) initial conclusion that finding evidence of positive risk-adjusted mutual fund performance is extremely difficult. One way to interpret this observation is that markets are so efficient that intermediaries cannot make significant risk-adjusted profits. This suggests that these intermediaries do not have sufficiently high levels of skill to be able to generate insights unavailable to the market as a whole.

Much debate exists, however, about whether this conclusion can be interpreted in this fashion. Grossman and Stiglitz (1980) offer one important theoretical refutation. If the market is informationally efficient, then no single agent would have sufficient incentives to acquire information and impound it into prices. In a sense, the presence of a large investment management industry is evidence that markets are not informationally efficient. Berk and Green (2004) offer another useful insight. They argue that if rational investors compete to find talented investment managers and managers face capacity constraints in the implementation of their strategies, in equilibrium, the result would be zero net-of-fee alpha with no detectable performance persistence even if superior investment ability does exist.

THE RETURNS OF INSTITUTIONAL INVESTMENT MANAGERS: HEDGE FUNDS

This section examines hedge fund returns. Hedge funds are a relatively new form of investment management vehicle. These intermediaries are relatively lightly regulated and have enormous trading flexibility, including the ability to use short

sales as well as take long positions. They generally promise alpha ("absolute returns" in the jargon of practitioners) to their investors and are generally paid high incentive fees when they generate returns above a benchmark. These features of hedge funds lead naturally to the expectation that their risk-adjusted performance will dominate that of mutual funds and that performance persistence should also be more prevalent among these intermediaries.

Two important issues plague studies of hedge fund performance. First, unlike mutual fund data, hedge fund data suffer from a lack of uniform reporting standards. For example, hedge fund managers can elect whether to report performance; if they do, they can decide the database(s) to which they report. They can also elect to stop reporting at their discretion. This ability to self-report biases hedge fund returns upwards (Fung and Hsieh, 2000; Liang, 2000) and raises concerns about whether the results of performance measurement studies are truly representative of the real investment performance of hedge funds. Given these limitations, there have been several attempts to control these data problems. These attempts include using a combination of statistical techniques (modeling stale reporting and database exits jointly with returns; see Jagannathan, Malakhov, and Novikov, 2009) and common-sense approaches (using diversified portfolios of hedge funds, called funds-of-funds, rather than individual hedge funds to measure industry performance; see Fung, Hsieh, Naik, and Ramadorai, 2008).

The second important issue is that hedge funds experience both fast-moving exposures to underlying assets due to their dynamic trading strategies and nonlinear exposures to these assets because of their use of derivative securities. This problem has spawned a growing literature focusing on developing risk-adjustment models that are appropriate for understanding hedge fund performance (e.g., Fung and Hsieh, 1997, 2004a, 2004b; Ackermann, McEnally, and Ravenscraft, 1999; Liang, 1999; Agarwal and Naik, 2004; Kosowski, Naik, and Teo, 2007; Chen and Liang, 2007; Patton, 2009; Bollen and Whaley, 2009; Patton and Ramadorai, 2009). These models contain combinations of linear and option-factors, and in recent years, account for time variation in hedge fund exposures to these factors.

When techniques that account for potential data biases and nonlinearities in hedge fund exposures are applied to performance measurement, they result in lower estimated hedge fund risk-adjusted returns. Despite this reduction, there still seems to be much evidence of skill in hedge funds' returns. Fung et al. (2008) discover that the average fund-of-funds does not deliver alpha. Yet, in their sample of more than 1,000 funds between 1994 and 2004, about 20 percent of the funds appear to have statistically significant positive and economically important persistent alpha. Jagannathan et al. (2009) also find that alpha is persistent for the top funds in their sample. Evidence in Kosowski et al. (2007), who use Bayesian and bootstrap techniques, supports this conclusion, and these authors also find a large spread between the ex-post performance of the top and bottom hedge funds ranked by *ex ante* performance. Other studies arriving at similar conclusions are Fung and Hsieh (1997, 2001, 2002, 2004a, 2004b), Agarwal and Naik (2004), and Hasanhodzic and Lo (2006). However, as discussed below, reasons exist to believe that the estimated alpha may be short-lived. In particular, investors' alpha-chasing behavior combined with capacity constraints to the implementation of hedge fund strategies presage significant declines in future alpha.

THE HOLDINGS AND TRADES OF INSTITUTIONAL INVESTMENT MANAGERS: LOW FREQUENCY DATA

This section analyzes institutional investors' holdings. The analysis of mutual fund returns, while useful, does not provide much information about funds' ability in the event that managers consume the rents that they generate in the form of fees (Berk and Green, 2004). Recognizing this, Grinblatt and Titman (1989) examine mutual fund holdings. They find evidence that using measured returns extrapolated from mutual fund holdings, several funds exhibit positive and significant risk-adjusted performance.

Following this early paper, the literature on institutional holdings moved in several new directions. First, researchers have begun to study other institutions besides mutual funds, mirroring the analysis of the returns of other types of intermediaries highlighted in the previous section. For example, Lakonishok, Shleifer, and Vishny (1992) examine the behavior of pension funds, Nofsinger and Sias (1999) study institutional equity owners as defined by Standard & Poor's, Kim and Nofsinger (2005) examine annual institutional holdings in Japan's business groups, and many other recent papers study all institutions required to make quarterly 13-F filings to the Securities and Exchange Commission.

Second, the literature examines the characteristics of stocks that institutional investors hold, not just their subsequent returns. Gompers and Metrick (2001) and Bennett, Sias, and Starks (2003), for example, run cross-sectional regressions of institutional ownership on the characteristics of individual stocks and discover that institutions have a preference for large and liquid stocks. Third, researchers are becoming increasingly interested in the changes in institutional positions (their flows instead of their holdings). Quarterly institutional flows appear to be positively correlated with lagged institutional flows (Sias, 2004), contemporaneous quarterly stock returns (Grinblatt, Titman, and Wermers, 1995; Wermers, 1999, 2000; Nofsinger and Sias, 1999; Bennett et al., 2003), and future quarterly stock returns (Daniel, Grinblatt, Titman, and Wermers, 1997; Wermers, 1999; Chen, Jegadeesh, and Wermers, 2000 for mutual funds; Bennett et al. for a broader set of institutions; Nofsinger and Sias for similar results at the annual frequency).

Others have extensively studied the relation between quarterly institutional flows and lagged quarterly stock returns, with somewhat mixed results. Burch and Swaminathan (2002) report a positive correlation between institutional flows and returns, but other authors find this to hold only for institutional purchases, not sales (Cai and Zheng, 2004), only for new institutional positions in a stock (Badrinath and Wahal, 2002), and only for stocks with high past returns (Grinblatt et al., 1995). In another recent study, Gompers and Metrick (2001) discover that past quarterly returns are negatively related to institutional flows once they control for market capitalization.

These empirical results are susceptible to different interpretations. Theoretical models in the behavioral tradition, such as DeLong, Shleifer, Summers, and Waldmann (1990), Hong and Stein (2003), Daniel, Hirshleifer, and Subrahmanyam (1998), and Barberis and Shleifer (2003) suggest that when groups of investors follow simple positive feedback strategies, stock prices diverge from their fundamental values. In support of these models, Nofsinger and Sias (1999) find evidence that institutional investors engage in such positive feedback trading and

that institutional herding increases after high stock returns. Yet, Cohen, Gompers, and Vuolteenaho (2002), who find that institutions are not simply following price-momentum strategies, dispute this finding. Instead, these authors find that institutions sell shares to individuals when a stock price increases in the absence of any news about underlying cash flows.

Of course, to resolve whether institutional trading strategies change conditional on the behavior of returns rather than cash-flow news, investigating the behavior of institutional investors in the periods surrounding earnings announcements (the point of release of cash-flow relevant news by firms) is useful. Unfortunately, this is where the literature on institutional flows is restricted by the low frequency of the available data. While some countries, such as Finland (Grinblatt and Keloharju, 2000a, 2000b) and Korea (Choe, Kho, and Stulz, 1999) record institutional ownership almost continuously, reporting in the United States is only quarterly. This makes determining whether institutions are reacting to stock price movements or causing price movements difficult, because no resolution exists on the intra-quarter covariances of institutional flows and returns. Researchers have made some recent progress on measuring these intra-quarter covariances. For example, Sias, Starks, and Titman (2006) point out that monthly return data can be combined with quarterly ownership data to make at least some inferences about monthly lead-lag relations between flows and returns. Boyer and Zheng (2009) apply this methodology to equity ownership data from the flow of funds accounts. While the Sias et al. approach ingeniously extracts additional information from quarterly data, it can put bounds only on monthly leads and lags, and has little to say about lead-lag relations at higher trading frequencies than monthly.

The need to investigate institutional behavior at the point of release of cash-flow–relevant information relates this line of research with the well-known phenomenon of post–earnings announcement drift. This phenomenon is the tendency for stock prices to move in the same direction as earnings surprises (with increases in prices for positive and decreases in prices for negative earnings surprises) for up to 60 days post-announcement. This phenomenon has been well-known for a long time (at least since the publication of Bernard and Thomas, 1989), so one would expect that sophisticated investors such as institutions should trade to take advantage of it. In support of this conjecture, Bartov, Radhakrishnan, and Krinsky (2000) find that post–earnings announcement drift is strongest in firms with low institutional shareholdings. As mentioned earlier, Cohen et al. (2002) find that institutions sell shares to individuals when a stock price increases in the absence of any news about underlying cash flows. Their measure of cash flow news is obtained from a vector-autoregressive decomposition of unexpected stock returns, following the early work of Campbell and Shiller (1988). Also, Ke and Ramalingegowda (2004) show that actively trading institutional investors move their stockholdings in the same direction as unexpected earnings and earn abnormal returns in subsequent quarters. While these results suggest that institutional investors act to take advantage of post–earnings announcement drift, their precision is somewhat limited by the low frequency of the data. Using quarterly data frequency complicates the task of saying whether institutions are reacting to stock price movements or causing price movements in the days surrounding earnings announcements. This leads to the topic of the next subsection, namely, analyzing the behavior of institutional investment managers at high frequencies.

THE HOLDINGS AND TRADES OF INSTITUTIONAL INVESTMENT MANAGERS: HIGHER FREQUENCY DATA

Recent papers use proprietary datasets to measure high-frequency institutional behavior. Froot, O'Connell, and Seasholes (2001), Froot and Ramadorai (2005), and Froot and Teo (2008) employ custodial data from the State Street Corporation and find evidence of flow persistence and bidirectional positive Granger causality between weekly institutional flows and returns on equity portfolios in various countries. Froot and Ramadorai (2008) use daily data on currencies and, using a similar analysis to Cohen et al. (2002), find that financial institutions act as if to push currency values away from fundamentals in the short run, but discipline currency values towards fundamentals over the longer run. Lee and Radhakrishna (2000) and Nofsinger (2001) study the Trades, Orders, Reports and Quotes (TORQ) dataset, a sample of trades with complete identification of market participants. Jones and Lipson (2003) use Audit Trail data from the NYSE, while Barber and Odean (2008) use weekly data from Plexus, a transactions-cost measuring service for a subset of money managers. Griffin et al. (2003) study the trades of NASDAQ brokerage houses that specialize in dealing with individual or institutional investors. They find that institutions buy stocks that have recently risen, both at the daily frequency and the intra-daily frequency. Related literature uses proprietary data to measure the trades of individuals, the complement to institutional trades. For instance, Kaniel, Saar, and Titman (2008) use Audit Trail data and find that individual investor purchases (sales) precede positive (negative) movements in stock returns. Odean (1998, 1999) and Barber and Odean (2000, 2001, 2008) use data from a discount brokerage and show that individual investors appear to overtrade and underperform.

These results have several important limitations. For example, the samples are typically restricted in their coverage of institutional investors, the cross section of stocks they consider, the time span they investigate, or some combination thereof. The proprietary data could also be subject to selection bias if institutions self-select into transactions-cost measuring services or custodial pools. To generate more representative results on the trading behavior of institutional investors at high frequencies, researchers attempt to use publicly available data from the New York Stock Exchange (NYSE). For example, Kraus and Stoll (1972), Holthausen, Leftwich, and Mayers (1987), Madhavan and Cheng (1997), Ofek and Richardson (2003), Bozcuk and Lasfer (2005), and many others use block trades as a measure of institutional participation in a stock. Much of this work seeks to estimate the price impact of block trades and finds that block sales temporarily depress stock prices. Furthermore, Chan and Lakonishok (1993) and Keim and Madhavan (1995) also find asymmetric price impacts of institutional purchases and sales using proprietary data.

However, block trades account for only a modest fraction of trading volume. In recent years, the Trade and Quote (TAQ) database of the NYSE has allowed researchers to look at smaller equity trades as well. This dataset records every trade and quote on all NYSE stocks beginning in 1993. Most transactions in the TAQ database can be identified as buys or sells using the procedure of Lee and

Ready (1991), which compares the transaction price to posted bid and ask quotes. A common procedure is to separate such classified buys and sells by dollar size, identifying orders above some upper (lower) cutoff size as institutional (individual), with an intermediate buffer zone of medium-size trades that are not classified. Lee and Radhakrishna (2000) evaluate the performance of several alternative cutoff rules in the TORQ dataset. They find, for example, that a $20,000 cutoff most effectively classifies institutional trades in small stocks. Hvidkjaer (2006) and Malmendier and Shanthikumar (2007) follow a similar approach. They partition TAQ into small, medium, and large trades using the Lee and Radhakrishna cutoff values. These authors acknowledge the Lee and Radhakrishna identification of small trades with individuals and large trades with institutions, but they prefer the labels "small traders" and "large traders" when describing their results.

Lee (1992), Bhattacharya (2001), and Shanthikumar (2004) all use variants of the Lee and Radhakrishna (2000) method to study higher-frequency institutional trading around earnings announcements. Shanthikumar, for example, finds that the imbalance between small purchases and small sales is unresponsive to the direction of unexpected earnings in the first month after an earnings announcement. In contrast, the imbalance between large purchases and large sales has the same sign as unexpected earnings. Shanthikumar interprets this finding as consistent with large traders' informational superiority and with attempts by such traders to take advantage of post–earnings announcement drift. Again, as in the more general literature on flows and returns, some papers study the behavior of individuals. Hirshleifer, Myers, Myers, and Teoh (2008) use proprietary weekly data from a discount brokerage service and provide evidence that individual investors are significant net buyers after both negative and positive unexpected earnings. They do not find evidence that individuals' net trades have predictive power for future abnormal stock returns.

The approach of identifying small trades with individuals and large trades with institutions is appealing on the grounds that the wealth constraint is a useful separating mechanism between these types of investors. Yet, such an approach is inevitably subject to error arising as a consequence of misclassifications. Campbell, Ramadorai, and Schwartz (2008) (and in earlier work, Campbell, Ramadorai, and Vuolteenaho, 2005) tackle this problem by marrying the TAQ data with the quarterly 13-F filings of institutional investors. Using these two datasets, they find the function, which when applied to aggregated buy- and sell-classified intra-quarter trades of different sizes, best predicts quarter-to-quarter changes in institutional ownership for a large sample of stocks on the NYSE over the period 1993 to 2000. The estimated function has the property that the smallest trades are informative about the direction of institutional trading, which calls into question the usual association of small trades with individual trading activity. The authors then apply this function to daily classified buy and sell volume, creating a daily measure of institutional order flow, and investigate its behavior around earnings announcements. The results show that their institutional order flow measure predicts earnings surprises, as well as the magnitude of the post–earnings announcement drift, providing evidence that institutional investors do appear to be well-informed about the direction of cash flows.

The evidence on the trading behavior of institutions strongly suggests that they are well informed about the direction of cash flow–relevant news. Yet, viewing

these results in a broader context is important. While institutional investors may well be informed, they do not have complete discretion over their trading decisions because their financing comes from outside investors. This is the subject of the next subsection.

CAPITAL FLOWS TO INSTITUTIONAL INVESTORS

Scholars have studied the behavior of capital flows to institutional investors in great detail. Several papers document that the capital-flow past-performance relationship in mutual funds is positive (Ippolito, 1992) and convex in shape: that is, the best-performing funds receive a disproportionate share of capital from outside investors (Sirri and Tufano, 1998). Chevalier and Ellison (1997) highlight that this behavior of capital flows creates incentives for fund managers to increase the riskiness of the fund conditional on year-to-date returns. This performance-chasing behavior of capital flows also has important implications for the future performance of investment managers. For example, while finding that some hedge funds have delivered positive risk-adjusted performance, Fung et al. (2008) find that hedge fund investor flows chase both past hedge fund returns and past hedge fund alphas. The future performance of high-performing hedge funds that receive these inflows suffers as a consequence, roughly consistent with the assumptions of the Berk and Green (2004) model (also see Zhong, 2008; Teo, 2008). Furthermore, scholars find that fund flows chase funds with high imputed managerial deltas, suggesting that investors are interested in fund managers with high incentives to perform in the future (Agarwal, Daniel, and Naik, 2009). These findings predict future declines in hedge fund risk-adjusted performance as competitive allocations of capital to these funds burden the implementation of hedge fund strategies.

There is another channel through which outside investors can affect fund performance. This uses insights from important recent literature that connects the funding from outside investors to financial intermediaries with "fire sales" of assets by these intermediaries, and the effects on underlying asset prices as a consequence of this behavior (see Shleifer and Vishny, 1992; Pulvino, 1998; Brunnermeier and Pedersen, 2009). In an important recent paper, Coval and Stafford (2007) employ new methodology to show that this line of reasoning is empirically important for mutual fund behavior, and consequently, for price determination in U.S. stocks. They provide evidence that mutual funds and hedge funds are often forced to redeem investments as a consequence of funding shocks that originate from their investor base. When such forced redemptions (or "fire sales") are correlated across institutions that hold particular stocks, these authors show that the prices of such stocks fall significantly (although temporarily). This fire sale channel is the subject of ongoing investigation by various financial economists (e.g., Acharya, Schaefer, and Zhang, 2008; Aragon and Strahan, 2009; Jotikasthira, Lundblad, and Ramadorai, 2009) and is an important issue, especially in light of the episodes of sudden capital withdrawal from intermediaries that were witnessed during the recent financial crisis.

DO INSTITUTIONAL INVESTORS ALWAYS BEHAVE RESPONSIBLY?

The discussion thus far has implicitly assumed that institutional investors attempt to arbitrage apparent market inefficiencies in the process of making returns for their investors. However, there are many situations in which institutional investors (or arbitrageurs more generally) have incentives to "ride" rather than trade against mispricings. For example, if they expect mispricing to increase over the short run, arbitrageurs have an incentive to jump on the bandwagon rather than trade against the mispricing. Brunnermeier and Nagel (2004) document just such an effect during the technology bubble before the NASDAQ crash of 2000. They find that hedge funds were long technology stocks on the way up, but reduced their positions in stocks that were falling in value, thus managing to avoid much of the downturn. Evidence of Griffin et al. (2003), who find that institutional investors trend-chased NASDAQ-100 stocks at high frequencies over the period of the NASDAQ bubble, support this finding.

A related literature detects evidence of trend-chasing behavior by investors when they trade in international markets rather than domestically. In many cases these studies are conducted using data on institutional investors (see Grinblatt and Keloharju, 2000a; Choe et al. 1999; Froot et al., 2001; Kim and Wei, 2002). Edison and Warnock (2008) find that cross-border flows follow the trend in dividend yields, not just equity returns, suggesting that the trend-chasing of international flows may be related to expectations of fundamentals rather than simply positive-feedback trading or bubble-riding behavior.

Brunnermeier and Pedersen (2009) describe another class of situations in which institutional investors act to exacerbate the deviation between prices and fundamentals. These authors study "predatory trading" occurring on the back of other investors' needs to reduce their positions. In particular, if some investors have knowledge of other investors' needs to liquidate positions, strong incentives exist for these investors to sell and subsequently repurchase the same assets. This leads to greater deviations of prices from fundamentals and greater illiquidity at precisely those moments when liquidity is sought by traders.

SUMMARY AND CONCLUSIONS

The literature on institutional investors is vast. The two main questions that researchers have sought to answer are whether institutional investors have detectable and consistently superior investment ability, and whether institutional investors act as if to discipline prices in financial markets. The answer to the first question seems to be that some institutions possess superior investment ability, but it is hard to detect and short-lived. The answer to the second question appears to be that institutions trade correctly before and after cash flow–relevant news announcements.

This apparent stabilizing behavior needs to be viewed with caution for at least three reasons. First, the fact that the post–earnings announcement drift and other anomalies continue to be persistent phenomena in equity markets suggests that even if institutional investors are trading as if to discipline prices, they are clearly

not doing enough of it. Second, the behavior of capital flows to institutions places important constraints on their discretion when investing. Sudden withdrawals of capital may force their trading behavior, and the fact that capital flows to institutions are nonlinearly related to past performance is another important distortion that affects institutional investors' incentives to act as arbitrageurs. Finally, several situations exist in which institutional investors have strong incentives to engage in positive feedback or predatory trading, both of which have potentially destabilizing influences on prices.

DISCUSSION QUESTIONS

1. Should an individual investor feel comfortable delegating his portfolio to an institutional investment manager? Is such an investor guaranteed to obtain high risk-adjusted returns from such delegation?
2. Hedge funds seem like a consistently high-performing set of investment managers. What are the risks embedded in investing in hedge funds? In particular, do investors completely understand the investment strategies of hedge funds?
3. What lies beneath the apparently "smart" behavior of institutional investors relative to that of individual investors? If individuals simply begin investing in groups rather than individually, would they make better investment decisions?
4. Given the relatively better performance of institutional investment managers compared to individual investors, will the aggregate individual investment in securities reduce to zero (i.e., full delegation)? What are the consequences for prices, returns, and market inefficiencies if this were to happen?
5. Should institutional investment managers be held responsible for not "leaning against the tide" when bubbles form? Is there some way to regulate their behavior or create incentives for them to provide this public good?

REFERENCES

Acharya, Viral, Stephen Schaefer, and Yili Zhang. 2008. Liquidity risk and correlation risk: A clinical study of the General Motors and Ford downgrade of 2005. Working Paper, New York University.

Ackermann, Carl, Richard McEnally, and David Ravenscraft. 1999. The performance of hedge funds: Risk, return and incentives. *Journal of Finance* 54:3, 833–74.

Agarwal, Vikas, Naveen Daniel, and Narayan Y. Naik. 2009. Role of managerial incentives and discretion in hedge fund performance. *Journal of Finance*, forthcoming.

Agarwal, Vikas, and Narayan Y. Naik. 2004. Risks and portfolio decisions involving hedge funds. *Review of Financial Studies* 17:1, 63–98.

Aragon, George, and Philip Strahan. 2009. Hedge funds as liquidity providers: Evidence from the Lehman bankruptcy. Working Paper, Boston College.

Avramov, Doron, and Russ Wermers. 2006. Investing in mutual funds when returns Are predictable. *Journal of Financial Economics* 81:2, 339–77.

Badrinath, Swaminathan G., and Sunil Wahal. 2002. Momentum trading by institutions. *Journal of Finance* 57:6, 2449–78.

Barber, Brad M., and Terrance Odean. 2000. Trading is hazardous to your wealth: The common stock investment performance of individual investors. *Journal of Finance* 55:2, 773–806.

Barber, Brad M., and Terrance Odean. 2001. Boys will be boys: Gender, overconfidence, and common stock investment. *Quarterly Journal of Economics* 116:1, 261–92.

Barber, Brad M., and Terrance Odean. 2008. All that glitters: The effect of attention and news on the buying behavior of individual and institutional investors. *Review of Financial Studies* 21:2, 785–818.

Barberis, Nicholas, and Andrei Shleifer. 2003. Style investing. *Journal of Financial Economics* 68:2, 161–99.

Barras, Laurent, Olivier Scaillet, and Russ Wermers. 2009. False discoveries in mutual fund performance: Measuring luck in estimated alphas. *Journal of Finance*, forthcoming.

Bartov, Eli, Suresh Radhakrishnan, and Itzhak Krinsky. 2000. Investor sophistication and patterns in stock returns after earnings announcements. *Accounting Review* 75:1, 43–64.

Bennett, James, Richard Sias, and Laura T. Starks. 2003. Greener pastures and the impact of dynamic institutional preferences. *Review of Financial Studies* 16:4, 1199–234.

Berk, Jonathan B., and Richard Green. 2004. Mutual fund flows and performance in rational markets. *Journal of Political Economy* 112:6, 1269–95.

Bernard, Victor L., and Jacob K. Thomas. 1989. Post-earnings-announcement drift: Delayed price response or risk premium? *Journal of Accounting Research* 27:1, 1–36.

Bhattacharya, Nilabhra. 2001. Investors' trade size and trading responses around earnings announcements: An empirical investigation. *Accounting Review* 76:2, 221–44.

Bollen, Nicolas P. B., and Jeffrey A. Busse. 2005. Short-term persistence in mutual fund performance. *Review of Financial Studies* 18:2, 569–97.

Bollen, Nicolas P. B., and Robert E. Whaley. 2009. Hedge fund risk dynamics: Implications for performance appraisal. *Journal of Finance*, forthcoming.

Boyer, Brian, and Lu Zheng. 2009. Investor flows and stock market returns. *Journal of Empirical Finance* 16:1, 87–100.

Bozcuk, Aslihan, and M. Ameziane Lasfer. 2005. The information content of institutional trades on the London stock exchange. *Journal of Financial and Quantitative Analysis* 40:3, 621–44.

Brunnermeier, Markus K., and Stefan Nagel. 2004. Hedge funds and the technology bubble. *Journal of Finance* 59:5, 2013–40.

Brunnermeier, Markus, and Lasse Pedersen. 2009. Market liquidity and funding liquidity. *Review of Financial Studies* 22:6, 2201–38.

Burch, Timothy R., and Bhaskaran Swaminathan. 2002. Are institutions momentum traders? Working Paper, University of Miami.

Busse, Jeff, Amit Goyal, and Sunil Wahal. 2009. Performance and persistence in institutional investment management. *Journal of Finance*, forthcoming.

Cai, Fang, and Lu Zheng. 2004. Institutional trading and stock returns. *Finance Research Letters* 1:3, 178–89.

Campbell, John Y., Tarun Ramadorai, and Allie Schwartz. 2008. Caught on tape: Institutional trading, stock returns, and earnings announcements. *Journal of Financial Economics* 92:1, 66–91.

Campbell, John Y., Tarun Ramadorai, and Tuomo Vuolteenaho. 2005. Caught on tape: Institutional order flow and stock returns. Working Paper, National Bureau of Economic Research No. 11439.

Campbell, John Y., and Robert J. Shiller. 1988. The dividend-price ratio and expectations of future dividends and discount factors. *Review of Financial Studies* 1:3, 195–228.

Carhart, Mark. 1997. On persistence in mutual fund performance. *Journal of Finance* 52:1, 57–82.

Chan, Louis K., and Josef Lakonishok. 1993. Institutional trades and intraday stock price behavior. *Journal of Financial Economics* 33:2, 173–99.

Chen, Hsiu-Lang, Narasimhan Jegadeesh, and Russ Wermers. 2000. The value of active mutual fund management: An examination of the stockholdings and trades of fund managers. *Journal of Financial and Quantitative Analysis* 35:3, 343–68.

Chen, Yong, and Bing Liang. 2007. Do market timing hedge funds time the markets? *Journal of Financial and Quantitative Analysis* 42:4, 827–56.

Chevalier, Judith, and Glenn Ellison. 1997. Risk taking by mutual funds as a response to incentives. *Journal of Political Economy* 105:6, 1167–200.

Choe, Hyuk, Bong-Chan Kho, and René M. Stulz. 1999. Do foreign investors destabilize stock markets? The Korean experience in 1997. *Journal of Financial Economics* 54:2, 227–64.

Cohen, Randolph, Paul Gompers, and Tuomo Vuolteenaho. 2002. Who underreacts to cash-flow news? Evidence from trading between individuals and institutions. *Journal of Financial Economics* 66:2-3, 409–62.

Coval, Joshua, and Erik Stafford. 2007. Asset fire sales (and purchases) in equity markets. *Journal of Financial Economics* 86:2, 479–512.

Daniel, Kent, Mark Grinblatt, Sheridan Titman, and Russ Wermers. 1997. Measuring mutual fund performance with characteristic-based benchmarks. *Journal of Finance* 52:3, 1035–58.

Daniel, Kent, David Hirshleifer, and Avanidhar Subrahmanyam. 1998. Investor psychology and security market under- and over-reactions. *Journal of Finance* 53:6, 1839–86.

DeLong, J. Bradford, Andrei Shleifer, Lawrence Summers, and Robert J. Waldmann. 1990. Positive feedback investment strategies and destabilizing rational speculation. *Journal of Finance* 45:2, 379–95.

Edison, Hali J., and Francis E. Warnock. 2008. Cross-border listings, capital controls, and equity flows to emerging markets. *Journal of International Money and Finance* 27:6, 1013–27.

Fama, Eugene, and Kenneth French. 2009. Mutual fund performance. Working Paper, University of Chicago.

Ferson, Wayne E., and Rudy W. Schadt. 1996. Measuring fund strategy and performance in changing economic conditions. *Journal of Finance* 51:2, 425–61.

Froot, Kenneth A., Paul O'Connell, and Mark Seasholes. 2001. The portfolio flows of international investors. *Journal of Financial Economics* 59:2, 151–93.

Froot, Kenneth A., and Tarun Ramadorai. 2005. Currency returns, intrinsic value and institutional investor flows. *Journal of Finance* 60:3, 1535–66.

Froot, Kenneth A., and Tarun Ramadorai. 2008. Institutional portfolio flows and international investments. *Review of Financial Studies* 21:2, 937–72.

Froot, Kenneth A., and Melvyn Teo. 2008. Style investing and institutional investors. *Journal of Financial and Quantitative Analysis* 43:4, 883–906.

Fung, William, and David A. Hsieh. 1997. Empirical characteristics of dynamic trading strategies: The case of hedge funds. *Review of Financial Studies* 10:2, 275–302.

Fung, William, and David A. Hsieh. 2000. Performance characteristics of hedge funds and CTA funds: Natural versus spurious biases. *Journal of Financial and Quantitative Analysis* 35:3, 291–307.

Fung, William, and David A. Hsieh. 2001. The risk in hedge fund strategies: Theory and evidence from trend followers. *Review of Financial Studies* 14:2, 313–41.

Fung, William, and David A. Hsieh. 2002. Asset-based style factors for hedge funds. *Financial Analysts Journal* 58:5, 16–27.

Fung, William, and David A. Hsieh. 2004a. Hedge fund benchmarks: A risk based approach. *Financial Analysts Journal* 60:5, 65–80.

Fung, William, and David A. Hsieh. 2004b. Asset-based style factors for hedge funds. *Financial Analysts Journal* 60:5, 65–80.

Fung, William, David A. Hsieh, Narayan Naik, and Tarun Ramadorai. 2008. Hedge funds: performance, risk and capital formation. *Journal of Finance* 63:4, 1777–803.

Goetzmann, William N., and Roger G. Ibbotson. 1994. Do winners repeat? Predicting mutual fund performance. *Journal of Portfolio Management* 20:2, 9–18.

Gompers, Paul A., and Andrew Metrick. 2001. Institutional investors and equity prices. *Quarterly Journal of Economics* 116:1, 229–60.

Griffin, John M., Jeffrey Harris, and Selim Topaloglu. 2003. The dynamics of institutional and individual trading. *Journal of Finance* 58:6, 2285–320.

Grinblatt, Mark, and Matti Keloharju. 2000a. The investment behavior and performance of various investor-types: A study of Finland's unique data set. *Journal of Financial Economics* 55:1, 43–67.

Grinblatt, Mark, and Matti Keloharju. 2000b. What makes investors trade? *Journal of Finance* 56:2, 589–616.

Grinblatt, Mark, and Sheridan Titman. 1989. Mutual fund performance: An analysis of quarterly portfolio holdings. *Journal of Business* 62:3, 393–416.

Grinblatt, Mark, Sheridan Titman, and Russ Wermers. 1995. Momentum investment strategies, portfolio performance, and herding: A study of mutual fund behavior. *American Economic Review* 85:5, 1088–105.

Grossman, Sanford J., and Joseph E. Stiglitz. 1980. On the impossibility of informationally efficient markets. *American Economic Review* 70:3, 393–408.

Hasanhodzic, Jasmina, and Andrew W. Lo. 2006. Can hedge-fund returns be replicated? The linear case. Working Paper, Massachusetts Institute of Technology.

Hendricks, Darryll, Jayendu Patel, and Richard Zeckhauser. 1993. Hot hands in mutual funds: Short-run persistence of relative performance, 1974–1988. *Journal of Finance* 48:1, 93–130.

Hirshleifer, David A., James N. Myers, Linda A. Myers, and Siew Hong Teoh. 2008. Do individual investors drive post–earnings announcement drift? Direct evidence from personal trades. Working Paper, University of California Irvine.

Holthausen, Robert W., Richard W. Leftwich, and David Mayers. 1987. The effect of large block transactions on security prices: A cross-sectional analysis. *Journal of Financial Economics* 19:2, 237–67.

Hong, Harrison, and Jeremy C. Stein. 2003. Differences of opinion, short-sales constraints, and market crashes. *Review of Financial Studies* 16:2, 487–525.

Hvidkjaer, Soeren. 2006. A trade-based analysis of momentum. *Review of Financial Studies* 19:2, 457–91.

Ippolito, Richard A. 1992. Consumer reaction to measures of poor quality: Evidence from the mutual fund industry. *Journal of Law and Economics* 35:1, 45–70.

Jagannathan, Ravi, Alexey Malakhov, and Dimitry Novikov. 2009. Do hot hands exist among hedge fund managers? An empirical evaluation. *Journal of Finance*, forthcoming.

Jensen, Michael C. 1968. The performance of mutual funds in the period 1945–1964. *Journal of Finance* 23:2, 389–416.

Jones, Charles M., and Marc L. Lipson. 2003. Are retail orders different? Working Paper, Columbia University.

Jotikasthira, Pab, Christian Lundblad, and Tarun Ramadorai. 2009. Asset fire sales and purchases and the international transmission of funding shocks. Working Paper, University of North Carolina.

Kaniel, Ron, Gideon Saar, and Sheridan Titman. 2008. Individual investor trading and stock returns. *Journal of Finance* 63:1, 273–310.

Ke, Bin, and Santhosh Ramalingegowda. 2004. Do institutional investors exploit the post-earnings-announcement drift? Working Paper, Pennsylvania State University.

Keim, Donald B., and Ananth Madhavan. 1995. Anatomy of the trading process: Empirical evidence on the behavior of institutional traders. *Journal of Financial Economics* 37:3, 371–98.

Kim, Kenneth, and John R. Nofsinger. 2005. Institutional herding, business groups, and economic regimes: Evidence from Japan. *Journal of Business* 78:1, 213–42.

Kim, Woochan, and Wei, Shang-Jin, 2002. Foreign portfolio investors before and during a crisis. *Journal of International Economics* 56:1, 77–96.
Kosowski, Robert, Narayan Y. Naik, and Melvyn Teo. 2007. Do hedge funds deliver alpha? A Bayesian and bootstrap analysis. *Journal of Financial Economics* 84:1, 229–64.
Kosowski, Robert, Alan Timmerman, Russ Wermers, and Halbert White. 2006. Can mutual fund stars really pick stocks? New evidence from a bootstrap experiment. *Journal of Finance* 61:6, 2551–95.
Kraus, Alan, and Hans W. Stoll. 1972. Price impacts of block trading on the New York stock exchange. *Journal of Finance* 27:3, 569–88.
Lakonishok, Joseph, Andrei Shleifer, and Robert Vishny. 1992. The impact of institutional trading on stock prices. *Journal of Financial Economics* 32:1, 23–43.
Lee, Charles M. C. 1992. Earnings news and small traders: An intraday analysis. *Journal of Accounting and Economics* 15:2-3, 265–302.
Lee, Charles M. C., and Balkrishna Radhakrishna. 2000. Inferring investor behavior: Evidence from TORQ data. *Journal of Financial Markets* 3:2, 83–111.
Lee, Charles M. C., and Mark J. Ready. 1991. Inferring trade direction from intraday data. *Journal of Finance* 46:2, 733–46.
Liang, Bing. 1999. On the performance of hedge funds. *Financial Analysts Journal* 55:4, 72–85.
Liang, Bing. 2000. Hedge funds: The living and the dead. *Journal of Financial and Quantitative Analysis* 35:3, 309–26.
Madhavan, Ananth, and Minder Cheng. 1997. In search of liquidity: Block trades in the upstairs and downstairs markets. *Review of Financial Studies* 10:1, 175–203.
Malmendier, Ulrike, and Devin Shanthikumar. 2007. Are small investors naive about incentives? *Journal of Financial Economics* 85:2, 457–89.
Mamaysky, Harry, Matthew Spiegel, and Hong Zhang. 2008. Estimating the dynamics of mutual fund alphas and betas. *Review of Financial Studies* 21:1, 233–64.
Nofsinger, John R. 2001. The impact of public information on investors. *Journal of Banking and Finance* 25:7, 1339–66.
Nofsinger, John R., and Richard W. Sias. 1999. Herding and feedback trading by institutional and individual investors. *Journal of Finance* 54:6, 2263–95.
Odean, Terrance. 1998. Are investors reluctant to realize their losses? *Journal of Finance* 53:5, 1775–98.
Odean, Terrance. 1999. Do investors trade too much? *American Economic Review* 89:5, 1279–98.
Ofek, Eli, and Matthew Richardson. 2003. Dot-com mania: The rise and fall of internet stock prices. *Journal of Finance* 58:3, 1113–38.
Patton, Andrew. 2009. Are "market neutral" hedge funds really market neutral? *Review of Financial Studies* 22:7, 2495–530.
Patton, Andrew, and Tarun Ramadorai. 2009. On the dynamics of hedge fund risk exposures. Working Paper, Duke University.
Pulvino, Todd C. 1998. Do asset fire sales exist? An empirical investigation of commercial aircraft transactions. *Journal of Finance* 53:3, 939–78.
Shanthikumar, Devin. 2004. Small and large trades around earnings announcements: Does trading behavior explain post-earnings-announcement drift? Working Paper, Harvard Business School.
Sharpe, William F. 1966. Mutual fund performance. *Journal of Business* 39:1(part 2), 119–38.
Shleifer, Andrei, and Robert W. Vishny. 1992. Liquidation values and debt capacity: A market equilibrium approach. *Journal of Finance* 47:4, 1343–66.
Sias, Richard. 2004. Institutional herding. *Review of Financial Studies* 17:1, 165–206.
Sias, Richard, Laura T. Starks, and Sheridan Titman. 2006. The price impact of institutional trading. *Journal of Business* 79:6, 2869–910.
Sirri, Erik, and Peter Tufano. 1998. Costly search and mutual fund flows. *Journal of Finance* 53:5, 1589–622.

