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# Behavioral Finance

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## Abstract

Behavioral finance studies the application of psychology to finance, with a focus on individual-level cognitive biases. I describe here the sources of judgment and decision biases, how they affect trading and market prices, the role of arbitrage and flows of wealth between more rational and less rational investors, how firms exploit inefficient prices and incite misvaluation, and the effects of managerial judgment biases. There is a need for more theory and testing of the effects of feelings on financial decisions and aggregate outcomes. Especially, the time has come to move beyond behavioral finance to social finance, which studies the structure of social interactions, how financial ideas spread and evolve, and how social processes affect financial outcomes.

## 1. INTRODUCTION

The stock price of EntreMed jumped approximately 600% in one weekend following the re-publication of information that was already publicly available five months earlier about a new cancer drug (Huberman & Regev 2001). This violated the efficient market hypothesis, which asserts that prices accurately reflect publicly available information. The efficient market hypothesis is based on the idea that most, or at least the most important, investors are rational in processing information. Behavioral finance, in contrast, studies how people fall short of this ideal in their decisions and how markets are, to some degree, inefficient.

The rise of behavioral finance over the past three decades has been felt throughout finance and economics. Many scholars are now ready to entertain the consequences of either rational or irrational aspects of human judgment as relevant for the particular application at hand. This readiness is greatest for errors made by individual market participants; vigorous debate continues about how psychological bias affects price determination in large and liquid markets. Nevertheless, a modern understanding of the finance field requires grounding in psychological as well as rational approaches. Today many of the leading theories about such fundamental topics as investor behavior, the cross section of returns, corporate investment, and money management derive from psychological factors.

Psychology has identified various judgment biases that can affect financial decision making. Because psychological bias is the distinctive feature of behavioral finance, I organize this review by the type of bias (see also Shiller 1999). Also, rather than viewing the psychology of judgment and decisions as a congeries of inexplicable facts, I organize the discussion of biases around a relatively small number of underlying evolutionary and psychological roots. Then, I discuss financial theories founded on each type of bias and the evidence bearing on them.

Some fundamentals of behavioral finance do not inherently depend on the specific psychological source of bias. So I discuss separately the topics of how arbitrage and flows of wealth promote market efficiency, how firms induce or react to mispricing, and how investor sentiment affects security markets.

The main focus of this review is on the effects, individual or aggregate, of individual-level bias. The topic of social processes (see Section 8) deserves greater attention in finance and a separate review. Also, I do not go deeply here into distinguishing the effects of psychological bias from rational risk effects (see, e.g., the review of Daniel, Hirshleifer & Teoh 2002).

Some surveys focus more heavily on issues that cut across different psychological biases, such as limits to arbitrage (Gromb & Vayanos 2010), noise trading (Shleifer 2000), and how valuations affect corporate behavior (Baker 2009). For a greater focus on prospect theory, readers are referred to the excellent survey of Barberis & Thaler (2003); on neurofinance, Bernheim (2009); on experimental economics and asset markets, Smith (2008); on investments and asset pricing, Hirshleifer (2001); on behavioral corporate finance, Baker & Wurgler (2012); on behavioral accounting, Libby, Bloomfield & Nelson (2002) and Hirshleifer & Teoh (2009a); and on policy, regulation, or field experiments, Thaler & Sunstein (2008), Hirshleifer (2008), and Card, DellaVigna & Malmendier (2011).

## 2. MARKET MISPRICING, ARBITRAGE, AND FINANCIAL AGENTS

### 2.1. Arbitrage

Arbitrage is the purchase or sale of goods to profit from differences in effective prices across trading venues. The term is used broadly to refer to the exploitation of profit opportunities whenever

some assets are overpriced relative to others, on the basis of the idea that buying cheap assets and selling similar but expensive ones can yield a relatively low-risk return. In perfect markets, arbitrage opportunities are limited by the risk aversion of investors and the riskiness of trading the mispriced asset (DeLong et al. 1991).

An oft-neglected fact is that arbitrage is a double-edged blade that can make prices either more or less efficient. In asset market equilibrium under disagreement, price reflects a weighted average of beliefs. So both the irrational impellers of mispricing and the more rational correctors of it believe that they are performing profitable arbitrage against inefficient market prices. Whether greater arbitrage capital reduces mispricing therefore depends on whether this capital is wielded by smart investors—those who both are rational and, if money managers, are not pandering to the mistaken beliefs of irrational investors about what a profit opportunity is.

A powerful argument for why markets are often highly efficient is that in the long run wealth tends to flow to smart arbitrageurs, who end up dominating the market. However, irrational investors can earn higher expected profits than will rational ones by bearing higher risk (DeLong et al. 1991) or by inducing self-validating feedback into fundamentals (Hirshleifer, Subrahmanyam & Titman 2006). Alternatively, rationality can falter if investing success increases subsequent bias (Daniel, Hirshleifer & Subrahmanyam 1998; Gervais & Odean 2001).

If wealth does flow to smart investors, their influence on prices increases, owing to either credit constraints or decreasing risk aversion. However, this process is often slow, as strategy performance is typically a very noisy indicator of ability (Yan 2008). Meanwhile, new naive money flows into markets each day; the succession of generations reshuffles wealth and talent.

If irrational investors misvalue the idiosyncratic components of the fundamental payoffs of many securities, if markets are frictionless, and if rational and irrational investors all bet on many securities, then owing to the large number of bets, the flow of wealth becomes swift and almost sure. This causes rational investors to acquire all the wealth very quickly. However, if most investors only place active bets on subsets of securities, the rate of wealth flow can be modest, accommodating relatively substantial and persistent mispricing (Daniel, Hirshleifer & Subrahmanyam 2001). Market frictions such as transactions costs further widen the scope for persistent mispricing by limiting exchange and thereby slowing the flow of wealth from irrational to rational investors.

## 2.2. Financial Agents

It is usually supposed that institutional money managers and professional investment advisors are smart arbitrageurs, acting on behalf of less sophisticated individual investors. Sophisticated investors perform careful analysis to learn about biases of investors or consequent mispricing, and the insight derived thereby can be used to educate clients or to deploy client funds to achieve high returns. However, owing to conflict of interest, or to imperfect rationality of investment professionals, employing agents is an imperfect remedy for ignorance and folly. For example, institutional mandates such as avoidance of tracking error create incentives that constrain the ability to arbitrage certain kinds of mispricing (Baker, Bradley & Wurgler 2011). Furthermore, money managers often pander to investor irrationality to attract inflows.

This does not make financial advice and delegation pure evils. For example, in the model of Gennaioli, Shleifer & Vishny (2015), “money doctors” skim off some of the gains from investment, but still increase welfare by encouraging otherwise-distrustful individuals to participate in the market. As for whether the ability of irrational investors to hire exploitive agents improves the efficiency of prices, there is no general unambiguous answer. So optimism about the inevitability of reaching almost perfect market efficiency must be tempered by recognition that agents may

exacerbate investor bias. Furthermore, when, by chance, mispricing gets worse, smart arbitrageurs lose money on their existing positions and have more trouble raising funds. So corrective arbitrage pressure on price is weakest when it is needed the most (Shleifer & Vishny 1997).