Teo, Melvyn. 2008. Hedge fund capacity constraints, liquidity, and hierarchy costs. Working Paper, Singapore Management University.
Treynor, Jack L. 1965. How to rate management of investment funds. *Harvard Business Review* 43:1, 63–75.
Wermers, Russ. 1999. Mutual fund herding and the impact on stock prices. *Journal of Finance* 54:2, 581–622.
Wermers, Russ. 2000. Mutual fund performance: An empirical decomposition into stock-picking talent, style, transaction costs, and expenses. *Journal of Finance* 55:4, 1655–95.
Zhong, Zhaodong. 2008. Why does hedge fund alpha decrease over time? Evidence from individual hedge funds. Working Paper, Rutgers University.

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CHAPTER 33

Derivative Markets

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INTRODUCTION

Derivative markets have provided excellent data for years. Investigations have delved into hedging, arbitrage, market maker inventory control, and agency problems in the form of dual trading and volume and volatility relationships. Since the embracing of behavioral economics by the finance literature, the rich source of data from futures markets has proved useful in adding to our knowledge in this area. In finance, behavioral economics issues relate to violations of expected utility theory, mostly focusing on framing problems. To date, leading finance journals have published important papers developing theory or providing empirical evidence of the effects of behavioral finance on or in derivative markets.

As with most academic literature, there are some differing empirical results on the extent to which derivative markets are affected by behavioral finance. Much of the literature deals with futures floor traders or market makers. Thus it is heartening that the latest research suggests these traders do not appear to be unduly harmed by rash emotional trading, such as might be due to loss aversion or overconfidence. If these professional traders are subject to large behavioral biases, then the prices generated in these markets would suffer from excess noise. Such findings could have serious implications for policy and regulation, but to date there seems to be no need for regulatory alarm.

Other literature deals with hedging and the theoretical price impacts of behavioral biases in hedgers and speculators. Traditional hedging models, such as minimum variance hedge ratios and so forth, might be affected by behavioral conditions. Because these models are generally forward looking, the concepts of regret aversion and overconfidence come to mind rather than the ex post problems of loss aversion. These theory papers have yet to be empirically tested but may prove interesting if researchers can obtain appropriate data.

The purpose of this chapter is to highlight the theoretical and empirical behavioral finance literature as it relates to derivative markets. The remaining portion of this chapter consists of five major sections. The first section introduces the fundamental generation of most of the data used in the bulk of the empirical analysis that follows. This is the futures trading architecture or microstructure. At least historically, the extremely open and transparent trading arena generates this lush futures data. The second section investigates the issue of the reluctance of traders

to realize losses in derivative markets. This is generally known as the disposition effect and is consistent with some parameterizations of the prospect theory of Kahneman and Tversky (1979). Futures markets are an excellent place to look for these effects because long and short positions are treated in a symmetric fashion and traders generally trade often, generating considerable data for analysis. The third section investigates the effect of prior outcomes on trading, primarily examining the effect of morning income on afternoon trading. There are three types of behaviors considered in the prior outcomes section: (1) loss aversion, although it is more a cumulative loss aversion, or break-even effect; (2) daily income targeting, which has been used to model labor supply, particularly taxi cab drivers; and (3) the house money effect or excessive speculation with recent income, which has been parsed into a reasonable gain and some excess, or house, money. The fourth section examines other behavioral issues including overconfidence and disappointment aversion. The final section provides a summary and conclusions.

FUTURES FLOOR TRADING

Before embarking on a review of the behavioral literature as it relates to futures trading, describing the baseline model of futures trading strategies is essential. Specifically, this description is important to understand the function and practice of those of futures floor traders from whom the bulk of the empirical work has drawn its data. Although there is limited research in this area, it is generally consistent. A presentation of the extant baseline empirical findings is necessary to establish some common and more or less rational patterns before exploring evidence of behavioral deviations.

Evidence on behavior in futures markets, whether in Taiwan, Australia, or the United States, typically examines the trading records of futures floor traders or their electronic equivalent. The term "local" is useful in describing the types of individuals who are members or leaseholders on a futures exchange and primarily execute trades for their proprietary accounts. They are "local" to the area or trading engine where others send orders from customers and futures brokers for execution. Another somewhat pejorative term is "scalper." The basic idea is that these floor traders have unique access to the confluence of orders coming from customers and may "scalp" an order, or, more politely, take a haircut. They do this by buying for a proprietary account at a price that is slightly lower than equilibrium and then selling for the proprietary account at a slightly higher price. In the microstructure literature, this is simply bidding and offering by market makers. In the futures market, the making of the market is typically an endogenous outcome of allowing proprietary trading on the floor. Many in the industry have different interpretations of the description of personal trading.

Critically, these locals are at the center of futures trading activity, directly observing the execution of futures customers' orders. They have the ability to instantaneously bid or offer and execute proprietary trades but are under no obligation to bid, offer, or even be present on the floor. All futures trades are subject to great transparency because the exchange is the guarantor to all trades. There is little opportunity to legally execute futures trades other than in the open and competitive framework, either on the historic trading floor or electronically. Special exceptions

are transfers across accounts and exchanges for physicals, which is essentially the delivery on a contract of a non-regular product.

Researchers typically assume that the risk borne by locals is highly idiosyncratic. Whether they are trading pork bellies, gold, crude oil, or stock index futures, the traders are isolated in their respective pits at any particular time. Certainly, as discussed by Kuserk and Locke (1994), they are not managing a diverse portfolio on an intraday basis. The geography of floor trading is such that the locals are located in the pit, literally below the line of sight from where floor traders acting as brokers receive visual signals from phone desks with orders to buy and sell for clients. This has changed dramatically with electronic order submission and handheld terminals in the pit. Nonetheless, unlike equity specialists, the locals do not see any private or aggregate limit order book. The typical futures floor trading venue from which the bulk of the data used in the papers cited below was generated is a wide-open, continuous, double oral auction. In this setting, orders from nonmembers such as "customers," member firms, and the trading of locals interact in seeming chaos at times.

Even though there are no official limit order books on the floor, trading rules are based on price and time priority, generated by shouting and gesturing. Electronic trading codifies this somewhat, depending on the trading architecture. There may be simultaneous electronic and pit trading, which obviously obscures the prioritization. Traders executing orders for customers or member firms hold paper orders and attempt to execute trades using the trade directions of the customer, such as executing limit orders or market orders. On the other hand, locals are free to bid or offer (or not) at any time. Their trading is simply a spontaneous reaction to current market conditions, the traders' perception and position, and personal expectations. There is no requirement for these traders to be present on the floor, let alone to provide an orderly market.

While floor traders acting as brokers earn a few dollars commission for every customer order executed, floor trader proprietary income derives from the expectation of buying low and selling high. An executed trade may thus be a meeting of the minds of two customer orders, two locals or, as is most common in the most active markets, a local and a customer. With no other major constraints on trading, prices in the futures market may fluctuate quickly. Floor traders do not halt trading when there is a huge one-sided order flow: The price simply adjusts. Traders on the floor make agreements and execute the trades, and the exchange then reconciles or matches the trades. The exchange also records and distributes simultaneously the sequence of trade prices on a global basis. While increasingly futures are traded electronically, floor trading remains a vibrant occupation in many countries including the United States. The current and historical records of such trading form a wonderful source for microstructure studies and, more importantly for the present analysis, behavioral studies.

The proprietary trading of these individuals offers data, when available, for a seemingly infinite set of experiments. Early research by Working (1967) and others established that in general the trading strategy followed by these traders falls within the realm of market making. Working was the first academic to have access or perhaps to understand the rich nature of the floor trader personal trading record.

Silber (1984) shows how such a trading strategy—supplying liquidity to customer orders—might function and offers some initial insight into trade timing and profitability. He finds that after exceeding the bounds of a certain profitable time window, trade profitability decreased with time. Thus, a profitable strategy is buying (selling) when there is large customer sale (buy) volume and quickly exiting the trade, hopefully after a reversal. If there is no sudden reversal, then exiting quickly is still the best strategy, thus limiting any potential loss from the trade. In other words, customer orders may be "informative," such as buying before a positive increase in price, or "liquidity" driven, uninformed. The interplay between these two order types with the floor trader dictates the bid and offer strategy and, perhaps more importantly, the appropriate (and often overlooked) trade exit strategy.

Kuserk and Locke (1993), who employ a larger dataset across many futures contracts, undertook a further analysis. Their findings bolster the preliminary findings of Working (1967) and Silber (1984). In particular, Kuserk and Locke find that futures floor traders, who trade for their own accounts, trade in relatively small amounts and take on relatively small inventories. Further, on a per contract basis, futures floor traders only make several dollars per contract traded. This income is much less in most actively traded futures contracts than the minimum price change would generate.

As an example, the Eurodollar futures price had in their sample a minimum price change of $25, yet futures traders were earning less than $5 a contract. If these traders simply had the ability to trade across the bid-ask spread, buying at the bid and selling at the offer, they would make about $25 a contract, or the minimum tick. Clearly the strategies employed by these market makers differ from traditional microstructure assumptions.

Manaster and Mann (1996) also examine such issues as the control of positions by floor traders. Surprisingly, they find that prices at which traders buy and sell are *positively* related to trader's positions, rather than the opposite, predicted by inventory control models. Thus, when floor traders are long, price rises on average, and when floor traders are short, prices fall on average.

The findings of Kuserk and Locke (1993) and Manaster and Mann (1996) offer the hope that the trading of locals is more challenging, if not adventurous, than the mechanical order processing of microstructure theory, and more opportune for behavioral studies. Indeed, Locke and Mann (2005) find that personal trading by floor traders appears to be quite risky, with nearly 50 percent of futures floor traders' proprietary trades leading to losses. All of these studies show a relatively low income on average for the amount risked, consistent with a small effective bid-ask spread for these markets.

Other recent studies relate to interesting aspects of futures floor trading. For example, Coval and Shumway (2001) investigate sound and futures trading. They record the decibel levels in the futures pit and relate them to volume and volatility. Kurov (2005) examines the relative execution costs of trades on the futures pit, including costs for locals and customers, and also limit versus market orders.

Much of this literature involving futures trading data is based on implied or explicit assumptions regarding information, similar to equities microstructure models. Overall, futures markets may be price discovery arenas, and thus some information may flow through futures trades. Sharpe (1991), who argues that futures markets should fill an important role and improve market efficiency, provides

support for this argument. If futures supply this price discovery role, then some futures trades will be information driven. Using an experimental setting, Porter and Smith (1995) find that adding futures markets to an economy significantly reduces the adverse impact of speculation (noise) on market prices. Here again, some fundamental information such as inventory information, weather-related information, and so on, is assumed to be flowing through the futures price. Because the locals are at the focal point of futures trading and may be implicitly processing this flow of information, their behavioral tendencies are critical for the resulting efficiency of these important markets. In support, List and Haigh (2005) show that for the group of traders they study, futures traders appear closer to being expected utility maximizers than do a control group of students. Combined, these findings suggest that futures markets play an important role in price discovery. In addition, the locals who are traders at the core of the market function as market makers with complex trading strategies. Thus, this baseline market-making model nicely frames the investigations into futures floor traders' potential behavioral deviations.

LOSS AVERSION AND THE DISPOSITION EFFECT

Much trading advice centers on disciplined trading and overcoming the reluctance to realize losses. This reluctance appears pervasive and may be costly. In this section the relationship of this reluctance to futures trading is developed.

Empirical Evidence of the Disposition Effect and Prospect Theory

A relative reluctance to realize losses, or the disposition effect, has traditionally been linked to prospect theory developed by Kahneman and Tversky (1979). For example, Shefrin and Statman (1985) bring this theory squarely into the financial literature, indeed coining the term "disposition effect." However, many papers fail to distinguish clearly these two behavioral aspects: the disposition effect and prospect theory. Barberis and Xiong (2009) and Kaustia (2009) offer new insights into this linkage, arguing that some of the empirical evidence consistent with the disposition effect is not consistent with prospect theory. Thus, the logic to be considered here is generally that empirical evidence of the disposition effect, which is provided overwhelmingly in the papers on derivatives trading cited in this chapter, should not necessarily be simultaneously viewed as evidence that harmful prospect theory governs traders. In other words, the disposition effect, per se, is a statistical phenomenon and is not in and of itself evidence of a dysfunctional behavior.

Critical to a finding of a general behavioral problem, irrespective of which particular behavioral quirk is under discussion, is identifying significant costs calculated from the observations thought to be related to that behavior. If there are no costs, then some empirical evidence that appears anomalous may be benign, or possibly the result of the particular institutional structure from which the data are generated. Thus, most behavioral research concentrates on the extent to which individuals are leaving money on the table when they exhibit particular "anomalies" such as the disposition effect. In that respect, the cumulative evidence is

decidedly in the camp of a seemingly costless disposition effect in futures markets, rather than more serious behavioral problems. Further theoretical or empirical work could identify the source of the disposition effect, which is quite possibly related to fortuitous market timing by futures floor traders. The analysis of Ferguson and Mann (2001), Kurov (2005), and Locke and Mann (2005) should assist in that pursuit as it offers evidence on futures trading related to market timing.

The growth of the behavioral finance literature accelerated after the publication of Odean (1998). This paper instigated a flurry of research seeking further evidence of retail and professional traders treating trades with gains different from trades with losses. First, Odean's traders exhibited the classic features of the disposition effect, selling stocks that had gains and holding stocks that had losses. More importantly, however, Odean found substantial costs associated with this trading pattern: Stocks that were sold continued to rise in price on average, while stocks that were held continued to fall in price on average. Thus, this evidence of significant trading costs supports a behavioral issue for these retail customers associated with the disposition effect.

Odean (1998) is emblematic of the seemingly universal agreement in the empirical literature that individuals are overly reluctant to realize losses and not so reluctant to capture gains. A recent study by Chen, Lakshminarayanan, and Santos (2006) reveals evidence of loss realization aversion in Capuchin monkeys. Perhaps human loss realization aversion may be a vestigial heuristic that can affect trader behavior endemically and negatively if unchecked by conscious trader discipline. Professional traders may survive by being better able to apply a conscious discipline to their trading, overcoming the innate tendency toward the disposition effect. If the decision on the disposition of a trade varies depending on whether the trade has a gain or a loss associated with it, all other things being equal, then this is interpreted as a finding of the disposition effect. For example, suppose the price of oil futures is $60 a barrel, and a trader has a long position in oil futures. Further assume that the market and trader expectations are that this is in some sense an efficient price, and that the trader is well capitalized so that the associated risk of this trade is minimal. Then the decision of whether or not to maintain this position or offset the position should not depend on whether the trader established the position when the price of oil futures was $55 (a trade with a paper gain of $5) or $65 (a trade with a paper loss of $5). However, empirically this does not appear to be the case.

Shefrin and Statman (1985) link the disposition effect to the prospect theory developed by Kahneman and Tversky (1979). This is the famous S-shape utility curve over some referenced gains or losses, instead of the more traditional utility over wealth. The assumption that traders govern themselves according to prospect theory, where the reference for gains or losses is myopic, rather than expected utility is consistent with a reluctance to offset losing positions. If trades are executed in line with prospect theory, this would be a violation of expected utility theory. There is a general sense that expected utility theory is somewhat normative. That is, this is the way that rational traders ought to analyze trading decisions. Violations of expected utility behavior such as may be induced by prospect theory lead to exploitable trading by arbitrageurs.

With regard to prospect theory, the induced behavior is potentially costly because traders inappropriately place a contemporaneous value on a sunk cost, the

initial value of the trade. For example, depending on their framing, traders might focus on the price paid for a stock, or its valuation at the end of the year, or the intraday change, rather than contemporaneous market conditions. The disposition effect, per se, is simply the empirical finding that investors hold more trades with losses than trades with gains. The inference is typically that this is due to a trader's prospect theory–induced reluctance to realize losses. However, the rationality of the trading can only be revealed by searching for significant costs associated with the disposition effect (shown by Odean, 1998, for example) by estimating the forgone profits associated with exiting winning and losing trades.

Futures Trading, the Disposition Effect, and Associated Costs

Because locals trade frequently and have symmetric payouts for long and short positions, their trading provides excellent data for examining the disposition effect. Frino, Johnstone, and Zheng (2003) investigate the asymmetric treatment of winning and losing trades by futures floor traders on the Sydney Futures Exchange. They examine equity index futures, the 3- and 10-year Australian bond futures, and Bank Accepted Bill futures. In addition to locals, Frino et al. use the trading of a control group of outside customers. Similar to Locke and Mann (2005), they examine market conditions between trade initiation and offset. They calculate "paper" gains and losses, which Locke and Mann refer to as marking to market. Thus, a running accounting is made for traders rather than using trade-dependent days. Odean (1998) excluded these "what if" days, choosing to focus only on days when traders executed trades.

Frino et al. (2003) find that traders tend to hold losing trades longer than winning trades. Quite surprisingly, they also find that riding losses more often than not turns out to be an ex post profitable strategy. This suggests the disposition effect, in this case, need not be costly. They find that this is true for locals but not for the control sample of nonlocals. Thus, there may be a difference between professional traders and customers regarding the source of the disposition effect. Frino et al. attribute the difference to informed trading by locals, a point which Ferguson and Mann (2001) and Locke and Onayev (2005, 2007) support.

It is likely that the bulk of "information" in the futures microstructure is semi-fundamental because it relates to knowledge or intuition of pending order flow, rather than the more traditional fundamental information. Locke and Onayev (2007) find that the information related to futures trading is short lived, consistent with an order flow/liquidity phenomenon. Floor traders are at the center of futures trading where customer orders to buy and sell interact. Informed trading is a potential problem and suggests some front running may be occurring. Chakravarty and Li (2003) show that such information-based trading by floor traders is not necessarily fraudulent. In other words, there is no hard evidence that locals are on average front-running particular trades by customers.

Locke and Mann (2005) also follow Odean's (1998) methodology and apply this to futures floor traders. Thus, they use exit trades and the history of the trade as well as contemporaneous conditions to identify whether floor traders have behavioral problems due to the trade history: that is, whether being categorized as a gain or

a loss affects the timing of the trade offset. Locke and Mann also perform some what-if analysis, such as what if the trader had offset the trade earlier, for example, at a better price, and what happens to the market price after the exit. They examine four different contracts on the Chicago Mercantile Exchange. Overall, Locke and Mann find that traders do tend to lose money when they hold trades longer. The authors combine this evidence with the lack of a cost for the trader and interpret this overall effect as a lack of discipline.

The vast amount of anecdotal evidence from the trading literature suggests that learning how to lose money quickly is a valued trait. While this seems like an odd logic, the truth of the statement is that sometimes trades result in bad outcomes, and a disciplined trader is not afraid to admit that the trade has gone bad, exit, and move on. Thus, the finding that these professional traders generally exhibit the disposition effect seems to suggest that these traders are not wholeheartedly following the trading literature. However, Locke and Mann (2005) find that traders who are less prone to hold losing trades too long are much more successful. More work in the area of discipline and success would be welcome.

In contrast with Odean (1998), Locke and Mann (2005) do not find on a trade-by-trade basis that traders who hold losing trades longer lose excessively relative to offsetting the trades. Trades that are offset when they are gains would not have benefited from being held longer, and trades that are offset when they are losses would not have suffered more losses from being held longer. Locke and Mann offer other evidence suggesting that the extent of the disposition effect is simply evidence of a lack of discipline rather than the result of costly adherence to prospect theory. Thus, there is no evidence that traders are irrationally reluctant to realize losses. Instead, the disposition effect accrues from lack of discipline, and some traders are more disciplined than others. This finding may add noise to these professional trader incomes but does not generate systematic losses as in the case of the retail investors in Odean and Frino et al. (2003).

Choe and Eom (2009) find evidence of the disposition effect in the Korean index futures market. They find that small retail investors exhibit this effect more than do institutional or foreign (non-Korean) investors. Also, similar to the findings in Locke and Mann (2005), experience and sophistication among professional traders (institutions and foreign accounts) tend to dampen the effect. Consistent with Odean (1998), the propensity for the disposition effect is negatively associated with retail investor success.

Also examining futures floor traders, Haigh and List (2005) perform an experiment in which they gain access to Chicago Board of Trade traders after hours and compare their experimental trading to a "control" group of students. They examine the extent to which the professional traders are more or less prone to making the statistical error of myopia in addition to having loss aversion. Myopia refers to the focus of the individual on the short run, or small sample, rather than the big picture. Researchers typically interpret this as focusing on recent gains or losses. If this myopia is combined with loss aversion, then the resulting trader behavior may be costly. Based on this experimental evidence, Haigh and List find that the professional traders are more prone to myopic loss aversion than the student sample. On the other hand, adding to the evidence that professional traders develop mental discipline with regard to losses, Alevy, Haigh, and List (2007) compare student to professional traders in experiments and find that only the students appear suboptimally responsive to the gain/loss domain.

Other Evidence of the Disposition Effect

Broadening the scope of the analysis to look at futures customers in addition to market makers requires data that are typically much scarcer. Heisler (1994) finds that small customers of futures markets tend to hold losses longer than gains. Thus, Heisler is consistent with Frino et al. (2003). Choe and Eom (2007) also look at how the disposition effect influences a trader's performance. They find that individual trader accounts reveal a greater tendency to have a disposition effect than institutions. An additional finding that experience dampens the disposition effect mitigates the extent and concern costs associated with the disposition effect, consistent with Locke and Mann (2005).

Low (2004) finds that researchers can use option prices to infer behavioral issues. In particular, Low finds that the relationship between risk (implied volatility of the S&P 100) and the contemporaneous S&P 100 return is not symmetric. Instead, implied volatility rises as price falls and falls as price rises. Low argues that this is consistent with the average investor being reluctant to realize losses.

Lien (2001) examines how loss aversion might affect hedging. If the expected change in the futures price is not zero, as in the case of true backwardation or contango, then loss aversion will affect the hedging strategy of a risk-averse trader. If the expected change in the futures price is positive, hedgers will purchase more futures contracts to hedge. When the expected change in the futures price is zero, there is no effect of loss aversion on hedging.

Similarly, Choe and Eom (2007) find an impact of the disposition effect on prices and volatility in the Korean futures market. They form an aggregate, cross-sectional measure of the disposition effect. Each trader has, on a given day, paper gains or losses. The aggregate disposition effect is the difference in the number of traders realizing gains as a percentage of potential for this (the sum of the number of traders with paper gains plus the number realizing gains), minus the number of traders realizing losses as a percentage of the potential for this (the sum of the number of traders with paper losses plus the number realizing losses). Further, if the disposition effect is concentrated on traders with long positions, then there is a depressing effect on prices.

Mattos, Garcia, and Pennings (2008) also investigate loss aversion and hedging in futures markets. They add the twist of probability weighting. The authors show that loss aversion should only have an impact when there is probability weighting. This seems similar to the finding in Lien (2001) that loss aversion has an impact when the futures market is in contango or backwardation. Mattos et al. find that probability weighting has the potential to have a much greater impact than changes in the level of loss aversion. On the other hand, when prior outcomes affect behavior, hedging is influenced most by such outcomes that influence risk attitudes. These effects remain smaller than those due to changes in probability weighting.

PRIOR OUTCOMES AND FUTURES TRADER BEHAVIOR

One of the behavioral issues that may arise is when (irrelevant) events that have occurred in the past influence current decisions. In this section the relationship of prior outcomes and futures trading behavior is examined.

Cumulative Loss Aversion

Similar to Locke and Mann (2005) and Frino et al. (2003), Coval and Shumway (2005) examine professional futures traders trading for proprietary accounts in a futures market. However, instead of examining trade disposition, Coval and Shumway examine aggregate or cumulative effects. In their analysis, traders with cumulative morning losses increase risk-taking in the afternoon. Further, and perhaps most interestingly, traders with morning losses exacerbate the noise in afternoon market prices with excessively aggressive trading. Because these findings are for professional traders, the findings of Coval and Shumway complement Haigh and List (2005) and challenge the notion that successful professional traders dampen emotions that may lead to costly behaviors. Indeed, Coval and Shumway appear to find marketwide effects of trader behavior.

Although the papers by Coval and Shumway (2005) and Locke and Mann (2005) rely on rich transaction-level data for professional futures traders, they arrive at different conclusions about the rationality of trader behavior. Due to these differing conclusions, discussing these two papers' particular investigative methods and findings is helpful.

Locke and Mann (2005) examine whether traders are more reluctant to close out losses than gains on a trade-by-trade basis, where each trade is continuously marked to market to keep a running measure of the trade's paper loss or gain. Thus, similar to Odean (1998) and Frino et al. (2003), Locke and Mann test directly for the disposition effect as described by Shefrin and Statman (1985).

On the other hand, Coval and Shumway (2005) examine the effect of cumulative profitability on subsequent behavior. In their formulation, an irrational aversion to potential daily losses leads to costly afternoon behaviors on those days when traders experience morning losses. In effect, Coval and Shumway see evidence of costly trader irrationality when they face the prospect of a daily loss. The cumulative prior income affects the disposition of each subsequent trade by biasing the value of subsequent gains and losses. Indeed, Coval and Shumway find that: (1) traders with morning losses execute a greater number of afternoon trades; (2) the increased trading is poorly executed, exacerbating afternoon price volatility; and (3) the traders with morning losses take on abnormally higher amounts of risk in the afternoon. Thus, when looking at Coval and Shumway and Locke and Mann (2005), the differing results are the outcome of differing methods of analysis.

Daily Income Targets

Locke and Mann (2009) also examine the effect of prior outcomes (morning income) on trader behavior. Following the basic setup of Coval and Shumway (2005), Locke and Mann investigate whether the fundamental findings of Coval and Shumway might be due to reference-dependent behavior, such as that modeled by Kőszegi and Rabin (2006). For example, if traders have in mind a daily income target and are behind this target by midday, they may adjust their effort in the afternoon to attempt to achieve that target. Any increased effort following morning losses is not due to an irrational and harmful fear of loss, but rather an attempt to make the requisite money for the day. In such a framework, increased

effort in the afternoon is not irrational and need not necessarily lead to market influences.

Similar to Coval and Shumway (2005), Locke and Mann (2009) find increased afternoon effort by traders who earned below-average income in the morning. Indeed, in a critical metric, Locke and Mann also find increased numbers of "price setting" trades, which are essentially poorly executed trades when the trader buys at high prices and sells at low prices. However, Locke and Mann show that as a percentage of all trading, such price setting trades do not increase when traders have losing mornings. In other words, in response to a less profitable than average morning, traders tend to increase trading activity in the afternoon, and, in keeping with this increased activity, execute more price setting trades. However, there is no evidence of increased erratic behavior. Further, Locke and Mann find no evidence that afternoon risk-adjusted income falls for traders following morning losses. This result, combined with Locke and Mann (2005), suggests that these professional traders are not subject to the excessive behavioral biases found by Haigh and List (2005) and Coval and Shumway.

House Money

Another effect of prior incomes may be the house money effect. *House money* is a term coined academically by Thaler and Johnson (1990) to apply to situations where an individual has excessive income over a period and treats that income essentially as a surplus or not his own income. In a gambling situation, suppose a gambler begins with $100 and then wins $50. Now the gambler, or trader, has $150, $100 of which is "his" and $50 of which is the "house" money. In this framing-dependent behavior, where wealth is compartmentalized into excess and non-excess, this "house money" compelled individuals to increase their risk taking because they consider part of their wealth as surplus. Thaler and Johnson investigate this hypothesis in an experimental setting, finding evidence of a house money effect.

Frino, Grant, and Johnstone (2007) examine local traders on the Sydney Futures Exchange (SFE) for a house money effect. They segregate morning incomes into losses and gains, and treat days with morning losses and days with morning gains separately. An explicit lunch hour breaks trading on the SFE. This offers some time for reflection and should bias against finding a link between afternoon trading and prior outcomes due to morning trading. Frino et al. find evidence that traders take on more afternoon risk on days with morning gains, which they consider evidence of a "house money effect." However, they find that the extent of the harm of this finding is muted. Some traders take on additional risks but actually increase income. This is especially true for traders who are not as susceptible to the house money effect. Yet those traders taking on extreme amounts of risk in the afternoon following morning gains are not profitable.

Low (2004) also finds that investors may be subject to a "house money" effect. Low finds that prior losses lead to increased "fear" or risk aversion, while prior gains lead to lower risk aversion. These are measured in terms of option implied volatility. Prior gains, conditional on volatility, have a relatively calming effect and decrease implied volatility. Low interprets this as supporting the "house money" effect.

OTHER BEHAVIORAL ISSUES

Among the plethora of potential behavioral effects on futures trading, two more are presented below: Overconfidence, a statistical problem, and disappointment aversion.

Overconfidence

Issues related to overconfidence date back to DeBondt and Thaler (1985). Overconfidence is mostly associated with statistical biases, overstating a mean, or understating volatility. Testing is thus tricky because the hypothesis is some rationality with a statistical bias versus irrationality. The macroeconomic effects of systematic overconfidence have been quaintly referred to as "irrational exuberance." Cheng (2007) broadens the analysis of overconfidence to analyze situations where traders are in different market microstructures, one a simulated electronic trading environment and the other similar to a futures trading environment. This is an innovative test. Overconfidence leads a trader to choose a market where he interacts directly with other traders, in a pit-style environment, rather than a more anonymous, electronic-style environment.

Disappointment Aversion

Disappointment aversion is traced to Gul (1991). Unlike loss aversion, which assumes that reactions depend ex post on arbitrary measures of gains or losses, disappointment aversion anticipates the loss, affecting a trade at its inception rather than at its disposition. Thus, the expected utility function antecedent to a trade incorporates the asymmetric response to gains and losses as in prospect theory. This behavioral issue affects trading at the inception, rather than the offset. Lien (2001) shows that the assumption of disappointment aversion increases the hedging of a risk-averse trader. Lien and Wang (2002) further examine the effect of disappointment aversion on futures hedging. They find that, conditional on risk aversion, a more disappointment-averse hedger will choose an optimal futures position closer to the minimum-variance hedge than will a less–disappointment-averse hedger. In other words, disappointment aversion appears to correct for risk aversion. Finally, they show that a disappointment-averse hedger will act more conservatively, not exploiting profitable opportunities as much as the conventional loss averse hedger will. Lien and Wang (2003) examine the effects of disappointment aversion on equilibrium. Effects vary depending on whether the speculator or producer is more or less disappointment averse.

SUMMARY AND CONCLUSIONS

The results of empirical studies on behaviors in the derivative markets are mixed. The bulk of the research suggests that emotion-based trading does not excessively influence futures floor traders or locals. There are some exceptions, but these are either in experimental settings or the result of incomplete analysis. Further research on the long-run effects of behavioral biases on success, especially among professional traders, is needed. Regarding theory, the disappointment aversion

effects offered in the papers by Lien et al. (2002, 2003) might be testable using the positions of hedgers and speculators and examining price changes. There are other areas that invite exploration, and much more should be forthcoming in the next few years.

DISCUSSION QUESTIONS

1. How does the trading of futures floor traders lend itself to an examination of behavioral effects?
2. What are the main empirical results regarding the disposition effect and its costs in futures floor trading?
3. What are the main results regarding the impact of morning outcomes on the afternoon trading of futures floor traders?
4. Explain the difference between disappointment aversion and loss realization aversion in terms of the potential impact on futures trading.

REFERENCES

Alevy, Jonathan E., Michael Haigh, and John A. List. 2007. Information cascades: Evidence from a field experiment with financial market professionals. *Journal of Finance* 62:1 151–80.

Barberis, Nicholas, and Wie Xiong. 2009. What drives the disposition effect? An analysis of a long-standing preference-based explanation. *Journal of Finance.* 64:2, 751–84.

Chakravarty, Sugato, and Kai Li. 2003. An examination of own account trading by dual traders in futures markets. *Journal of Financial Economics* 69:2, 375–97.

Chen, M. Keith, Venkat Lakshminarayanan, and Laurie R. Santos. 2006. How basic are behavioral biases? Evidence from capuchin monkey trading behavior. *Journal of Political Economy* 114:3, 517–37.

Cheng, Philip Y. K. 2007. The trader interaction effect on the impact of overconfidence on trading performance: An empirical study. *Journal of Behavioral Finance* 8:2, 59–69.

Choe, Hyuk, and Yunsung Eom. 2007. The aggregate price impact of the disposition effect. Working Paper, Seoul National University.

Choe, Hyuk, and Yunsung Eom, 2009. The disposition effect and investment performance in the futures market. *Journal of Futures Markets* 29:6, 496–522.

Coval, Joshua, and Tyler Shumway. 2001. Is sound just noise? *Journal of Finance* 61:5, 1887–1910.

Coval, Joshua, and Tyler Shumway. 2005. Do behavioral biases affect prices? *Journal of Finance* 60:1, 1–34.

DeBondt, Werner F. M., and Richard Thaler. 1985. Does the stock market overreact? *Journal of Finance* 40:3, 557–81.

Ferguson, Michael F., and Steven C. Mann. 2001. Execution costs and their intraday variation in futures markets. *Journal of Business* 74:1, 125–60.

Frino, Alex, Joel Grant, and David Johnstone. 2007. The house money effect and local traders on the Sydney futures exchange. *Pacific-Basin Finance Journal* 16:1-2, 8–25.

Frino, Alex, David Johnstone, and Hui Zheng. 2003. The propensity for local traders in futures markets to ride losses: Evidence of irrational or rational behavior? *Journal of Banking and Finance* 28:2 353–72.

Haigh, Michael, and John A. List. 2005. Do professional traders exhibit myopic loss aversion? *Journal of Finance* 60:1, 523–34.

Heisler, John. 1994. Loss aversion in a futures market: An empirical test. *Review of Futures Markets* 13:3, 793–826.

Gul, Faruk. 1991. A theory of disappointment aversion. *Econometrica* 59:3, 667–86.
Kahneman, Daniel, and Amos Tversky. 1979. Prospect theory: An analysis of decision under risk. *Econometrica* 47: 2, 263–92.
Kaustia, Markku. 2009. Prospect theory and the disposition effect. *Journal of Financial and Quantitative Analysis*, forthcoming.
Köszegi, Botond, and Matthew Rabin. 2006. A model of reference-dependent preferences. *Quarterly Journal of Economics* 121:4, 1133–65.
Kurov, Alex. 2005. Execution quality in open-outcry futures markets. *Journal of Futures Markets* 25:11, 1067–92.
Kuserk, Gregory J., and Peter R. Locke. 1993. Scalper behavior in futures markets: An empirical examination. *Journal of Futures Markets* 13:4, 409–31.
Kuserk, Gregory J., and Peter R. Locke. 1994. Market maker competition on futures exchanges. *Journal of Derivatives* 1:4, 56–66.
Lien, Donald. 2001. Futures hedging under disappointment aversion. *Journal of Futures Markets* 21:11, 1029–42.
Lien, Donald, and Yaqin Wang. 2002. Risk aversion, disappointment aversion and futures hedging. *Journal of Futures Markets* 22:2, 123–41.
Lien, Donald, and Yaqin Wang. 2003. Disappointment aversion equilibrium in a futures market. *Journal of Futures Markets* 23:2, 135–50.
List, John A., and Michael Haigh. 2005. A simple test of expected utility theory using professional traders. *Proceedings of the National Academy of Sciences of the United States of America* 102:3, 945–8.
Locke, Peter R., and Steven. C. Mann. 2005. Professional trader discipline and trade disposition. *Journal of Financial Economics* 76:2, 401–44.
Locke, Peter R., and Steven C. Mann. 2009. Daily income target effects: Evidence from a large sample of professional commodities traders. *Journal of Financial Markets*, 12:4, 814–831.
Locke, Peter R., and Zhan Onayev. 2005. Trade duration: Information and trade disposition. *Financial Review* 40:1, 113–29.
Locke, Peter R., and Zhan Onayev. 2007. Order flow, dealer profitability, and price formation. *Journal of Financial Economics* 75:3, 857–87.
Low, Cheekiat. 2004. The fear and exuberance from implied volatility of S&P 100 index options. *Journal of Business* 77:3, 527–46.
Manaster, Steven, and Steven C. Mann. 1996. Life in the pits: Competitive market making and inventory control. *Review of Financial Studies* 9:3, 953–75.
Mattos, Fabio, Philip Garcia, and Joost M. E. Pennings. 2008. Probability weighting and loss aversion in futures hedging. *Journal of Financial Markets* 11:4, 433–52.
Odean, Terrance. 1998. Are investors reluctant to realize their losses? *Journal of Finance* 53, 1775–98.
Porter, David P., and Vernon L. Smith. 1995. Futures contracting and dividend uncertainty in experimental asset markets. *Journal of Business* 68:4, 509–41.
Sharpe, William F. 1991. Capital asset prices with and without negative holdings. *Journal of Finance* 46:2, 489–509.
Shefrin, Hersh, and Meir Statman. 1985. The disposition to sell winners too early and ride losers too long: Theory and evidence. *Journal of Finance* 40:3, 777–90.
Silber, William. 1984. Marketmaker behavior in an auction market: An analysis of scalpers in futures markets. *Journal of Finance* 39:4, 937–53.
Thaler, Richard H., and Eric J. Johnson. 1990. Gambling with the house money and trying to break even: The effects of prior outcomes on risky choice. *Management Science* 36:6, 643–60.
Working, Holbrook. 1967. Tests of a theory concerning floor trading on commodity exchange. *Food Research Institute Studies* 7: Supplement, 5–48.