Owing to heavier total pressure from irrational investors speculating about systematic factors, we typically expect greater mispricing of factors than of idiosyncratic payoff components, except for idiosyncratic opportunities that arbitrageurs simply do not notice (Daniel, Hirshleifer & Subrahmanyam 2001). For example, the book-to-market and accrual characteristics are associated with return comovement (Fama & French 1993; Hirshleifer, Hou & Teoh 2012), so if the value and accrual anomalies (both discussed below) represent mispricing, they are probably relatively hard to arbitrage away.

### 3. PSYCHOLOGICAL FOUNDATIONS

Because people need to make judgments and decisions quickly using limited cognitive resources, they necessarily use shortcuts (Simon 1956; Kahneman, Slovic & Tversky 1982), often called heuristics. All thinking builds on cognitive algorithms that operate automatically below the level of consciousness. The term heuristics encompasses innate and automatic processes as well as learned or consciously selected rules of thumb. Heuristics often work well within some domains and for some types of problems, but badly in others. Heuristic simplification implies more errors for decision problems that range farther from the types of problems that the human mind evolved to deal with in the ancestral past.

In dual-process theories of cognition, an automatic, nondeliberative system quickly generates perceptions and judgments; a slower, more effortful system monitors and revises such judgments as time and circumstances permit (Stanovich 1999, Kahneman 2011). Following Haidt & Kesebir (2010), I refer to the fast process as the intuitive system and the slow process as the reasoning system. Kahneman (2011) describes human thinking as largely intuitive and heavily influenced by the associations that are triggered by the presentation of a decision problem. People are overconfident that their intuitive way of thinking about a problem is correct; information that does not immediately come to mind tends to be completely neglected, a phenomenon that Kahneman calls WYSIATI (what you see is all there is).

Feelings provide the value weights assigned to possible outcomes to motivate decisions and actions. Affective reactions can also facilitate making fast use of urgent information about the environment (as in the affect heuristic) (Slovic et al. 2002). For example, a risky investment opportunity may trigger fear and, thereby, useful hesitation. However, feelings often short-circuit useful analysis, as with exiting the stock market in sudden panic or buying a hot stock on the basis of enthusiasm rather than critical evaluation. Such affective short-circuiting can also create self-discipline problems, such as not saving for retirement.

In modern financial markets, there are great benefits to making decisions analytically rather than relying solely on feelings and intuition. Intuition-generating mechanisms suited to the human ancestral environment provide poor guidance for decisions in modern markets and large economies. Beliefs have a social-signaling as well as a decision-making role. In the theory of Trivers (1991), people overestimate their personal merits so as to be more persuasive to others about them. Such self-deception comes at the cost of errors deriving from overconfident beliefs. The three abovementioned elements—heuristic simplification, affective short-circuiting, and self-deception—explain most of the psychological biases studied in behavioral finance. These elements also underlie the dynamic psychological updating processes that maintain biases despite having opportunities to learn from past errors.

## 4. OVERCONFIDENCE AND SELF-ESTEEM MAINTENANCE

### 4.1. Psychology of Overconfidence

I begin with the third element underlying psychological biases discussed above: self-deception. An immediate consequence of self-deception is that people will be overconfident about their merits of various sorts. In overprecision, people think that their judgments are more accurate than they really are. Overconfidence tends to be stronger when correct judgments are hard to form, such as when uncertainty is high. The difficulty effect is the finding that overprecision is stronger for challenging judgment tasks.

Recent studies both of overplacement (overestimation of one's rank in the population) in the psychological laboratory (Benoit, Dubra & Moore 2015) and the field (Merkle & Weber 2011) and of overprecision in financial field settings confirm that overconfidence is very strong (Ben-David, Graham & Harvey 2013). Because high ability contributes to good outcomes, overestimation of one's merits promotes overoptimism about one's prospects. People tend to be overoptimistic about their life prospects (Weinstein 1980), which affects their economic and financial decisions (Puri & Robinson 2007). If overconfidence is to persist as new information about ability arrives, there must be biases in updating processes that favor a positive self-assessment. Such self-enhancing attribution bias is well documented (Langer & Roth 1975).

People tend to shift their attitudes in favor of actions they have chosen or have been induced to engage in without compensation, a phenomenon that motivates the theory of cognitive dissonance (Festinger & Carlsmith 1959). Such shifts help people reconcile their past choices with the perception that they are good decision makers. Self-enhancing updating promotes escalation of commitment (sticking too stubbornly to a choice despite opposing information) (Staw 1976), including the sunk cost effect (reluctance to terminate costly activities after expending resources on them) (Thaler 1980), and rationalization of one's past behaviors (Nisbett & Wilson 1977).

### 4.2. Investor Overconfidence and Self-Esteem Maintenance

Overconfidence and the psychological mechanisms that maintain self-esteem can explain trading aggressiveness and patterns of overreaction and underreaction in stock prices. The following subsections describe how these psychological factors affect trading and prices in both static and dynamic settings, and how this can explain empirical patterns of return predictability. I also discuss how overconfidence together with market frictions can interact to create bubbles and how overconfidence affects firm and advisor behavior.

**4.2.1. Overconfidence and trading aggressiveness in static settings.** Overconfidence causes investors to trade more aggressively, which tends to reduce their welfare (Odean 1998). Overconfidence therefore helps solve the active investing puzzle: Individual investors trade individual stocks despite losing money doing so (Barber & Odean 2000), and they invest in active funds instead of indexing to obtain better net performance. Consistent with overconfidence, in experimental markets, some investors overestimate the precision of their signals, are more subject to the winner's curse, and do worse in trading (Biais et al. 2005).

By promoting bets on individual securities, overconfidence reduces diversification. However, as discussed below, underdiversification has other sources as well. So greater confidence, by encouraging participation in otherwise-neglected asset classes, can also promote diversification. Indeed, a greater feeling of competence about investing is associated with weaker home bias in investing (discussed below) (Graham, Harvey & Huang 2009).

**4.2.2. Overconfidence and price overreaction in static settings.** Overconfidence about some value-relevant information signal causes overreaction in prices and, therefore, long-run correction (Odean 1998). This implies negative return autocorrelations. Any psychological force that causes overreaction to information will tend to make high price be a proxy for overvaluation and low price for undervaluation. This leads naturally to the size (market value) effect. For example, overextrapolation of fundamentals or prices can cause such effects (Lakonishok, Shleifer & Vishny 1994).

Scaling by a proxy for fundamentals, such as book value, cleanses market price of variation not derived from mispricing. So in the overconfidence-based capital asset pricing model of Daniel, Hirshleifer & Subrahmanyam (2001), fundamental-to-price ratios predict returns even more strongly, if the fundamental proxy is not too noisy. Both capital asset pricing model beta and fundamental-to-price ratios such as book-to-market predict returns. Because price-related variables (often scaled by fundamentals) capture both risk and mispricing effects, they can sometimes dominate beta in return prediction regressions even when risk is priced. Empirically, high beta stocks underperform (Frazzini & Pedersen 2014).

Book-to-market is an example of how mispricing can be proxied by the deviation of market price from a benchmark that is less subject to misvaluation. Empirically, stocks with low price relative to fundamental proxies on average experience high subsequent returns. Such proxies include book value, earnings or cash flow (the value effect), past price (the winner/loser effect), or a constant (the size effect). The value effect has been confirmed in many markets and asset classes (Asness, Moskowitz & Pedersen 2013). Short-term interest rates can act as a fundamental scaling for long-term rates. So overconfidence further implies that the forward premium for bonds denominated in different currencies can negatively predict exchange rate shifts, an effect known as the forward premium puzzle (Burnside et al. 2011).

Further implications of overconfidence derive from comparative statics on its determinants. For example, the difficulty effect implies stronger overconfidence effects for hard-to-value stocks. Consistent with this, the value effect is stronger among high R&D stocks (Chan, Lakonishok & Sougiannis 2001); momentum is also stronger for hard-to-evaluate stocks (as indicated by uncertainty proxies) (Jiang, Lee & Zhang 2005).

**4.2.3. Bias in self-attribution and trading aggressiveness in dynamic settings.** In models of the dynamics of overconfidence, profits on an investor's existing long or short position increase confidence, resulting in greater subsequent trading aggressiveness (Daniel, Hirshleifer & Subrahmanyam 1998). Thus, for securities that are in positive net supply, high past returns should be associated with greater subsequent trading (Gervais & Odean 2001). Consistent with bias in self-attribution, trading activity by individual investors increases after they experience high returns (Barber & Odean 2002). Similarly, investor trading and market trading volume increase after high returns (Statman, Thorley & Vorkink 2006; Griffin, Nardari & Stulz 2007).

**4.2.4. Overconfidence, biased self-attribution, and price under- versus overreactions.** Bias in self-attribution implies short-run continuation of stock returns and long-run reversal. When a stock has risen, for example, relative to other stocks, this overreaction tends to continue in the short run, and, on average, the price later falls. However, this correction is hindered, so the decline on average tends to continue over a period of time. Thus, short-run return continuation and long-run reversal together are consistent with a process of continuing overreaction and then correction (Daniel, Hirshleifer & Subrahmanyam 1998). This model also implies post-event return continuation (post-event abnormal returns of the same sign on average as the event-date reaction) if firms tend to select good news actions in response to underpricing (as with issuing overpriced shares and repurchasing underpriced shares) and continuation after earnings surprises.

Empirically, a contrasting pair of stylized facts is the tendency of stock returns to continue in the short run (positive autocorrelations with a conditioning period of several months) (Jegadeesh & Titman 1993) versus a tendency to reverse in the long run (negative autocorrelations with a conditioning period of several years) (De Bondt & Thaler 1985). The short-run effect is called momentum, which is present in many asset classes in the time series (Moskowitz, Ooi & Pedersen 2012) and the cross section. The long-run reversal of returns is called the winner/loser effect.

Event studies typically report post-event return continuation, i.e., average post-event abnormal returns of the same sign as the event-date reaction, as summarized in Hirshleifer (2001). For example, seasoned equity issues as well as initial public offerings (IPOs) and debt issues tend to be followed by negative abnormal returns (the new issues puzzle) (Loughran & Ritter 1995, Spiess & Affleck-Graves 1995), and repurchase by high returns (Ikenberry, Lakonishok & Vermaelen 1995). Equity issuance is followed by low average market returns in many countries (Henderson, Jegadeesh & Weisbach 2006). At the aggregate level as well, the share of equity issues in total new equity and debt issues has been a negative predictor of US market returns (Baker & Wurgler 2000). Also consistent with overconfidence and bias in self-attribution, earnings surprises are associated with subsequent abnormal returns of the same sign (post-earnings announcement drift, discussed in Section 5).

The ability of overconfidence and its dynamic counterpart, self-attribution bias, to explain a wide range of major patterns of return predictability is notable, but it does not prove that overconfidence is the cause. Indeed, later sections discuss alternative possible psychological explanations for several of these effects. Distinguishing theories requires homing in on their distinctive implications.

**4.2.5. Overconfidence, short-sales constraints, and overpricing.** In the model of Miller (1977), owing to short-sale constraints, only relatively optimistic beliefs are impounded into price, resulting in overvaluation. Investors stubbornly disagree, although rationally optimists should update pessimistically given the knowledge that there are sidelined pessimists. Such disagreement can be explained by overconfidence on the part of optimists that their own analysis is superior or that disagreeing investors are rare (as in WYSIATI).

Empirically, dispersion of analyst forecasts is negatively associated with subsequent abnormal returns (Diether, Malloy & Scherbina 2002). Clear examples of overpricing derived from disagreement and short-selling constraints occurred during the millennial high-tech boom, when the market value of a parent firm was sometimes substantially less than the value of its holdings in one of its publicly traded divisions (Lamont & Thaler 2003). Also consistent with the Miller theory, stocks with tighter short-sale constraints have stronger return predictability anomalies (Nagel 2005) and greater long-short asymmetry in the accrual anomaly (Hirshleifer, Teoh & Yu 2011).

Volatility increases the scope for disagreement, implying greater overvaluation. Empirically, stocks with high idiosyncratic risk (Ang et al. 2006) underperform. In markets with short-sale constraints, investors may buy overvalued stocks in the expectation of selling at an even higher price to overconfident investors. Lower available float should exacerbate such bubbles (Hong, Scheinkman & Xiong 2006), as confirmed for a bubble in Chinese warrants (Xiong & Yu 2011).

### **4.3. Managerial and Advisor Overconfidence and Overoptimism**

Managers who are overconfident in their abilities will tend to be optimistic about their firms' prospects as well. In the model of Bernardo & Welch (2001), overconfidence has a bright side, as it encourages entrepreneurs to engage in socially desirable experimentation. Survey evidence confirms that entrepreneurs tend to be overoptimistic about their future success.

Overconfidence and overoptimism have obvious costs, but they can also help shareholders by encouraging risk-averse managers to take good risky or innovative projects (Campbell et al. 2011). This leads to a benefit to matching managerial optimism or confidence appropriately to firms (Goel & Thakor 2008). Different degrees of optimism between entrepreneurs and outside investors can result in inefficient screening of projects, creating a role for rational banks to act as a bridge between these two groups (Coval & Thakor 2008).

#### **4.3.1. Evidence on overconfidence, optimism, and investment and financing decisions.**

Several strands of evidence display both the bright and dark sides of managerial overconfidence and overoptimism suggested by theoretical models. On the dark side, bidders on average earn low returns from takeovers, more optimistic managers are more likely to make acquisitions, and the market reacts more negatively to their bids (Malmendier & Tate 2008).

Optimistic CEOs also use less external finance, especially equity (Malmendier, Tate & Yan 2011), and finance relatively more with short-term debt (Graham, Harvey & Puri 2013). The investment of firms with overoptimistic managers (as proxied by voluntarily retaining equity-like claims in the firm) is more sensitive to cash flow (Malmendier & Tate 2005). This suggests that such managers view their firms as undervalued, making external capital seem expensive to them.

Both overconfidence and overoptimism are associated with greater corporate investment (Ben-David, Graham & Harvey 2013). Potentially on the bright side, overoptimistic managers spend more on R&D and obtain more patents relative to their R&D spending, perhaps because of a greater willingness to bear risk (Hirshleifer, Low & Teoh 2012). The optimism of analyst forecasts at long horizons suggests either that analysts are overoptimistic or that they forecast optimistically for agency reasons (Richardson, Teoh & Wysocki 2004). The association of analyst political attitudes with forecast optimism suggests that psychological factors play a role (Jiang, Kumar & Law 2014).