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PART VI

Social Influences

CHAPTER 34

The Role of Culture in Finance

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INTRODUCTION

The argument that culture plays an important role in finance and economics has been gaining prevalence in the financial economics literature during recent years. One motivation for this increased attention could be from the growth in behavioral finance where countries, firms, and investors seem to behave in ways that are not easily explained by conventional economic theories. An important issue in the literature is the channels through which culture matters and how prevalent is its effect so that the impact on finance may influence outcomes over a long period of time. Cultures change very slowly. At the country level, there is little debate that protection of investor rights is important for economic development and growth. There is also much evidence that financial development benefits economic growth (Levine, 1997). There are substantial differences across countries in the importance of capital markets, in the access of firms to external finance, and in the ownership of publicly traded firms. As La Porta, Lopez-de-Silanes, Shleifer, and Vishny (2000) show, a common element explaining these differences is the extent to which investors are protected from expropriation by managers, controlling shareholders, and governments. Several papers now document that countries could be different in the way they protect investor rights because of cultural factors that impact the importance of protecting certain groups or in the importance of certain areas of development. Generally, a country's culture could affect both how financial markets are viewed within a country and how they contribute to social welfare. Also, culture could influence decisions at the firm and investor levels. This chapter will examine the role of culture in finance decision making from the country to the investor and firm levels.

The view that culture is an important determinant of economic institutions has a long tradition dating back at least to the work of Weber (1930). This tradition provides powerful arguments for why some cultures are more supportive of financial markets than others. In this influential work Weber argues that cultural changes, namely the Calvinist reformation, played a critical role in the development of capitalism and its institutions. Many others such as Lal (1999) emphasize the importance of Western individualism as an explanation for the growth of markets in the West. In a seminal paper on the role of culture as a determinant of institutions, Greif (1994, p. 914) compares Maghribi traders of the eleventh century

and Genoese traders of the twelfth century and concludes that "Differences in the societal organization of the two trading societies can be consistently accounted for as reflecting diverse cultural beliefs." Greif (p. 914) states that his "findings suggest the theoretical and historical importance of culture in determining societal organizations, in leading to path dependence of institutional frameworks, and in forestalling successful intersociety adoption of institutions."

A great amount of the theoretical discussion of culture and the development of institutions has been done through an examination of the impact of religion. Historically, religion had much to say about the rights of creditors and much less to say about the rights of shareholders. As Tawney (1954) shows, the prohibition of usury was a fundamental tenet of the medieval church. Usury meant generally receiving interest on loans and led to excommunication. Creditor rights differed sharply across Protestant and Catholic countries in the sixteenth century. This raises the question of whether these differing attitudes toward creditor rights have persisted sufficiently to help understand the variation in creditor rights across countries in the late twentieth century.

Cultures change and adapt in response to economic changes, but they generally do so slowly. If predominant values in some countries are less supportive of market interactions than in other countries, one would expect investor rights to be less well protected in these countries for a number of possible reasons. First, the case to strengthen these rights is less compelling to their citizens and politicians. Second, these countries might have institutions fostered by their culture that make financial markets less valuable. For instance, extended families limit the use of markets for individuals because many transactions take place within the extended family that otherwise would require the use of markets. Third, these countries might have different economic fundamentals that make market interactions less valuable. For example, Glaeser and Scheinkman (1998) provide a model where usury laws serve as a primitive means of social insurance. In their model, economic conditions can make such laws useful. At the same time, however, the existence of such a form of social insurance makes financial innovations less profitable and hence slows down financial development. They argue that if culture explains differences in investor protection, then culture proxies for more fundamental differences in economic conditions across countries.

Much of the recent work on the impact of culture on finance looks at the role of culture on country-level economic development. This approach affects finance in various ways. One is that a country may have beliefs about the use of certain financial instruments. For instance, the use of debt is prohibited in Islam, and thus debt will play less of a role in economic development. Another channel through which culture has influence is through the relations across groups in a particular country, which may influence trading and development. The group and cross-cultural dynamics can also play a key role in trading between countries. The perception or relationship between countries is driven at least to some degree by culture and can affect cross-border trading. A new and developing area of the research on culture and finance is the impact of culture on decision making within the firm.

The rest of the chapter has the following organization. A commonly used working definition of culture is presented to establish the context of the examination. This includes the channels through which culture impacts finance. One of the

concerns in this type of literature is how culture should be measured. Therefore, the next section focuses on a discussion of the various approaches to measuring culture. The next two sections examine how culture affects various levels of finance. One section investigates the impact of culture on economic development, while the other evaluates the influence of culture on firm and investor-level decisions. Finally, the chapter provides a summary and conclusions.

WHY CULTURE MATTERS

What is culture? Following the discussion in Stulz and Williamson (2003, p. 314), the definition of culture developed in North (1990) and Boyd and Richerson (1985) is the "transmission from one generation to the next, via teaching and imitation, of knowledge, values, and other factors that influence behavior." With this definition, one can focus on the channels through which culture can influence finance. Guiso, Sapienza, and Zingales (2006) use a similar definition and argue that this definition helps to avoid the reverse causality argument that finance affects culture. To focus on the channels through which culture can influence finance requires examining the sources of these influences on behavior. The most common ways to examine these relationships is through language, wars, ethnicity, and religion because these are sources of general commonality of a group. For culture to play a role in finance, it has to influence choices over the long term. Roland (2004) argues that cultural influences change very slowly. Guiso et al. discuss three possible reasons for this to be the case. The first is that parents tend to teach children what they have learned without reevaluating the reasons for past actions. Second, organizations that promote culture may have a vested interest in maintaining a certain behavior because it may provide them with rents. Finally, some cultural norms may have lower economic value but have other benefits that are more widespread and valued despite their economic inefficiency.

There is another perspective on culture from the works of Hofstede (1980) and Schwartz (1994). The studies take the perspective of measuring behaviors across individuals in a country by using a survey to examine the attitudes toward values. These authors then use the outcomes to group countries. The different approaches to measuring culture will not be deeply explored, but this chapter will focus on direct measures of culture that can explain behaviors within the context of an explicit set of beliefs in a group or country. This approach is the one most accepted by economists in explaining the importance of culture on economics. For instance, religion directly affects the beliefs of a group and its activities across many areas. Thus, the use of religion can help explain behaviors of a country or group. The channels through which culture can influence finance are first discussed.

Culture can affect firm-level finance and development through at least three channels. First, the values that are predominant in a country or group depend on its culture. For example, charging interest can be a sin in one religion but not in another. With this belief, a country that prohibits interest due to its religious doctrine could adversely influence the growth and development of firms and markets within that country. Second, culture affects institutions. For instance, cultural values and priorities influence the legal system. Third, culture affects resource allocation in an economy. Religions that encourage spending on churches or guns take resources away from investment in production. The channel details to be discussed will

use the source of the transmission of culture for ease of understanding. The most common mechanisms for the transmittal of cultural beliefs are language, religion, and membership in a social organization or group. Culture is discussed in this context.

Values

The culture of a country or group can influence its values and thus the way the economy develops over time. Lal (1999, p. 17) argues that "cosmological beliefs—an essential element of 'culture'—have been crucial in the rise of the West and the subsequent evolution of its political economy." For example, religion is a key component of a system of beliefs. Historically, religions have had much to say about the rights of creditors, but less about the rights of shareholders. As Tawney (1954) shows, the prohibition of usury was a fundamental tenet of the medieval church. Usury, which led to excommunication, could be interpreted as simply receiving interest on loans. The Council of Lyons, which took place in 1274, even prescribed excommunication for anybody who would rent a house to a usurer. The medieval church was intent on restricting economic transactions to those in which one of the parties would not be taking advantage of the other because of greater bargaining strength. The Calvinist Reformation viewed the payment of interest as a normal part of commerce, thereby creating the possibility for modern debt markets to develop. In the aftermath of the Calvinist Reformation, creditor rights differed sharply among Protestant and Catholic countries.

This raises the question of whether these differing attitudes toward creditor rights have persisted sufficiently to help explain the variation in creditor rights across countries in the late twentieth century. According to Noonan (1957, p. 377), the declaration of Pope Pius XII in 1950 that bankers "earn their livelihood honestly" suggests otherwise. Yet, as Albacete (2001, p. A27) notes, Catholic leaders argue that what distinguishes Catholic social thought from the Protestant Anglo-Saxon culture is that it does not "regard private property and its economic benefits as absolute goods. They are subject to the good of society." This is consistent with the argument that religions differ in their assessment of investor rights. A version of the Catechism cited by Bainbridge (2002, p. 13) explains that "those responsible for business enterprises are responsible to society for the economic and ecological effects of their operations. They have an obligation to consider the good of persons and not only the increase of profits." Reviewing *Rerum Novarum*, the encyclical of Leo XIII that attacks Manchesterian liberalism, and the work of Fanfani that deemed Catholicism incompatible with capitalism, Novak (1993, p. 13) talks about the "rather common Latin Catholic bias against capitalism."

The issue of the extent to which the "good of society" limits the rights attached to private property is a longstanding issue whose resolution at a point in time can have pervasive effects on finance. Puritan thought in the seventeenth century emphasized that individuals were responsible for their actions and that they had to live up to the contracts they entered into of their own free will. With this thinking, there was no role for higher legal or religious authorities to step in and change contract terms for the good of society or for laws to be approved that would hinder individuals from entering contracts.

The Reformation created another cultural divide that matters for finance. Whereas the Catholic Church has a supreme arbiter of the common good, the Protestant faiths do not. With Protestantism, each individual determines on his own what is right. Churches then become associations of individuals who think alike, rather than hierarchical organizations through which the definition of the common good is passed down to the members. If the existence of a common good for society to which the actions of individuals are subordinate is central to a culture, there cannot be competition in churches or government so that centralization is the most effective mechanism. In contrast, if the common good is realized through the actions of independent individuals following their calling, competition among churches or for the provision of government services is good. As John Calvin (1960), the French theologian and reformer, wrote in his *Institutes of the Christian Religion* (book 4, Chapter 2, paragraphs 8 and 31), it is "safer for a number to exercise government, so that . . . if one asserts himself unfairly, there may be a number of censors and masters to restrain his willfulness." Lal (1999, p. 174) argues that individualism "is the unique cosmological belief of the West," which is in contrast to the communalism prevalent in the rest of the world. Based on this discussion, the individualism associated with the Calvinist Reformation and the Puritans is distinct. Perhaps not surprisingly, French writers have a tendency to view common law as having an "individualist spirit" (David, 1980, p. 26).

Guiso, Sapienza, and Zingales (2008) explore another avenue in which culture can affect finance. They examine the impact of religion and ethnicity on trust and show that religion and ethnicity affect trust within a society. These authors then show that the level of trust influences economic outcomes. The impact of religion on trust exists even when the participants do not regularly attend church. The level of trust within a society can influence its development, and the level of trust across countries can affect the level of cross-border trade. Guiso et al. use relative trust across European countries to examine the impact of trust on bilateral trade. The outcome is that more trust leads to more trade between countries. In another study on the effect of culture and values, Guiso, Sapienza, and Zingales (2003) show that religion plays an important role on the savings behavior of various groups.

Coffee (2001) argues that cultural characteristics help explain why private benefits from control differ across countries. Nenova (2003) finds that the benefits from control are lower in countries with a Scandinavian civil law tradition compared to common-law countries. Coffee makes the point that the Scandinavian civil law tradition is sufficiently like other civil law traditions that the lower benefits from control in Scandinavian countries cannot be explained by differences in legal regimes. Therefore, Coffee (p. 325) concludes that "social norms in Scandinavia may discourage predatory behavior by those in control of the firm."

Institutions

From the prior discussion of the development of religious thought, one would expect that the differences between the Protestant and Catholic views of the world affect institutions, especially legal systems. Both the Lutheran and the Calvinist reformations emphasize that individuals can reach correct decisions based on their own reading of the Bible. Calvin further argued that an individual's duty is to oppose rulers who impose laws or take actions that are incompatible with what

the individual believes God would want. Rightly or wrongly, this empowers individuals. According to Sereni (1956), such a belief is incompatible with a legal system in which a code defines "principles of conduct" as Napoleon required in his comments to the Conseil d'Etat while the *Code Civil* was being written.

In the sixteenth century, the practice of law in England was fragmented so that cases were heard by different courts depending on the nature of the case and the parties involved. Except for the common-law courts, the other courts followed the civil law tradition. Common-law courts were the courts for most people involving felonies and issues related to land rights. With the Puritans, the common-law courts prevailed over all others (Berman, 1993).

In effect, civil law and common-law countries view contracts differently. As David (1980, p.132) states, "The French law of contract is based on a principle of morality, stressed by the canonists, for whom it was a sin for a person not to fulfill his promises. English law . . . sees above all in the contract a bargain: what matters is not that a promise should be enforced, it is that the other party, the promise, who has furnished consideration for the promise, should not suffer any damage as a consequence of the breach." This common-law approach to contracts dates from the Puritans. Berman (1993) explains this approach to contracts as stemming from the importance of covenants to Puritans. Berman (p. 205) cites Witte who states that the cardinal ethical principle of Puritanism was "that each man was free to choose his act but was bound to the choice he made, regardless of the consequences."

With the followers of the Calvinist Reformation, multiple churches were possible, and there was no role for a hierarchical structure that would integrate these churches (Crottet, 1995). There was no justification for giving too much power to specific individuals, who could be corrupt, incompetent, or evil. Decentralization has far-reaching implications. For example it limits rent seeking by fostering competition and by limiting the value of the rents obtained. Decentralization also limits corruption because officials who want to sell public goods face competition in doing so (Shleifer and Vishny, 1993). In addition, decentralization is also associated with higher trust (La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 1997). The key difference between the Protestant and Catholic religions is that the former is based on individual faith while the latter is based on knowledge. By its very nature, a religion based on knowledge creates a hierarchical centralized structure—those who know more guide those who know less.

Decentralization thus reduces the power of politicians. The problem with politics, as emphasized by Rajan and Zingales (2003), is that at times politicians are supportive of markets and at other times they are not. Politicians who want dramatic changes can implement them more easily in a civil law system than in a common-law system. In fact, in a civil law system, the law is an instrument in the hands of politicians, whereas in a common-law system, judges at times slow down the politicians. In common-law countries, courts typically lay down legal rules in the context of specific cases. The civil law approach is the opposite, in that the legislature sets legal rules based on the doctrine promulgated by the legislators. With civil law, legislators can replace a statute with a new one. As Sereni (1956, p. 58) notes, "as a rule a common-law statute does not propose completely to supersede the pre-existing traditional law governing the topics covered by it, nor does it propose to lay down general principles of its own."

Culture also affects innovation in institutions. A common language can facilitate the transfer of ideas across countries. Religion has played a role in the transmission of innovations as well. The greater tolerance in England of religious minorities late in the seventeenth century partly explains why England was such a hotbed of financial innovation (Neal, 1990). In an analysis of innovation in the dairy industry in Denmark and Ireland in the late nineteenth century and early twentieth century, O'Rourke (2002) finds that religion played a role for several reasons. In particular, worthwhile innovations were often rejected in Ireland simply because those proposing them had a different religion from the farmers. He also finds that the Protestant Danish farmers were more willing to form cooperatives, which are based on trust, than were the Catholic Irish farmers. Though there is no study of financial innovation focused on cultural factors such as O'Rourke's study of innovation in the dairy industry, one would expect the cultural factors he identifies to play a role in financial innovation as well.

The quality of government and institutions are keys to the economic development of any country or society. La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1999) show that religion and ethno-linguistic heterogeneity are key components in the development and quality of governments around the world. Landes (2000) also supports the notion that culture is important for the development and quality of institutions. In his work on the development of European countries and economies, Landes (pp. 516, 523) answers the questions as to how and why by stating, "If we learn anything from the history of economic development it is that culture makes all the difference. . . what counts is work, thrift, honesty, patience, tenacity."

Resource Allocation

Different cultures have diverse attitudes toward finance. Historically, Catholics had deep misgivings about anything related to finance. The mere fact that there were papal declarations on the acceptability of receiving interest in payment and that banking is not a sinful profession indicates the extent of these misgivings. Such misgivings meant that the brightest individuals in a Catholic country were less likely to enter finance professions.

There are strong differences among religions in the resources used to support church activities. By definition, a hierarchical church will consume more resources. Ekelund, Hébert, and Tollison (2002) provide an analysis of the Protestant Reformation that emphasizes the high price that the Roman Catholic Church was charging for religious services. They point out that the Roman Catholic Church was engaged in exploiting its market power through price discrimination to maximize its revenue and that the Protestant churches were new entrants in what they call the market for religious services.

MEASUREMENT

This section examines the measurement of culture and how it is used in research. The above discussion is based on the idea that culture is determined by a factor that leads behavior. Much of the prior literature that relies on this definition uses measures of culture such as language, race, wars, ethnicity, and religion. The support for these measures, as discussed in Guiso, Sapienza, and Zingales (2009), is that

these factors are the channels through which people inherit their behaviors and do not have much, if any, control over them. Additionally, these factors are easily measured and used in analyzing culture and outcomes. Though these measures make the discussions and testing easier for some, there are other approaches to culture that are commonly used in the literature and worth mentioning.

The most popular measurement of culture that has been used in the literature is based on measures used by Hofstede (1980). The Hofstede measures are based on a survey of 117,000 employees done between 1967 and 1973. From the survey, five dimensions of culture are developed. These dimensions of culture are as follows: (1) power distance, relating to how society deals with inequality; (2) uncertainty avoidance, relating to the level of stress in a society when confronted with an unknown future; (3) individualism vs. collectivism, dealing with how individuals are integrated into groups; (4) masculinity vs. femininity, related to the division of emotional roles between men and women; and (5) long-term vs. short-term orientation, which is concerned with the focus on the future or the present. Schwartz (1994) criticizes the measures used by Hofstede and constructs a series of similar measures that addresses the criticisms. Compared to Hostede's measures, Schwartz's measures are more focused on the outcome or impact of past factors on current behavior. These measures are likely influenced by one's religion, language, race, ethnicity, or other historical factors in which one has little or no control. They could also be influenced by other short-term factors such as social capital (Becker, 1996) and thus can be changed over one's lifetime. The fact that the Hofstede factors can change due to short-term influences is one of the criticisms of this and other similar measures of culture.

More recently, additional measures of culture have emerged and are used to examine the impact of culture on many facets of finance, which will be discussed in the following sections. These measures include trust and egalitarianism. Reuter (2009) provides a comprehensive discussion of the measurement of culture and how this affects the culture research.

CULTURE AND ECONOMIC DEVELOPMENT

The effect of culture on finance happens at two levels. One is the impact at the level of economic development while the other is at the firm or investor level. An important responsibility of any government is the economic development of a nation. Over time, countries that appear to be similar develop at different rates and in divergent ways. In a review of the literature, Levine (1997) shows that financial development substantially affects economic growth. The manner in which a culture views different aspects of the financial markets will influence the growth of that aspect of the financial markets.

In a case study of the of the Maghribi and Genoese traders of the eleventh and twelfth centuries Greif (1994) argues the importance of culture in the development of a society. The case study examines the importance of culture and how the acceptance of institutions can impact the economic development of a society. Even though countries are interested in economic development, they react very differently to accepting institutions that will facilitate that growth and development because of the cultural view of the society. Greif argues that the Maghribi traders who were Muslim and more "collectivist" were less accepting of institutions and

more accepting of personal relationships for trading activity while the Genoese traders were more "individualist" and depended more on institutions to facilitate trade. The varying views affected the economic development of each group over time.

In an overview of the research on trust, La Porta et al. (1997) argue that trust is an important element of the development of a society's institutions. Putnam (1993) argues that trust is formed over the centuries through "horizontal networks of association" between people. He then contends that the source of this trust could be from structures over time such as religion. Putnam, for instance, maintains that the Catholic Church with its hierarchical structure has discouraged the formation of trust. La Porta et al. then use the percentage of a population belonging to a particular religion and the level and type of structure of the religion, whether it is more horizontal or vertical in its relationships, to test its impact on the development of institutions in a country. The results show that countries with more dominant hierarchical religions tend to have less efficient institutions.

To examine the role of trust on various economic outcomes, Guiso et al. (2006, 2009) investigate how trust affects economic attitudes and stock market participation. In their 2006 study, they make the connection between the intensity of religious beliefs and economic attitudes using data from the World Values Survey and control for country-fixed effects by performing separate analyses in individual countries. They identify six dependent variables that could affect economic growth: (1) trust and cooperation, (2) women, (3) the government, (4) the law, (5) the market and its fairness, and (6) thriftiness. While attitudes differed across religious denominations, on average, religious people trust each other and the government and legal system more than the nonreligious. Religious people are also less willing to break the law and are more likely to believe that the markets' outcomes are fair. This explains the finding that religion in general is good for the development of stronger institutions and is positively associated with attitudes that support free markets. Additionally, this study shows that religious beliefs are typically associated with "good" economic attitudes or attitudes that are conducive to higher per capita income and growth, though the effects differed across religious denominations. More specifically, Guiso et al. (2006) find that Christian religions are more likely to have attitudes conducive to economic growth and Muslims have the most anti-market attitudes. However, the study was unable to determine which religions are better for economic growth.

Guiso et al. (2009) focus on how generalized and personalized trust impacts stock market participation. Because investing in stocks requires individuals to trust the fairness of the system and reliability of the numbers, the expectation is that only investors with high enough trust levels will invest in the stock market. The more an investor trusts, the higher the optimal portfolio share invested in stocks. The study also proposes that adding a fixed cost of participating lowers the amount of mistrust required to stay out of the stock market. Guiso et al. survey 1,943 Dutch households on questions of trust, attitudes toward risk, ambiguity aversion, and optimism. Controlling for risk and ambiguity aversion, and optimism, they find that trusting others increases the probability of direct participation in the stock market by 6.5 percent. Using a separate survey of 1,834 Italian households, the authors investigate how mistrust of institutions that facilitate stock market operations discourages stock market participation. As in the case with generalized

mistrust, the findings show that mistrust in institutions has a negative and large effect on stock market participation as well as on the portion of an individual's portfolio invested in stocks and risky assets.

As the literature documents, culture affects institutions in various ways that may affect economic development. Stulz and Williamson (2003) examine the impact of culture in investor protection. They argue that differences in culture (proxied by differences in religion and language) cannot be ignored when examining why investor protection differs across countries. A country's principal religion predicts the cross-sectional variation in creditor rights better than a country's natural openness to international trade, its language, its income per capita, or the origin of its legal system. More specifically to particular religions, Catholic countries protect the rights of creditors less well than Protestant countries. Stulz and Williamson also find that a country's natural openness to international trade mitigates the influence of religion on creditor rights. Culture proxies also help in the understanding of enforcement of investor rights across countries.

These studies show that culture affects economic development through the effect on institutions that protect the rights of investors. This effect on development goes back for centuries and thus is formed by historical factors that persist over time and overcome short-term factors that are transient or controllable by investors. Additionally, culture influences the trust of systems in a country, which affects participation in the stock market and other factors that impact growth. The next section examines the impact of culture on cross-border trade and investment.

Culture and Trade

The economic impacts of culture affect more than just internal growth. Culture also affects both the trade with and investment in other countries, as well as its openness to trade and development. Guiso et al. (2009) examine how cultural factors affect economic exchanges between countries. They base their study on data of the levels of bilateral trust between European countries. The authors find that the geographic proximity between the involved countries and commonality between their languages significantly affect the level of bilateral trust. This suggests that cultural commonalities are the dominant influences on trust. Using religion as a proxy for a country's cultural tradition, the research shows that countries where 90 percent of the citizens share the same religion have a level of bilateral trust that is one-quarter of a standard deviation higher than those countries without such a dominant religion. After determining the factors that contribute to bilateral trust, the effect of trust on international trade and investment is explored. Guiso et al. find that a lower level of bilateral trust results in less trade between two countries, especially for transactions involving differentiated goods whose quality can vary greatly. The study also finds that less trust leads to less portfolio investment and less direct investment.

Siegel, Licht, and Schwartz (2008) use a measure of egalitarianism, which they argue expresses a society's tolerance for the abuse of market and political power. This in turn affects the way in which firms interact with other market participants. They show that their measure of egalitarianism is based on exogenous social factors such as religion, fractionalization, and war experience. The egalitarian distance influences cross-border flows of equity, debt, and mergers and acquisitions.

These studies support the idea that culture plays an important role in not only the development of institutions in a country but also in the trade flows between markets. Generally, investors prefer to do business with others that share the same set of beliefs, language, or ethnicity. Culture clearly plays a role in the trading behavior and thus development of countries around the world. The next levels of the influence of culture are at the firm and investor level, which are explored in the next section.

IMPACT OF CULTURE ON FIRM AND INVESTOR BEHAVIOR

There has recently developed a growing literature on the impact of culture on firm and investor behavior. This literature examines the role that culture plays on firm investment behavior along with the influence of culture on investor decision making. Given that culture has a role in the development of institutions, finding that culture may affect a manager or an investor is not surprising. Grinblatt and Keloharju (2001) show that Finnish investors prefer to hold, buy, and sell securities of firms that are located close to the investor, communicate in the same language, and have CEOs that are of the same cultural background. The study illustrates a new dimension to the "home bias" literature (see Chapter 15) and shows that the preference for certain securities goes beyond the location of the firm but also possesses a cultural component.

Culture also affects trading strategies. Some cultural characteristics are consistent with more risk taking than others. Consistent with this idea, Chui, Titman, and Wei (2009) find that cultural differences influence the returns on momentum strategies. Using the cultural measure differences in Hofstede (2001), they show that countries with higher individualism exhibit higher trading volume and volatility and are strongly associated with higher momentum profits. They argue that individualism is related to overconfidence and self-attribution bias (see Chapter 13).

A developing literature also exists on the impact of culture on corporate decisions. Hilary and Hui (2009) use a sample of U.S. firms and the religious activity within counties across the United States. The study investigates how a county's religious participation influences the corporate decisions of firms. The authors show that firms in more religious counties are more risk-averse and require higher internal rates of return before investing. Consequently, these firms experience a slower growth rate in the long term. The study also shows that investors react more positively to investing and financing decisions made by firms with a higher level of religiosity because these firms act when the associated ROI is high. Lastly, CEOs are more likely to join firms in counties with a similar level of religious participation as their last firm, consistent with the prediction that corporate culture affects the distribution of CEOs across firms.

Cultural biases are also associated with other aspects of corporate decisions. Ramirez and Tadesse (2007) show that culture is associated with firm cash holdings. The study argues that firms from countries with high uncertainty avoidance, which is the level of stress in a society when confronted with an unknown future, have higher cash holdings in order to hedge against undesired states of the world. Also,

consistent with this argument, Chui, Lloyd, and Kwok (2002) use a sample of 5,591 firms from 22 countries and show that culture plays an important role in firms' capital structure. Similar findings on the impact of culture on dividend policy and agency show the importance of culture in corporate decisions (Shao, Kwok, and Guedhami, 2008; Fidrmuc and Jacob, 2008; Breuer and Salzmann, 2008).

Culture plays a central role in many aspects of finance including investor portfolio decisions as well as management decisions within a firm. Evidence consistent with this idea is well documented in the literature. The main difference in most of the literature at the investor and firm level is the measurement of culture. Researchers seem more divided on the measures of the dimensions of culture than on those related to the source of the cultural bias. There is still much to be understood about country, firm, and individual finance decisions by exploring the effect of culture on finance.

SUMMARY AND CONCLUSIONS

Culture influences finance in many ways. Much has been learned about the impact of law and politics on many facets of finance. Societies decide on the types of law and institutions that they desire to develop. But that decision is influenced by cultural biases that have been developed by religious beliefs, wars, language, ethnicity, and other factors that determine current behavior. The determinant of current behavior that is based in culture does not change easily or quickly. Therefore, cultural biases will affect the development of laws and the enforcement of those laws, as well as institutions and capital markets. The development of laws and financial markets directly influences the economic development of a country.

Beyond the macroeconomic effects of culture, culture directly influences firms and investor behavior. The factors that influence decisions on the type of system that develops in a country are the same factors that influence the decisions that are made at the micro level.

DISCUSSION QUESTIONS

1. What are the channels through which culture influences economic and financial development in a country?
2. In the discussion of cross-border trade, investment, and how they are affected by trust, the chapter discusses how Finnish investors make investment decisions as well as how trust influences investment across countries. What role could this play in explaining home bias?
3. A dilemma in the literature is the measurement of culture and how cultural value affects outcomes. What are the potential issues on the types of measurements of culture?

REFERENCES

Albacete, Lorenzo. 2001. America's hispanic future. *New York Times*, June 19, p. A27.

Bainbridge, Stephen M. 2002. The bishops and the corporate stakeholder debate. *Villanova Journal of Law and Investment Management* 4:1, 3–28.

Becker, Gary. 1996. Preferences and values. In *Accounting for taste*, (ed.) Gary Becker, 3–23, Cambridge: Harvard University Press.

Berman, Harold J. 1993. *Faith and order: The reconciliation of law and religion*. Emory University Studies in Law and Religion. Atlanta: The Scholar's Press.

Boyd, Robert, and Peter J. Richerson. 1985. *Culture and the evolutionary process*. Chicago: University of Chicago Press.

Breuer, Wolfgang, and Astrid Salzmann. 2008. Cultural dimensions of corporate governance systems." Working Paper, Aachen University. Available at SSRN http://ssrn.com/abstract=1260746.

Calvin, John. 1960. *Institutes of the Christian religion* (1559 translation edition). Westminster: John Know Press.

Chui, Andy, Allison Lloyd, and Chuck Kwok. 2002. The determination capital structure: Is national culture a missing piece to the puzzle? *Journal of International Business Studies* 33:1, 99–127.

Chui, Andy C. W., Sheridan Titman, and K. C. John Wei. 2009. Individualism and momentum around the world. *Journal of Finance*, forthcoming.

Coffee, John C. 2001. Do norms matter? A cross-country examination of the private benefits of control. *University of Pennsylvania Law Review* 149:6, 2151–77.

Crottet, Bernard. 1995. *Calvin*. Paris: J. C. Lattés.

David, Rene. 1980. *English law and French law*. London: Steven & Sons.

Ekelund, Robert B., Jr., Robert Hébert, and Robert D. Tollison. 2002. An economic analysis of the Protestant reformation. *Journal of Political Economy* 110:3, 646–72.

Fidrmuc, Jana P., and Marcus Jacob. 2008. A cultural explanation of agency model of dividends. Working Paper, Warwick Business School and European Business School International University. Available at SSRN http://ssrn.com/abstract=1102591.

Glaeser, Edward L., and Jose A. Scheinkman. 1998. Neither a borrower nor a lender be: An economic analysis of interest restrictions and usury laws. *Journal of Law and Economics* 41:1, 1–36.

Greif, Avner. 1994. Cultural beliefs and the organization of society: A historical and theoretical reflection on collectivist and individualist societies. *Journal of Political Economy* 102:5, 912–50.

Grinblatt, Mark, and Matti Keloharju. 2001. How distance, language, and culture influence stockholdings and trades. *Journal of Finance* 56:3, 1053–73.

Guiso, Luigi, Paola Sapienza, and Luigi Zingales. 2003. People's opium? Religion and economic attitudes. *Journal of Monetary Economics* 50:1, 225–82.

Guiso, Luigi, Paola Sapienza, and Luigi Zingales. 2006. Does culture affect economic outcomes? *Journal of Economic Perspectives* 20:2, 23–48.

Guiso, Luigi, Paola Sapienza, and Luigi Zingales. 2008. Trusting the stock market. *Journal of Finance* 63:6, 2557–600.

Guiso, Luigi, Paola Sapienza, and Luigi Zingales. 2009. Culture biases in economic exchange. *Quarterly Journal of Economics* 124:3, 1095–131.

Hilary, Gilles, and Kai Wai Hui. 2009. Does religion matter in corporate decision making in America? *Journal of Financial Economics*, forthcoming.

Hofstede, Geert. 1980. *Culture's consequence*. New York: Sage Publications.

Hofstede, Geert. 2001. *Culture's consequence, 2nd ed*. New York: Sage Publications.

La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert W. Vishny. 1997. Trust in large organizations. *American Economic Review* 87:2, 333–8.

La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert W. Vishny. 1999. The quality of government. *Journal of Law, Economics and Organization* 15:1, 222–79.

La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert W. Vishny. 2000. Investor protection and corporate governance. *Journal of Financial Economics* 58:1-2, 3–27.

Lal, Deepak. 1999. *Unintended consequences: The impact of factor endowments, culture, and politics on long-run economic performance*. Cambridge: MIT Press.

Landes, David. 2000. Culture makes almost all the difference. In *Culture matters*, (eds.) Lawrence E. Harrison and Samuel P. Huntington. New York: Basic Books.
Levine, R. 1997. Financial development and economic growth: View and agenda. *Journal of Economic Literature* 35:2, 688–726.
Neal, Larry. 1990. *The rise of financial capitalism*. Cambridge: Cambridge University Press.
Nenova, Tatiana. 2003. The value of corporate votes and control benefits: A cross-country analysis. *Journal of Financial Economics* 68:3, 325–51.
Noonan, John T., Jr. 1957. *The scholastic analysis of usury*. Cambridge: Cambridge University Press.
North, Douglass. 1990. *Institutions, institutional change and economic performance*. Cambridge: University Press, Cambridge.
Novak, Michael. 1993. *The Catholic ethic and the spirit of capitalism*. New York: The Free Press.
O'Rourke, Kevin H. 2002. Culture, politics and innovation: Evidence from the creameries. CEPR Working Paper No. 3235, London.
Putnam, Robert. 1993. *Making democracy work: Civic traditions in modern Italy*. Princeton: Princeton University Press.
Rajan, Raghuram G., and Luigi Zingales. 2003. The great reversals: The politics of financial development in the twentieth century. *Journal of Financial Economics* 69:1, 5–50.
Ramirez, Andres, and Solomon Tadesse. 2007. Corporate cash holdings, national culture, and multinationality. Working Paper, William Davidson Institute.
Reuter, Charles-Henri. 2009. A survey of culture and finance. Working Paper, European School of Management.
Roland, Gerard. 2004. Understanding institutional change: Fast moving slow moving institutions. *Studies in Comparative International Development* 38:4, 109–31.
Schwartz, Shalom H. 1994. Beyond individualism/collectivism: New cultural dimensions of values. In *Individualism and collectivism: Theory, method and application*, (eds.) Uichol Kim, Harry C. Triandis, Cigdem Kagitcibasi, Sang-Chin Choi, and Gene Yoon, 239–250. Newbury Park: Sage Publications.
Sereni, Angelo P. 1956. The code and case law. In *The code Napoleon and the common-law world*, (ed.) Bernard Schwartz, 55–79. New York: New York University Press.
Shao, Liamg, Chuck C. Y. Kwok, and Omrane Guedhami. 2008. Is national culture a missing piece of the dividend puzzle? Working Paper, University of South Carolina.
Shleifer, Andrei and Robert W. Vishny. 1993. Corruption. *Quarterly Journal of Economics* 108:3, 599–618.
Siegel, Jordan I., Amir N. Licht, and Shalom H. Schwartz. 2008. Egalitarianism, cultural distance, and foreign direct investment: A new approach. Working Paper, Harvard Business School. Available at SSRN: http://ssrn.com/abstract=899082.
Stulz, René M., and Rohan Williamson. 2003. Culture, openness, and finance. *Journal of Financial Economics* 70:3, 313–49.
Tawney, Richard H. 1954. *Religion and the rise of capitalism*. Harcourt, Brace & World, Inc., New York.
Weber, Max. 1930. [1904]. *Protestant ethic and the spirit of capitalism*. London: Allen & Unwin.

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CHAPTER 35

Social Interactions and Investing

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INTRODUCTION

How do social interactions affect investment behavior? Answering this question touches on vast and diverse research in the field of financial economics. Investment decisions may be influenced by observing the decisions of others to the point that some individuals may ignore their own private information. Individuals' preferences may depend on the actions and choices of others. Wealth and consumption may be measured relative to the wealth and consumption of others in the community. Social interactions can have positive or negative effects on investor welfare. Individuals may be more likely to save for retirement if their colleagues join savings plans. Alternatively, individuals may follow others into underperforming assets.