**4.3.2. Dynamics of managerial and analyst confidence.** Turning to the dynamics of managerial bias, evidence suggests that managers tend to attribute good performance excessively to their own abilities rather than luck. Bias in managerial self-attribution has been found in the contexts of repeated acquisitions (Billett & Qian 2008) and in the issuance of management earnings forecasts after past successes (Hilary & Hsu 2011).

## **5. LIMITED ATTENTION AND COGNITIVE PROCESSING**

We next turn to another of the three elements underlying psychological bias: heuristic simplification. Owing to limited attention and processing power, people tend to neglect relevant information signals and strategic features of the decision environment. This is manifested in a variety of more specific effects described below, such as evaluation based on categories, the influence of framing and reference points on judgments, conceptual discretizing of continuous quantities, flawed tracking of costs and benefits in mental accounting, and the heuristic updating of beliefs.

### **5.1. Failure to Process Signals and Features of the Decision Environment**

People tend to neglect low salience signals and overreact to salient or recent news. Owing to WYSIATI, they also tend to be unaware of such errors and, hence, often do not correct them. People also neglect important features of their decision environments, such as strategic motives for the actions of others. Such neglect is reflected in cognitive hierarchy models, evidence in the

experimental game theory literature (Camerer, Ho & Chong 2004), and other models of neglect of strategic motives (Hirshleifer & Teoh 2003, Eyster & Rabin 2005).

**5.1.1. Financial theories of information neglect.** Information sources can be biased because of inherent psychological bias, infection by public excitement, or conflict of interest. When investors do not adjust appropriately for biased signal provision, trading mistakes and mispricing follow (see Section 7.2). In the models of Hirshleifer & Teoh (2003), Peng & Xiong (2006), and Hirshleifer, Lim & Teoh (2011), a subset of investors neglect a value-relevant information signal, resulting in return predictability. Examples of such signals include the deviation between generally accepted accounting principles and pro forma earnings, footnotes in financial statements about option compensation to managers, the breakdown of earnings between components with different value relevance (cash flows versus accruals), and earnings surprises.

Limited-attention theories imply positive abnormal returns after neglected good news and negative abnormal returns after neglected bad news. Firms can temporarily increase their stock prices through earnings management, and they presumably do so when the gains from having a high stock price are large. For two reasons, limited attention causes overreactions as well as underreactions. First, investors overreact to salient news. Second, neglect of earnings components implies overreaction to the less predictive component, accruals (Sloan 1996; Hirshleifer, Lim & Teoh 2011).

Hong & Stein (1999) study the interaction between news watchers who condition only on signals about future cash flows and momentum traders who condition only on a partial history of prices. The information possessed by news watchers is gradually incorporated into prices, and naive momentum trading causes trends to overshoot and later correct. This generates return under- and overreactions. Momentum is strongest among low-attention stocks owing to slower diffusion of information. Consistent with this prediction, Hong, Lim & Stein (2000) find that momentum is stronger for small stocks and stocks with low analyst coverage.

**5.1.2. Financial evidence on information neglect, salience, and distraction.** Many investors are naive in their financial beliefs and do not understand basic concepts such as equity or diversification (Lusardi & Mitchell 2011). Notably, there are (short-lived) episodes of extreme trading in response to egregious confusions between the abbreviated names of firms and the ticker symbols of other firms (Rashes 2001). Such episodes suggest that more subtle confusions are rife.

Section 1 provides an example of the high influence of salient news announcements. At the opposite extreme, there is severe neglect of nonsalient information, such as that contained in demographic predictors of shifts in product demand (DellaVigna & Pollet 2007). A venerable anomaly is the sluggish reaction of stock prices to earnings surprises and revisions in analyst forecasts of earnings, post-earnings announcement drift (Foster, Olsen & Shevlin 1984; Bernard & Thomas 1989). Both the fact that subsequent returns associated with earnings surprises are concentrated at later earnings announcements and that market reactions reflect naive seasonal random walk expectations support a limited-attention explanation.

Accruals, the accounting adjustments made to cash flows to obtain earnings, are less positive than cash flow as a predictor of profitability. Neglect of the distinction between these earnings components and of the incentives of managers to manage earnings causes accruals and their abnormal “managed” component to be negative predictors of returns, the accrual anomaly (Sloan 1996; Teoh, Welch & Wong 1998a,b). Accruals are also associated with bias in analyst forecasts (Teoh & Wong 2002).

The accrual anomaly is based on a comparison of two nonparallel quantities: earnings and cash flow. The cash analog to earnings is free cash flow, which is net of investment expenditures (just as

earnings is net of depreciation). So the deviation between cash and accounting profitability should be a better indicator than are accruals of misvaluation. Cumulating the deviations over time yields net operating assets, which is a much stronger return predictor than accruals (Hirshleifer et al. 2004).

Salience and distraction, by modulating investor attention, affect trading and mispricing. Several data confirm that information that is more salient or easier to process is incorporated more sharply into prices. The prices of country funds underreact to changes in the value of underlying assets, except when the news appears in the front page of the *New York Times* (Klibanoff, Lamont & Wizman 1998). Industry information is impounded into prices more rapidly in simple pure-play firms than in conglomerates that operate across industries (Cohen & Lou 2012).

Consistent with high salience of news media coverage and the Miller (1977) disagreement model, individual investors are net buyers of stocks that have recently gained media attention as well as stocks with high abnormal trading volume or extreme one-day returns (Barber & Odean 2008). Suggestive of gradual growth in net demand for stocks that have become the focus of investor attention, stocks with unusually high trading volume over a day or a week on average earn a return premium during the next month (Gervais, Kaniel & Mingelgrin 2001).

There should generally be greater resort to intuitive, heuristic thinking when an investor's attentional resources are depleted, such as when there is greater decision pressure or distracting news. The sensitivity of the market reaction to earnings surprises is weaker on Fridays when attention may be low (DellaVigna & Pollet 2009) and when the number of distracting same-day earnings announcements is large (Hirshleifer, Lim & Teoh 2009), resulting in correspondingly larger post-earnings announcement drift.

## 5.2. Neglecting Basic Features of the Decision Environment

Even professionals have cognitive constraints and rely on heuristics. For example, a survey of CFOs found use of naive capital budgeting approaches such as the payback criterion and the use of a single discount rate to evaluate very different kinds of projects (Graham & Harvey 2001). In narrow framing (Kahneman & Lovallo 1993), a decision problem is viewed in isolation from some of the factors that are relevant for it. For example, in Choi, Laibson & Madrian (2009), individuals neglected the employer-matching feature of contributions to their retirement plans, unless the decision problem was designed to force employees to make integrated decisions. Under narrow framing, the addition of each asset to a portfolio is evaluated on the basis of whether it is viewed as inherently good or bad instead of in terms of its diversifying contribution to the overall portfolio.

In fact, people tend to invest in excessively narrow sets of assets and asset classes. A notable stylized fact is that investors tend to eschew foreign securities, home bias (French & Poterba 1991, Tesar & Werner 1995). This effect is stronger for investors with lower cognitive abilities and financial literacy (Grinblatt, Keloharju & Linnainmaa 2011). Sections 4 and 6 discuss other reasons for underdiversification.

## 5.3. Financial Theories of Category Thinking

Behavioral explanations for comovement involve either irrational amplification of fundamental comovement or other kinds of misperceptions. In the former, overconfident investors who overreact to information about fundamental factors induce return comovement (Daniel, Hirshleifer & Subrahmanyam 2001). In the model of Hirshleifer & Jiang (2010), a factor portfolio is built by going long and short on misvalued firms, and a stock's factor loading measures the extent to which the firm inherits investor overreaction to fundamental factors. Such loadings are therefore proxies

for firm-level misvaluation. Empirically, there is comovement in stock returns associated with a misvaluation factor based on debt and equity issuance and repurchase; loadings on this factor are strong return predictors.

An alternative explanation for comovement in excess of fundamentals is that investors think heuristically about security categories. A basic mechanism of thought is classification; thus, instances can be evaluated on the basis of the features of their categories (see, e.g., Ashby & Maddox 2005). Such a heuristic is powerful, but flawed when categories are nonuniform.

In the style-investing model of Barberis & Shleifer (2003), assets that share a style comove more than would be implied by fundamentals. Shifting the category of an asset raises its correlation with its new style. Owing to style-based trading, style-level momentum and value strategies are predicted to be more profitable than their asset-level counterparts. Related implications can be derived in a model that focuses explicitly on constraints on investors' attention (Peng & Xiong 2006). Style investing can explain the temporary high returns of stocks following their S&P inclusion (Harris & Gurel 1986, Shleifer 1986), comovement of stocks that share styles such as size and book to market, and increased comovement of stocks that are added to the S&P 500 with existing index members (Barberis, Shleifer & Wurgler 2005). Both overreaction to fundamental factor signals and style investing imply comovement in excess of what would be expected rationally. Consistent with this implication, presumably naive retail investor trading is associated with return comovement (Kumar & Lee 2006).

#### 5.4. Reference Dependence and Framing

Cognitive processes are to some extent specific to the domain of the decision problem (Cosmides & Tooby 2013) and to the modality of presentation (graphical, numerical, or verbal; probabilities versus frequencies) (see, e.g., Gigerenzer & Hoffrage 1995). Even for particular decision problems and modalities, alternative descriptions of logically identical decision problems, such as the highlighting of a different reference for comparison of outcomes, have large effects on choices, a phenomenon known as framing (Tversky & Kahneman 1981). Optimizing based on deviations of payoffs from reference points (a key feature of prospect theory, discussed below in this section) implies framing effects, and therefore also implies choices that become inconsistent as changing presentations or circumstances cause reference points to shift.

Extensive evidence indicates that seemingly irrelevant reference points matter to investors and firms. Firms manage earnings to meet salient thresholds (forecasts or past earnings) (DeGeorge, Patel & Zeckhauser 1999), and stock prices react sharply to even a small shortfall. Firms' borrowing rates seem unduly influenced by previous rates (Dougal et al. 2015). Past stock price highs affect firm and investor behavior and predict future stock and market returns (George & Hwang 2004; Baker, Pan & Wurgler 2012).

When individuals do not have an answer to a decision problem, they often substitute the solution to a related simpler problem: Attribute substitution (Kahneman & Frederick 2002) can explain money illusion (Fisher 1928), wherein nominal, instead of real, prices are used for investment decisions. In this spirit, Ritter & Warr (2002) argue that mistaken discounting at nominal interest rates induced long US bear and bull markets as inflationary trends shifted.

#### 5.5. Conceptual Discretizing, Loss Aversion, and Probability Weighting

Expected utility theory cannot explain, with plausible levels of aversion to large risks, the degree to which people avoid small gambles (Rabin 2000). Termed loss aversion (Kahneman & Tversky 1979), this phenomenon has been modeled as a distaste for gambles whose payoffs sometimes fall

slightly short of a reference point. This suggests a kink in the value function at the reference point (as in prospect theory, discussed below) (but see also Gal 2006).

Empirically, loss aversion affects the trading decisions of professional investors (Coval & Shumway 2005). Economists have long strived to understand the high estimated premium of equity expected returns over bonds (Mehra & Prescott 1985). By increasing effective risk aversion, loss aversion offers a possible explanation for the equity premium and nonparticipation puzzles; shifts in loss aversion due to the house money effect can also explain high equity return volatility and the value effect in a cross section of returns (Benartzi & Thaler 1995, Barberis & Huang 2001; but see also Beshears et al. 2012). The equity premium over long-term bond yields has, however, been small for the past four decades (Welch & Levi 2013), which is consistent with this explanation if investors over time have started to understand that their loss aversion was excessive.

Loss aversion may reflect the use of a heuristic of discretizing continuous variables so that even a small loss is perceived to be essentially different from a small gain. I call this phenomenon conceptual discretizing, and it can also explain why individuals overweight fairly unlikely events yet underweight extremely unlikely ones (treated as “virtually impossible”). Such probability weighting is a key ingredient in prospect theory. In the model of Barberis & Huang (2008), probability weighting induces a demand for positively skewed lottery stocks. Alternatively, social interactions can induce such a demand even if investors have no direct preference for skewness (Han & Hirshleifer 2014). These approaches can explain the high investor demand for and low future returns experienced by positively skewed stocks (Boyer, Mitton & Vorkink 2010; Eraker & Ready 2015).

## 5.6. Mental Accounting and Realization Preference

Mental accounting is a system that people use to track their gains and losses relative to a reference point and to feel rewarded or punished for them. It involves narrow framing, wherein people separately optimize different kinds of gains and losses that are placed in different mental accounts. Investors reexamine each account intermittently for occasional action. Under mental accounting, people care about the labeling of payoffs by account, even when completely fungible across accounts, as this affects attribution as a gain or a loss. Narrow framing, reference dependence, loss aversion, and mental accounting are efficiently modeled as nontraditional preferences. However, all can be viewed as reflecting mistakes of analysis or belief, as when investors decide whether to sell a stock by focusing on its marginal return distribution without thinking about why they should care about covariance with their portfolios.

**5.6.1. Realization preference.** If selling a stock makes the incremental payoff in its mental account more salient, then investors should become more willing to realize realization preference as the net gain increases. Under loss aversion, this applies even to small gains and losses, implying a jump at zero, sign realization preference. Such behavior can enhance self-esteem, if it is easier to pretend that mere “paper” losses will be regained. In the model of Grinblatt & Han (2005), a greater willingness to sell above, rather than below, the purchase price causes price underreaction to news. Empirically, this effect helps explain return momentum. However, pure underreaction theories do not explain the evidence that momentum reverses in the long run (Griffin, Ji & Martin 2003; Jegadeesh & Titman 2011). In a test focusing directly on realizations, Lim (2006) finds that individual investors are more likely to sell losers, as opposed to winners, on the same day. This is consistent with the dual risk attitudes of prospect theory (risk loving in the loss domain, risk averse in the gain domain) together with realization preference.

The disposition effect is the strong and widespread regularity that the probability of an investor selling an asset conditional upon a gain is greater than it is conditional upon a loss (Shefrin & Statman 1985). This effect is often appealed to as strong evidence that psychological bias affects trading, yet which bias causes it is unknown.