The voluminous literature includes theoretical models, laboratory experiments, field experiments, and empirical studies. This chapter begins by briefly covering the well-developed theory literature on herding, information cascades, and preferences. It then moves quickly to its main focus—a discussion of recent empirical work on herd behavior and correlated trading. The intent of this chapter is not to give short shrift to the theoretical literature but rather to focus on the abundant empirical studies about the effects of neighbors, colleagues, information diffusion, and social capital on investment decisions.

This chapter ends with an analysis of the challenges faced by empiricists when studying social interactions and investment behavior. For an example of such a challenge, consider a hypothetical study of herding behavior. Financial economists may notice that investment managers in New York City are net buyers of IBM stock in the month of April 1996. Expanding the study in the time-series dimension, financial economists may notice that in most months, NYC investment managers (as a group) are either net buyers or net sellers of IBM stock. The finding that investment managers tend to buy or sell together is evidence of herd behavior. Gathering more months of data allows financial economists to be increasingly confident in a statistical sense that NYC fund managers herd when focusing on IBM stock.

Ultimately, financial economists are interested in asset prices. Therefore, many papers test whether a time series of net buys is correlated with a time series of

stock returns. Suppose that in the aforementioned hypothetical study, a positive (time-series) correlation is found between the NYC fund managers' trade imbalances (buys-minus-sells) of IBM stock and the stock's returns. How should financial economists interpret this positive correlation? Note that a group of investors' buys-minus-sells has a number of names in the literature including: trading imbalances, order imbalances, net trades, net buys, and many more. The words "order imbalances" typically refer to executed orders and are thus the same as trading imbalances.

Many papers interpret a positive correlation between trading imbalances and stock returns as evidence that herd behavior "moves" stocks prices. When studying monthly data, can one make such a causal statement? Does net buying "push" prices higher and net selling "push" prices lower? Beyond contemporaneous effects, there might be a positive correlation between the trading imbalances and lagged stock returns (called "positive feedback trading"). Researchers might also find a positive correlation between trading imbalances and future returns (evidence of informed trading if the returns do not later reverse themselves).

Why do NYC mutual fund managers tend to trade a given stock in the same direction? There may be several reasons. For example, managers may be benchmarked against their peers. The managers may be hedging against price rises of scarce local resources. Or they may have similar information from local news, from discussions with local companies, or from talking amongst themselves. Finally, fund managers might simply be following a rule of thumb such as "buy last month's winners." Ascribing a causal link between trading imbalances and returns turns out to be very difficult.

To answer the questions posed in this introduction, the chapter has the following structure. The first section reviews herding and information cascades. This is followed by a discussion of preferences, relative wealth, and indirect effects that may cause investors to trade together. The next section covers the large empirical literature on correlated trading (also known as herding). The next three sections review work on neighbors/colleagues, information diffusion, and social capital respectively. The difficulties of making causal links between social interactions and investment behavior are discussed next. The relatively few papers that address these causation issues are reviewed in this section. The final section provides a summary and conclusion.

HERDING AND INFORMATION CASCADES

Investors choose portfolios as part of their savings plans for future consumption. Traditional asset pricing models assume investors only evaluate risks and expected returns when choosing optimal portfolios. They hope to grow their wealth while at the same time being wary of economic downturns especially around the time of retirement. In traditional and frictionless markets, all investors know each stock's expected return. Investors also know the covariance matrix of stock returns. In frictionless markets, investors can freely analyze and trade all assets. There is little benefit to observing the actions of others.

What happens when information cannot be freely traded or when an investor's utility function depends on the choices and actions of others? To help answer these questions, there is a large, well-developed, and now 20-year old literature

on herding and information cascades. The literature is so well developed that numerous, thorough, and easily accessible review articles exist, including Devenow and Welch (1996), Bikhchandani, Hirshleifer, and Welch (1998), Bikhchandani and Sharma (2001), and Hirshleifer and Teoh (2003). The review articles cover the well-known papers in this area including Banerjee (1992), Bikhchandani, Hirshleifer, and Welch (1992), and Welch (1992).

Theory Models

Hirshleifer and Teoh (2003) provide a useful taxonomy of different behaviors along with definitions and reviews of relevant papers. As shown in Exhibit 35.1, the Hirshleifer and Teoh taxonomy outlines a double hierarchy of means of convergence. There are four nested levels of observational hierarchy depicted by rectangles. The most inclusive category is "A: Herding/Dispersing". The most restrictive category ("D: Informational Cascades") is one in which observing the actions of others can lead an individual to ignore his own private information.

Additional factors such as payoff externalities may lead to herding behavior. Mobile phones and text messaging became increasingly popular over the past decade as more people purchased compatible devices. Suppose all individuals initially receive the same marginal value from buying the first mobile phone. As more people buy phones, the marginal value of owning a phone increases, and more individuals rationally choose to purchase the phones—a form of herd behavior.

Reputational concerns may induce economic agents to engage in similar behaviors. Scharfstein and Stein (1990) study herd behavior of firm managers who are concerned about their reputations in the labor market. Researchers have applied a similar idea of reputation to studying stock analyst recommendations. If being seen as different from the average analyst is not highly valued, analysts have an

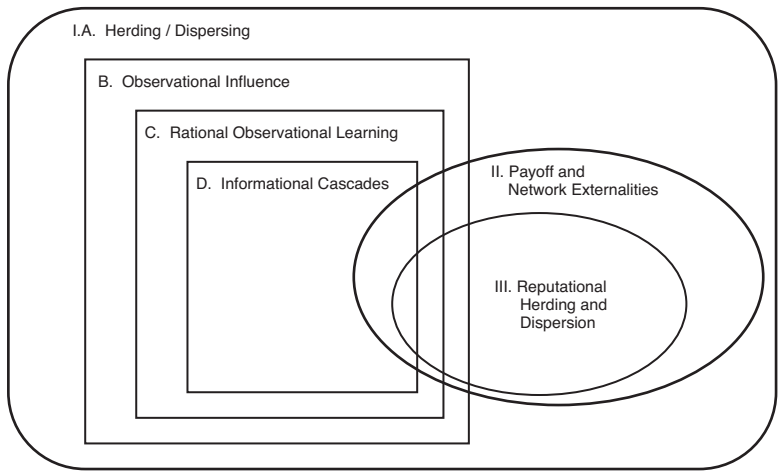

Exhibit 35.1 The Hirshleifer and Teoh Taxonomy

Note: This figure shows the Hirshleifer and Teoh (2003) taxonomy of herding, payoff and reputational interactions, social learning, and cascading. Rectangles represent an observational hierarchy and describes informational sources of herding. The largest rectangle is the most inclusive category.

incentive to produce forecasts and recommendations with low dispersion as noted by Chevalier and Ellison (1999), Graham (1999), and Hong, Kubik, and Solomon (2000).

Recently, two working papers by Ozsoylev (2006, 2007) extend the traditional rational expectations framework in which investors glean information from publicly observable prices. In Ozsoylev's frameworks, an investor may obtain additional information by observing the demands of certain other investors. The author presents a series of directed graphs that define different social networks (i.e., who can observe the actions of whom). The graphs link different social networks to asset prices. One conclusion is that when information is initially private and dispersed, social interactions can impair information aggregation.

Experimental Results

Experimental economics lends itself particularly well to studying information cascades. Researchers can precisely control an individual's information set. Anderson and Holt (1997) conduct an experiment in which individuals sequentially and privately see a colored marble that has been drawn from one of two urns. An individual makes a private decision about from which urn he or she thinks the marble comes. An announcer conveys the decision to other participants. Individuals are rewarded for choosing the correct urn. Individuals who get to choose later in the sequence have the "advantage" of hearing the decisions of earlier individuals. Anderson and Holt (p. 859) report that "some decision sequences result in reverse cascades, where initial misrepresentative signals start a chain of incorrect decisions that is not broken by more representative signals received later." The authors find that cascades occur approximately 75 percent of the time with normal cascades being twice as prevalent as reverse cascades.

Celen and Kariv (2004) extend experimental results by distinguishing between herd behavior (a series of individuals make identical decisions) and informational cascades (agents make identical decisions while ignoring their own private signals). The authors employ a cutoff elicitation technique to obtain subjects' beliefs and experimentally distinguish between the two behaviors. They find herds develop 36 percent of the time with 97 percent of the herds being correct. Cascades happen 35 percent of the time, far in excess of what Celen and Kariv's model predicted.

Cipriani and Guarino (2005) study a financial/laboratory market in which subjects receive private information about an asset's value and sequentially trade with a market maker. Theory predicts that herds should not form and the authors' results concur. Interestingly, subjects ignore their private information and refuse to trade in some cases.

Empirical Results

There are many empirical studies of herd behavior. One of the first is by Lakonishok, Shleifer, and Vishny (1992), who study the holdings of 769 tax-exempt funds. Quarterly changes in holdings represent the net trades of a given fund and can be measured on a stock-by-stock basis. Suppose 50 percent of holdings increase on average. The authors find that 52.7 percent of the managers in their study change their holdings in one direction while 47.3 percent change their

holdings in the opposite direction. While the imbalance may seem small (i.e., only 2.7 percentage points away from 50 percent), the funds in their sample hold $124 billion or about 18 percent of the total actively managed holdings of all pension funds. When their imbalance measure is in its upper 20 percent, abnormal stock returns are 1.81 percent. When the imbalance measure is in its lower 20 percent, abnormal stock returns are –0.31 percent. The authors interpret the positive relation between net trades and stock returns as evidence that herding "moves" stock prices. Understanding whether the observed relation between trades and returns is causal remains one of the most challenging areas of financial economics.

A later section of this paper reviews studies of correlated trading (herding) in more depth. Interpretations of the positive relation between the herd behavior and stock price movements will also be discussed. A particular focus of this chapter is the difficulty inherent in assigning causality from trades to price movements.

PREFERENCES, RELATIVE WEALTH, AND INDIRECT EFFECTS

Rather than be directly influenced by observing the actions of others, investors may be indirectly influenced. Habit formation models, for example, introduce the possibility that investors care about current consumption relative to levels of past consumption. Such assumptions differ from traditional models, which assume investors care only about the level and variance of their own consumption and do not consider consumption relative to past levels.

Abel's (1990) "catching up with the Joneses" preferences assume an investor's current utility depends on his or her current consumption relative to a lagged cross-sectional average level of consumption. Consuming the same (real dollar) amount of goods no longer provides the same level of utility if others have been consuming increasing amounts. Stated differently, owning a Porsche near San Francisco may have had low utility in the late 1990s. Why? The dot-com bubble offered many people the opportunity to own similar (or better) cars. Note that Abel's external habit model lends itself easily to thinking about how the actions of others may indirectly affect an investor's decisions: that is, others' past consumption raises the overall level of habit. Internal habit models, such as Constantinides (1990), do not necessarily help in thinking about social interactions. This is because an investor compares current consumption to his or her own level of past consumption (habit).

Habit formation models have become increasingly popular in macro asset pricing as economists seek to reconcile smooth levels of aggregate consumption with high observed stock returns and high levels of stock price volatility. Consider a group of investors who have consumed similar (real) dollar amounts over the past 20 years. In the coming year, the marginal value of consuming an extra dollar of goods can fluctuate wildly if the level of planned consumption moves closer to, or farther from, these investors' habit level. Campbell and Cochrane (1999) use habit formation and fluctuating marginal values to model a number of asset market features.

Scarce local resources may also cause an individual's investment choices to be influenced by the choices of other members of his community. DeMarzo, Kaniel, and Kremer (2004) present a rational general equilibrium model in which

competition for scarce local resources induces concern about relative wealth in a community. For example, an investor who plans to retire in Switzerland cares very much about the costs of health care and services in Switzerland and less about health care costs in other areas. If Swiss resources are scarce, the investor recognizes that competition will exist in the future and alters his portfolio today. The community effects give investors the incentive to herd and choose similar portfolios. Another implication of the DeMarzo et al. framework is that small groups of traders with behavioral biases can have large effects on asset prices by influencing the community to trade in a similar direction.

DeMarzo, Kaniel, and Kremer (2008) further explore the link between relative wealth concerns and financial bubbles. Even when agents care only about their own consumption, community effects can influence asset prices. As the authors explain, in standard asset pricing models, trading against price distortions is both profitable and helps eliminate the distortions. In their paper, agents are sensitive to the wealth of others in their community. Trading against the crowd increases the relative wealth risk. Thus, investors may be reluctant to sell overpriced assets and buy underpriced assets. The net result is that asset bubbles can form. Rational investors are reluctant to trade against such bubbles.

CORRELATED TRADING

For every share of stock bought, a share is sold. This "adding-up constraint" ensures that any marketwide trade imbalance measure (buys-minus-sells) is zero, for any stock, over any time period. Consider the trades of one well-defined investor group such as mutual funds. Over a set period of time such as a day, week, month, or quarter, shares bought of a given stock need not equal shares sold because *other* investor groups are also involved in the trades. Focusing again on a well-defined investor group, non-zero trade imbalances are evidence of possible herding behavior. Thus, any empirical study that consistently measures non-zero trading imbalances can be thought of as a study that finds evidence of herd behavior. Technically, adding-up constraints apply to shares. Many herding measures are concerned with the number of investors buying or selling together. If all investors trade the same number of shares, counting share imbalances is equivalent to counting investor imbalances. Even when investors do not trade the same number of shares, share imbalances are typically highly correlated with imbalances based on the number of investors.

The adding-up constraint mentioned in the previous paragraph allows financial economists to comment on the behavior of at least two groups of market participants. If mutual funds are found to have been net buyers of IBM stock during April 1996, then the group of investors labeled "non-mutual funds" represents net sellers over the same time period. If mutual funds are found to be herding, "non-mutual funds" are also likely to be herding.

As previously mentioned, there is a wealth of empirical herding studies that directly follow the work of Lakonishok, Shleifer, and Vishny (1992). Many use the same herding measure (henceforth called the "LSV herding measure"). For a well-specified investor group trading stock i over a period of time t, the LSV measure is shown below. If there is no herding, the measure should be zero.

Note that t can be almost any length of time such as a day, week, month, or quarter.

$$LSV_{i,t} = \left| p_{i,t} - \bar{p}_{i,t} \right| - E \left| p_{i,t} - \bar{p}_{i,t} \right| \tag{35.1}$$

where

$$p_{i,t} = \frac{Buys_{i,t}}{Buys_{i,t} + Sells_{i,t}} \tag{35.2}$$

Typically, $Buys_{i,t}$ is the number of investors who increase their ownership in stock i over time period t and $Sells_{i,t}$ is the number of investors who decrease their ownership in stock i over time period t. The term $\bar{p}_{i,t}$ is included to account for times when the investor group experiences buying or selling across all stocks (e.g., times of large mutual fund inflows that cause most managers to buy). As a proxy for $\bar{p}_{i,t}$ many researchers use the proportion of all stock trades by the investor group that are purchases during time period t. The final term of the expression is an adjustment factor because noise in datasets causes the first term to be non-zero, even if the numbers of buyers and sellers are equal on average. Papers often report average LSV measures. These measures average $LSV_{i,t}$ across all stocks and time periods.

In general, empirical studies find low levels of institutional herding (the fraction of institutional investors who buy together is found to be close to one half). However, a small imbalance can represent millions of dollars of excess buying or selling. In addition to studies of institutional trading, the last decade has seen an increase in studies of individual investor herding. Many measures of individual herding are much larger than measures of institutional herding. Exhibit 35.2 provides a meta-analysis of different LSV herding measures. Versions of the table originally appeared in working drafts of Feng and Seasholes (2004). The accompanying table notes are important in understanding the measures and where to find them in the original papers. While LSV measures are typically low, there is large dispersion across studies.

Finally, many studies cover both positive feedback trading (buying past winners and selling past losers) and herding. If an investor group is found to engage in positive feedback trading on average, financial economists should expect to find herding behavior. This mechanical link stems from the fact that there is only one price history per stock. Consider an investor group who buys based on past positive stock returns. If recent returns are positive, then group members, on average, should be buying today, that is, herding.

Institutional Trading

Grinblatt, Titman, and Wermers (1995) study 10 years of mutual fund trades. The authors focus on both positive feedback trading and herding. Grinblatt et al. (p. 1099) find a LSV herding measure of 2.5 meaning that "if 100 funds traded [in a given] stock-quarter, 2.5 more funds traded on the same side of the market than would be expected [by random]." The mutual funds exhibit more herding when buying past winners than past losers. Evidence of herding increases dramatically

Exhibit 35.2 Comparison of Herding Measures

Note: This table compares Lakonishok, Shleifer, and Vishny (1992) or "LSV" herding measures across different studies. The measure is defined in their paper and in Equations (35.1) and (35.2) of this chapter

Note	Study	Country	Investor Group	Frequency	LSV Measure
a.	Grinblatt et al. (1995)	USA	Mutual Funds	Quarterly	0.0250
b.	Feng and Seasholes (2004)	PRC	Individuals	Daily	0.0255
c.	LSV (1992)	USA	Pension Funds	Quarterly	0.0270
b.	Feng and Seasholes (2004)	PRC	Individuals	Weekly	0.0293
d.	Wermers (1999)	USA	Mutual Funds	Quarterly	0.0340
e.	Choe et al. (1999)	Korea	Foreigners	Daily	0.0365
f.	Kim and Wei (2002)	Korea	Foreign Institutions	Monthly	0.0434
g.	Dorn et al. (2008)	Germany	Individuals	Daily	0.0480
g.	Dorn et al. (2008)	Germany	Individuals	Weekly	0.0540
g.	Dorn et al. (2008)	Germany	Individuals	Monthly	0.0640
g.	Dorn et al. (2008)	Germany	Individuals	Quarterly	0.0830
h.	Kim and Wei (2002)	Korea	Foreign Individuals	Monthly	0.1117
i.	Lobao and Serra (2006)	Portugal	Mutual Funds	Quarterly	0.1354
j.	Choe et al. (1999)	Korea	Foreigners	Daily	0.2124

Notes:
a. From Table 4: The mean herding statistic for all 274 funds and all quarters.
b. From Table 2: Table is from a working paper version of Feng and Seasholes (2004) dated September 2002. The table with LSV herding measures is not in the final published version.
c. From Table 2: The mean herding statistic for all cases.
d. From Table II: Data include all funds, from 1975 to 1994, with five or more trades.
e. From Table 4: Represents a lower bound estimate from this study. The value 0.0365 is the average of all 50 reported measures before crisis and during crisis.
f. From Table 5: Data from non-resident institutions and averaged over the tranquil period, pre-crisis period, and in-crisis period. The value of 0.1117 is the average of the three reported values (0.05781; 0.04690; 0.02553).
g. From Table I: All values are from the mean LSV measure.
h. From Table 5: Data from non-resident individuals and averaged over the tranquil period, pre-crisis period, and in-crisis period. The value of 0.1117 is the average of the three reported values (0.13241; 0.11860; 0.08422).
i. From Table 3: Data from 1998 to 2000 and include more than five funds trading in the same period.
j. From Table 3: Represents an upper-bound estimate from this study. The value 0.2124 is the average of all 50 reported measures before crisis and during crisis.

when the sample is limited to stock quarters with at least 5 or 10 trades. The authors conclude by noting a link between the degree to which a fund engages in positive feedback trading and the fund's performance.

Sias and Starks (1997) test the relations between levels of institutional ownership and stock return autocorrelation. They find that both an individual stock's return autocorrelation and a portfolio's return autocorrelation increase with

institutional ownership. They focus on stock-holding levels rather than trades. Holding levels are the sum of all past buys minus the sum of all past sells. As such, institutions with similarly high levels of holdings in the same stock most likely engaged in similar average levels of buying in the past.

Wermers (1999) finds high levels of herding in small stocks and in the trades of growth-oriented funds. His 20-year sample starts in 1975 and ends in 1994. A portfolio composed of stocks with the highest levels of buy-side herding has significantly positive abnormal returns in both the current and next quarter. A portfolio composed of stocks with the most sell-side herding has significantly negative returns in the current quarter and the following three quarters. Because returns over future quarters appear permanent (i.e., they do not reverse themselves), Wermers concludes that fund trading helps to speed the adjustment of stock prices toward fundamental values.

Nofsinger and Sias (1999) also study positive feedback trading and herding. Their results are consistent with those in other papers. Stocks with a high degree of herding from buying (selling) have significantly positive (negative) returns over the same period. The authors obtain data on the number of shares owned by institutions. Institutional fractional ownership is simply the number of shares owned divided by number of shares outstanding. The authors then define individual fractional ownership as one minus institutional fractional ownership. Nofsinger and Sias (p. 2293) conclude that "returns are strongly [positively and contemporaneously] correlated with changes in institutional ownership." Due to the adding-up constraint imposed in this paper, the conclusion could just as easily be drawn that returns are strongly negative and contemporaneously correlated with changes in individual ownership.

Sias (2004) attempts to disentangle positive feedback and herding effects by decomposing the fraction of institutional buying over adjacent quarters. As mentioned at the start of this section, if institutions follow positive feedback trading strategies, a financial economist is likely to (mechanically) find positive herding measures. In this paper, Sias employs linear regressions. The left-hand side variable is the fraction of institutions with increasing positions in a given quarter. The two right-hand side variables are the fraction of institutions with increasing positions last quarter (institutions following their own trades) and returns in the previous quarter (feedback trading/following the trades of others). Sias compiles trade data for five trader types: banks, insurance companies, mutual funds, independent advisors, and unclassified. Having five investor groups means that the adding-up constraint does not mechanically link the trading of any two groups. Of course, the net trades of all five groups must still sum to zero over a given period. Sias concludes that institutions follow their own trades and that this effect can explain much of the observed herding behavior.

Individual Herding

Choe, Kho, and Stulz (1999) provide one of the first papers to document high levels of correlated trading (herding) among individual investors. While the focus of the paper is the behavior of foreign institutions during the Asian financial crises, they also measure individual trading imbalances.

When studying transaction-level data, researchers should avoid double counting some individuals' trades. Suppose a financial economist is constructing a daily herding measure. Simply counting the number of buy and sell trades will overstate herding. This is because some individuals may break up a single trade into parts that are executed throughout the day. Stated differently, if an individual breaks up a 1,000-share buy order into ten 100-share orders, it might look like herd behavior (really a type of "self-herding") because there is now a plethora of buy orders. To protect against mis-measuring herding, all trades by the same individual should be aggregated over each time period/security combination.

Exhibit 35.2 shows the result of controlling for possible self-herding. When Choe et al. (1999) treat each purchase as coming from a distinct investor, the average LSV herding measure for foreign investors is 0.2124 (indicating that approximately 79 percent of trades are in the same direction). When foreign investors are first grouped into 658 classes based on country of residence and all trades within a class are aggregated by stock and day, the average LSV herding measure shifts to a more reasonable 0.0365 level.

The Asian financial crisis provides the setting for a Korean study by Kim and Wei (2002) that includes individual herding results. The authors calculate the LSV herding measure for both foreign institutions and foreign individuals. They calculate the measures during three time periods: December 1996 to May 1997 (tranquil period), June 1997 to October 1997 (pre-crisis period), and November 1997 to June 1998 (crisis period). The authors find strong evidence of herd behavior among foreign investors before the crisis. Surprisingly, the levels of herding fall during the crisis period. Kim and Wei conclude that foreigners did not destabilize prices.

Feng and Seasholes (2004) focus exclusively on correlated trading by individual investors. The authors study brokerage account data from the People's Republic of China (PRC). They aggregate trades at the "fund account-level" effectively combining all trades by the same individual even if the individual controls different stock accounts. They use an institutional feature of brokerage offices in the PRC to help identify sources of correlated trading. Because this is one of the few papers to focus on the identification issues, further discussion occurs in a later section of this chapter.

Kumar and Lee (2006) provide a complete description of individual trading imbalances among retail (individual) investors in the United States. The authors study 62,387 households who collectively make an average of 1,244 trades per day between 1991 and 1996. Kumar and Lee form a buys-minus-sells measure for each stock-month. Their measure is defined as dollars bought minus dollars sold, all divided by dollars bought plus dollars sold. There is evidence of marketwide buy-minus-sell imbalances. More importantly, the buys-minus-sells index helps explain the returns of stocks in the smallest size quintile.

Andrade, Chang, and Seasholes (2008) test a multi-asset version of the Grossman and Miller (1988) model. If individual trades are non-informational and the market's risk-bearing capacity is limited, the model predicts that the trades can induce temporary price reversals. Buys push prices up today, but these movements reverse themselves in the coming days, weeks, or months. The model also shows that trading in one stock can affect the prices of other stocks due to liquidity supplier hedging activities. The authors use data from individuals in Taiwan. The

magnitude and duration of price reversals are stunning. Each week, the authors sort stocks into quintiles based on net buying. The week zero return difference between stocks bought (quintile 1) and stocks sold (quintile 5) is 2.37 percent. The prices then converge over the following 10 weeks. There are 52 basis points of convergence in the first week alone (a figure that compounds to more than 26 percent of temporary return predictability per annum).

Kaniel, Saar, and Titman (2008) do not study herd behavior per se, but the authors do study individual trades on the New York Stock Exchange (NYSE). They consistently find non-zero trade imbalances indicating that individuals typically buy or sell together (herding). Interestingly, their results regarding individual trade imbalances and stock returns are different from results reported in other papers. Individual trades on the NYSE act to provide liquidity to others who demand immediacy. As prices are falling, Kaniel et al. show that individuals tend to be net buyers. As prices rise, individuals tend to be net sellers. The amount of return predictability following intense individual trading is enormous. In the 20 days (trading month) following intense individual buying, market-adjusted returns are +0.80 percent on average. In the 20 days after intense individual selling, market-adjusted returns are –0.33 percent on average.

Dorn, Huberman, and Sengmueller (2008) study more than 37,000 retail clients from one of Germany's largest discount brokers. The authors differentiate between speculative trades and other trades. They also differentiate between market orders and (executed) limit orders. Dorn et al. use the LSV herding throughout the paper. Individuals in Germany are found to herd at daily, weekly, monthly, and quarterly frequencies.

Barber, Odean, and Zhu (2009) study 66,456 households from a large discount broker and 665,553 investors from a large retail broker. Individuals are net buyers of stocks at the same time (a cross-sectional, herding-related result). In the time-series dimension, stocks with positive trade imbalances during one month are likely to have positive trade imbalances in future months. In fact, the persistence can last up to 24 months. Interestingly, the authors find that individuals tend to buy stocks with strong past returns (positive feedback trading). The result is surprising because earlier studies find that institutions engage in positive feedback trading. Adding-up constraints imply that not all investors can be positive feedback traders.

NEIGHBORS AND COLLEAGUES

Recently, a series of papers investigated the roles of neighbors and colleagues in economic decisions. Focusing on neighbors and/or colleagues is a natural way to study social interactions. Duflo and Saez (2002) study individuals' decisions to enroll in a tax-deferred savings plan. The individuals in the study are university employees. The authors ask whether the decisions of colleagues in the same department affect others' enrollment decisions and the choices of vendors (once enrolled). Staff at the university's 11 libraries has participation rates that vary from 14 percent to 73 percent even though salary and tenure are relatively similar across groups. The range of participation rates suggests that colleagues influence investment behavior.

Duflo and Saez (2002) recognize that many decisions within a group are correlated for reasons that have nothing to do with individuals simply imitating the

actions of others. For example, a group of investors may be of similar ages and thus have similar spending and savings needs. The authors attack these issues by studying 12,500 university employees. The individuals are organized into departments and share the same savings plan and the same program inputs. The authors get around the worry that individuals with similar traits choose to be in the same department by studying average participation rates across departments. They find that when a department's participation rate increases by 1 percent, an individual's participation rate increases by 0.2 percent. When the share of the contribution allocated to one vendor increases by 1 percent, an individual's share increases 0.5 percent. Duflo and Saez end the paper with this still-unanswered query: Does the observed behavior stem from learning or from a desire to conform to a social norm?

Duflo and Saez (2003) follow their earlier work by conducting a randomized experiment within a population of university employees. This experiment (p. 815) allows the authors to "shed light on the role of information and social interactions in employees' decisions to enroll in a Tax Deferred Account."

The Duflo and Saez (2003) study uses the following research design. The authors send invitations for an investment fair to a randomly selected group of university employees. The employees are chosen from a randomly selected subset of the university's departments. The research design (called a "classical encouragement design") allows the authors to study the effect of the invitations on investment fair attendance. Treated individuals are five times more likely to attend the fair. The research design also allows for measuring the causal effects of fair attendance (and social effects) on the decision to enroll in a savings plan. Individuals from treated departments are significantly more likely to enroll than those from untreated departments. There is no significant difference in enrollment when looking within a department.

Hong, Kubik, and Stein (2004) find suggestive evidence that individuals who interact more with their neighbors or who attend church are more likely to participate in the stock market. They study 7,500 households from a 1992 University of Michigan survey. The authors are well aware that some readers worry that the paper's social variables (like church attendance) do not detect the effect of social interaction per se, but rather individual personality traits. Clearly, unobserved community-wide effects are worrisome as well.

Hong, Kubik, and Stein (2005) study the investment decisions of mutual fund managers in the same city. According to Hong et al. (p. 2802), their key result is that "a given manager's purchases of a stock (as a fraction of her total portfolio) increase by roughly 0.13 percentage points when other managers from different fund families in the same city increase their purchases of the same stock by 1 percentage point." While suggestive of social behavior affecting investment choices, the study relies on limited data. There are eight quarters of holdings data and thus seven periods to observe changes in holdings (net trades). Furthermore, 69.4 percent of all assets are held by funds in one of three cities (New York, Boston, and Los Angeles).

Brown, Ivkovic, Smith, and Weisbenner (2008) are acutely aware of the endogeneity issues that affect economists' ability to answer the question of whether social interactions affect investment behavior. Brown et al. (p. 1511) explain that "because individuals are not randomly assigned to communities, the observed

correlation between the stock ownership of an individual and his community could reflect numerous unobservable influences that induce a spurious correlation even after controlling for observable characteristics." The authors implement an instrumental variable strategy.

The research design in Brown et al. (2008) begins by identifying "native" individuals whom they define as people who live in the same community throughout their panel and who still reside in their birth state. They then create an instrument for the average ownership within a community by measuring the lagged ownership of "nonnative" neighbors (those born in different communities and different states). The results are striking. A 10-percentage point increase in the average ownership of one's community leads to a 4-percentage point increase in the likelihood that an individual will own stocks.

Bodnaruk (2009) attempts to identify community effects by examining Swedish investors who move from one location to another. In this study of portfolio composition, he takes as given that investors tilt their portfolios toward local stocks. After moving, holdings of stocks that were originally considered local fall on average (the stocks are no longer considered local after the move). Also after moving, investors begin to tilt their portfolios toward stocks located near their new homes. It is difficult to determine whether these portfolio shifts are the result of different public/local news or whether they result from private conversations with members of the new community.

A recent working paper by Knupfer (2008) studies the relation between an individual's social interactions and the propensity to tilt a portfolio toward local stocks. He finds more social investors have stronger local biases than do less social investors.

INFORMATION DIFFUSION

There is a small and underdeveloped literature on information diffusion. Trying to measure how information diffuses from one investor to another seems like a natural topic for financial economists interested in social interactions. Shiller and Pound (1989) use a questionnaire to survey institutional and individual investors. They find that direct interpersonal communication is very important in one's investment/decision-making process. Unfortunately, there have been relatively few papers since that provide further understanding of information diffusion.

The difficulty in measuring information diffusion arises because investors' information sets are unobservable. At present, there is almost no way to ascertain the information to which an investor has been exposed. A financial economist cannot know what information an investor has retained. Laboratory experiments present a possible setting for studying information sets. Unfortunately, studying diffusion may not be feasible in a laboratory because of the difficulty in setting up and funding a large-scale experiment. If possible, the experimental design should allow a researcher to "place information" in part of the population and then measure how that information moves throughout the rest of the population.

In an early "diffusion" paper, Boness and Jen (1970, p. 282) describe "a dynamic adjustment mechanism in the stock market. Adjustments are made at market clearing prices by traders in response to new information on their individual holdings of stocks." In reality, the model is an econometric specification containing

simultaneous equations. There are exogenously determined values of information relevant to stock prices and predetermined behavioral patterns of investors perceiving and adjusting to new information.

Hong and Stein (1999, p. 2145) assume "private information diffuses gradually across the [population]" in their study of stock price momentum and reversals. They do not study information diffusion per se. Papers such as Hong, Lim, and Stein (2000) and Doukas and McKnight (2005) test whether stock price momentum is the result of slow information diffusion. These papers do not test for slow information diffusion. To carry out their tests, the latter two sets of authors use residual analyst coverage as a proxy for the rate of information diffusion.

Finally, Ivkovic and Weisbenner (2007) study the relation between a household's stock purchases and purchases made by neighbors. The authors use the 1991 to 1996 Barber and Odean dataset of trades from a large discount broker. A 10 percentage point increase in neighbors' purchases of stocks from a given industry is associated with a 2 percentage point increase of a household's purchases of stocks from the same industry. The authors use the term "information diffusion" to indicate a correlation between a household's investments and the investments of neighbors. Results could stem from word-of-mouth effects, similarities in preferences, or common reactions to news. Identifying the underlying cause is a difficult task.

SOCIAL CAPITAL

The link between investment decisions and social capital is another emerging area of research. Social capital is defined by DiPasquale and Glaeser (1999, p. 355) as "the social links among citizens." Guiso, Sapienza, and Zingales (2004, p. 528) define it as "the advantages and opportunities accruing to people through membership in certain communities." One can think of social capital as an incentive to improve the quality of one's community. Investing in a public good can build social capital.

DiPasquale and Glaeser (1999) document that U.S. homeowners invest more in social capital than do non-homeowners. As DiPasquale and Glaeser (p. 356) point out, "homeownership is an endogenous variable that is correlated with other individual characteristics that may determine good citizenship." The authors use the average homeownership rate of an individual's income quartile as an instrument for homeownership. They find the instrument increases the effect of homeownership on measures of citizenship.

Guiso et al. (2004) study the role of social capital in a country's capital development. The empirical work measures differences in the level of social capital across Italy. Guiso et al. (p. 526) find that "in high-social-capital areas households are more likely to use checks, invest less in cash and more in stock, have higher access to institutional credit, and make less use of informal credit." The primary measures of social capital are voter turnout/participation in referenda and blood donation. Participation in referenda is highest in northern Italy (just south of the Alps) and lowest in southern Italy (especially in Calabria and Sicily).

Many papers reviewed in this chapter combine work from the fields of social psychology and financial economics. In general, there is little work that combines techniques from the fields of sociology and financial economics. Explaining why financial economists do not see more papers that overlap with sociology is a

question worth considering. Presumably, there are differences between the goals of the two fields.

Wikipedia (http://en.wikipedia.org/wiki/Economics) defines economics as "the social science that studies the production, distribution, and consumption of goods and services." Also, there is a definition that captures much of modern economics and is articulated by Lionel Robbins in his 1932 essay: "The science which studies human behaviour as a relationship between ends and scarce means which have alternative uses."

Wikipedia (http://en.wikipedia.org/wiki/Sociology) defines sociology as "a branch of the social sciences that uses systematic methods of empirical investigation and critical analysis to develop and refine a body of knowledge about human social structure and activity, sometimes with the goal of applying such knowledge to the pursuit of social welfare. Its subject matter ranges from the micro level of face-to-face interaction to the macro level of societies at large."

The above definitions appear to have substantial overlap especially in the area of social welfare. Hertz (1998) provides an ethnographic study of trading behavior on the Shanghai stock exchange. Her work is an excellent example of combining the fields. Undoubtedly, producing research that spans sociology and financial economics remains an area with potential. However, ethnography typically relies on interviews and in-depth case studies. Case studies are rare in top finance journals.

CAUSALITY AND IDENTIFICATION

This chapter highlights difficulties in making a causal link between social interactions and investment behavior. Do more social interactions affect investment behavior? Or do individuals simultaneously "choose" their preferred levels of social behavior and their investments? Stated differently, the second question asks whether there are unobserved factors that determine an individual's propensity to engage in both social behavior and investing. These unobserved factors may include physiological similarities and differences among individuals. For example, individuals who have similar levels of risk aversion may choose to live near each other and may hold similar portfolios. The unobserved factors may also include community-wide effects such as recent factory closures or other shocks to a community's wealth.

Over the past decade, financial economists have been increasingly interested in answering the *causal* question of whether social interactions affect investment behavior. Successfully answering such a question requires independent variation in the level of individuals' social interaction. Finding such independent variation is difficult.

Laboratory experiments represent one strategy for identifying causality. A researcher can create controlled settings that should allow him or her to independently vary a subject's level of social interaction. Laboratory research has the advantage of being able to run experiments multiple times; thus, experiments can generate independent data samples. The trouble with implementing laboratory experiments comes from recreating the investment choices faced by individuals. The world's stock markets are enormous (approximately US$ 30 trillion in capitalization). Bond, currency, commodity, and real estate markets are also large. A fund

manager faced with a US$ 10 million investment may behave differently from a laboratory subject faced with a US$ 10 choice.

Field experiments, such as the one conducted by Duflo and Saez (2003), offer financial economists a second strategy for identifying causal effects. The department structure found in most universities allows the authors to "treat" some departments and not others. Within a department, the authors' research design allows them to randomly "treat" some individuals and not others. Random treatment allows the researchers to create independent variation in key variables of interest.

Instrumental variables are a third strategy for identifying causal relations between social interactions and investment decisions. Brown et al. (2008) use Social Security numbers to determine (estimate) individuals' birth states. They can then divide investors into those who are "native" (live in the same community throughout the sample period and live in the same state since birth) and those who are "nonnative" (born in a different community and state). The authors' goal is to test for causation running from community effects to investment behavior. To run such a test, they need a variable (the instrument) that affects the decision to own stocks only through community effects and not through other possible channels. According to Brown et al. (2008, p. 1511), their instrument is based on "the average ownership of the birth states of 'nonnative' neighbors." In addition, Brown et al. (p. 1509) control for "individual and community fixed effects, a broad set of time-varying individual and community controls, and state-year effects." The authors conclude that neighbors matter. The more likely one's neighbors are to participate in the stock market, the more likely an individual is to participate as well.

Exploiting Market Structures

The ability to exploit existing market structures represents the fourth strategy for identifying causality and possible explanations of herding. This identification strategy is sometimes known as a "natural experiment." The word "experiment" implies that a researcher can vary key parameters. Because researchers rarely have such an ability, this section refrains from using this terminology.

Feng and Seasholes (2004) question an implicit conclusion of many herding papers: Herd behavior *affects* stock prices. The authors first present a rational expectations equilibrium model in which investment choices (trades) and stock returns are simultaneously determined. The model is based on insights and assumptions from Brennan and Cao (1997). Investors are assumed to have better information about locally headquartered firms than they do about remotely headquartered firms. Upon receiving new information, investors with less information (diffuse priors) about a firm's prospects update beliefs more heavily than those with more information (narrow priors). In equilibrium, when investors have different priors, public news causes some to be buyers and others to be sellers. Thus, good news about a firm leads to four simultaneous effects: (1) all investors update their beliefs (positively) about the stock's future dividends; (2) the stock price goes up; (3) less-informed investors are net buyers; and (4) more-informed investors are net sellers. That is, local investors are net sellers of local stocks on days the stock prices go up. Distant investors are net buyers of the same stocks on the same days. Related predictions exist on days stock prices go down.

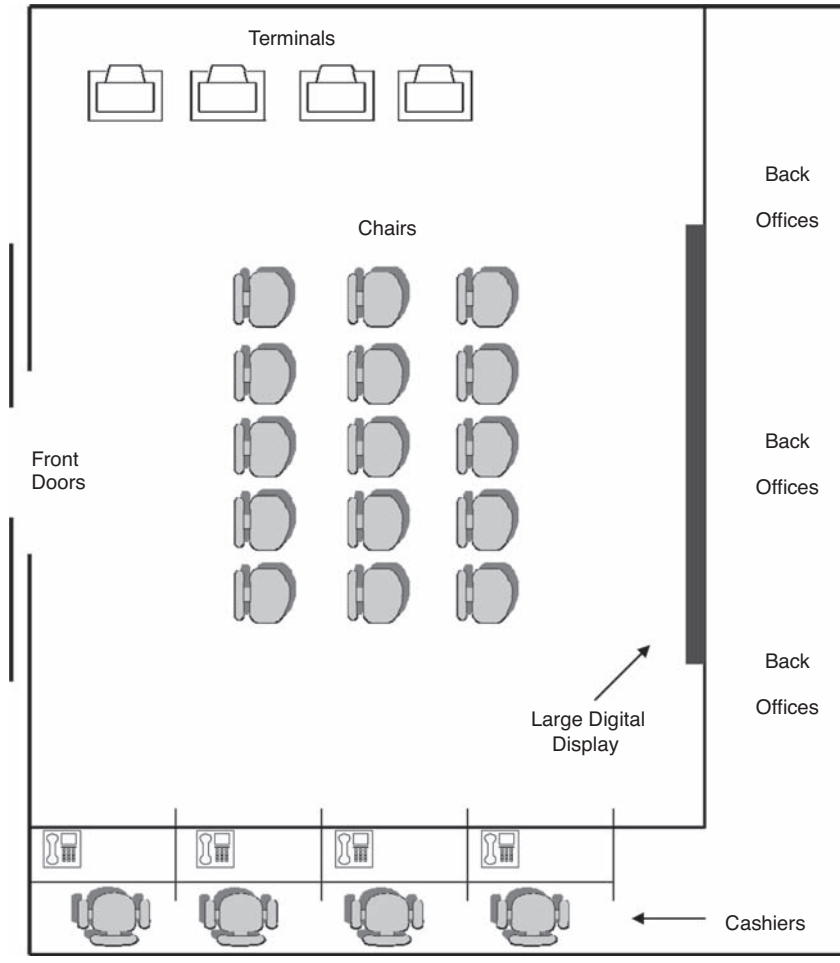

Exhibit 35.3 Typical Brokerage Office Layout in the PRC
Source: Adapted from Feng and Seasholes (2004).

Feng and Seasholes (2004) exploit a feature of the PRC stock market: An investor can place trades only at the branch office where she originally opened her account. Because telephone and computer trades were rare at the time of the study, the rule implies that a given investor must physically travel to a specific brokerage office in order to place her trades. Brokerage offices in the PRC are large open rooms.

The layout shown in Exhibit 35.3 appears to offer an ideal setup for encouraging correlated trading (herd behavior). Investors can freely discuss stocks while viewing price updates on large electronic displays. Many investors such as day traders, retirees, and nonworking spouses spend hours each day at brokerage offices in the PRC.

Feng and Seasholes (2004) use brokerage office location to help categorize investors by their information sets. Their data come from four offices in the Shanghai

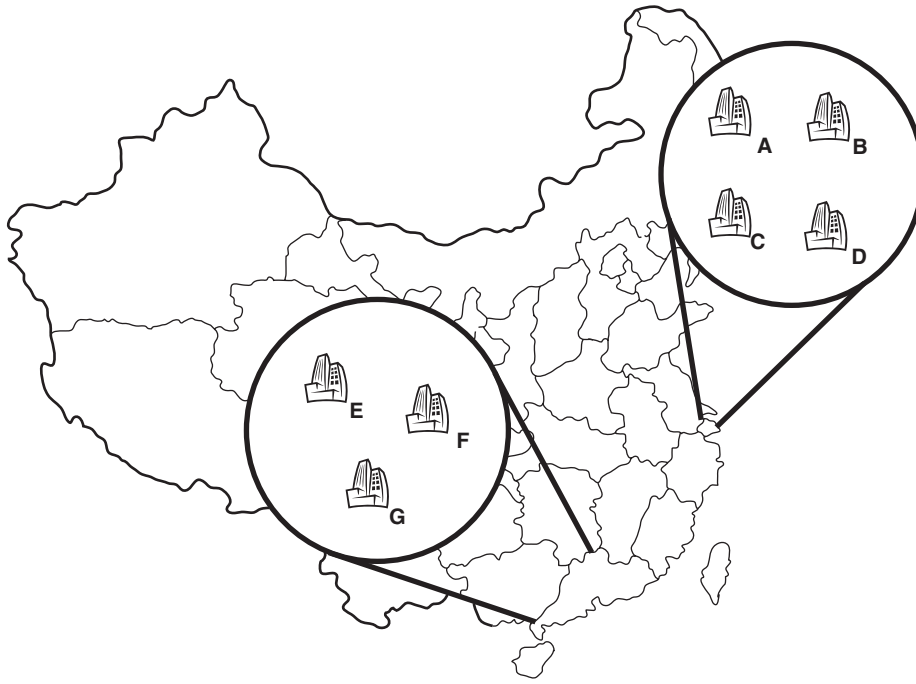

Exhibit 35.4 Brokerage Office Locations in the PRC

Note: This figure depicts brokerage office locations in the Feng and Seasholes (2004) study. All brokerage offices are in the People's Republic of China (PRC). There are four offices in the Shanghai municipality (labeled "A," "B," "C," and "D") and three offices in Guandong province (labeled "E" "F" and "G").

municipality (labeled A, B, C, and D in Exhibit 35.4) and three offices in Guangdong province (labeled E, F, and G). Brokerage offices within a province are separated by kilometers. Shanghai and Guangdong are about 1,650 kilometers apart. PRC brokerage system rules allow Feng and Seasholes to test the following hypotheses:

a) If individuals are influenced by those directly around them, then financial economists should measure non-zero buys-minus-sells imbalances within a given branch office.
b) If herds develop only within a branch office, there is no a priori reason for seeing similarly signed imbalances for the same stock on the same day across offices. Hence, trading imbalances for a given stock should be uncorrelated across offices.
c) If individuals are influenced by province-level effects, then researchers should see high correlations of trading imbalances for the same stocks on the same days across offices within the same province.
d) If individuals' priors are built up from local news or discussions with workers at local companies, then correlations should be high for trading imbalances for the same stock on the same day across offices within the same province.

e) If individuals' priors are built up from local news or discussions with workers at local companies and if a stock is headquartered in the same province as a brokerage office, individuals/locals should be net sellers on days when the stock price goes up, and net buyers on days when the stock price goes down.
f) If individuals' priors are built up from local news or discussions with workers at local companies and if a stock is headquartered in a distant province, individuals should be net buyers on days when the stock price goes up, and net sellers on days the stock price goes down.
g) If the decision to buy or sell a given stock is related to marketwide effects (news), then there may be a common component across the net trades of isolated investor groups (branch offices). Loadings on the common component may be of opposite signs due to adding-up constraints.

Feng and Seasholes (2004) focus on a sample of high-volume stocks that are headquartered in Guangdong province and are listed on the Shenzhen Stock Exchange (also in Guangdong province). For a given stock, net trades are positively correlated across brokerage offices in Guangdong province. Net trades are positively correlated across brokerage offices in Shanghai municipality. Most importantly, net trades are negatively correlated across the two regions. The negative correlation reflects an adding-up constraint: if one group is buying, another group must be selling.

The relations between trading and stock returns follow patterns predicted by the authors' rational expectations model. When a stock's price goes up, local investors are net sellers and distant investors are net buyers. When a stock's price goes down, local investors are net buyers and distant investors are net sellers. There is a strong first principal component of net trades explaining 31.8 percent of total cross-office variation. Net trades that originate from branches in Guangdong province load positively on the first principal component. Net trades that originate from branches in Shanghai municipality load negatively on the component.

Feng and Seasholes (2004) study a market setting in which researchers *(ex ante)* expect to find herds developing among investors in the same room/branch office. Instead, the authors find strong evidence that trading behavior and stock returns can be explained by a rational expectations equilibrium model. The authors' research design allows them to divide investors by information sets, providing surprising results. Most importantly, rational expectations models do not predict that herds "move" stock prices. Instead, holdings, changes in holdings, and prices are co-determined in equilibrium.

SUMMARY AND CONCLUSIONS

This chapter is motivated by the question "How do social interactions affect investment behavior?" There are many areas in the field of financial economics that provide a basis for attempting to answer this question. For example, there is a well-developed and nearly 20-year-old literature on herding and information cascades. Over the past decade, researchers have tested predictions from these theories in laboratory experiments.

The emphasis of this chapter is on recent empirical papers covering correlated trading (herding), the effects of neighbors/colleagues, information diffusion, and links between social capital and financial development. There is also a nearly 20-year old literature on herd behavior by fund managers, security analysts, and company investment managers. Recent studies look at the effects of neighbors and colleagues on an individual's investment decisions.

The chapter discusses the difficulty of identifying a causal link between social interactions and investment behavior. Many papers report suggestive correlations between variables linked to social interactions and variables linked to investment behavior. For example, individuals who attend church are also likely to participate in the stock market. There is, however, ample room for future research that solidifies *causal* links. The chapter ends with a review of four strategies currently being used to identify causality: (1) laboratory experiments, (2) field experiments, (3) instrumental variable approaches, and (4) exploitation of market structures (also known as natural experiments).

DISCUSSION QUESTIONS

1. If a group of investors tends to buy and sell together, are these investors "herding"? Explain why or why not.
2. How can financial economists measure information diffusion among investors?
3. Why do so few papers combine the fields of sociology and finance, especially when studying social interactions and investing?
4. If a group of investors tends to buy and sell together, should financial economists study their behavior if there is no correlation between the net trades and contemporaneous returns? Explain why or why not.

REFERENCES

Abel, Andrew B. 1990. Asset prices under habit formation and catching up with the Joneses. *American Economic Review* 80:2, 38–42.

Anderson, Lisa R., and Charles A. Holt. 1997. Information cascades in the laboratory. *American Economic Review* 87:5, 847–62.

Andrade, Sandro, Charles Chang, and Mark S. Seasholes. 2008. Trading imbalances, predictable reversals, and cross-stock price pressure. *Journal of Financial Economics* 88:2, 406–23.

Banerjee, Abhijit V. 1992. A simple model of herd behavior. *Quarterly Journal of Economics* 107:3, 797–817.

Barber, Brad, Terrance Odean, and Ning Zhu. 2009. Systematic noise. *Journal of Financial Markets*, forthcoming.

Bikhchandani, Sushil, David Hirshleifer, and Ivo Welch. 1992. A theory of fads, fashion, custom, and cultural change as informational cascades. *Journal of Political Economy* 100:5, 992–1026.

Bikhchandani, Sushil, David Hirshleifer, and Ivo Welch. 1998. Learning from the behavior of others: Conformity, fads, and informational cascades. *Journal of Economic Perspectives* 12:3, 151–70.

Bikhchandani, Sushil, and Sunil Sharma. 2001. Herd behavior in financial markets. *IMF Staff Papers* 47:3, 279–310.

Bodnaruk, Andriy. 2009. Proximity always matters: Local bias when the set of local companies changes. *Review of Finance* 13, 629-656.

Boness, James A., and Frank C. Jen. 1970. A model of information diffusion, stock market behavior, and equilibrium price. *Journal of Financial and Quantitative Analysis* 5:2, 279–96.

Brennan, Michael J., and H. Henry Cao. 1997. International portfolio investment flows. *Journal of Finance* 52:5, 1851–80.

Brown, Jeffrey R., Zoran Ivkovic, Paul A. Smith, and Scott Weisbenner. 2008. Neighbors matter: Causal community effects and stock market participation. *Journal of Finance* 63:3, 1509–31.

Campbell, John Y., and John H. Cochrane. 1999. By force of habit: A consumption-based explanation of aggregate stock market behavior. *Journal of Political Economy* 107:2, 205–51.

Celen, Bogachan, and Shachar Kariv. 2004. Distinguishing informational cascades from herd behavior in the laboratory. *American Economic Review* 94:3, 484–98.

Chevalier, Judith A., and Glenn Ellison. 1999. Career concerns of mutual fund managers. *Quarterly Journal of Economics* 114:2, 389–432.

Choe, Hyuk, Bong-Chan Kho, and René M. Stulz. 1999. Do foreign investors destabilize stock markets? The Korean experience in 1997. *Journal of Financial Economics* 54:2, 227–64.

Cipriani, Marco, and Antonio Guarino. 2005. Herd behavior in a laboratory financial market. *American Economic Review* 95:5, 1427–43.

Constantinides, George M. 1990. Habit formation: A resolution of the equity premium puzzle. *Journal of Political Economy* 98:3, 519–43.

DeMarzo, Peter M., Ron Kaniel, and Ilan Kremer. 2004. Diversification as a public good: Community effects in portfolio choice. *Journal of Finance* 59:4, 1677–715.

DeMarzo, Peter M., Ron Kaniel, and Ilan Kremer. 2008. Relative wealth concerns and financial bubbles. *Review of Financial Studies* 21:1, 19–50.

Devenow, Andrea, and Ivo Welch. 1996. Rational herding in financial economies. *European Economic Review* 40:3-5, 603–15.

DiPasquale, Denise, and Edward L. Glaeser. 1999. Incentives and social capital: Are homeowners better citizens? *Journal of Urban Economics* 45:2, 354–84.

Dorn, Daniel, Gur Huberman, and Paul Sengmueller. 2008. Correlated trading and returns. *Journal of Finance* 63:2, 885–920.

Doukas, John A., and Phillip J. McKnight. 2005. European momentum strategies, information diffusion, and investor conservatism. *European Financial Management* 11:3, 313–38.

Duflo, Esther, and Emmanuel Saez. 2002. Participation and investment decisions in a retirement plan: The influence of colleagues' choices. *Journal of Public Economics* 85:1, 121–48.

Duflo, Esther, and Emmanuel Saez. 2003. The role of information and social interactions in retirement plan decisions: Evidence from a randomized experiment. *Quarterly Journal of Economics* 118:3, 815–41.

Feng, Lei, and Mark S. Seasholes. 2004. Correlated trading and location. *Journal of Finance* 59:5, 2117–43.

Graham, John R. 1999. Herding among investment newsletters: Theory and evidence. *Journal of Finance* 54:1, 237–68.

Grinblatt, Mark, Sheridan Titman, and Russ Wermers. 1995. Momentum investment strategies, portfolio performance, and herding: A study of mutual fund behavior. *American Economic Review* 85:5, 1088–105.

Grossman, Sanford J., and Merton H. Miller. 1988. Liquidity and market structure. *Journal of Finance* 43:3, 617–33.

Guiso, Luigi, Paola Sapienze, and Luigi Zingales. 2004. The role of social capital in financial development. *American Economic Review* 94:3, 526–56.
Hertz, Ellen. 1998. *The trading crowd: An ethnography of the Shanghai stock market*. Cambridge: Cambridge University Press.
Hirshleifer, David, and Siew Hong Teoh. 2003. Herd behavior and cascading in capital markets: A review and synthesis. *European Financial Management* 9:1, 25–66.
Hong, Harrison, Jeffrey D. Kubik, and Amit Solomon. 2000. Security analysts' career concerns and herding of earning forecasts. *Rand Journal of Economics* 31:1, 121–44.
Hong, Harrison, Jeffrey D. Kubik, and Jeremy C. Stein. 2004. Social interaction and stock-market participation. *Journal of Finance* 59:1, 137–63.
Hong, Harrison, Jeffrey D. Kubik, and Jeremy C. Stein. 2005. Thy neighbor's portfolio: Word-of-mouth effects in the holdings and trades of money managers. *Journal of Finance* 60:6, 2801–24.
Hong, Harrison, Terence Lim, and Jeremy C. Stein. 2000. Bad news travels slowly: Size, analyst coverage, and the profitability of momentum strategies. *Journal of Finance* 55:1, 265–95.
Hong, Harrison, and Jeremy C. Stein. 1999. A unified theory of underreaction, momentum trading, and overreaction in asset markets. *Journal of Finance* 54:6, 2143–2184.
Ivkovic, Zoran, and Scott Weisbenner. 2007. Information diffusion effects in individual investors' common stock purchases: Covet thy neighbors' investment choices. *Review of Financial Studies* 20:4, 1327–57.
Kaniel, Ron, Gideon Saar, and Sheridan Titman. 2008. Individual investor trading and stock returns. *Journal of Finance* 63:1, 273–310.
Kim, Woochan, and Shang-Jin Wei. 2002. Foreign portfolio investors before and during a crisis. *Journal of International Economics* 56:1, 77–96.
Knupfer, Samuli. 2008. Does social interaction amplify behavioral biases? Evidence on local bias. Unpublished Working Paper, London Business School.
Kumar, Alok, and Charles M. C. Lee. 2006. Retail investor sentiment and return comovement. *Journal of Finance* 61:5, 2451–86.
Lakonishok, Josef, Andrei Shleifer, and Robert W. Vishny. 1992. The impact of institutional trading on stock prices. *Journal of Financial Economics* 32:1, 23–43.
Lobão, Júlio, and Anna Paula Serra. 2006. Herding behavior evidence from Portuguese mutual funds. In *Diversification and portfolio management of mutual funds*, (ed.) Greg N. Gregoriou, 167–97. New York: Palgrave-MacMillan.
Nofsinger, John R., and Richard W. Sias. 1999. Herding and feedback trading by institutional and individual investors. *Journal of Finance* 54:6, 2263–95.
Ozsoylev, Han N. 2006. Rational expectations and social interaction in financial markets. Unpublished Working Paper, University of Oxford.
Ozsoylev, Han N. 2007. Asset pricing implications of social networks. Unpublished Working Paper, University of Oxford.
Scharfstein, David S., and Jeremy C. Stein. 1990. Herd behavior and investment. *American Economic Review* 80:3, 465–79.
Shiller, Robert J., and John Pound. 1989. Survey evidence on the diffusion of interest and information among investors. *Journal of Economic Behavior and Organization* 12:1, 47–66.
Sias, Richard W. 2004. Institutional herding. *Review of Financial Studies* 17:1, 165–206.
Sias, Richard W., and Laura T. Starks. 1997. Return autocorrelation and institutional investors. *Journal of Financial Economics* 46:1, 103–31.
Welch, Ivo. 1992. Sequential sales, learning, and cascades. *Journal of Finance* 47:2, 695–732.
Wermers, Russ. 1999. Mutual fund herding and the impact on stock prices. *Journal of Finance* 54:2, 581–622.

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CHAPTER 36

Mood

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INTRODUCTION

People experience good and bad moods. There are instances when moods influence actions, sometimes in important ways. In fact, much research in psychology documents how emotions and moods affect behavior (see, for example, Schwarz and Clore, 1996). Much of this psychological research is done with mood induction studies in which people are asked questions after their moods are induced or altered by various means. While this evidence is intriguing, it is often dismissed by economists who argue that mood will not affect important real-life decisions such as the decision to buy or sell a stock.

Economists have spent decades building and testing models that examine how people make important decisions. Almost all of these models assume that people rationally make decisions that are in their best interest. These "expected utility" models typically ignore the influence of moods and emotions because economists doubt their importance and modeling mood might be difficult. Economists like to believe that people make important decisions on the basis of long-term considerations. Because moods and emotions often fluctuate, they should not affect decisions that might have a long-term impact. Even if some investors allow moods to affect their decisions, others should take opposing trades to reverse any impact that such behavior might have on prices. This sort of logic leads most economists to conclude that the stock market is efficient and unaffected by mood.

Despite the views of economists, many market participants have long thought that investor mood might affect decisions and prices. Keynes (1936, p. 162) famously thought that financial markets are driven by animal spirits, which he defined as "... a spontaneous urge to action rather than inaction, and not as the outcome of a weighted average of quantitative benefits multiplied by quantitative probabilities." More recently, Akerlof and Shiller (2009) discuss how emotional and intangible factors such as confidence in institutions, illusions about the nature of money, or a sense of being treated unfairly can affect how people make decisions about borrowing, spending, saving, and investing. Also, Alan Greenspan and Shiller have articulated that they believe market participants can suffer from irrational exuberance (Shiller, 2000). Many active traders justify their market strategies with vague references to investor mood or psychology. Given the large movements of stock prices in the past few years, conventional wisdom suggests that markets

are periodically subject to bubbles, generally presumed to be created and sustained by something closer to emotion or mood than by expected utility maximization.

Some of the most controversial research in behavioral finance attempts to test whether investor mood affects prices. Mood research is controversial because the existence of the proposed mood effects implies profitable trading strategies that do not seem consistent with the arguments for market efficiency. This view is also controversial because it is so closely related to the central idea of behavioral finance in that something other than expected future dividends and risk affects stock market prices. If mood and emotions influence decisions, economists have much work to do.

This chapter has the following organization. The next section discusses several properties that any good mood measure should satisfy. The following section reviews several different mood variables and their correlation with market returns, including weather, length of day, and sporting results. The next section discusses why mood might matter for returns. The final section offers a summary and conclusions.

MEASURING MOOD

Investigating the effect of investor mood on market returns requires a measure of investor mood. A good measure of mood should involve several properties. First, the measure should clearly affect either a large number of market participants or a well-defined subset of participants. It should alter the mood of these participants in a predictable way, making them feel systematically sad or happy, or relatively risk tolerant or risk averse. Second, a good mood measure should be relatively simple or unambiguous to observe or calculate over relatively long periods.

Finally, the best mood measures will have a clear causal relation to financial markets. Some potential mood measures are closely related to market values, which increase the difficulty of knowing whether variations in the mood measure cause variations in market returns, or whether variations in the market or some related variable cause variations in the mood measure. For example, a consumer sentiment index seems like a natural measure of investor mood, but both market returns and other variables related to the state of the macroeconomy are likely to partially determine the value of the index. Documenting a correlation between consumer sentiment and returns does not, therefore, show that sentiment or mood affects returns. In other words, a good mood measure either clearly causes returns to fluctuate or it does not, but there is no prospect that returns cause the mood measure to fluctuate.

STUDIES THAT CORRELATE MOOD AND RETURNS

Several important mood variables include weather, hours of sunlight, and the results of sporting contests. Other mood variables that have been proposed include the cycle of the moon and religious holidays. This section discusses the evidence related to each of these variables. The chapter focuses on interpreting the evidence and thus does not give a comprehensive list of all the mood papers in the finance literature.

Weather Studies

In the past few decades, psychologists have found and documented a relationship between exposure to sunshine and behavior. For example, a lack of sunshine has been linked to depression (Eagles, 1994) and suicide (Tietjen and Kripke, 1994). People seem to feel better when they are exposed to more sunshine. Sunshine has also been linked to financial decisions such as tipping a server at a restaurant. More sunshine is associated with higher tips. Rind (1996) conducts an experiment in which people inside a restaurant are informed about the state of the current weather (truthfully or not). He finds that the belief in the amount of sunshine even leads to higher tips. If sunshine leads to optimism, an investor may be more inclined to buy stocks on sunny days versus cloudy or rainy days. This extra demand might cause a positive correlation between sunshine and stock returns.

Saunders (1993) provides one of the earliest studies relating investor mood to stock returns. He regresses daily returns of several stock indexes on measures of sunshine in New York City from 1927 to 1990. He documents a statistically significant and robust relation, showing that sunnier days correspond to more positive returns for the Dow Jones Industrial Average (DJIA) and the NYSE/AMEX indexes from the Center for Research in Security Prices (CRSP) database.

Some financial economists consider Saunders's (1993) work an example of the spurious results that can be produced by data mining. There are, after all, various weather variables that might be correlated with returns including temperature, sunlight, barometric pressure, wind speed, and precipitation. Researchers such as Kramer and Runde (1997) largely ignore Saunders' findings, assuming that he ran many regressions and only reported those correlations that randomly happened to appear statistically distinguishable from zero.

The best way to address data mining is to test hypotheses with a new sample. Hirshleifer and Shumway (2003) take this approach and estimate the relation between sunshine and stock returns in 26 different countries from 1982 to 1997. Similar to Saunders (1993), they find a robust and significant relation between weather and returns. Sunnier days are associated with higher stock market returns. They further explore whether trading on weather reports about sunshine would be a profitable strategy. Hirshleifer and Shumway conclude that only a trader with very low transaction costs could take advantage of the "sunshine effect."

Several subsequent studies explore the sunshine effect. Researchers such as Chang, Nieh, Yang, and Yang (2006) and Yoon and Kang (2009) have confirmed the weather effect in other time periods or countries. Others have extended or further refined the sunshine effect. For example, Cao and Wei (2005) argue that temperature has an effect that is distinct from cloud cover. Loughran and Schultz (2004) find that while trading appears to be localized (variables that affect the vicinity of a corporation's headquarters appear to affect trading in the company's stock), local weather does not appear to affect trading. Goetzmann and Zhu (2005) find that New York weather affects transactions costs and thus presumably market makers, but local weather does not appear to affect individual investors.

Given the evidence provided by these studies, the results suggest that a positive historical correlation exists between sunshine and market returns. While some may view this relationship as a spurious correlation produced by data mining, many researchers consider this to be fairly strong evidence that mood affects prices. The

fact that a positive correlation exists in various markets outside of the sample in which the effect was originally documented suggests that the sunshine effect has merit.

As a mood variable, sunshine meets all the criteria discussed above for a good measure. Many psychology research papers document the effects of sunshine on mood and behavior. Moreover, the government measures sunshine in many places around the world hourly. Most important, there is no reasonable way to argue that market returns affect the weather, so a "reverse causality" argument is implausible. In thinking about sunshine as a mood variable, an important fact to remember is that future daily sunshine in a particular location is difficult to predict, and on any particular day some countries experience sunny weather while others face other weather. Therefore, the sunshine effect does not imply a large arbitrage opportunity. Further, the fact that it does not represent a large arbitrage opportunity makes the sunshine effect relatively credible. Consistent with the findings of Coval and Shuwmay (2005), the sunshine effect appears to affect prices somewhat in the short run, but in the long run, traders appear to arbitrage away any potential profits from trading on the weather.

Seasonal Affective Disorder Studies

Experimental research in psychology documents a direct link between depression and heightened risk aversion (Carton, Jouvent, Bungener, and Widlocher, 1992), including some of a financial nature (Eisenberg, Baron, and Seligman, 1998). Researchers also link depression to seasonal affective disorder (SAD), a condition that affects many people when daylight hours diminish (see, for example, Molin, Mellerup, Bolwig, Scheike, and Dam, 1996; Young, Meaden, Fogg, Cherin, and Eastman, 1997). A mild case of SAD is often referred to as the "winter blues." The findings from psychology support the prediction that the depressive mood associated with shorter days might translate to a greater degree of risk aversion, leading to testable hypotheses about the seasons and stock market returns.

Two early studies of investor mood and market returns examine how SAD affects prices. Kamstra, Kramer, and Levi (2003) find that returns from around the globe appear to correlate to the variation in the number of daylight hours that occurs throughout the year. They find that countries in the Southern Hemisphere display return effects that are six months out of phase with Northern Hemisphere countries. Countries that are farther away from the equator display stronger SAD effects. Garrett, Kamstra, and Kramer (2005) examine the effect with an equilibrium asset pricing model that allows the price of risk to vary with daylight hours. They conclude that the SAD effect is consistent with predictable time-varying risk aversion. In a related paper, Kamstra, Kramer, and Levi (2000) show that days corresponding to changes in daylight saving time also correspond to predictable returns patterns.

Similar to the studies on weather effects, this research can be closely tied to a large psychology literature that documents the significant behavioral effects of both the length of the day and changes in daylight saving time. Length of day is easy to measure, and the notion that market returns affect day length is not credible. However, unlike daily cloudiness, both daylight savings and day length are almost perfectly predictable, even years in advance, and they are almost perfectly

correlated across countries. Moreover, the magnitude of the SAD effect appears to be on the order of 10 percent per year, which seems sufficiently large to arbitrage. There might be several reasons for stock returns to follow a seasonal pattern, including tax considerations (possibly responsible for the January effect), summer vacations, and statistical artifact. Pinegar (2002) and Jacobsen and Marquering (2008) criticize these studies as potentially spurious, and a debate of comments and responses between scholars has ensued.

Sports Studies

A third mood variable that has been correlated with market returns is the results of sporting contests. Edmans, Garcia, and Norli (2007) show that the results of international sport matches affect market returns. According to their evidence, countries that lose in the elimination stage of the World Cup typically experience a stock market loss of about 0.5 percent the following day. The effect of sporting events is not exclusive to soccer. International cricket, rugby, and basketball games show similar effects. Edmans et al. discuss several psychology studies that document the mood effects of sporting results. They argue that sporting results satisfy all the criteria for being a good mood measure: Sporting results affect people, are easy to measure, and cannot be plausibly caused by market returns. The authors also show that their results are not sensitive to outliers. Interestingly, losses seem to cause negative returns; however, wins do not cause similar positive returns.

Several other authors document similar effects in countries around the globe. Berument, Ceylan, and Ogut-Eker (2009) show how three Turkish soccer teams affect stock market returns in Istanbul in proportion to the fanaticism of their fans, and Boido and Fasano (2006) show how soccer results affect returns in Italy. Berument, Ogut-Eker, and Dogan (2007) show that Turkish soccer results also affect currency exchange rates.

None of the papers about sports effects explicitly considers a trading strategy based on those effects. The magnitudes of the effects and the frequency of important sporting events suggest that significantly outperforming the market by trading on sports effects would be difficult. Any strategy based on sports effects would also probably involve implicitly betting on the outcome of sporting matches. Alternatively, the sports effects documented suggest that fans can hedge both their own disappointment and sporting-related market losses by betting against their national teams. Sports fans are unlikely to begin behaving in this way.

Other Mood Measures

Two studies hypothesize that the phases of the moon are correlated with market returns. Studies by Dichev and Janes (2003) and Yuan, Zheng, and Zhu (2006) show that returns are lower on the days around a full moon than they are on days around a new moon. However, the psychology literature on phases of the moon is somewhat mixed. For example, studies such as McLay, Daylo, and Hammer (2006) look for lunar effects on psychiatric and emergency room admissions to hospitals and find none. Furthermore, as with day length, the phases of the moon are the same across countries and are perfectly predictable.

Frieder and Subrahmanyam (2004) examine the effects of religious holidays on returns and volume, documenting that Rosh Hashanah and Yom Kippur both affect volumes and returns. Volumes are relatively low on both days, presumably because Jewish traders avoid markets on those days. Average returns are unusually high immediately after Rosh Hashanah, which is a lively New Year celebration for Jews. Yet, they are unusually negative immediately after Yom Kippur, a day of atonement on which Jews reflect on their past mistakes. These effects seem consistent with the mood that is likely to be induced on these holidays.

Mood and Sentiment

A large literature in financial economics exists surrounding investor sentiment. While sentiment and mood are essentially the same concept, academic research about sentiment generally explains monthly returns with variables that are closely related to the market or the economy, such as the closed-end fund discount or responses to surveys about economic conditions. This research is interesting because it relates quantities that are clearly important, such as the closed-end fund discount or survey data on how investors and consumers feel about the economy, to market returns. However, telling whether these sentiment indicators actually affect returns or whether the indicators and returns are both affected by some other variable, such as liquidity or the strength of the macroeconomy, is difficult.

Research on mood effects often employs higher frequency data and variables that are not closely related to markets such as weather or sports results. The advantage of using such variables is that there is generally little question about whether the variables cause returns to fluctuate or whether returns cause the variables to fluctuate. Still, their effects on the market are usually relatively small.

WHY MOOD MATTERS

There are several potential explanations for why mood affects economic decision making. As discussed above, psychologists have amassed much evidence that mood affects various types of decisions. One simple explanation of the effects of mood on returns is that mood affects risk aversion. Some evidence is consistent with this conjecture (Kliger and Levy, 2003). More generally, mood effects on the market that are driven by external phenomena such as weather or sports may be related to misattribution biases or to cognitive limits.

Lucey and Dowling (2005) summarize the research on the connection between mood and economic behavior. The psychological theory that they offer for mood effects is mood misattribution. According to this theory, people use their moods as information in most of the decisions they make. A bad mood indicates to the decision maker that something is wrong with his or her current situation, leading him or her to consider the decision more analytically and critically. A good mood is associated with less careful decision making. While this decision-making heuristic might work well for certain everyday decisions, misattribution theory predicts that mood even influences decisions that are not related to the cause of the mood. The wisdom of buying or selling a stock, for example, seems unlikely to be related to whatever is causing a current mood. Allowing a mood that is unrelated to a decision to affect that decision is what psychologists call mood misattribution.

A related explanation of mood effects is the influence of visceral factors proposed by Loewenstein (2000). Loewenstein argues that strong emotions determine short-term actions much more strongly than people generally acknowledge. He argues that the effect of visceral factors creates difficulty for people when they are making choices that are inter-temporally consistent because the factors change frequently with the environment. Decision makers have difficulty anticipating the visceral factors that will affect their future welfare when making current decisions. If moods are related to the visceral factors that Loewenstein discusses, then finding that moods are uncorrelated with stock market returns would be surprising.

SUMMARY AND CONCLUSIONS

Much evidence indicates that investor mood affects stock market returns. Several studies document a connection between daily sunshine and market returns. Seasonal length of day, daylight saving changes, and the results of sporting contests also appear to be correlated with returns. While consistent with much evidence in psychology, these results are inconsistent with modern models of finance and the efficient market hypothesis.

While evidence indicates that mood matters, most mood effects do not appear to be particularly large. Because market participants generally face substantial transaction costs to take advantage of short-term mispricing, the existing empirical evidence on mood effects does not suggest that investors leave much money on the table. Finding evidence that investors could make large gains by trading on mood variables would be surprising because most mood variables are easy to observe and even predict. The fact that the mood literature does not suggest the presence of large arbitrage opportunities in the marketplace actually makes mood results more credible. If the literature claimed the existence of large profit opportunities based on mood effects, then skeptics could reasonably ask why professional money managers fail to take advantage of those profit opportunities.

Even mood effects that are difficult to arbitrage should not exist in asset prices. The existence of even small mood effects on returns implies that some market participants are trading on their moods. These market participants are almost certainly making suboptimal decisions. Thus, while mood effects may not have substantial implications for professional money managers, they are important to the traders creating them. If these traders could determine that they are trading based on their mood, they might be able to take corrective action and avoid some bad decisions.

DISCUSSION QUESTIONS

1. How can someone test whether more or less sophisticated people are more susceptible to trading based on moods?
2. What variables besides weather, season, or sports outcomes might make good mood variables? Justify this choice.
3. Suppose that a person's utility function depends both on his total wealth and on the current weather. From the perspective of a model such as the Intertemporal Capital Asset Pricing Model, what sort of portfolio should such a person hold?
4. Is trading on moods likely to be costly? Why or why not?

REFERENCES

George A. Akerlof and Robert J. Shiller. 2009. *Animal spirits: How human psychology drives the economy, and why it matters for global capitalism*. Princeton, NJ: Princeton University Press.

Berument, M. Hakan, Nildag Basak Ceylan, and Gulin Ogut-Eker. 2009. Soccer, stock returns and fanaticism: Evidence from Turkey. *Social Science Journal*, forthcoming.

Berument, M. Hakan, Gulin Ogut-Eker, and Burak Dogan. 2007. Football and exchange rates: Empirical support for behavioral economics. *Psychological Reports* 101: 2, 643–54.