Experimental and field evidence reveals a reverse disposition effect (selling losers) for delegated holdings in mutual funds. Reversal of the disposition effect when investors can assign blame to others suggests that the urge to maintain self-esteem is a key driver (Chang, Solomon & Westerfield 2014). A direct realization preference explanation for the disposition effect was suggested by Shefrin & Statman (1985) and modeled by Barberis & Xiong (2012). Other possible explanations derive from the dual risk preference feature of prospect theory; Barberis & Xiong (2009) point out limitations of this approach, whereas Henderson (2012) and Li & Yang (2013) describe conditions under which the prospect theory explanation can work.

There is evidence of neurological processes associated with realization preference (Frydman et al. 2014). However, discontinuity tests of US investor trades do not support sign realization preference and show that it is not the source of the disposition effect. Furthermore, the empirical V shape in probability of both selling and buying as functions of gains or losses suggests that realization preference is not the dominant motive for selling decisions in general (Ben-David & Hirshleifer 2012).

Contrary to common discussions, there is currently no strong empirical indication as to whether preference-based models or explicit belief bias models will offer a better explanation for the disposition effect. In empirical papers, explanations have typically been discussed in a static fashion. Recent models derive predictions that reflect the dynamics of trading with realization preference (Barberis & Xiong 2012, Ingersoll & Jin 2013).

**5.6.2. Prospect theory.** Reference dependence and loss aversion are ingredients in prospect theory (Kahneman & Tversky 1979, Tversky & Kahneman 1992), wherein individuals maximize a weighted sum across states of the world of value functions (utilities), value depends on gains or losses rather than levels, and the weights are functions of probabilities (as discussed above). Value is an S-shaped function of gain/loss (dual risk attitudes), resulting in risk aversion in the gain domain and risk seeking in the loss domain. Loss aversion is reflected in a kink in the value function at zero gain or loss. Financial theories and evidence based on the different ingredients of prospect theory are discussed above.

## 5.7. Heuristic Learning

I next turn to the psychology of belief updating in response to evidence. Heuristic learning mechanisms imply systematic errors in investor and manager beliefs and behavior. I also discuss the evidence from security trading and market prices that bears upon learning errors.

**5.7.1. Representativeness, hyperactive pattern recognition, and overextrapolation.** According to the representativeness heuristic (Kahneman & Tversky 1973), people assess the probability of a state of the world on the basis of how typical of that state the evidence seems to be. This is reasonable if typicality is a proxy for the conditional probability of the evidence given the state of the world. However, people should rationally adjust for the prior probabilities of the outcomes. In reality, people tend to underweight verbal statements about unconditional population frequencies in updating beliefs: Base-rate underweighting is another symptom of WYSIATI.

Furthermore, perceptions of how typical a piece of evidence is of a state of the world often poorly reflect its conditional probability. For example, error management theory holds that

the human mind evolved to overweight the probabilities of opportunities or dangers when the potential cost of neglect is high (Haselton & Nettle 2006). This suggests that people are subject to hyperactive pattern recognition. For example, people tend to overweight small samples when drawing inferences about distributions (the law of small numbers) (Tversky & Kahneman 1971). However, they also rely too little on large samples.

In financial markets, overextrapolation of security returns implies positive-feedback trading. In the model of DeLong et al. (1990b), exogenous positive-feedback trading causes overreaction and long-run return reversal, and it may also be the cause of short-run momentum. In the model of Barberis, Shleifer & Vishny (1998), conservatism bias (Edwards 1968), wherein individuals hold too tightly to estimates based on early observations, causes short-term underreaction to earnings news (consistent with the post-earnings announcement drift anomaly). Owing to the representativeness heuristic, if sequences of good earnings news occur, then investors fixate on this pattern and overreact. This combination of effects generates return momentum and reversal as well as an overreaction/reversal pattern in response to trends in public value signals (e.g., earnings news sequences). Empirically, investors naively extrapolate in experimental markets, surveys, and field studies, and in various investments (e.g., Smith, Suchanek & Williams 1988). There is less support for overreaction to trends in public financial signals (Chan, Frankel & Kothari 2004; Daniel & Titman 2006).

**5.7.2. Reinforcement learning.** Under reinforcement learning, individuals extrapolate only from their own direct experience and without properly reflecting on the informativeness of the data. There is financial evidence that investors learn to make financial decisions via naive reinforcement. Investors overextrapolate their own past performance in making investment choices (Choi et al. 2009; Chiang et al. 2011). Furthermore, past life experiences also affect both investor and managerial decisions (Greenwood & Nagel 2009; Malmendier, Tate & Yan 2011).

**5.7.3. Inertia and habits.** People easily lock into habits and rely on them with little thought. This leads to big mistakes when circumstances change. However, when there is memory loss about the reasons for past decisions and if an environment is reasonably stable, relying on habits is constrained optimal (Hirshleifer & Welch 2002). Action-induced attitude changes, as with cognitive dissonance and the sunk cost fallacy, can also induce inertia. Empirically, retirement investors seldom update their portfolios as conditions change (Choi et al. 2004). The status quo bias (Samuelson & Zeckhauser 1988), a preference for the default choice among a set of options, also economizes on the reasoning system's slow, effortful cognition. For example, defaults for pension plan contributions and allocations have large effects on investment decisions (e.g., Madrian & Shea 2001).

## 6. FEELINGS

Turning to the last of the three elements of psychological bias mentioned above, feelings are a key source of the quick assessments provided by the intuitive system and can overwhelm cooler analysis. For example, people who plan to consume sparingly may be later tempted to consume heavily, resulting in time-inconsistent choices. This shows how immediacy can intensify the effects of feelings. People who foresee this can gain by imposing consumption rules upon themselves (Ainslie 1975).

Present-biased decision making (quasi-hyperbolic discounting) (Laibson 1997) has been applied in models of savings, liquidity premia, and the equity premium puzzle. To resolve the time inconsistency of such preferences in favor of saving more, people impose personal rules such as

consuming only out of interest and dividends, not principal (Thaler & Shefrin 1981). This can explain the preference of investors for cash dividends (Shefrin & Statman 1984).

People often misattribute arousal and other transient feelings to other sources, thus biasing their judgments (Schwarz & Clore 1983). Good mood increases optimism and risk taking (Kuhnen & Knutson 2011). The feeling's type, not just its valence, matters. For example, people tend to be more pessimistic and risk averse when fearful and more optimistic and risk tolerant when angry (Lerner & Keltner 2001).

### **6.1. Familiarity and Liking**

Repeated exposure to an unreinforced stimulus tends to make people like it more, a phenomenon known as the mere exposure effect (Bornstein & D'Agostino 1992). The evolutionary basis for this may be that what is familiar tends to be understood better, thus reducing risk. Alternatively, experience of a stimulus without adverse consequences may indicate low risk. Indeed, familiarity reduces feelings of risk (Weber, Siebenmorgen & Weber 2005). However, the familiarity heuristic can go astray, as when people prefer to bet on a matter about which they feel expert instead of on another precisely equivalent gamble (Heath & Tversky 1991).

The endowment effect (Kahneman, Knetsch & Thaler 1990) is a preference for retaining what one has over exchanging for a better alternative (as with refusing to swap a lottery ticket for an equivalent one plus cash). A possible explanation is loss aversion. Alternatively, an already-owned good may be affectively attractive by virtue of sense of ownership. Ambiguity aversion is a distaste for layered gambles relative to single-stage gambles with identical payoff distributions (Ellsberg 1961, Bossaerts et al. 2010). For example, investors may dislike uncertainty about the structure of a financial market, as opposed to solely disliking the risk associated with a future state realization given that particular structure.