Boido, Claudio, and Antonio Fasano. 2006. Football and mood in Italian stock exchange. Working Paper, University of Salerno.

Cao, Melanie, and Jason Wei. 2005. Stock market returns: A note on temperature anomaly. *Journal of Banking and Finance* 29: 6, 1559–73.

Carton, Solange, Roland Jouvent, Catherine Bungener, and Daniel Widlocher. 1992. Sensation seeking and depressive mood. *Personality and Individual Differences* 13: 7, 843–49.

Chang, Tsangyao, Chien-Chung Nieh, Ming Jing Yang, and Tse-Yu Yang. 2006. Are stock market returns related to weather effects? Empirical evidence from Taiwan. *Physica A: Statistical Mechanics and its Applications* 364: 15, 343–54.

Coval, Joshua, and Tyler Shumway. 2005. Do behavioral biases affect prices? *Journal of Finance* 60: 1, 1–34.

Dichev, Ilia, and Troy Janes. 2003. Lunar cycle effects in stock returns. *Journal of Private Equity* 6: 4, 8–29.

Eagles, John M. 1994. The relationship between mood and daily hours of sunlight in rapid cycling bipolar illness. *Biological Psychiatry* 36: 6, 422–424.

Edmans, Alex, Diego Garcia, and Oyvind Norli. 2007. Sports sentiment and stock returns. *Journal of Finance* 62: 4, 1967–98.

Eisenberg, Amy E., Jonathan Baron, and Martin E. P. Seligman. 1998. Individual differences in risk aversion and anxiety. Working Paper, University of Pennsylvania.

Frieder, Laura, and Avanidhar Subrahmanyam. 2004. Nonsecular regularities in returns and volume. *Financial Analysts Journal* 60: 4, 29–34.

Garrett, Ian, Mark Kamstra, and Lisa A. Kramer. 2005. Winter blues and time variation in the price of risk. *Journal of Empirical Finance* 12: 2, 291–316.

Goetzmann, William N., and Ning Zhu. 2005. Rain or shine: Where is the weather effect? *European Financial Management* 11: 5, 559–78.

Hirshleifer, David, and Tyler Shumway. 2003. Good day sunshine: Stock returns and the weather. *Journal of Finance* 58: 3, 1009–32.

Jacobsen, Ben, and Wessel Marquering. 2008. Is it the weather? *Journal of Banking and Finance* 32: 4, 526–40.

Kamstra, Mark, Lisa A. Kramer, and Maurice Levi. 2000. Losing sleep at the market: The daylight saving anomaly. *American Economic Review* 90: 4, 1005–11.

Kamstra, Mark, Lisa A. Kramer, and Maurice Levi. 2003. Winter blues: A SAD stock market cycle. *American Economic Review* 93: 1, 324–43.

Keynes, John M. 1936. *The general theory of employment, interest and money*. London: Macmillan.

Kliger, Doron, and Ori Levy. 2003. Mood-induced variation in risk preferences. *Journal of Economic Behavior and Organization* 52: 4, 573–84.

Kramer, Walter, and Ralf Runde. 1997. Stocks and the weather: An exercise in data mining or yet another capital market anomaly? *Empirical Economics* 22: 4, 637–41.

Loewenstein, George. 2000. Emotions in economic theory and economic behavior. *American Economic Review Papers and Proceedings* 90: 2, 426–32.

Loughran, Tim, and Paul Schultz. 2004. Weather, stock returns, and the impact of localized trading behavior. *Journal of Financial and Quantitative Analysis* 39: 2, 343–64.

Lucey, Brian M., and Michael Dowling. 2005. The role of feelings in investor decision-making. *Journal of Economic Surveys* 19: 2, 211–37.
McLay, Robert N., Amado A. Daylo, and Paul S. Hammer. 2006. No effect of lunar cycle on psychiatric admissions or emergency evaluations. *Military Medicine* 171: 12, 1239–42.
Molin, Jeanne, Erling Mellerup, Tom Bolwig, Thomas Scheike, and Henrik Dam. 1996. The influence of climate on development of winter depression. *Journal of Affective Disorders* 37: 2–3, 151–55.
Pinegar, J. Michael. 2002. Losing sleep at the market: Comment. *American Economic Review* 92: 4, 1251–56.
Rind, Bruce. 1996. Effects of beliefs about weather conditions on tipping. *Journal of Applied Social Psychology* 26: 2, 137–47.
Saunders, Edward M., Jr. 1993. Stock prices and Wall Street weather. *American Economic Review* 83: 5, 1337–45.
Schwarz, Norbert, and Gerald L. Clore. 1996. Feelings and phenomenal experiences. In *Social psychology: Handbook of basic principles,* (eds.) Arie W. Kruglanski and E. Tory Higgins, 385–407. New York: Guilford Press.
Shiller, Robert. 2000. *Irrational exuberance*. Princeton, NJ: Princeton University Press.
Tietjen, Glenn H., and Daniel F. Kripke. 1994. Suicides in California (1968–1977) — Absence of seasonality in Los Angeles and Sacramento counties. *Psychiatric Research* 53: 2, 161–72.
Yoon, Seong-Min, and Sang Hoon Kang. 2009. Weather effects on returns: Evidence from the Korean stock market. *Physica A: Statistical Mechanics and Its Applications* 388: 5, 682–90.
Young, Michael A., Patricia M. Meaden, Louis F. Fogg, Eva A. Cherin, and Charmane I. Eastman. 1997. Which environmental variables are related to the onset of seasonal affective disorder? *Journal of Abnormal Psychology* 106: 4, 554–62.
Yuan, Kathy, Lu Zheng, and Qiaoqiao Zhu. 2006. Are investors moonstruck? Lunar phases and stock returns. *Journal of Empirical Finance* 13: 1, 1–23.

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PART VII

Answers to Chapter Discussion Questions

CHAPTER 2 TRADITIONAL VERSUS BEHAVIORAL FINANCE

1. Following the philosophy of instrumental positivism, the value of a theory is to demonstrate the power to predict phenomena. Even if assumptions are false, a theory that is able to predict outcomes will be useful to scientists who are trying to describe the world. Every theoretical model makes assumptions that are false in order to focus attention on variables and forces of interest in a tractable setting. Economists make many false assumptions in their models, such as the absence of transaction costs, an infinite number of traders in a market, and normally distributed variables. Lack of realism in assumptions is a problem only if they result in predictions that are not upheld.
2. Positivists such as Karl Popper had an unrealistic (and non-predictive) understanding of how scientists behave. While theories that have clearly terrible predictive power tend not to retain many adherents, both behavioral and traditional researchers in finance can point to many predictive successes in their own area, and many predictive failures in the others. Even if researchers focused only on predictive power and simplicity, whether numerous studies would actually alter their beliefs is unclear. Moreover, science is a social endeavor. Students learn from their teachers, faculty learn from and persuade their departmental colleagues, and access to resources can depend on social connections. All of these interactions have social aspects that are independent of predictive power of the researchers' theories.
3. Behavioral finance is unlikely to soon generate theories of sufficient simplicity, tractability, and predictive power that traditionalists are won over and drop their assumptions of *Homo economicus.* However, the experience in accounting departments shows that behavioralists and traditionalists can co-exist with limited interaction and some degree of tension, as long as behavioralists conduct research on institutions that are widely agreed to lack the power to discipline individual irrational behavior. In accounting, this strategy has led to those who use behavioral methods being relegated to second-tier institutions and struggling to publish in top journals. Today, many top departments in finance include behavioralists, and behavioral work is published in the most prestigious finance journals. Behavioral finance can thrive, side-by-side with traditional finance. This can occur if

those at the top institutions can show some success in explaining how behavioral forces affect aggregate behavior in some institutions more than in others, while others simultaneously focus on institutions with less disciplinary power, allowing them to continue publishing behavioral work regardless of how strongly behavioralist views are shunned in the institutions with the greatest disciplinary power (financial markets). Unless these other institutions gain in prestige, relative to financial markets, these researchers may struggle to maintain their positions in top departments.

4. Researchers in finance are typically most interested in aggregate outcomes such as market prices, volume and liquidity, the speed of capital flows, and firm-wide and economy-wide capital structure. Human decisions are one input driving these aggregate outcomes, but the structure of institutions also matters. Even simple institutions (such as averaging analyst forecasts) can eliminate the impact of human idiosyncrasies to the extent that they result in variation in behavior that is close to random. Highly competitive market institutions are even more effective in eliminating the impact of individual deviations from a simple model of human behavior. Behavioral finance can attain simplicity by focusing on how institutions largely (though not completely) eliminate the effects of complex human quirks, and by focusing on how aggregate outcomes in those institutions are influenced by one or two particularly salient behavioral forces.

CHAPTER 3 BEHAVIORAL FINANCE: APPLICATIONS AND PEDAGOGY IN BUSINESS EDUCATION AND TRAINING

1. Differences exist in teaching a behavioral versus a traditional finance class because the two areas use paradigms involving different theoretical constructs and foundations. Behavioral finance is rooted in cognitive psychology and to some extent in neuroscience. Traditional finance is founded on the mathematical constructs of expected utility maximization and market efficiency. Behavioral finance focuses on how decisions are actually made (positive finance) whereas traditional finance focuses on how decisions should be made (normative finance). In order for the elegant mathematical models of traditional finance to work, the assumption is that decision makers' brains are capable of conducting complicated computations just like a computer. That is not the case in behavioral finance, where humans are considered to have physical, mental, and emotional limitations. Thus, behavioral finance and traditional finance lead to different ways of formulating basic definitions, concepts, and parameters as well as prescribing strategy for managers, investors, and consumers in general. For example, consider the notion of risk and the role that it plays in the decision-making process. To the traditional economist, risk is a one-dimensional phenomenon and is defined in terms of variance and covariance around some expected mean return. To the behaviorist, risk is a multidimensional human experience, where natural psychological phenomena such as heuristics, biases, affect, and framing influence the decision-making process by individuals.

2. The answer to this question is both yes and no. As a general rule, teaching some behavioral finance to students and professionals is better than not teaching any. Not teaching students about behavioral finance is effectively equivalent to denying them access to learning how corporate managers, investment professionals, and consumers actually make their decisions. On the other hand, because the fast-growing field of behavioral finance has accumulated enough robust content, the subject can be used in stand-alone courses.
3. Given the nature of financial decision making, which involves both qualitative and quantitative analysis, effective behavioral finance cases should cover both dimensions. Mini-cases are often available at the end of some textbooks. They provide good learning experiences on both the quantitative and qualitative aspects of financial decision making. Given the current stage of development in this field, there are relatively few comprehensive books and cases on behavioral finance compared to those in traditional finance. Teaching behavioral finance classes is similar to teaching traditional finance classes because both involve making decisions, whether they are modeled, mathematically or cognitively.
4. What scholars are learning about human behavior in making finance-related decisions is growing exponentially. Anecdotal evidence of "anomalies" in the movement of share prices has been addressed in finance texts for more than 30 years. Several decades after the seminal works of Tversky and Kahneman (1971) and Kahneman and Tversky (1979), the impact of cognitive psychology on investor and manager financial decision-making behavior is covered with selective topics in many traditional texts. The implications of recent advances in neuroscience are now being fully integrated into behavioral finance research. Insufficient capacity exists in traditional texts to provide adequate treatment of a field of study that integrates finance concepts, principles, and theories with the findings of cognitive psychology and neuroscience. This justifies incorporating a comprehensive behavioral finance course within the finance curriculum. While this adds to the finance curriculum subject matter that is not traditionally considered finance-oriented, the complexities of making good financial decisions demand that finance students understand the world as it is. To do less perpetuates the perverse effects of biases, heuristics, and framing in the decision making of future managers, analysts, and investors.

CHAPTER 4 HEURISTICS OR RULES OF THUMB

1. Intuition refers to an informal and unstructured mode of reasoning, not a conscious, analytical, step-by-step process. Intuition contributes to heuristics and to an important degree where there is major uncertainty. The recent focus on heuristics evolved as a means of explaining reasoning processes that are essentially cognitive, even though differing from formal rational choice theory. Intuition derives from an unconscious process that takes associations and experience into account and combines them in a manner that is difficult to explain. To the extent that heuristic judgment substitutes for

rational choice theory but is analytical and leads to generally predictable biases, intuitive factors play a secondary role.

2. Economists and financial analysts once maintained that there was a tendency for the most successful individuals to make decisions in a manner that approximated rational choice theory. They also believed that there was no pattern to the errors that they and other less successful individuals made. This was part of the deductive nature of traditional microeconomic and financial analysis. The recent work on heuristics grew out of the earlier studies of Simon and his followers, and emphasized the limits to human calculation and the need to think in terms of bounded rationality. It describes the process by which people actually make decisions and ascertains that the deviations of the heuristics that people employ from objective standards, relying on probability analysis, can be explained in terms of human psychology and are relatively predictable. The findings of this approach are transforming economic and financial analysis into much more inductive fields of study.
3. Emotions can trigger cognitive reasoning processes, particularly where the anticipated outcomes are highly disconcerting and when there is not excessive time pressure. Beyond that, decision makers must recognize how people actually make decisions. To the extent that emotional factors lead to large biases, indicating the direction and magnitude of those biases is a first step toward doing something about what might be regarded as the questionable outcomes to which they might lead.
4. Although the guidelines for dealing with biases are useful, they have been developed primarily for general heuristics. Those guidelines have some applicability to activity-specific heuristics, but generalizing about how to identify and deal with biases for the vast number of specific heuristics required for day-to-day decisions is more difficult. Practitioners are likely to be much more interested than academicians in guidelines for dealing with the biases of specific heuristics. Some organizations have proprietary guidelines, but they are understandably not eager to share them. Moreover, research on specific heuristics is not as likely to provide seminal material for other researchers. This is probably the main reason so little funding for that type of inquiry has been made available.

CHAPTER 5 NEUROECONOMICS AND NEUROFINANCE

1. Neuroeconomists utilize research tools including neuroimaging, hormone assays, and genetic tests that identify the biological substrates of observed behavior. In particular, many researchers use predictive studies of decision making, which achieve causative explanatory power (versus correlative analyses). As a result of understanding the biological drivers of non-optimal financial behavior, interventions that accommodate or alter the underlying neurobiology of economic decision makers have been developed.
2. This chapter discussed the primary neural motivation systems: the reward approach system, which governs reward valuation and opportunity pursuit, and the loss avoidance system, which motivates threat detection and

avoidance. The chapter also described the effects of neurochemicals such as dopamine (excitatory) and serotonin (anxiolytic). Medications including benzodiazepines and beta-blockers and drugs of abuse such as marijuana and alcohol alter financial risk taking.

3. Neuroeconomics provide interesting insights into risk-taking behavior. In order for practitioners to apply the lessons to their own decision making, they must first cultivate self-awareness of their thoughts, feelings, life events, and behaviors around the times of their best and worst decisions. Keeping a decision journal can also be helpful. Those keeping a journal can then compare their current decision options with past episodes and ascertain whether lessons from neuroeconomics (such as relying on the advice of other "experts" and thus doing less due diligence work themselves) apply to their current situation. The same procedure works for findings that were initially a result of behavioral finance research such as framing and the endowment effect.
4. Critics of neuroeconomists often point to small sample sizes, lack of replication, noisy data (especially in fMRI experimentation), and reductionism in the explanations that result from piecing together disparate research threads.

CHAPTER 6 EMOTIONAL FINANCE: THE ROLE OF THE UNCONSCIOUS IN FINANCIAL DECISIONS

1. Emotional finance can be viewed as a branch of behavioral finance that seeks to address directly the key role emotions play in all financial activity. It draws on a psychoanalytic understanding of how the human mind works, and explicitly recognizes the powerful unconscious forces that drive investment decisions and their consequences. "Cognitive" behavioral finance (CBF) by contrast, applies the insights of the experimental cognitive psychologists, for example, to financial markets. CBF focuses on human judgmental processes and financial decision making under conditions of risk and uncertainty. CBF stresses the implications of investor *cognitive* limitations for their investment and related decisions, and the range of heuristics and judgmental biases people employ that can lead to decision errors. Importantly, CBF considers investors as essentially "rational" after "learning," whereas emotional finance places emphasis on the unconscious processes in investor activity. However, because cognition and emotion jointly drive all financial decisions, cognitive behavioral finance and emotional finance have a complementary role to play in the understanding of financial markets and investor activity.
2. Emotional finance seeks to explore the role of unconscious processes in driving financial decisions and market behaviors. It draws on the psychoanalytic understanding of the human mind to provide a more systematic perspective on how feelings may influence investor behavior. Useful insights include:
   - How financial markets (the future) are (is) inherently *uncertain*, which generates emotional responses at both neurological and psychological levels, predominantly those of *anxiety → stress.*

- How unrecognized emotions or phantasies are deep drivers of human decisions and create unconscious conflict that people deal with by "splitting" and "idealization." This can help enhance the understanding of the psychological meaning of investments, investment processes, and markets to market participants.
- How all judgments are made within two basic oscillating mental states. The sense of reality in which an investment decision is made can be dealt with in an *integrated* (or depressive [D]) state, that is, realistically, with awareness of both the upside and downside and degree of uncertainty. Alternatively, it can be dealt with in a *divided* (paranoid-schizoid [PS]) state of mind where doubt is "split off" with the investment unconsciously idealized (as all good) or denigrated (as all bad). Emotional finance recognizes how financial markets provide a powerful environment in which these competing unconscious processes can be acted out.
- How any investment can represent a *phantastic object*, that is, that it can have an exceptionally exciting and transforming meaning in unconscious phantasy (as with dot-com stocks, collateralized debt obligations, and hedge funds). Emotional finance teaches that all investments have the potential to become represented in investors' subjective or psychic reality as phantastic objects even in normal market conditions.
- How individuals behave in groups (markets), depending on how they deal with reality. *Work groups* engage in creative reality-based thinking/functioning in the pursuit of common goals. *Basic assumption groups*, on the other hand, are designed to provide comfort and good feelings to their members by collectively and unconsciously warding off what group members would rather not know. A divided state of mind dominates. Such *groupthink*, well described by Janis (1982), was clearly at work in financial markets until the credit crisis burst with, seemingly, politicians, central bankers, and regulators equally caught up in the same phantasy.

3. Emotional finance is a new area in finance and is at a very early stage in its development. In contrast, early papers in behavioral finance first appeared 40 years ago. The chapter provides some illustrations of its potential practical value. For example, emotional finance can help explain the unconscious meaning of risk and uncertainty to investors, the way momentum in markets might be partly driven by investors' emotional needs, why market underreaction to bad news is seemingly such a robust anomaly, and how people find great difficulty in making proper pension provision. Most importantly, emotional finance can help understand the repeated occurrence of such systemic events as asset pricing bubbles and related market phenomena where the role of the phantastic object and a market-divided state of mind are paramount. Another important goal is to help market participants deal more effectively with the uncertain, complex, and competitive market environments in which they operate by being more aware of the emotional factors at work, and the dysfunctional effects of often unconscious anxiety and stress on their investment decisions. The value of effective management and team processes in the case of professional investors in this context is evident. Nonetheless, financial economists are clearly at the beginning of a long journey toward formally integrating an understanding of emotions

with the workings of financial markets and investor behavior. Subsequent work may need to take a more empirical direction if emotional finance is to become acceptable to traditional finance academics.

4. "Hedge fund" is a generic term encompassing a wide range of investment strategies and vehicles that, in principle, have absolute return as their main investment goal. Emotional finance can help in understanding the attractions of hedge funds to investors. This is in spite of their high probability of loss, as well as gain, unclear return patterns, frequent lack of transparency, great complexity, and the lack of recourse by investors because of the largely unregulated and unconstrained nature of these investment vehicles. Properly managed and regulated hedge funds have an important place in any diversified investment portfolio in finance theory. Yet, the more speculative and celebrated ones have the potential of being represented in investors' unconscious minds as *phantastic objects* with associated unrealistic expectations of exceptional returns with no risk. This is despite such notable implosions as Long Term Capital Management, Amaranth, Peleton, and Bear Stearns. The fact that hedge funds are only open to high net worth individuals (sophisticated investors who can "afford" to lose) is part of their allure. Only the select can join, thereby increasing their value as phantastic objects. Hedge funds represent a *divided* (or PS) sense of reality. Yet, in an *integrated* (or D) state of mind, hedge funds are just another investment class with returns less correlated with those of other asset classes—not magic.

   Bernie Madoff represents the iconic hedge fund phantastic object who implicitly promised his investors the opportunity of high returns with no risk, seemingly forever. Not surprisingly, everyone wanted to join in this state of euphoria where investors could apparently realize unconscious phantasies with no downside risk. Such was the strength of belief in the phantastic object that any attempt to question whether Madoff's returns were real was futile. No one wanted the party to stop. Unconscious belief in the transformational nature of the phantastic object leads to *groupthink* with even the Securities and Exchange Commission seemingly involved. When the $65 billion fraud was eventually uncovered, euphoria inevitably turned to panic and blame with even those who had benefited the most, his feeder funds, equally viewing themselves as victims.

5. Emotional finance views investors in markets as entering into implicit emotional attachments with the assets in which they invest. This view goes well beyond the traditional notions of risk and return of standard finance. Advocates of emotional finance believe that emotional attachments lie at the root of asset pricing bubbles when a *divided* (or paranoid-schizoid [PS]) state of mind reigns. In the case of dot-com mania, the term "mania" associated with the bubble serves to demonstrate the general recognition that investors were caught up emotionally in the drama, as with a Greek tragedy.

   In particular, emotional finance sees dot-com stocks as *phantastic objects,* investments that have an exceptionally exciting and transformational meaning in unconscious reality, mental representations of something that has the promise of fulfilling an individual's deepest desires. Because of this, dot-com valuations departed in such an extreme way from fundamental value. In parallel, the associated idea of the "new economy" could be viewed as a

superficially plausible cover story to rationalize the departure from reality into phantasy. Investors denied the associated unconscious guilt and fear until psychic defenses against reality were ultimately overwhelmed, leading to panic, collapse, anger, humiliation, guilt, and blame, and with the phantastic object now hated. As a consequence, investors viewed both the Internet sector and equity markets as tainted for several years.

CHAPTER 7 EXPERIMENTAL FINANCE

1. Experiments in finance are best viewed as being similar to economic models. Both models and experiments necessarily simplify more complicated settings in order to allow a clear analysis of how the variables of interest affect behavior. The simplification allows clear causal inferences within the setting being examined (high internal validity), but there is always the risk that the results would not generalize to more complex settings (low external validity). A single experiment or model is unlikely to have high external validity, but a series of experiments or models can provide a strong foundation for hypothesizing about phenomena in naturally occurring markets. Those hypotheses can be tested by using econometric methods on data drawn from more complex settings.
2. Experimental tests of economic models run the risk of using very complicated settings to show that people prefer more money to less. Researchers can avoid this problem by relaxing the structural, behavioral, or equilibrium assumptions underlying the model. For example, a model might make the behavioral assumption that agents can engage in unlimited information processing; an experiment can shed light by examining whether aggregate behavior of the market act *as if* that assumption were true. Equilibrium assumptions are almost never imposed within laboratory settings, so tests of models with multiple equilibria are particularly informative.
3. Not every experiment needs to test a precise prediction of an economic model. Experiments in psychology almost never do that, but instead rely on intuition and the results of prior experiments to generate hypotheses. In finance, intuitions can be developed from models simpler than the institution being created in the laboratory, and drawn from results of far more complex real-world settings. Such exploratory work can be helpful in developing new theory and testable predictions.
4. Many laboratory studies in finance and economics are not experiments, but demonstrations. By failing to manipulate variables, researchers expose themselves to the criticism that any aspect of the task, subject pool, or environment could be driving the results. Manipulating one variable increases the unlikelihood that any of these aspects could drive the difference across treatments, unless there is reason to believe that it will interact with the manipulated variable.

CHAPTER 8 THE PSYCHOLOGY OF RISK

1. The difference between risk and uncertainty is a major issue within the judgment and decision-making domain. A person making a judgment under risk

is confident about the shape of the normal distribution curve because it is based on the assumption that all the expected outcomes are determined. An individual making a decision under the condition of uncertainty is uninformed of the precise forecasts of all potential outcomes because this person does not know the shape of the normal distribution in which the results are determined. Risk is identifiable, forecasted, and well known, whereas uncertainty is unrecognizable, incalculable, and unfamiliar. An example of risk is the standard deviation of the expected return on a common stock investment. An example of uncertainty is whether the stock market will decrease or increase the next trading day.

2. The origin of the standard finance viewpoint of risk is based on Markowitz's research on modern portfolio theory (MPT) and Sharpe's development of the capital asset pricing model (CAPM). MPT is based on the premise that individuals can minimize risk for an expected level of return by building a diversified portfolio of securities. The major slogan associated with MPT is the notion of "Don't put all your eggs in one basket." The positive relationship between risk and return is a major assumption because most investors are risk averse (i.e., investors have a preference for less risk than higher risk), make judgments based on rationality (i.e., selecting the optimal choice), and, as a result, they expect a premium for accepting additional risk. The CAPM is an investment tool that shows the expected return on a stock investment is equivalent to the risk-free rate of return plus a risk premium. The model utilizes a stock's beta, in combination with the average person's level of risk aversion, to calculate the return that people require on that particular stock. Beta is a measure of market risk in which, the higher the beta, the more sensitive the returns on the stock to changes in the returns on the market.

   Another important aspect of standard finance is the notion of the objective aspects of risk, for example, beta, the CAPM, and MPT are all based on quantitative (numerical) variables. These topic areas of standard finance have been the foundation for many innovative investment products that today have a wide range of applications throughout the business community.

3. The founding principles of the behavioral finance perspective of risk are prospect theory and loss aversion. Prospect theory is based on the premise that investors assess a loss or gain on a specific reference point (e.g., the purchase price of a mutual fund). This assumption of prospect theory is linked to the concept of loss aversion because individuals assign more weight to losses than they do to gains. An emerging research topic in behavioral finance is the finding of an inverse (negative) relationship between perceived risk and expected return (perceived gain). The behavioral finance view incorporates both the objective factors (e.g., beta, standard deviation, and variance) and subjective issues (e.g., overconfidence, worry, and heuristics) in the assessment of risk for a specific financial product or service. The subjective judgment process that investors experience is based on the notion of bounded rationality and behavioral decision theory. Bounded rationality is when a person reduces the number of options to a collection of smaller abbreviated steps, even though this may overly simplify the decision. Behavioral decision theory is based on the assumption an individual will

decide on the perceived satisfactory choice although this may not be the optimal alternative to select. All of these topics of behavioral finance provide evidence that the judgment process is highly complex and influences our final investment decisions.

4. Because this is a question designed to evaluate your "critical thinking skills," there is no correct answer. However, questions you may ask yourself in evaluating your approach to answering this question are: (1) Did your viewpoint of risk change about standard and behavioral finance after reading this chapter? (2) Based on your personal experience of investing, does your current viewpoint of risk support standard finance or behavioral finance? (3) Do you agree with the author's final remark "Both standard finance and behavioral finance provide a valuable contribution to the assessment of risk in which they are complementary rather than mutually exclusive"? Establishing your own personal viewpoint of standard and behavioral finance is important because these investment concepts will help improve your understanding and ability to make better decisions throughout your lifetime.

CHAPTER 9 PSYCHOLOGICAL INFLUENCES ON FINANCIAL REGULATION AND POLICY

1. The psychological attraction approach explains the accounting rules and disclosure/reporting regulation as consequences of psychological biases and heuristics on the part of policymakers and users. Rule-makers may adopt policies to help users overcome their judgment and decision biases. On the other hand, the biases and heuristics of the rule-makers themselves may lead to pernicious rules.
2. Individuals with limited processing power cannot compute and analyze all available data in a timely way. Disclosing every transaction of a company may be counterproductive if investors have to spend limited cognitive resources to separate extraneous information from relevant information. Aggregating data into categories (revenues versus expenses, or assets versus liabilities) provides more readily accessible and useful information.
3. Rule makers may perceive derivative securities to be inherently risky investments or may be subject to the pressure of users (investors) who have this perception. Downside risk is especially salient for investors, which makes risk disclosures that focus on the probability of large loss especially attractive to investors as compared with disclosures that reflect the full probability distribution of possible outcomes. Regulation requiring risk disclosure that encourages reports that emphasize probability of large loss can reinforce investor bias.
4. One way that the media influence the public and financial regulators is by disseminating and repeating salient or vivid stories and images. By personalizing stories about financial events, the media encourage the public to react emotionally. News media also amplify availability cascades by selectively emphasizing ideas about dangers in the financial system that are the focus of public discourse at a given point in time.

5. After adverse events, people like to have scapegoats. This can trigger calls for regulation to prevent future malfeasance by villains. Overconfidence by regulators in their abilities may cause excessive faith that a proposed regulatory solution is needed and superior to market solutions to a problem.
6. Whether a regulation is adopted depends on the relative salience or visibility of the benefits versus the costs. Regulators may adopt a regulation that has negative net benefits but whose costs are dispersed or hidden. For example, regulation limiting speculation or short-term investing has a salient (alleged) benefit of stopping price manipulators. The potential cost of hindering the incorporation of new information into market price is not salient.

CHAPTER 10 DISPOSITION EFFECT

1. There are two reasons that the disposition effect can be harmful to investors. First, the disposition effect can increase investors' tax burden. Many investors realize only gains during most tax years and do not realize losses to offset some of the gains. This leads to increased taxes because the government levies capital gains taxes based on the realized gains and not on the overall portfolio return. Second, the disposition effect can interfere with rational decision making. The historical purchase price is irrelevant information when considering the future prospects of a stock. According to various studies, losing stocks that investors hold subsequently underperform the winning stocks that they sell. So in many cases, investors would be better off by doing exactly the opposite of what they are thinking of doing. A practical test of whether an investor is holding on to losing stocks for the wrong reason is to ask: Would you buy that stock today if you did not already own it?
2. If many investors have gains on a particular stock, some of them are eager to sell due to the disposition effect. This can slow down the advance of the stock following positive news so the market price can underreact to positive information in this situation. Sooner or later the market price would nevertheless catch up with the fundamental value. Consider also a stock in which many investors have losses. As negative news about the stock arrives, disposition investors will more likely just hold onto their shares and not sell at a loss. This slows down the rate of decrease in the price. Under these scenarios the disposition effect can thus lead to momentum in stock price, that is, the tendency of the price to continue in the direction of its initial move.
3. Realized returns would be equal to portfolio returns if investors periodically sell all of their holdings. Assuming zero transaction costs, realized returns would be unbiased predictors of portfolio returns even if the investors did not sell all the stocks, but decided randomly which stocks to sell. However, the disposition effect says that there is a systematic tendency for investors to pick which stocks to sell, and they tend to pick the ones in which they can realize a profit. The returns from the worst stocks are not observed by looking at the realized returns, and hence realized returns will overstate the total portfolio return. Objective investment performance evaluation therefore cannot be based on realized returns.

CHAPTER 11 PROSPECT THEORY AND BEHAVIORAL FINANCE

1. Prospect theory assumes that choice behavior is often determined by changes in wealth and the subjective value one attaches to such changes. Moreover, some argue that individuals attach a greater weight to losses than to equivalent gains in wealth. This argument is illustrated in what is referred to as the value function. Subjective expected utility assumes that individuals are concerned with their long-run state of wealth and do not attach a differential weight to losses or gains in wealth.
2. Kahneman and Tversky (1979) argue that emotive variables are key factors to explaining human choice behavior. In contrast, Simon (1987b) is more focused on the limitations of the human brain's capacity to process information and the imperfections and asymmetries of the information that require processing. For Kahneman and Tversky, even if these problems do not exist, the inclusion of emotive variables will generate choice behavior inconsistent with subjective expected utility theory.
3. The equity premium puzzle relates to the fact that the long-run premium differential between stocks and bonds is much greater than what can be explained by the differential risk of holding these two financial assets. However, the equity premium puzzle can be explained if two key traits characterize the behaviors of individuals: (1) if individuals are risk averse to the extent suggested by evidence drawn from experimental and psychological economics and (2) if individuals evaluate returns to their investment in period blocks of time (such as at one-year intervals). This is called myopic loss aversion.
4. If individuals weigh losses more heavily than gains, they would tend to be risk averse such that they could value an investment yielding a lower expected value of income. One example of this relates to the certainty effect wherein individuals choose a prospect with a lower expected value if a particular level of income is guaranteed. If the certain outcome becomes only highly probable (95 versus 100 percent), the individuals might then choose the prospect yielding the highest expected value. Moreover, individuals might sell assets of increasing value too soon so as to secure gains and to hold losing assets for too long hoping that the value of these assets will increase. Both cases illustrate loss aversion.
5. The situation in which individuals weigh losses more heavily than gains and are concerned with changes to wealth more than the final state of wealth can be rational, intelligent behavior in a world of "Knightian" uncertainty where risks cannot be calculated with any degree of accuracy. In other words, wealth maximization need not be a core criterion for rationality. Individuals might still be maximizing utility, but utility maximization involves much more than wealth maximization. Moreover, framing effects, which are directly related to prospect theory, can be rational in that individuals regard frames as a signal in a world of imperfect and asymmetric information and Knightian uncertainty.

CHAPTER 12 CUMULATIVE PROSPECT THEORY: TESTS USING THE STOCHASTIC DOMINANCE APPROACH

1. Estimating beta requires running a simple regression where the independent variable (X) is the market return (denoted as R_{mt}) and the dependent variable (Y) is the return on the stock (denoted as R_{it}). The slope coefficient will thus be the beta of the stock:

$$R_{it} = \alpha + \beta_i \times R_{mt} + \varepsilon_t$$

To incorporate Kahneman and Tversky's decision weights requires:

A. Sorting the values of R_{mt} and R_{it} according to their sign, that is, to positive and negative values.

B. Transforming the outcome probabilities $p_i\,(1/n)$ to Kahneman and Tversky's decision weights $w_i\,(1/n)$ by using Kahneman and Tversky's CPT cumulative probability formula (equation 12.5):

$$\left.\begin{aligned} w^{*-}(p) &= \frac{p^{\delta}}{[p^{\delta} + (1-p)^{\delta}]^{1/\delta}} \\ w^{*+}(p) &= \frac{p^{\gamma}}{[p^{\gamma} + (1-p)^{\gamma}]^{1/\gamma}} \end{aligned}\right\}$$

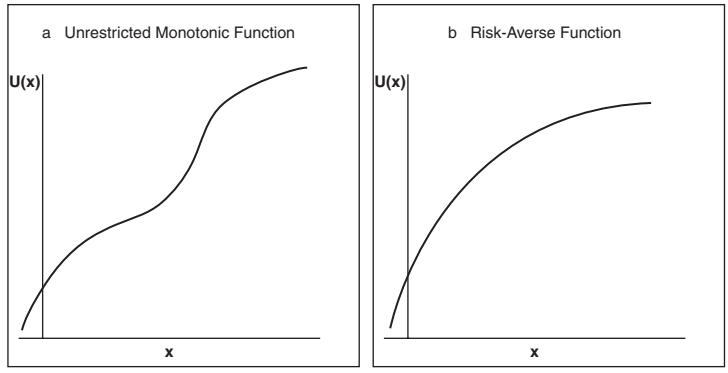
where the experimental parameter estimates are: $\gamma = 0.61$, $\delta = 0.69$, p is the cumulative (objective) probability, and $w^*(p)$ is the cumulative decision weight, $w^{*-}(p)$ relates to the negative outcomes, and $w^{*+}(p)$ relates to the positive outcomes).

C. Using Kahneman and Tversky's decision weights $w_i\,(1/n)$ as probabilities to be employed in the regression.

2. Yes, PSD still holds and the dominance is independent of wealth. G will still dominate F because both cumulative distributions are shifted to the right by the same amount. Take for example the cumulative distributions in task IV of experiment 1 illustrated in Exhibit 12.1b, and in Exhibit 12.1a for comparison reasons, where G^* dominates F^* by PSD. Shifting both distributions by \$10,000 does not change the calculation of:

$$\left.\begin{aligned} \int_{-\infty}^{y} [G(t) - F(t)]dt \geq 0 \text{ for all} \quad y \leq 0 \\ \int_{x}^{\infty} [G(t) - F(t)]dt \geq 0 \text{ for all} \quad x \geq 0 \end{aligned}\right\}$$

suggesting that G will still dominate F. This is illustrated in Exhibit 12.1b.



3. Refer to Exhibit 12.5a and 12.5b. Let X be a random variable that can assume one of two outcomes, X_1 or X_2. Let p be the probability that X_1 occurs and $(1 - p)$ the probability that X_2 occurs. The mean outcome $\overline{X}$ can thus be calculated: $\overline{X} = pX_1 + (1 - p)X_2$. The expected utility is shown in Exhibit 12.5a and 12.2b at point D, which lies on the chord connecting points A and B. Point C, which lies on the utility function, is the certainty equivalent, with a utility equal to that of point D, that is, the expected utility. Using this approach, one can draw a conclusion regarding the curvature of the utility function U(X). If point C (certainty equivalent) lies to the left of point D ($\overline{X}$), as in Exhibit 12.5a, the utility function is thus concave, typical for a risk-averse investor. If point C (certainty equivalent) lies to the right of point D ($\overline{X}$), as in Exhibit 12.5b, the utility function is thus convex, typical for a risk-seeking investor. However, if the random variable X assumed three or more outcomes, one could not draw a conclusion about the curvature of the utility function. Going back to the case of two outcomes, there is only one chord connecting the two points, namely A and B, and point D must lie on this chord. With three or more outcomes, this is not the case as Point D does not lie on one of the chords thus no conclusion can be drawn regarding the curvature of the utility function.
4. One can conduct similar experiments of choices with prospects with unequal and small probabilities to those that were conducted in this study. Let F and G be the cumulative distributions of two options under consideration and establish a situation where F dominates G by PSD with decision weights. Examine the choices. If most subjects prefer F, the result supports CPT. If most subjects prefer G, CPT is rejected.

CHAPTER 13 OVERCONFIDENCE

1. The researcher has to design a questionnaire in which he asks, say, 20 general knowledge questions. Subjects are asked to provide an upper and lower bound of a 90 percent confidence interval for each of the 20 questions. Then, the researcher counts the number of correct answers outside the intervals provided. This "number of surprises" (the number of correct answers outside the intervals provided by a well-calibrated person, usually

higher than 2) is the degree of overconfidence of a person. The mean over these individual overconfidence scores is the degree of miscalibration of the group.

2. Overconfidence is usually modeled as overestimation of the precision of private information. In investor trading models, the uncertain liquidation value of a risky asset is modeled as a realization of a random variable. Assume the liquidation value v is a realization of a normal distribution with mean 0 and variance $\sigma_{\tilde{v}}^2$, that is, $\tilde{v} \sim N(0, \sigma_{\tilde{v}}^2)$. Some or all investors receive private information signals, s. These signals contain information, but they are noisy, that is, they contain a random error ε as well. Assuming that random variables (the distribution of the liquidation value, $\tilde{v}$, and the distribution of the error term, $\tilde{\varepsilon} \sim N(o, \sigma_{\tilde{\varepsilon}}^2)$) are independent, the signal s is usually written as a realization of the random variable $\tilde{s}$, which is the sum of the random variables $\tilde{v}$ and $\tilde{\varepsilon}$, that is, $\tilde{s}(= \tilde{v} + k \cdot \tilde{\varepsilon}) \sim N(0, \sigma_{\tilde{v}}^2 + k^2 \cdot \sigma_{\tilde{\varepsilon}}^2)$. The parameter k captures the finding of overconfidence. If the parameter k is in the interval $(0, 1)$, an investor underestimates the variance of the signal, s (or, stated equivalently, underestimates the variance of the error term). If $k = 0$, an investor even believes that he knows the value of the risky asset with certainty.
3. Models incorporating overconfidence make predictions such as "The higher the degree of overconfidence of an investor, the higher the portfolio turnover of this investor" or "Firms with optimistic managers invest more in fixed assets than firms with well-calibrated investors, even when controlling for other factors." Such hypotheses can be tested by measuring the degree of investor or manager overconfidence with the help of a questionnaire. The above hypotheses can then be tested by regressing portfolio turnover or corporate investment on overconfidence measures of people and control variables.
4. Overconfidence can help explain phenomena such as excessive trading of individual investors, stock market anomalies such as the momentum effect, or overinvestment in fixed assets by firms.

CHAPTER 14 THE REPRESENTATIVENESS HEURISTIC

1.

Sequence	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
(a)	−	+	−	+	−	+
(b)	−	−	−	+	+	+
(c)	+	+	−	+	−	−

This question illustrates the way people may experience problems when dealing with sequences of events generated by a random process and believe the observed pattern of events has the same characteristics as the underlying random process does itself (i.e., *misconception of randomness)*. In this question, because share prices follow a random walk to a first approximation, each of the three price movement sequences (a), (b), and (c) is equally likely with probability of occurrence $= 1/64\,[(1/2)^6]$. However, typically more than half of respondents when asked this question view sequence (c) to be the most

likely as it appears most representative of the characteristics of a random process, that is, no seemingly systematic pattern. Respondents are, in effect, reading into these small sequences of random events apparent patterns. Knowing such sequences should be random, they then look to see which sequence intuitively is most "representative" of what they would expect a random sequence to look like. The correct answer is that (a), (b), and (c) are all equally likely to have occurred.

2. The representativeness heuristic relates to the way judgments are made based on the degree of similarity between events and classes. It teaches that people assume like goes with like and make subjective probability assessments based on superficial stereotypes. Tversky and Kahneman (1974) describe different aspects of representativeness bias:
   - *Insensitivity to prior information:* Ignoring prior probabilities and base rate evidence.
   - *Insensitivity to sample size:* Making probability assessments based on representativeness alone.
   - *Misconception of chance:* Seeing patterns in random events and placing too much faith in the representativeness of a small number of observations, the "law of small numbers."
   - *Insensitivity to predictability:* Ignoring the potential (lack of) accuracy of the prediction, relying on representativeness alone.
   - *Regression toward the mean:* Expecting extreme outcomes to be followed by further extreme outcomes,
   - *The illusion of validity:* Viewing confidence in a judgment as a function of the degree of representativeness not the underlying characteristics of the decision situation.
3. The research evidence relating to the validity of the representativeness heuristic is largely based on simple, abstract, and context-free laboratory-type experiments using unskilled decision makers such as undergraduate students as subjects. Even when experiments with apparent face value validity are conducted with experts who then make "incorrect" judgments, such results cannot be used to infer these "errors" are necessarily due to representativeness bias. This is because in real-world decision contexts, such respondents would be applying their knowledge and expertise directly to solve the specific problems with which they are dealing, not relying on their intuition alone. Also, research studies into representativeness mainly focus on individual judgments made independently of those of other decision makers. This does not always happen in reality.

   Markets consist of large numbers of highly sophisticated and skilled investors making real and very complex decisions with serious consequences in a highly social context. Thus, there is little reason to believe that markets behave anthropomorphically. Generalizing from simple mis-specified subjective probability assessments manifest by often very naïve individuals in stylized psychological laboratory situations to real financial markets and professional investors, as is frequently done in behavioral finance, is highly problematic. Paradoxically, doing this is consistent with such behavioral finance proponents being prone to the operation of representativeness bias themselves. Nonetheless, in practical terms, if investors and other financial decision makers are aware of their propensity to make judgments consistent

with what is termed the representativeness heuristic, then this may result in decisions being made on a less automatic and more considered basis. This should reduce the likelihood of error-prone outcomes.

4. Observing the operation of the representativeness heuristic in real-world financial markets is very difficult, if not impossible. This is due to their high degree of complexity and the large numbers of factors determining asset prices, which will likely confound attempts to test the validity of the heuristic directly. As such, researchers have to fall back on indirect "natural experiments" to explore for evidence in line or otherwise with representativeness bias. Examples of relevant studies discussed in the chapter demonstrating evidence consistent with the representativeness heuristic include:
   - Investor response to dot-com stock and mutual fund name changes and mutual fund advertising.
   - The "good company (good management), good stock" bias where management quality is confused with the value of a firm as an investment.
   - How investors make decisions based on inappropriate extrapolation of market returns, mutual fund performance, or stock price trends.
   - How the "book/market" anomaly may be explained by representativeness bias.
   - How the poor performance of sell-side analyst stock recommendations may be explained, among other things, by their apparent proneness to suffer from representativeness bias in their investment judgments.
   - How investment plan sponsors can view the previous investment performance of fund managers they are considering hiring incorrectly as representative of their likely future performance in line with extrapolation bias. They may also suffer from similar representativeness-type biases to those present in the employment interview such as confusing personal attractiveness with competence.
   - Related evidence in studies of star sell-side analysts and CEOs.
   - How the esteem in which technical analysis is often held by market participants may be more due to their suffering from representativeness bias than any underlying empirical support for its predictive value.

   Nonetheless, evidence of this nature consistent with the theory of representativeness does not mean representativeness actually explains such anomalous market behaviors. All it can do is to observe ex post certain investor or market regularities that do not contradict the predictions of the representativeness heuristic. This is very different from testing directly for the existence of representativeness bias in the judgments made by actual financial market participants.
5. Being aware of the propensity to representativeness-type biased behavior when making investment decisions is clearly the first step to relying more on reflective-type judgments than far less effortful reflexive ones—thus hopefully resulting in less error-prone or biased decisions. The chapter specifically suggests that investors should not be misled by highly detailed scenarios, should pay attention to base rates wherever possible, need to recognize that chance is not self-correcting, and ought not to ignore regression toward the mean. However, these are just some of the aspects of representativeness-type behavior decision makers need to guard against when making financial judgments. The main point is to be aware of how and why particular

judgments are being made and the underlying processes that may be driving these. Self-reflection rather than intuition in decision situations is critical if people want to capitalize on what is known about representativeness.

CHAPTER 15 FAMILIARITY BIAS

1. The model-based approach to measuring familiarity bias starts with the prediction of the international capital asset pricing model (ICAPM) that investors should hold assets in proportion to their share of world market capitalization. Actual portfolio weights are compared to those implied by the data and the difference between the theoretical and observed weights represent familiarity bias. A problem with this approach is that empirical tests of the ICAPM have repeatedly failed. Thus, any difference between actual and theoretical portfolio weights may not be evidence of familiarity bias, but rather model mis-specification.

   The data-based approach derives optimal portfolio weights from a mean-variance optimization. A problem with this approach is that it requires an *ex ante* measure of both expected returns and return variance. While return variance may be estimated with relatively high precision, forecasting asset returns with historical data is a futile exercise in many ways. Furthermore, the high correlation across asset returns leads to a nearly singular return covariance matrix. As a result, even small changes in expected returns can lead to large changes in the optimal portfolio weights derived from the data-based approach.
2. One of the first studies to dismiss transaction costs as an explanation for familiarity bias was Tesar and Werner (1995), who estimated that turnover rates on foreign equity were actually higher than those on domestic equity. If foreign assets carried higher transaction costs, the foreign assets should be expected to be traded at lower, not higher, volumes. Other studies such as Glassman and Riddick (2001) and Jeske (2001) compute the transaction costs on foreign equity needed to justify the observed domestic equity shares, given the lower risk and higher return available through diversification. These studies estimate transaction costs far above any reasonable measures, suggesting that something else is limiting diversification.

   While the transaction costs needed to justify the observed portfolio weights are far in excess of any estimates of actual foreign equity costs, there may be less observable costs limiting diversification. Purchasing foreign or unfamiliar assets exposes an investor to appropriation risk from insiders or the state. In fact, Stulz (2005) finds that foreign asset ownership is lowest in countries with weak minority shareholder protection or a high risk of government appropriation.
3. If investors cannot cheaply acquire information about unfamiliar assets, they will be less likely to purchase these assets. Investors theoretically use all available information when forecasting asset returns and risk. If one asset has less information than another, the forecast error on this asset is likely to be higher, and will thus require a higher expected return before being purchased. Numerous studies offer support for information asymmetry as an explanation for familiarity bias. Brennan and Cao (1997) find that investors who buy foreign assets exhibit the kind of return-chasing behavior

(buying high and selling low) indicative of limited information. Others report that variables that proxy for information flows such as the distance between an investor and the country issuing an asset, language, overlapping trading hours, and bilateral telephone traffic are significant determinants of familiarity bias. These variables appear to matter more for less sophisticated investors who are more likely to rely on country-specific rather than firm-specific information when making portfolio allocation decisions. Massa and Simonov (2006) show that familiarity bias declines following a change of profession or relocation, suggesting that these investors are no longer privy to the kind of local knowledge that makes investing in the familiar a rational choice. Finally, information (as proxied by proximity) affects performance as several studies such as Choe, Kho, and Stulz (2005), Dvorak (2005), Ivković and Weisbenner (2005), and Grote and Umber (2006) have documented.

While theoretically appealing, asymmetric information is probably not the sole explanation for familiarity bias. First, the limited information explanation only fits the data when investors forecast higher returns on local assets than foreign assets. When investors forecast higher returns on foreign assets, they should tilt their portfolios toward these assets. This does not occur, however, as familiarity bias stays fairly stable over time.

Second, the massive gains to be made through diversification suggest that a market should have developed to better disseminate information about far-away financial markets. This is especially relevant with advances in information technology reducing barriers to the flow of information. That familiarity bias persists, suggesting that while investors have access to information about "unfamiliar assets," they are not taking advantage of it. This is supported by research by Choi, Laibson, and Madrian (2005), who find that while the Enron bankruptcy was sending a clear and dire warning about the dangers of overinvesting in own-company stock, employees of the company continued to invest in Enron stock. Thus, information asymmetry may explain some, but not all, of the observed familiarity bias.

4. Heavily investing in own-company stock exposes investors to more risk than a diversified portfolio for two reasons. First, there is the greater idiosyncratic risk that comes from investing in a single asset over a diversified portfolio. Second, returns on company stock are often highly correlated with labor income. If a firm goes bankrupt, its employees could see a loss of both their income and their savings. By diversifying into non-company stock, employees could better insulate their consumption from labor income risk.

   There are several possible rationalizations for investing in own-company stock. First, employees gain certain tax advantages when they invest in own-company stock, such as having these returns taxed at the capital gains rate rather than ordinary income. However, survey evidence by Benartzi, Thaler, Utkus, and Sunstein (2007) reveals that only 10 percent of employees are even aware of this benefit. Second, employees may have insider information about the firm's performance. While theoretically appealing, these employees would have to have a massive information advantage to offset the estimated fifty cents on the dollar value they receive from investing in own-company stock (Muelbroek, 2005).

   Survey evidence reveals that employees miscalculate the risk of investing in own-company stock, often taking the decision by employers to match

contributions in kind as an implicit endorsement of the stock. That these employees consistently underestimate the risk of company stock even in the midst of publicized bankruptcies such as Enron suggests that they may be subject to the behavioral bias of overconfidence when investing in such a stock.

5. One potential explanation for familiarity bias is overconfidence. Barber and Odean (2001) find that overconfident investors tend to invest more in assets with which they are familiar even if they do not have superior information about these assets. Goetzmann and Kumar (2008) and Hau and Rey (2008) find that younger uneducated investors tend to display more overconfidence. Finally, Karlsson and Nordén (2007) use Swedish pension data to show that familiarity bias is highest for older single men with low levels of education, perhaps due to the greater overconfidence among men documented by Barber and Odean (2001).
6. Faced with limited information about financial markets, an investor may be forced to use broader generalizations when assessing the risk and return of an asset. For example, consider a French investor who is considering investing in two equities, one French and one Italian. If that investor does not have access to firm-specific information about either equity, he may prefer to invest in the French equity simply because he feels more confident about assessing the risk of the French firm than the Italian firm. As firm-specific information about both assets increases, the French investor is more likely to make an investment decision based on fundamentals rather than a generalized assessment of risk based on familiarity.

CHAPTER 16 LIMITED ATTENTION

1. Psychological factors that affect how much attention individuals pay to particular information include the presence of distracting stimuli, salience of the information, availability of the information, and the ease of processing the information.
2. Studies show that greater underreaction to public information occurs when investors are likely to be less attentive (e.g., Fridays, non-trading hours, when many other announcements take place on the same day), when the relevant information is qualitative, less salient, and hard to process, and when the trading volume is low. These results suggest that investor inattention is a plausible explanation for market underreactions.
3. Corporate managers tend to disclose bad information when investors are less attentive, use pro-forma earnings that often exclude certain expenses, manage earnings, or guide earnings forecasts to beat market expectations, and choose accounting methods strategically. Thus, managers profit from trading on personal accounts and issuing equity on favorable terms. They need to be careful to conduct their trades outside of the blackout periods that many companies have voluntarily imposed to avoid violating insider trading laws.
4. Individuals may ignore broad considerations and frame decisions in narrow contexts due to their limited processing power. Limited attention also implies that individuals are prone to using simplifying heuristics because

they reduce processing costs. Individuals with limited attention do not consider the distribution of outcomes but instead simplify a decision problem to discrete choices, often dichotomous, using a reference point.

CHAPTER 17 OTHER BEHAVIORAL BIASES

1. A basic premise is that status quo bias influences all investor behavior unless indicated otherwise. Examples include:
   - Keeping the same brokerage account, stock advisor, and fund manager
   - Investing the same proportions invested in stocks, bonds, and money market accounts over a lifetime despite the changing needs of the investor
   - Keeping the same ideas of what constitutes a good or bad investment

   The discussion could be linked into the other sections on inertia, especially conservatism and why it can co-exist with representativeness. Occasionally, status quos break down. For example, this may occur with large groups of people who almost simultaneously change their views on what constitutes a good or bad investment.
2. Biased self-attribution has various moderators as discussed in the chapter. If investors are actively aware of these moderators, they should be able to lessen the negative influences of the bias. For example, a highly important task leads to greater biased self-attribution. If investors viewed each investment decision as just one of many investment decisions, biased self-attribution could reduce the perceived importance of the individual task. Similarly, high self-esteem and good prior performance and experience lead to biased self-attribution. Investors could educate themselves to view their prior investment outcomes compared to an appropriate benchmark such as a basic capital asset pricing model, which could lessen their unjustified high self-esteem and perception of good prior performance.
3. The application of American-centered research in finance to an understanding of the behavior of investors from different cultures has limitations. If cultures and psychological outlooks differ, then using an American-centric psychological theory to study the behavior of all the world's investors is, at best, a "first glance" at the theory's global applicability. Theories, especially behavioral finance theories, might need to be re-evaluated to recognize this emerging literature. The discussion could elaborate on the references to cultural differences within the chapter.
4. This discussion primarily focuses on the "unknown" risk element of the affect heuristic. Research shows that the affect heuristic is more influential in decision making when there is a greater element of unknown risk. Compared to professional investors, small individual investors are expected to experience greater levels of unknown risk when investing. Thus, such investors would allow their affective reactions to influence their investment decision making to a greater extent. Although the chapter broadly covers this subject, the discussion could be extended to a discussion of bounded rationality and investor decision making. For example, does the level of bounded rationality faced by investors determine the level of affect they rely on in their decision making? Do certain types of media influence investors in different ways? Might the lively Jim Cramer on *CNBC* encourage

a greater role for affect in his viewers' decision making compared to the influence of affect on the reader of the more sedate *Wall Street Journal*?

CHAPTER 18 MARKET INEFFICIENCY

1. Prices matter for optimal risk allocation. Correct prices facilitate efficient risk sharing. The entity able to bear more risk takes on the risk. If prices are wrong, then quantifying risk and making good portfolio decisions is very difficult. If prices are correct, average investors would not make mistakes in picking stocks as long as they were diversified. If they assume higher risk, they would be compensated with higher (expected) return. However, if prices are incorrect, unsophisticated traders (who do not understand the game) may lose money. More generally, irrational prices can arbitrarily affect allocation of wealth in the economy. A perception that prices are arbitrary would lead to uninformed investors pulling out of the stock market. Lower investor participation would lead to lower liquidity in the financial markets, leading, in turn, to firms being unable to raise capital, unable to make optimal unconstrained investment decisions, and a general reduction of growth in the economy.

   Wrong prices also matter for companies. If correct, prices give useful information about business planning factors such as expected economic growth, discount rates, or volatility. Bad prices compromise business and consumer planning. For example, consider the firm's investment decision. A simple investment rule might involve computing Tobin's Q as the ratio of the market value of installed capital to its replacement cost. If market prices (the numerator in the ratio) are correct, Q guides capital allocation decisions efficiently. The rule of "if $Q > 1$, invest more, if $Q < 1$, invest less" is similar to taking all positive net present value investments. But if prices are wrong, Q gives the wrong signals. Finally, if correct, stock prices enhance the role of corporate governance. By bringing attention to poorly performing firms, falling prices can help shareholders step in early when firms are mismanaged. Incorrect prices compromise this role.
2. A long-short arbitrage strategy involves selling the DTB future and buying the LIFFE future. This forms a perfect hedge at time T. However, the investor needs to put up a margin: say, €3000 (London) and €3500 (Frankfurt). So this is not textbook arbitrage because neither the cost is zero nor are any profits received upfront. Suppose the trade occurs at time t_1 ($t < t_1 < T$), one of two things can happen:

   Case 1. Prices converge to €242,500. The investor gets the margin back and makes a profit of €5,000.

   Case 2. Prices diverge further. Say the DTB contract goes from €245,000 to €250,000. The investor gets a capital call for €5,000 to maintain his position. Again, this is a deviation from textbook arbitrage because the investor's future obligations are not zero.
3. This is not an arbitrage opportunity because it is based on ex-post information. At the time of the announcement, whether the merger will eventually fail is unknown. Hence, this situation does not permit constructing an arbitrage opportunity.

CHAPTER 19 BELIEF- AND PREFERENCE-BASED MODELS

1. The neoclassical financial theory is based on various strong assumptions of which many are unrealistic. However, such assumptions are needed to derive the necessary mathematical formulas. The neoclassical models are usually quantitative and normative in character. Therefore, testing them against market data is possible. Unfortunately, quite often the actual market observations deviate seriously from predictions of the neoclassical theory.

   Models offered by behavioral finance are usually more intuitive and less formal. They have descriptive character and are difficult to test empirically. Behavioral models are good in explaining market anomalies ex post, but applying them for ex ante predictions is difficult.

   In this sense, neoclassical and behavioral finance might be seen as complementing each other. The neoclassical model delivers a benchmark on how markets should behave, and the behavioral model explains why empirical findings differ from neoclassical predictions.
2. The Model of Investor Sentiment by Barberis, Shleifer, and Vishny (1998) assumes that all investors at a given moment believe in either a mean reverting process or trend continuation. Investors switch their belief from one pattern to the other in light of observations that differ from expectations, but this happens with a delay. The Model of Investor Sentiment predicts the simultaneous occurrence of short-term continuations and long-term reversals, but is unable to explain the existence of long-term continuations of stock returns.

   The model by Daniel, Hirshleifer, and Subrahmanyam (1998) assumes that investors can be divided into two categories: the informed and the underinformed. Only informed traders may influence the market. Due to overconfidence they overreact to private information, whereas incorrect attribution of events makes them underreact to public signals. The model proposed by Daniel et al. (1998) predicts short-term continuations and the possibility of both long-term reversals and continuations. This model is unable to explain the existence of long-term reversals after some market events.

   In the model by Hong and Stein (1999), there are two categories of investors: the "news watchers," who apply fundamental analysis, and the momentum traders, who follow the development of short-term price trends. The model shows how the coexistence of those two categories of investors may lead from market underreaction to overreaction, and explains short-term continuations and long-term reversals. The model has difficulty in explaining long-term post–announcement drift after selective events.
3. Errors in the processing of information sometimes lead to underreaction and at other times to market overreaction. Insufficient response to new positive information or overreaction to bad news results in asset underpricing. Conversely, overreaction to positive signals or underreaction to bad news contributes to asset overpricing. Investors can underreact to a given type of information while at the same time overreacting to other news.

Among the key psychological phenomena that may cause market underreaction are anchoring, cognitive conservatism, and the confirmation bias. Because of unrealistic optimism, wishful thinking, and loss aversion, market underreaction may occur particularly in the face of negative information.

Market overreaction can stem from the availability bias, overconfidence together with the calibration effect, and also the illusion of truth. Unrealistic optimism and wishful thinking in this case lead to a situation where market overreaction is more frequently seen in the case of positive signals.

4. The short series effect takes place when an investor draws premature conclusions based on limited observations. Such situations take place when decision makers do not know the rules that underpin the generation of successive observations.

   By contrast, if the distribution of a random process is well known, underestimation of the importance of the sample size may lead to the so-called gambler's fallacy, which is an unjustified belief that even in small samples, the number of outcomes should be in line with the probability distribution.

   In the capital market, a short series effect leads to attempts to discover trends in random sequences of price changes. Yet, the gambler's fallacy is a source of premature expectations of return reversals. Trend seeking is more typical for individual investors, whereas reversal anticipation is more frequent among professionals.

5. Shifts in a degree of risk aversion depending on the reference point are responsible for the so-called disposition effect, which is a tendency to sell profit-gaining stocks "too fast" and to keep the loss-generating items "too long." The disposition effect may lead to temporary underpricing or overpricing of assets.

   Investors who hold stocks that recently have substantially gained in value would like to secure their profits. They exhibit a higher degree of risk aversion and apply a higher discount rate. When they decide to sell at the profit, they generate an extra supply of stocks, and this may cause momentary underpricing.

   Investors who hold assets that recently have lost in value do not want to close their positions with a definite loss. They exhibit a lower degree of risk aversion. Their risk aversion changes into loss aversion. Because they decide to hold assets, the supply is limited. In this way, a temporary stock overvaluation may occur.

CHAPTER 20 ENTERPRISE DECISION MAKING AS EXPLAINED IN INTERVIEW-BASED STUDIES

1. The marketplace reveals the result of decision making in the various enterprises in the market, given prevailing demand and the particular context. This information is ex post and does not provide much insight into the reasoning underlying the decisions that are made. Another approach is required to achieve this insight and to assess the likely decision making of enterprises in the period ahead. Open-ended, in-depth interview-based

studies seem to offer a promising alternative not only for understanding the reasoning in individual enterprises but also for formulating more realistic hypotheses about market behavior.

2. With open-ended interviews, the responses are unlikely to be sufficiently comparable to use statistical analysis. However, they may provide fuller explanations and lend themselves to a better understanding of why enterprises act as they do. Although each respondent may not answer each question and particular factors will differ, this approach may help formulate better behavioral hypotheses. As such, the admittedly dissimilar responses, while violating the requirements for sound statistical analysis, provide another valuable empirical tool.
3. Studies such as those of Bewley (1999) show a tendency toward rigid wages and provide a rationale for this phenomenon. Yet the same studies acknowledge the presence of certain conditions and contexts that lessen the rigidity, sometimes appreciably. Even during 2008–2009, when prevailing conditions weakened the case for wage rigidity, there seems to have been less flexibility than strict logic would have led many to expect. Economic output and employment declined sharply, but some wages fell very little, and some not at all.
4. Advances that have reduced the cost of data and programs and that have increased the availability of programs to handle data have made calculation more feasible than previously. However, if there is a time constraint, some uncertainty, as well as several other conditions, optimization is unlikely, and decision makers must introduce heuristics into their calculations. Judgments are impossible without them. Even with improvements in the cost and availability of data and programs as well as in measurement techniques, financial and economic predictions have not improved in recent years. If decision making has become more predictable recently, it is primarily at the level of individuals and enterprises. Moreover, that improvement in prediction at the micro level may be because decision makers are now more inclined to use heuristics than before and are more aware of the tendencies of those heuristics and ways to take their biases into account.

CHAPTER 21 FINANCING DECISIONS

1. Managerial traits theory augments tradeoff theory. Optimism and overconfidence introduce an additional source of heterogeneity and may therefore explain why financing decisions vary despite comparable firm and industry characteristics. Moreover, managerial traits theory offers a novel explanation for the ambiguous evidence with respect to tests of the standard pecking order theory. Biases can explain the co-existence of the standard and the reverse pecking order preferences.
2. In the presence of conflicts among claimholders, a biased manager makes less suboptimal decisions compared to an unbiased counterpart. In the case of manager-shareholder conflicts, rational managers underutilize debt to maintain the discretion to divert funds, whereas biased managers select higher debt levels. Such managers unknowingly restrict themselves from diverting funds and increasing shareholder welfare. In the case of the

underinvestment problem, which is a variant of bondholder-shareholder conflicts, optimistic and/or overconfident managers invest earlier as compared to rational managers. As a result, the underinvestment problem is alleviated, and shareholder welfare increases. If there are not any conflicts among claimholders or managerial biases are too extreme, the biases may be detrimental for shareholder welfare.

3. Following the logic of the survey measures that compare forecasts and realizations, one could construct measures based on management forecasts and realizations of sales, earnings, and cash flows. Managerial forecasts of accounting figures are often public information, which facilitates data availability when compared to survey-based measures.

   Furthermore, one could develop instruments for optimism and overconfidence based on the analysis of their sources. Examples of potential determinants include age, gender, tenure, cultural background, and education. Bertrand and Schoar (2003) find that managers from earlier birth cohorts act more conservatively, while managers with an MBA act more aggressively.

4. Asymmetric incentive schemes, that is, schemes that reward success over-proportionally and punish failure under-proportionally, could make managers act as if they are optimistic or overconfident, respectively. These incentive systems can be implemented by compensation contracts. Alternatively, they can also be enforced by corporate culture, for example, by emphasizing opportunities while neglecting risks in internal communication.

   Internal promotion tournaments select overconfident individuals into top positions. According to a selection process that is based on observed past performance, an overconfident manager has the highest probability of being promoted to chief executive officer when he is competing with otherwise rational managers (Goel and Thakor, 2008). Alternatively, based on existing insights about the sources of biases that are associated with personality traits, shareholders could recruit managers who are more likely to be initially biased.

5. Board members who are contemplating hiring biased managers have to take into account the entire range of potential benefits and costs in addition to the issues brought forward with respect to financing decisions. Biases can be beneficial because they may mitigate adverse effects from managerial risk aversion (Goel and Thakor, 2008). At moderate levels of overconfidence, the actions of a biased manager will approach those of a risk-neutral manager, leading to a greater number of risky positive net present value projects being accepted. Research suggests that optimistic and overconfident individuals have better social skills. In particular, they are likely to be happier, more popular, more willing to help others, more committed, willing to work long hours, and have more creative problem-solving skills (Taylor and Brown, 1988; Puri and Robinson, 2007).

   Managerial biases may also have costs. Biased managers are inclined to inefficiently use corporate resources through overinvestment or engaging in destructive mergers and acquisitions. Biased managers are more likely not to learn from their mistakes as they attribute failure to bad luck and not personal ineffectiveness. By the same token, they are also likely to be immune to external feedback and suggestions.

CHAPTER 22 CAPITAL BUDGETING AND OTHER INVESTMENT DECISIONS

1. Managers are likely to be overconfident in a capital budgeting context for several reasons. First, capital budgeting decisions are difficult, and people are typically more overconfident about difficult problems. Second, because managers infrequently make major capital budgeting decisions and the feedback from past decisions is often imprecise, they have difficulty learning about and correcting their biases. Third, the managers who tend to be retained and promoted are generally those who have been highly successful. Because individuals tend to overestimate the degree to which they are responsible for their success, they become overconfident. Fourth, overconfident individuals may be attracted by managerial positions because they overvalue their prospects in these jobs. Fifth, firms may prefer hiring overconfident managers because they can be less costly to motivate than their rational counterparts.
2. Overconfident managers put too much weight on their information. When their information indicates that a project is more profitable than initially expected, they overvalue the project; otherwise, they undervalue it. Because the competition across firms ensures that managers quickly undertake the most easily identifiable profitable projects, most available projects are not obviously profitable. As a result, the majority of projects require an information collection effort and a sufficiently positive signal before managers choose to undertake them. That is, a negative signal generally leads to rejecting a project whether or not the manager's overconfidence makes him overweight his information. By contrast, a positive signal leads to overinvestment when the manager's overconfidence makes the project appear sufficiently strong. In other words, manager overconfidence affects the investment decisions of firms only through the reinforcing bias that it has on positive information. Similarly, optimistic managers perceive all projects to be more profitable than they really are. Thus, such managers also tend to invest in projects that their rational counterparts would not consider.
3. One method to measure executive overconfidence involves using stock and stock option data. Chief executive officers (CEOs) who hold on to their vested stock options past their optimal exercise time and increase their exposure to their firm's specific risk by regularly acquiring additional company stock are classified as overconfident. A second method is to use the tone employed in the popular press to characterize a CEO. CEOs who are described as being "confident" and "optimistic" are more likely to be overconfident than those who the press portrays as "cautious" and "conservative." A third method is to administer surveys that include questions whose answers can be used to infer the respondents' behavioral traits. For example, a tight distribution in a manager's prediction of future market returns is indicative of overconfidence. A fourth method to estimate the overconfidence of managers is to use data about their forecasts of company earnings. Managers can be categorized as being overconfident when they tend to overstate their company's earnings forecasts.

4. In theory, a firm's investment should be driven exclusively by the profitability of its opportunities, as measured by Tobin's Q. However, researchers find that a firm's cash flows positively relate to investment even when Q is an explanatory variable. Researchers test for the effect of managerial overconfidence on this relationship by allowing the correlation between investment and cash flow to vary with executive overconfidence. For example, this can be done by adding an explanatory variable that interacts cash flow and a measure of executive overconfidence. According to Heaton (2002), because overconfident managers are reluctant to finance new investments by issuing risky securities, large cash flows provide the financial slack that these managers need to pursue their aggressive investment strategy. Malmendier and Tate (2005a) find that the interaction term is positive and significant. That is, the impact of cash flows on investment is stronger when the manager is overconfident.
5. When a firm's risk-neutral shareholders hire a manager to make investment decisions on their behalf, the manager's overconfidence reduces the moral hazard that his risk aversion creates. That is, the manager's overconfidence makes him think that he can control risk better than he really can, naturally offsetting the conservatism that comes with his risk aversion. In this context, managerial overconfidence can be useful as it reduces the tension between incentives and risk-sharing that is inherent in the contractual relationship between a risk-neutral principal and a risk-averse agent. Because the overconfident manager can intrinsically commit to an investment strategy that is closer to that desired by the firm's shareholders, the realignment of his incentives does not necessitate as large a transfer of risk. As a result, the contractual arrangement between the two parties tends to be more efficient.

CHAPTER 23 DIVIDEND POLICY DECISIONS

1. The problem with these theories is that they describe the dividends puzzle in detail, but do not help solve the fundamental problem of why firms distribute dividends. The dividend clientele hypothesis proposes that groups of investors have greater preference for dividends than others and therefore pressure firms to pay dividends. Investors potentially can be clustered according to their characteristics into groups who favor dividends and those who do not. Furthermore, the theory may explain why some investors would be interested in dividends more than others. However, this theory does not provide a clear explanation of why anyone would be interested in dividends at the basic level.

   The firm life-cycle hypothesis is similar to the dividend clientele hypothesis in the sense that it identifies a cluster of firms that are more likely to pay dividends such as large, mature, and stable firms. These firms have steady cash flows and perhaps fewer investment opportunities, and therefore accumulate cash that they can distribute to investors. Hence, the theory explains the cross-section of dividend payers with respect to their characteristics. The theory does not explain why firms decide to pay dividends in the first place, as opposed to distributing funds in stock repurchasing.

2. Dividends could be a social norm, that is, firms distribute dividends because "all firms do it." The main problem of testing this hypothesis is that it requires ruling out alternative economic explanations. Specifically, suppose that firms distribute dividends because they mitigate an asymmetric problem for a small fraction of firms and because some consider this a social norm for others.

   Identifying the social norm channel requires isolating social norms from other confounding factors, that is, to show that dividends are paid with no economic purpose. This is challenging because dividends seem to serve such a purpose for a small fraction of firms. Alternatively, one needs to show that given a change in social norms, firms change their dividends policy. For at least some firms, social norms may begin with some fundamental rationale. Thus, separating the initial rationale from dividend paying with no economic rationale would be difficult.
3. No. Theories of managerial biases explain why some firms pay more dividends than others and why some firms avoid paying dividends. These theories do not explain and do not attempt to explain why investors like dividends and why dividends are useful.
4. These theories explain the fundamental reasons investors like dividends. In these theories investors fail to behave optimally according to neoclassical models. In the bird-in-hand theory, investors do not understand that dividends are the same as capital gains in terms of their value. In the self-control theory, investors feel guilty and hence suffer disutility when they need to sell investments to finance consumption. For mental accounting, investors use a prospect theory utility function, which evaluates payoffs independently of total wealth. With such a utility function, investors put much weight on small positive payments (dividends), and therefore receiving such payments is beneficial to them.

   The empirical challenge in testing these theories requires identifying the exact mental process that investors experience to understand the source of the demand for dividends. This is usually feasible in a laboratory setting but hard to accomplish using archival data, for example, entering an investor's thought processes is difficult.
5. Yes. The valuation yardstick hypothesis suggests that investors like dividends because they help them to value firms. Nevertheless, the bulk of the empirical evidence shows that dividends do not have high explanatory power of future returns. Therefore, dividends are not useful as valuation tools because returns are too noisy. Despite the fact that dividends are not useful valuation tools, investors can still use them for valuation in the same way that they use other pieces of information that are not particularly useful such as a 52-week high, P/E ratio, and past returns.

CHAPTER 24 LOYALTY, AGENCY CONFLICTS, AND CORPORATE GOVERNANCE

1. Agency is a situation that arises when one person, the agent, is expected to subsume her autonomy and act in the interests of another, the principal.

In finance, a typical agency framework casts chief executive officers (CEOs) as agents and shareholders as principals because CEOs are expected to run firms to maximize shareholder wealth, and set aside any personal interests that might conflict with this.

The traditional finance view of agency arises from a fundamental distinction in microeconomics. This distinction is that people maximize utility, while firms maximize value, usually defined as the expected present value of a stream of present and future cash flows. This distinction gives rise to a fundamental conflict: How can a firm's top managers make decisions that maximize both their utility and their firm's value?

Microeconomics presumes that the firm's top managers are faithful agents who forsake their own utility maximization and maximize firm value because of a duty to act in the interests of their principals—the firm's owners (shareholders). Finance presumes that the top managers maximize their own utility functions and that the value of their firm is consequently lower than microeconomics would predict. This reduction in value is called an agency cost, and the fundamental conflict is called an agency problem or principal-agent problem.

An example might be a CEO who uses a firm's funds to build a palatial head office or to acquire luxurious corporate jets or other perks that add to his utility but subtract from shareholders' future dividends. Other examples might be a CEO who diverts corporate funds into her money-losing pet projects or personally favorite political causes, or who hires personnel with characteristics (such as race and gender) she favors rather than with the skills the firm needs.