### **6.2. Financial Theories Based on Feelings**

Financial theorizing about feelings has been mostly informal (but see Mehra & Sah 2002), which is surprising given their psychological importance. A basic theme is that mood swings affect optimism, risk tolerance, and market prices. Owing to misattribution of transient moods to long-term prospects, mood swings associated with weather or sports events can affect prices (as documented in Saunders 1993, Hirshleifer & Shumway 2003, Edmans, García & Norli 2007). Seasonal shifts in length of day can induce seasonal affective disorder and are correlated with market returns (Kamstra, Kramer & Levi 2000).

Skepticism about the foreign and unfamiliar offers an explanation for the failure of investors to participate in important asset classes. Models of ambiguity aversion can help explain nonparticipation and familiarity bias as well as their effects on asset pricing (Chen & Epstein 2002, Cao et al. 2011). Such models may provide an affective interpretation. Feelings of envy may also help explain the attractiveness of investments with lottery payoffs, as individuals hear about high payoffs obtained by others. In the model of Goel & Thakor (2010), managers' takeover decisions are influenced by feelings of envy toward other managers, resulting in merger waves.

### **6.3. Evidence on Financial Effects of Familiarity and In-Group Bias**

People prefer local and familiar investments, such as those in firms of which they are customers (Grinblatt & Keloharju 2001, Huberman 2001). One, though not the only, reason is that investors may have superior information about local or familiar firms (Coval & Moskowitz 1999). At the cost of poor diversification, employees also invest in their own firms without showing signs of

superior information (Benartzi 2001). Furthermore, informational superiority seems an unlikely explanation for home bias exhibited by great masses of unsophisticated investors.

In-group bias (belief in the superior merits of one's own group), which is relatively neglected in analytical modeling, implies bias in financial investing and economic exchange in favor of one's own culture. Several studies provide supporting evidence of this phenomenon (Grinblatt & Keloharju 2001). Consistent with in-group bias and with theories based on aversion to uncertainty or unfamiliarity, distrust is an important barrier to participation in the stock market (Guiso, Sapienza & Zingales 2008) and to exchange and investment between countries (Guiso, Sapienza & Zingales 2009). More generally, familiarity and in-group biases are sources of underdiversification, a problem to which unsophisticated investors are especially subject (Goetzmann & Kumar 2008).

#### **6.4. Sentiment, Shifting Optimism, and Risk Tolerance**

Investor sentiment is the fluctuating general attitude toward investment categories, such as growth stocks or long-term bonds. It can be associated with shifts in assessments of expected returns or of risk. Waves of irrational enthusiasm for, or abhorrence of, certain investment characteristics derive from shifts in the salience of emotional or cognitive triggers in the economic environment. Self-reinforcing social processes induced by media bias or conformity effects can magnify such shifts.

In the model of DeLong et al. (1990a), irrational noise trading induces fluctuations in the price of an asset with risk-free dividends. Short horizons of rational risk-averse investors prevent full arbitrage between this asset and an asset with identical dividends that is not subject to noise trading. Their theory implies that the speculative asset trades on average at a discount relative to fundamentals as compensation for its excess volatility.

Lee, Shleifer & Thaler (1991) more broadly suggest that closed-end funds, like other small stocks, are subject to noise trading, so that irrational trading induces premia or discounts relative to the price of their underlying assets. Consistent with a risk discount for stochastic fund premia, funds trade on average at discounts relative to their holdings. Furthermore, discounts and premia comove across funds and with the returns on small stocks in general, which suggests that sentiment exerts a common influence among naive individual investors.

If sentiment induces mispricing, then sentiment measures should predict future abnormal returns. Empirically, US closed-end fund discounts and premia predict future small stock returns (Swaminathan 1996). However, in distinguishing the pricing effects of sentiment from the pricing effects implied by other hypotheses, it is useful to employ measures of sentiment that are not based on market prices (Qiu & Welch 2006). When several sentiment proxies are low, stocks that are hard to value and arbitrage earn high subsequent returns (Baker & Wurgler 2006). High sentiment increases the profitability of the short legs but not the long legs of cross-sectional return anomalies (Stambaugh et al. 2012).

Measures of global sentiment negatively predict country-level returns. Both global and local sentiments are stronger return predictors for stocks that are hard to value and to arbitrage (Baker, Pan & Wurgler 2012). Shifts in market sentiment create incentives for interested parties to incite misvaluation. In the theory of Baker & Wurgler (2004), managers cater to investor preferences for or against dividends. When stock price premia on payers are high, firms start paying dividends to incite higher valuations. Consistent with this prediction, when sentiment favors dividends more, nonpayers tend to initiate dividends.

### **7. FIRM BEHAVIOR: EXPLOITING VERSUS INCITING MISVALUATION**

Fundamental for understanding firm behavior in inefficient markets is a distinction between exploiting (an action taken in response to a preexisting level of mispricing) and inciting (an action

designed to shift the level of mispricing) (Hirshleifer 2001). Inciting takes advantage of the function describing the relation between market price and the firm's action. It encompasses actions taken to shift mispricing either upward or downward.<sup>1</sup>

To illustrate this distinction, consider a firm that issues equity to exploit preexisting overvaluation. Owing to the negative average reaction to the announcement, a reduction in overvaluation tends to result. However, this reaction will normally be considered an unavoidable adverse side effect from the firm's viewpoint, in which case it is not incitement. In contrast, a repurchase can be incitement if its purpose is to induce higher valuation (rather than merely distributing cash or profiting from purchasing underpriced shares).

Upward earnings management designed to induce overvaluation (or eliminate undervaluation) is also incitement. Most financial executives in one survey reported that they would sacrifice economic value to avoid missing quarterly earnings forecasts (Graham, Harvey & Rajgopal 2005). Similarly, managing earnings downward with the purpose of reducing the stock price (e.g., to persuade potential competitors that the business is unprofitable or to reduce the cost of share repurchase) is downward incitement. Verbal communication, such as misleading disclosures and discussions with media and analysts (typically upward hype), can also be used to incite misvaluation.

### 7.1. Theories of Exploitive Advisors and Firms

Section 5 notes how neglect of public signals results in return predictability based on accounting information. Thus, manipulation of disclosures can incite over- or undervaluation (Hirshleifer & Teoh 2003; Hirshleifer, Lim & Teoh 2011). Stein (1996) models the exploitation of exogenous stock market mispricing by firms in their financing and investment decisions. In Stein's model, misvaluation has a greater effect on real investment decisions when managers have short time horizons. As a result, firms should sometimes paternalistically discount using beta even when beta is not a return predictor. In Daniel, Hirshleifer & Subrahmanyam (1998), firms select new issues and repurchase amounts as a function of mispricing to exploit investor overconfidence. This implies positive abnormal returns after repurchase and negative returns after new issues.

When a firm is first going public, it can raise capital more profitably when investors are optimistic. Ljungqvist, Nanda & Singh (2006) model the exploitation of individual investor optimism in IPOs. Cornelli, Goldreich & Ljungqvist (2006) provide evidence that institutional investors and underwriters exploit misvaluation of IPOs by individual investors.