2. As in finance, an agentic shift in social psychology arises where one person, the agent, is expected to subsume his autonomy and act in the interests of another. A typical example might be a soldier who is expected to set aside his own interests and obey the orders of superiors in the military chain of command. An agentic shift occurs if the soldier ceases to weigh the consequences of his actions and instead reflexively obeys orders. This causes problems if the orders are illegal or unethical.

   An example commonly cited in social psychology is German soldiers, who loyally obeyed orders to carry out the Holocaust. In finance, an agentic shift might cause problems if a firm's officers, directors, middle managers, and employees loyally obey a CEO bent on obviously wrong, illegal or unethical undertakings. In both cases, the agents' defense—"I was just obeying orders"—seems grossly inadequate after the fact.
3. A generalized agency problem, as described in this chapter, occurs if the degree of loyalty the agent displays is socially non-optimal. This concept encompasses both the socially suboptimal loyalty of the CEO to shareholders in the standard finance agency problem and the socially excessive loyalty of corporate officers, directors, middle managers, and employees to a CEO's inept, unethical or illegal orders that is caused by an agentic shift.
4. Such reconciliation might be brought about in several ways. One approach is to think of an agentic shift as rational utility maximizing behavior where information is very costly. Following a plausibly better informed

superior might be more cost-effective than paying to become informed most of the time. This sort of behavior is called an information cascade and can occur wherever uninformed people imitate others they think are better informed.

Alternatively, people might derive utility from belonging to a chain of command or other hierarchical structure. If belonging to an organized group yields higher survival odds than rugged individualism over the course of human evolution, human nature might have come to include such a trait.

The latter view is supported by exit interviews of Milgram's subjects, which suggest that social psychology's agentic shift occurs because agents derive genuine utility from acting loyally, doing their duty, and living up to what is expected of them. This suggests that people gain utility from "being loyal," "doing their duty," and the like. This is consistent with a sort of "warm glow" people associate with the emotionally charged concepts "duty" and "loyalty."

5. Milgram's experiments show a slight attenuation of the agentic shift if the subject is physically separated from the authority figure, a marked attenuation if the subject observes dissenting peers, and a complete cessation of obedience if the subject observes conflict between rival authority figures. In the framework of the previous discussion question, these situations appear to erode the subjects' utility of loyalty by increasing degrees.

   In finance, the authority figure is the CEO, and social welfare might be advanced if cost-effective ways can be found to erode officers, directors, middle managers, and employees' loyalty to CEOs pursuing inept, unethical, or illegal strategies. Requiring that key board subcommittees meet with the CEO absent might create physical distance between the committee members and the CEO, and so might somewhat attenuate any agentic shift affecting them. Independent directors, if they truly owe nothing to the CEO, might serve as dissenting peers in board or board committee meetings. If independent directors voiced questions about questionable corporate policies, this might markedly attenuate any agentic shift pervading the boardroom and cause everyone present to weigh the consequences of alternative decisions for themselves. If an independent chair of the board, who truly owed nothing to the CEO, disagreed openly with the CEO, she might serve as an alternative authority figure in board meetings, and the disagreement might trigger a complete cessation of any agentic shift. This cessation would leave everyone in the boardroom bereft of the comfort of fitting into a chain of command and with no alternative but to bear the cognitive and other costs of weighing the two sides of the conflict.

   Of course, endless debate adds to decision-making costs, so the socially efficient outcome would be to entertain dissent up to the point where its costs outweigh its value added. Unfortunately, where this optimal point lies is very unclear. For example, a particularly vexing situation can arise if an employee, finding something seriously amiss, acts as a "whistleblower" and goes to the press or the authorities with evidence of corporate wrongdoing. Whistleblowers, often relatively powerless low-level employees, can face

harassment, persecution, or blacklisting, and many countries now have whistleblower protection laws. Though clearly necessary, such laws are sometimes criticized for giving too much power to malcontents, emotionally unstable employees, and even extortionists. This dispute highlights the problem of distinguishing constructive from destructive dissent.

Examples in other fields are abundant. In politics, democracies have an opposition party or parties and a designated leader of the opposition, whose duty is to criticize the policies of the government. In Westminster-style parliamentary democracies, the opposition parties are referred to as the "loyal opposition" and the leader of the largest opposition party is called the "Leader of the Loyal Opposition." The term "loyal" in this context reflects loyalty to the country and voicing ongoing and open criticism of the government is the way this loyalty is expressed.

In modern common-law legal systems, each attorney argues one side of the case. This places rival authority figures in front of the judge and jury, who should then be induced to consider the merits of the case themselves. In contrast, legal systems in China or Russia typically put a magistrate in charge of a courtroom. The state-appointed magistrate orders investigations, grills witnesses, and reaches a judgment—all without any dispute, except by defendants who protest innocence.

Academic researchers seeking to publish articles in prestigious scientific journals must cope with peer review. Journal editors send every potentially publishable submitted article to one or more other researchers in the authors' area. These peer reviewers are explicitly charged with exposing flaws in the research. The editor then weights the authors' claims against the criticisms of any dissenting peer and comes to a decision about publishing or rejecting the submitted article.

These examples from other fields suggest ways of effectively disengaging agentic shifts in finance. Perhaps a board of directors should have a "leader of the loyal opposition"—possibly a lead independent director charged with openly and continually questioning corporate decisions out of loyalty to the shareholders. Generally, a director moved to openly criticize corporate policies is expected to resign. Instead, such directors should be welcomed as ongoing members of the board. Perhaps boards confronted with difficult decisions should charge directors to act as adversaries, each doing her best to push for her assigned cause—just as rival lawyers each press their sides of the case. The full board might then come to a decision much as a jury does in a criminal case. Perhaps directors, concerned about a troubled direction corporate policies are taking, might hire independent consultants to serve a role analogous to the referees in academic peer review.

Of course, parliamentary democracies, common-law courts, and academic peer review all put limits on debate. Unending argument for the sake of argument likely adds little or nothing to the quality of the final decision, and the same is likely true in corporate boardrooms. Parliaments, courts, and editorial boards have all developed sophisticated checks and balances that help induce dispute if it is helpful and suppress dispute if it is not. Corporate governance reforms seek a better such balance in boardrooms.

CHAPTER 25 INITIAL PUBLIC OFFERINGS

1. This question relates to Miller's (1977) argument and the models of Derrien (2005) and Ljungqvist, Nanda, and Singh (2006). For the three components of the IPO puzzle to emerge from the model, there needs to be disagreement among investors (for instance, in the form of strong demand at high prices from sentiment investors) and short-sale constraints. For first-day returns to be high during periods of high sentiment, there needs to be another force that prevents issuers from setting the IPO price exactly where sentiment investors think it should be. This can come from institutional features of the IPO market. (In Chapter 25, see the "Optimistic Investors and IPO Underpricing" subsection for more details.)
2. If strong investor sentiment leads to overpricing in the stock market, it offers windows of opportunity to firms, which may respond by going public when they are overvalued. Therefore, time-varying investor sentiment can explain time-varying IPO volumes and in particular hot-issue markets. Alternatively, hot-issue markets can occur for fundamental economic reasons when a large number of firms in an industry or the entire economy needs to raise capital to finance their growth. In Pastor and Veronesi (2005), private firms hold an option to go public. When expected profitability is high, this option is more valuable and many firms decide to go public. Benveniste, Busaba, and Wilhelm (2002) show that hot-issue markets can also arise when underwriters bundle IPOs in order to share the costs of going public between many firms from the same nascent industry.
3. Auctioned IPOs are essentially IPOs where the role of the underwriters is limited. The question amounts to asking what role underwriters play in traditional IPOs in the presence of sentiment investors. There is robust evidence that during the dot-com bubble of the late 1990s, underwriters voluntarily underpriced IPOs, which is consistent with the predictions of the investor sentiment models presented in the chapter. Presumably, in the absence of underwriters, IPO prices would have been higher, which would have benefited issuers at least in the short run. This is true only if the presence of sentiment investors in the IPO process does not discourage informed investors from participating in the offering.
4. Retail investors should be excluded from IPO participation only if they affect the price discovery process in IPOs, for instance by discouraging institutions from participating in some IPOs. There is no evidence that this has been the case. This is not surprising given that at least in the theories of investor sentiment discussed in the chapter, all other actors of the IPO (issuers, underwriters, and institutional investors) benefit from the presence of sentiment investors. Retail investors are typically less sophisticated investors than institutions, and as such, they are probably more subject to sentiment. Hence, empirical studies on the impact of sentiment on IPOs have focused on the behavior of retail investors. However, there is no guarantee that all retail investors are sentiment investors and that none of the institutions are. In addition, retail investors are *de facto* excluded from IPO participation. In the typical IPO, the underwriters allocate most shares to institutions. The role of retail investors is limited to aftermarket trading but

may indirectly affect the IPO pricing decision, as in the models of investor sentiment discussed in Chapter 25.

CHAPTER 26 MERGERS AND ACQUISITIONS

1. There can be two related reasons. First, if $Q < P < S$, then target shareholders gain in the short run but lose in the long run. So, target managers with short horizons can profit by selling the shares they obtain in the exchange. Second, target managers can use the merger transaction as an opportunity to cash out of their illiquid stock and option holdings, and may also receive side payments from the bidder.

   Hartzell, Ofek, and Yermack (2004) study a sample of transactions between 1995 and 1997 and find that target chief executive officers (CEOs) receive special bonuses or increased golden parachutes as side payments from the merger. This finding suggests that target CEOs often have short horizons and prefer cash payments to long-run involvement in the bidding firms. Cai and Vijh (2007) find that target CEOs with a higher illiquidity discount of their stock and option holdings accept a lower premium, are less resistant to the bid, and leave more often after the acquisition. These findings offer support to the Shleifer and Vishny (2003) argument that target managers have short horizons and use takeovers as an opportunity to cash out.
2. A challenge for distinguishing between the misvaluation and the Q hypotheses is that both hypotheses share several implications on offer characteristics. Exhibit 26.1 summarizes the empirical findings of how bidder and target valuations affect offer characteristics. Although most of the findings are consistent with both hypotheses, three findings about acquirers' returns help to distinguish the hypotheses.

   The relation between bidder valuation and bidder announcement return helps to distinguish the misvaluation and the Q hypotheses. Under the Q hypothesis, offers by high valuation bidders should generate greater total gains from the takeover and therefore higher bidder returns. In takeover samples before 1990, Lang, Stulz, and Walkling (1989) and Servaes (1991) find evidence consistent with the Q hypothesis. Under the misvaluation hypothesis, however, the market should react negatively to equity offers because it overvalues the equity of the bidder more than the equity of the target. Alternatively, takeover offers may trigger more careful valuations of the bidder, and the prices of overvalued bidders should correct downward. The finding of Dong, Hirshleifer, Richardson, and Teoh (2006) that announcement returns are significantly lower for overvalued bidders supports the view that market misvaluation drives the takeovers in the 1990s.

   The high-valuation bidders, especially for bidders in the late 1990s, tend to have poor long-run stock performance, consistent with the misvaluation hypothesis.

   Savor and Lu (2009) find that the announcement effect of failed stock mergers is positive on bidder returns, which is consistent with the misvaluation hypothesis and inconsistent with the Q hypothesis. Under the Q

hypothesis, cancellation of value-enhancing mergers should have a negative impact on bidder value.

Overall, the bidder return evidence above gives support for the misvaluation hypothesis, especially for acquisitions in the 1990s.

3. Under the misvaluation hypothesis, overvalued stock bidders gain from acquiring less overvalued targets. Overvaluation also enables bidders to more easily raise capital to make cash offers (and so the relative bidder overvaluation can still be observed in cash offers), and cash bidders profit from acquiring undervalued targets.

   The evidence about whether bidders gain in the long run is controversial. Many studies find poor long-run performance after mergers, especially for bidders with high valuations (Loughran and Vijh, 1997; Rau and Vermaelen, 1998; Moeller, Schlingemann, and Stulz, 2005; Song, 2007; Fu, Lin, and Officer, 2009). A challenge is to identify the "without-acquisition" benchmark bidder return. Ang and Cheng (2006) and Savor and Lu (2009) offer evidence that bidders actually gain in the long run. Even if bidders do not gain from some takeovers, it is not necessarily evidence against the Shleifer and Vishny (2003) model that specifies the condition for the bidder to gain in the long run (i.e., $P < S$). Furthermore, agency theory can be incorporated into the misvaluation hypothesis: Some CEOs work for their shareholders, whereas others are self-serving (Jensen, 2005; Harford and Li, 2007). In the latter case, mergers may benefit the CEOs but not the shareholders of the bidding firms.

4. Testing theories about aggregate level merger activity is challenging for several reasons. First, there are much fewer data available at the aggregate market or industry levels than at the cross-sectional transactions level. Second, tests are sensitive to the classification of merger waves and market valuation levels. Third, aggregate level misvaluations may be correlated with macroeconomic or industrial shocks.

   Nelson (1959) observes that merger activity concentrates during times of high stock valuations when the means of payment is generally stock. The recent three merger waves of the 1960s, 1980s, and 1990s fit well with the Shleifer and Vishny (2003) framework. Verter (2003) provides more systematic evidence that merger volume increases with aggregate market valuation as well as dispersion in valuation, and periods of high levels of stock acquisitions are followed by low market returns. Lamont and Stein (2006) and Baker, Foley, and Wurgler (2009) offer further support to the theme that aggregate market valuation affects merger activity.

   On the other hand, Harford (2005) provides evidence that economic, regulatory, and technological shocks drive industry merger waves when there is sufficient overall capital liquidity. Once including the liquidity component, market-timing variables have little power to predict merger waves. Bouwman, Fuller, and Nain (2009), who study the characteristics of takeovers during high versus low market valuation periods, conclude that the long-run bidder underperformance following high valuation takeovers is consistent with managerial herding and inconsistent with market timing.

On the whole, the evidence suggests a strong possibility that market misvaluations affect aggregate merger activity, though other economic forces are also likely drivers of merger waves.

5. The Shleifer and Vishny (2003) (SV) model is based upon transactions between public firms. When both of the combining firms' stocks are traded, overvalued bidders buy relatively undervalued targets with stock, and bidders profit by acquiring undervalued targets with cash. One stylized fact is that stock bidders have lower announcement returns than cash bidders in public-public transactions. This is consistent with the SV model.

   In contrast, the means of payment in takeovers of unlisted target firms conveys very different information. Acquirers of private or subsidiary targets tend to have positive announcement returns even in stock acquisitions. Officer (2007) shows that unlisted targets are often sold at discounts. Fuller, Netter, and Stegemoller (2002) find that acquisitions of unlisted targets are associated with positive bidder announcement returns that generally increase with the target-bidder relative size, consistent with the view that unlisted targets are sold at bargain prices. Finally, Cooney, Moeller, and Stegemoller (2009) offer another explanation for the positive bidder wealth effect of the acquisition of private firms. In a sample of acquisitions of private firms with valuation histories, they find that the positive bidder announcement returns are mainly driven by targets that are acquired for more than their prior valuation, consistent with the prospect theory of Kahneman and Tversky (1979), which posits that a reference valuation point in the past can affect the current valuation. Presumably, the prior valuation point is particularly important in the valuation of unlisted targets for which stock prices are unavailable.

CHAPTER 27 TRUST BEHAVIOR: THE ESSENTIAL FOUNDATION OF FINANCIAL MARKETS

1. Trust has three characteristics. First, the trusting person (trustor) must knowingly make himself vulnerable to another person or institution (trustee). Second, the trustor must know the trustee is in a position to violate the trustor's trust and personally benefit from doing so. Third, the trustor must nevertheless expect that the trustee will not take advantage of him and violate his trust.
2. If the trustor is rational in believing that the trustee is trustworthy, trust is quite rational. The deeper question is whether it is rational to believe that another person might behave in an unselfish, trustworthy fashion. Although this idea is inconsistent with the *Homo economicus* account of all human behavior, it is amply supported by the empirical evidence on actual human behavior in trust games. So trust may often be rational.
3. Trust can be motivated by the selfish hope of personal gain. As discussed above, this is quite rational where the trustor reasonably believes the trustee is in fact trustworthy. As trust games indicate (and at least during some periods, in stock markets), trust can increase personal returns.

4. Without trust behavior, a securities market would likely be a thin shadow of its present self. Logic, introspection, and emerging macro data all suggest that trust is an essential ingredient to a large and thriving market.

CHAPTER 28 INDIVIDUAL INVESTOR TRADING

1. The major puzzle is why investors trade so much. The amount of trading is in excess of any traditional rational model predictions. In analyzing this trading, evidence shows that the puzzle is magnified by the fact that the trading generates lower returns than a buy-and-hold strategy. In addition to excessive trading, individuals exhibit the disposition effect, the local bias, and the slow pace in individual learning.
2. The two major categories of biases discussed in this chapter are overconfidence/self-attribution and heuristics. Overconfidence leads to excessive trading and risk taking. There are many types of heuristics such as salience, representativeness bias, and extrapolation bias. These heuristics influence investors' beliefs about risks and expected returns, lead them toward local firms and the disposition effect, and reduce their ability to learn from their mistakes.
3. The distribution of performance is generally poor compared to the market averages. The distribution allows for a small fraction of individual investors to beat the market, but much of this might be explained by luck. After accounting for transaction costs and appropriate risk attribution, the performance is even worse. One of the driving forces of this poor performance is that psychological biases frequently influence investors to make bad decisions.
4. The most obvious cost to trading is transaction costs. A less obvious cost that is consistent with traditional economic theory is opportunity costs. However, the costs of allowing one's psychological biases to influence investment decisions might be the highest cost.

CHAPTER 29 INDIVIDUAL INVESTOR PORTFOLIOS

1. The first such implication, which is known as the portfolio separation theorem, states that portfolio choice can be separated into two steps: (1) Choose an optimal risky portfolio and (2) allocate funds across risky and riskless portfolios. The optimal risky portfolio is well diversified and is the same for all investors regardless of risk tolerance. The second implication is that if the optimal risky portfolio has a positive risk premium, the investor should always allocate a positive amount to this portfolio.

   The first implication is inconsistent with empirically observed portfolios with substantial direct investments in stocks of only a few different companies. Investors often combine well-diversified investments in mutual funds with direct stock portfolios. The second implication is inconsistent with limited stock market participation, that is, the absence of investments in stocks or equity funds in portfolios of many households. This lack of

exposure to the stock market is concentrated among the poor households. However, many relatively wealthy and well-educated investors also choose not to invest in stocks.

2. While biases can help explain some aspects of investor behavior, they have several shortcomings. First, the biases have to be large to explain the observed portfolio allocations. Second, making quantitative predictions with regard to portfolio choice is difficult. Third, biases have to be persistent to survive market cycles and resist learning over long time periods. Finally, household characteristics significantly affect portfolio choice, which suggests a preference-based approach to explain portfolio choice is plausible.

   Participation costs can explain why many poor investors do not hold stocks. However, if cost was the complete story, then all investors below some wealth threshold would avoid stocks and all investors above that threshold would hold stocks. Empirical evidence shows limited participation across all wealth cohorts. The costs cannot account for the wealthier investors and households with existing investment accounts who choose to avoid stocks.

3. Rank-dependent utility and cumulative prospect theory include decision weights that may differ from the objective probabilities of outcomes. Experimental evidence indicates that events in the tails of the distribution are given higher weight than their objective probabilities. By emphasizing the tail events, these utilities make it possible to model simultaneously investor's concern with unfavorable outcomes in the left tail (risk aversion) and the desire of favorable high returns (risk seeking). As a result, the optimal portfolio predicted by these utilities includes diversified and undiversified segments, as observed in the data.

CHAPTER 30 COGNITIVE ABILITIES AND FINANCIAL DECISIONS

1. One approach is to allow investment experience and cognitive aging to affect the perceived costs of stock market participation. Specifically, young investors might avoid participating in the stock market because they are inexperienced while older investors might exit the stock market because their information-processing abilities and thus their stock selection skill have deteriorated. Therefore, a simple extension of limited participation models is to model the costs of participation as a U-shape function of age.

   A learning process can also be explicitly introduced in portfolio choice models in which learning depends on both age and experience. In particular, learning can be a concave function of experience that shifts downward as people age and their cognitive abilities diminish:

$$Learn = c_1 + c_2 f\left(\text{experience}\right), \quad c_1 = g\left(age\right), \quad \frac{\partial c_1}{\partial age} < 0$$

Learning is important because more experienced and knowledgeable investors can potentially estimate the distribution of asset returns better. For example, the level of learning can determine how precisely an investor estimates risk. The higher the level of learning, the more precise the risk estimates can be. This intuition can be incorporated into mean-variance optimization problems in which the investor's estimate of the variance-covariance matrix of returns is crucial.

2. Various aspects of the retail data set indicate that it is representative. First, consistent with prior evidence (e.g., Poterba, 2001), the mean portfolio size increases monotonically with age and there is no evidence that older investors reduce their exposure to equity as their investment horizon decreases. In fact, older investors have greater proportional investment in the stock market, both when measured as a proportion of their total wealth and their annual income.

   The cross-sectional variations in wealth and income in the sample also match well with corresponding cross-sectional variations in the more representative Survey of Consumer Finances (SCF) data. For instance, consistent with the evidence in Poterba (2001), the wealth level peaks within the age range of 65 to 69. Additionally, the annual income peaks within the age range of 47 to 52, which is also consistent with the predictions of the life-cycle models.

3. Korniotis and Kumar (2009) find that even if investors do not reduce their holdings of risky assets as they grow older, they shift their wealth into less risky assets. In particular, they estimate panel regression models to examine the characteristics of age-based group portfolios in a multivariate setting. In these regressions, the excess weight assigned to a stock in the aggregate group portfolio is the dependent variable, and the mean return, idiosyncratic volatility, skewness, kurtosis, and price of the stock are the primary independent variables. The excess portfolio weight allocated to stock i in month t is given by:

$$EW_{ipt} = (w_{ipt} - w_{imt})/w_{imt}$$

where w_{ipt} is the actual weight assigned to stock i in group portfolio p in month t and w_{imt} is the weight of stock i in the aggregate market portfolio in month t. The group portfolio is constructed by combining the portfolios of all investors who belong to a particular age group p. Additionally, in those regressions they include the following control variables to characterize investors' stock preferences: (1) market beta, which is also estimated using past 60 months of data, (2) firm size, (3) book-to-market ratio, (4) short-term momentum (past one-month stock return), (5) longer-term momentum (past twelve-month stock return), (6) an S&P 500 dummy that is set to one if the stock belongs to the S&P 500 index, (7) monthly volume turnover, and (8) annual dividend yield.

   The regression estimates indicate that older investors favor relatively less risky stocks than younger ones. Specifically, older investors' preferences for

stocks with higher idiosyncratic volatility, higher market beta, lower market capitalization, and lower prices are weaker than those of younger investors. Further, older investors exhibit weaker preference for stocks with higher skewness, which indicates they are less likely to chase extreme positive returns.

4. Korniotis and Kumar (2008) show that the SHARE-based model can predict the cognitive abilities of individuals in the 2004 Health and Retirement Study. Like the SHARE data set, the HRS data set contains information on the financial status for a sample of about 4,000 U.S. households who are over the age of 50. The 2004 HRS wave also includes direct cognitive abilities measures, which Korniotis and Kumar (2008) use to construct an out-of-sample test. For the test, they first use the SHARE-based model to obtain imputed smartness proxies for the individuals in the HRS sample using their demographic information. Then, the authors calculate the correlation between the imputed and actual smartness levels of the HRS individuals. They find this correlation to be high and above 50 percent. The outcome of this out-of-sample test is not surprising because the correlates of cognitive abilities have been shown to be similar across different countries and cultures.
5. To identify the component of the performance differential that can be attributed to each of the investor characteristics in the smartness proxy, Korniotis and Kumar (2008) estimate the distortion-conditional performance differentials when only subsets of investor attributes are used as proxies for cognitive abilities. The performance differentials are defined using characteristic adjusted returns.

   When Korniotis and Kumar (2008) use only income to define the cognitive abilities proxy, the performance differentials are positive ($\approx$ 2 percent) when portfolio distortions are high. The evidence is qualitatively similar, although somewhat weaker, when they use the social network proxy. In both instances, the estimates are either insignificant or statistically significant at the 0.10 level. When Korniotis and Kumar use the education proxy or age as the cognitive abilities proxy, the performance differential estimates are stronger (about 2.75 percent), and the statistical significance improves.

   Next, Korniotis and Kumar (2008) consider an equal-weighted linear combination of standardized income, education proxy, age, and social network, with a negative sign on age. In this case, they find that the performance differentials are higher when portfolio distortions are high ($\approx$ 3.25 percent). As expected, the imputed cognitive abilities measures obtained from the empirical model deliver the strongest result. The annualized characteristic-adjusted performance differentials corresponding to portfolios with high portfolio concentration, high turnover, and high local preference are 5.83 percent, 5.56 percent, and 5.77 percent, respectively. All three performance differential estimates are significant at the 0.05 level. This evidence indicates that, while the individual cognitive abilities determinants or their simple linear combination have the power to discriminate between informed and biased investors, the imputed values of cognitive abilities have considerably higher discriminatory power.

CHAPTER 31 PENSION PARTICIPANT BEHAVIOR

1. No consensus exists among experts about the answer to this question. Some believe that the documented lack of financial literacy (Lusardi and Mitchell, 2007) and numerous examples of behavioral biases in retirement decision making suggest that plan sponsors should automate plan decisions as much as possible to help participants avoid mistakes that hurt their ability to save for a financially secure retirement. They also point to the lack of interest (MacFarland, Marconi, and Utkus, 2004) among some participants as further support for their case.

   On the other hand, if individuals do not learn how to make sound investment decisions over their working careers, they will be ill-prepared to make financial decisions that they will face later in life. Currently, most retirement plans have not focused on simplifying or automating the distribution phase of retirement, so such a scenario is possible. Many experts believe that financial education with thoughtful plan design using automated elements is most optimal.

   Clearly, more work is needed in the financial education area to design and evaluate programs that are effective in improving participants' financial decision making. In addition, more research is needed to test whether individuals are less susceptible to behavioral biases in retirement decision making if they become financially literate and whether programs can be designed to overcome the lack of interest by some individuals. At that point, this question can be more easily answered.
2. How behavioral finance may relate to the annuity decision is a new and emerging area of research. Brown (2008) outlines several behavioral theories that may enhance understanding about the annuity puzzle. He offers several behavioral reasons, such as mental accounting, framing, loss aversion, regret aversion, and the illusion of control, to explain the low demand for this product. In addition, Hu and Scott (2007) show how cumulative prospect theory, loss aversion, and mental accounting can influence the demand for annuities. Agnew et al. (2008) and Brown et al. (2008) provide further evidence of the potential influence of framing.
3. Several theories have been proposed to explain why individuals would invest in their own company stock. Some of these theories include the familiarity bias (Huberman, 2001), loyalty (Cohen, 2009), endorsement effects (Benartzi, 2001; Brown et al., 2007), and excessive extrapolation (Agnew, 2006; Brown et al. 2007, Choi et al. 2004; Huberman and Sengmueller, 2004).
4. One of the most successful changes to plan design is the introduction of automatic enrollment. By changing the enrollment method from opt-in to opt-out, participation rates have increased substantially (Madrian and Shea, 2001). If people were investing rationally, this small change should have had no influence on participation, but it does. Some reasons this occurs is the status quo bias and procrastination. One drawback is that when individuals are automatically enrolled they often anchor to low default contribution rates and default investment vehicles that are too conservative.

   Another successful change in plan design is to have automated increases in savings through programs such as SMarT, which has also improved

savings outcomes (Thaler and Benartzi, 2004). Knowledge of investor psychology guided the design of this program. The architects, Richard Thaler and Shlomo Benartzi, overcome participants' self-control issues by relying on future lock-in. They also time contribution increases with pay raises to minimize loss aversion and allow inertia after joining the program to work in the participant's favor.

Carefully designed defaults are a third important plan feature. Individuals are prone to a default bias when participating and investing in their retirement plans. With this knowledge, plan providers can design plan defaults that are best suited for their type of participants.

Finally, although not without design problems, target date funds are theoretically a good investment vehicle for helping investors allocate their assets over the long term. These funds automatically rebalance, overcoming individuals' tendency toward inertia and the status quo bias.

CHAPTER 32 INSTITUTIONAL INVESTORS

1. Although finding outperformance by active investment managers is very difficult, sophisticated econometric techniques have recently revealed some evidence of such ability in mutual funds. A significant minority of hedge funds exhibit positive risk-adjusted performance as well. However, the lack of observed post-fee outperformance, on average, does not necessarily mean that investment managers do not possess ability. If the market for capital provision is competitive, this might be expected in equilibrium (Berk and Green, 2004). Furthermore, the investment behavior of institutions seems to indicate that they possess better information than individuals about the direction of future cash flows.

   Nevertheless, individual investors face a difficult choice when considering whether to delegate their portfolios because institutional investors charge high fees, which potentially eliminate the benefits from their superior investment ability. A reasonable solution to this conundrum may be to delegate the majority of a portfolio to a low-cost passive fund.
2. There are many risks embedded in hedge fund investments. One risk is that hedge fund returns appear to resemble those of out-of-the-money put options, that is, consistently positive during non-crisis periods and very high and negative during crises. Another is that investors often do not consider operational risks (the risk involved in the day-to-day business functions of the fund) when evaluating hedge fund investments. Investors, however, should consider operational risks because disregarding them can result in negative consequences. Investors do not seem to completely understand the investment strategies of hedge funds, especially given the lack of both transparency and mandatory reporting in these investment vehicles.
3. One difference between individual investors and institutional investors is the relatively greater average wealth available to institutions versus individuals. The greater wealth of institutions enables them to bargain harder with sellers of securities to reduce transaction costs. Another difference is the organizational structure of institutional investors, which may confer greater discipline on the investment processes. The point at which a group

of individuals effectively becomes an institution is unclear. If such cooperatives adopted rules and pooled their resources, they may be able to achieve some of the same benefits as institutional investors.

4. The aggregate share of the equity market owned by institutions has steadily increased over time and has surpassed 50 percent of the aggregate market in the United States. Whether this share will get to 100 percent is unclear, given an increasing prevalence of day-trading activity. The consequences for the dynamics of returns are also unclear. One possible scenario is that markets will become more efficient as a consequence of greater institutional ownership. Scholars should view this "more efficient" scenario critically in light of the observation that the behavior of capital flows to investment managers exerts a substantial influence on their investment decisions. Individual investors still ultimately dictate these capital flows.
5. Given that capital flows from individual investors exert a substantial influence on the investment decisions of fund managers, holding institutional investment managers completely responsible for occasionally behaving in a destabilizing fashion in asset markets would appear unreasonable. One innovation that hedge funds use to control this problem is to institute lock-up periods that prevent investors from withdrawing capital for predetermined periods of time. While this policy helps hedge funds control pressure for fire sales, it has also come under criticism from investors in those funds, especially during crisis periods.

CHAPTER 33 DERIVATIVE MARKETS

1. Futures traders who execute proprietary trades have often been seen as market makers. This goes back to the work of Working (1967), Silber (1984), and Kuserk and Locke (1993). Recent evidence such as that by Kurov (2005) and Locke and Mann (2005) shows that the trading strategies of floor traders is rather complex. Thus, unlike the constrained specialists on NYSE, the futures floor trader is simply a speculator. The trading is symmetric, and longs and shorts more or less equal in costs. Floor traders trade often, giving many observations over a brief period.
2. Frino, Johnstone, and Zheng (2003) and Locke and Mann (2005) both find evidence of the disposition effect. That is, futures floor traders who execute proprietary trades seem to hold onto losing trades longer than winning trades. Locke and Mann find no costs associated with this effect whereas Frino et al. find that losing trades that are held longer are profitable, on average, in the long run. Choe and Eom (2009) also find evidence of the disposition effect using account data on Korean index futures trading. Retail traders appear to have costs associated with the effect similar to Odean (1998). Haigh and List (2005) find that in a controlled experiment, some floor traders appear to be more subject to loss aversion than a sample of business students.

   Based on the large data sets used in Frino et al. (2003) and Locke and Mann (2005), the conclusion should be that Haigh and List's (2005) findings are due to the use of experiments rather than real-world data or possibly that these were brokers and not primarily locals.

3. The cumulative loss aversion tested by Coval and Shumway (2005). They find that when traders have losing mornings, they tend to trade irrationally in the afternoon. Traders execute more trades and more price setting trades on afternoons when they have morning losses. They execute trades at poor prices. Locke and Mann (2009) find that all of this is not necessarily the case. Indeed, they show that the *percentage* of price setting, or poorly executed trades, does not increase following morning losses. Locke and Mann offer an explanation of daily income targeting similar to the taxi cab literature where cab drivers adjust their schedule later in the day dependent on earlier incomes.
4. Loss realization aversion is the result of an "S"-shape utility function over changes in wealth as in Kahneman and Tversky's (1979) prospect theory. If a trader is holding a position and the position has a gain, the trader is likely to offset the trade immediately because there is little marginal utility to holding the trade longer and a large loss of utility should the price reverse. On the other hand, if the trader is holding a trade with a loss, the trader is likely to hold the trade because there is little loss in utility should prices fall further and a huge gain in utility should they reverse.

   Disappointment aversion incorporates loss aversion in an *ex ante* fashion. Thus, disappointment aversion influences the decision to open a trade instead of the decision to offset a trade. This may affect all traders, such as hedgers, when they open a trade. In the hedging literature, there is some discussion of optimal hedging. A disappointment-averse trader may better approach the optimal hedge compared to a risk-averse trader.

CHAPTER 34 THE ROLE OF CULTURE IN FINANCE

1. Cultures are established through common beliefs in a society. These common beliefs affect values that a society uses to develop laws and drive decisions made by managers and investors. This set of cultural beliefs and values also carries over to the development of institutions that enforce laws and drive the development of markets. Finally, there is an impact on the resource allocation within a country. The allocation of resources, which is affected by a country's culture, determines how and in what areas development will be focused. These areas could be those that are vital for economic development.
2. The "home bias" literature concerns the idea that investors overinvest in securities in the home country or region. This home bias holds both across countries and within a particular country where there is regional "local bias." The culture literature suggests that trust could potentially explanation home bias. Investors prefer to invest in securities that they trust and firms that are closer to their cultural beliefs and thus create a bias for investing in geographically close firms.
3. One perspective on the measurement of culture is to focus on the foundation of a cultural belief (religion, language, or ethnicity of a region) and how this may affect outcomes. One problem with this approach is that regions around the world are not homogeneous, which could be problematic for classifying countries. Another approach focuses on behavioral outcomes and how that behavior affects actions of the country or firm. A drawback with this

approach is what is being measured and how the behavior developed over time. The research normally uses the former for the theoretical foundation while using the latter for most of the empirical work on culture.

CHAPTER 35 SOCIAL INTERACTIONS AND INVESTING

1. Based on Hirshleifer and Teoh's (2003) taxonomy of herding shown in Exhibit 36.1, the group of investors can be said to be "herding." Unfortunately, the reason the investors tend to buy and sell together is unknown. They may be influenced by observing others, learning, or may be part of an information cascade. There may be network externalities and/or reputational concerns. Observing a group of investors buying and selling together is interesting but calls for further investigation.
2. Measuring information diffusion is very complicated because financial economists cannot view investors' information sets. One needs to measure changes in people's information sets as the information diffuses through a population. Two directions future research might follow are laboratory experiments and natural experiments. The former is potentially expensive, while the latter requires innovation. Devising ways to measure information diffusion is an open area of research.
3. This is currently an unanswered question. Ethnographic studies in sociology typically rely on interviews and in-depth case studies. While case studies are a popular teaching tool in business schools, top finance journals do not publish many papers based on case studies.
4. Just because net trades (buys-minus-sells) are not correlated with contemporaneous returns, one should not forget to check whether the trades are correlated with lagged and/or future returns. Correlation with future returns is especially interesting to financial economists. A positive correlation between net trades and future returns might indicate that the investors have value-relevant information. They buy before prices increase and sell before prices decrease.

   One could ask why there is no correlation with contemporaneous returns. Are frictions low? Or, one could ask why the investors are trading together. Is there a utility gain based on trading in the same directions as one's peers? Finally, checking what percentage of trades investors initiate may be worthwhile. If the majority of trades are initiated and the investors trade in the same direction, this might provide insights into how the investors process information and how they choose which stocks to buy.

CHAPTER 36 MOOD

1. A researcher could use individual investor data such as data from a stock brokerage, which provides sophistication information. Possible variables might include age, education, investment experience, and income or wealth. The researcher could then examine the trading behavior of investors during

different measures of sunshine in their area or the season. Thus, investor sophistication could be linked with susceptibility to mood.

2. National news results might also be good mood variables as long as they were news results that are unrelated to economic activity. Other mood variables might include the lunar cycle, days that include culturally lucky numbers, or holidays in which the market does not close, such as Valentine's Day.
3. Such a person should hold a combination of the traditional market portfolio and a portfolio that hedges changes in the weather. This would imply that stocks with greater sensitivity to changes in the weather might bear a weather risk premium. The weather hedge portfolio would increase the investor's wealth during periods of depressing weather, thus supporting the investor's well-being and reducing the volatility of the investor's utility.
4. Trading on moods is likely to be costly. Because mood variables predict returns, trading on moods affects moves in prices. When people are in a good mood and buying equities simultaneously, they push equity prices up, which may result in buying at relatively high prices. When they sell simultaneously, they sell at relatively low prices. This effectively makes their transaction costs high. If a trader can accurately predict fluctuations in mood, such as predicting the weather, this would reduce some of these costs.

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