Investors with limited attention will sometimes overlook opportunism. For example, if investors evaluate bonds heuristically based upon bond ratings while neglecting risk in the form of correlation of bond payoffs with economic catastrophe, then intermediaries have an incentive to design bonds with high ratings and high catastrophe correlation (Coval, Jurek & Stafford 2009). Another way to exploit customers is to add complexity. In the model of Carlin (2009), intentionally added complexity of financial products results in equilibrium price dispersion among competing providers. Exploitation and incitement can have adverse macroeconomic effects as well. In the theory of Gennaioli, Shleifer & Vishny (2012), intermediaries design securities that seem nearly risk free to take advantage of investor neglect of nonsalient risks, resulting in booms and crashes.

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<sup>1</sup>In contrast, catering (Baker & Wurgler 2012) is defined as an action taken to increase price above fundamental value. It is also common to distinguish inciting or catering from timing, wherein a firm is sure to undertake an action but uses discretion as to when. Timing is a form of exploitation in the terminology here. However, this is not an exhaustive partition of cases: A firm can exploit in its choice of whether, rather than when, to take an action. Post-event return drift is often interpreted as timing without consideration of this very plausible possibility. More importantly, the possibility of incitement of misvaluation is often ignored in favor of timing in response to preexisting misvaluation.

## 7.2. Evidence on Exploitive Advisors and Firms

Evidence suggests that investors are overly credulous about the strategic incentives of information sources, leaving them vulnerable to manipulation by firms, advisors, and intermediaries (such as analysts, brokers, and money managers). Daniel, Hirshleifer & Teoh (2002) argue that credulity derives from limited attention and overconfidence and that it explains a wide range of financial behaviors and pricing anomalies. Jensen (2005) argues, for example, that firm overvaluation promotes exploitive behavior on the part of managers. For example, evidence suggests that investors are naive about the strategic behavior firms employ in their financial reporting. Issuers manage earnings upward at the time of IPO and seasoned issue. Greater upward management is also associated with worse post-event average abnormal returns (Teoh, Welch & Wong 1998a,b), suggesting that firms successfully incite overvaluation prior to issue, rather than just exploiting preexisting misvaluation.

As mentioned above, analyst forecasts do not discount adequately for earnings management. Furthermore, evidence suggests that investors are naive about analyst incentives to bias forecasts (Richardson, Teoh & Wysocki 2004) and recommendations (Malmendier & Shanthikumar 2007). Investors seem to be credulous about the strategic motives of managers in various other contexts as well: For example, investors may trust that name changes are indicative of firm and fund policies (Cooper, Gulen & Rau 2005), that fund marketing expenses are unimportant (Barber, Odean & Zheng 2005), and that broker-recommended funds are superior (Guercio & Reuter 2014).

The theoretical models of financing in inefficient markets discussed above predict abnormal returns after new issues and repurchase because firms sell their shares when overpriced and buy them back when they are underpriced. Consistent with firms exploiting overvaluation by using securities, return continuation occurs after new issues and repurchase (see Section 4). In general, the occurrence of an event can predict subsequent abnormal returns either because existing mispricing is exploited or because the event incites mispricing. Thus, post-event abnormal return evidence does not, in itself, establish whether overvaluation causes issuance, whether issuance causes overvaluation, or whether other actions associated with issuance cause overvaluation (e.g., earnings management inciting overvaluation at the time of issue). These distinctions are often overlooked.

## 7.3. Misvaluation, New Issues and Repurchase, and Post-event Returns

Several studies point more specifically to exploitation of preexisting overpricing as part of the explanation for corporate actions. Surveys of US CFOs find that misvaluation of their firms' stocks is an important factor in deciding whether to issue equity and that CFOs try to time interest rates in issuing debt (Graham & Harvey 2001). Furthermore, measures of prior misvaluation based on the deviation of price from contemporaneous fundamentals are associated with subsequent new issuance of debt and of equity in particular, especially among overvalued firms (Dong, Hirshleifer & Teoh 2012).

Investment and growth-related measures are negative predictors of abnormal stock returns (Titman, Wei & Xie 2004; Cooper, Gulen & Schill 2008; Polk & Sapienza 2009). Such evidence does not resolve whether investment induces overvaluation (either as incitement or as an unintended side effect) or whether investment choices exploit preexisting misvaluation. Evidence that higher levels of discretionary accruals are associated with greater investment is consistent with incitement. However, consistent with exploitation also playing a role, proxies for prior misvaluation predict investment (Gilchrist, Himmelberg & Huberman 2005).

Misvaluation can also affect takeover behavior. In the model of Shleifer & Vishny (2003), overvalued bidders use equity and undervalued bidders pay cash. Loughran & Vjih (1997) find

negative post-event abnormal returns to stock acquirers, which is potentially consistent with (but not proof of) misevaluation affecting takeover behavior. Proxies for misvaluation are also associated with the use of equity as payment, transaction characteristics, and market reactions to announcement in ways largely consistent with the model of Shleifer & Vishny (2003) (Ang & Cheng 2006, Dong et al. 2006). Rhodes-Kropf, Robinson & Viswanathan (2005) also provide evidence of valuation (though not necessarily of mispricing) effects.

## 8. CONCLUSION: BEHAVIORAL FINANCE AND SOCIAL FINANCE

I close with suggestions for future research. First, given the large grab bag of possible behavioral biases to choose from, building a financial model by assuming some behavior that seems plausible, or even by invoking a documented psychological bias, is not always compelling. A healthy nascent trend in behavioral economics and finance has been to run laboratory and field experiments that closely match the decision environment assumed in the financial model.

Second, the affective revolution in psychology of the 1990s, which elucidated the central role of feelings in decision making, has only partially been incorporated into behavioral finance. More theoretical and empirical study is needed of how feelings affect financial decisions, and the implications of such effects for prices and real outcomes. This topic includes moral attitudes that infuse decisions about borrowing/saving, bearing risk, and exploiting other market participants.

Third, behavioral finance should continue its evolution from broad descriptions of imperfect rationality and its consequences, such as noise trading or sentiment, to analysis of particular psychological biases or categories of effects (e.g., overestimation of mean payoff, underestimation of risk, or shifting risk preferences). Doing so will naturally draw more focused attention to specific pathways of causality, thereby helping to address endogeneity issues in some tests of the effects of sentiments or the media.

Most importantly, there is a need to move from behavioral finance to social finance (and social economics). Social finance includes the study of how social linkages affect information flows in securities markets (Cohen, Frazzini & Malloy 2010; Ozsoylev et al. 2014), how social norms, moral attitudes, religions, and ideologies affect financial behaviors (Hilary & Hui 2009; Hong & Kacperczyk 2009; Kumar 2009; Kumar et al. 2011; Hong & Kostovetsky 2012; McGuire, Omer & Sharp 2012; Hutton, Jiang & Kumar 2014) and of how ideologies that affect financial decisions form and spread. This enterprise will draw on social psychology and sociology as well as cognitive psychology and decision theory and will require focused attention to the microstructure of social transactions.

Previous research has documented the spread of investment and managerial behaviors through observation of public behaviors or through social networks (see, e.g., the review of Hirshleifer & Teoh 2009b). However, mere contagion is consistent with the spread of almost any behavior. To derive richer implications, it will be crucial to understand the transmission biases and amplification processes that make some investment ideas spread more easily than others. For example, the survey evidence and discussions of Shiller (2000) provide an initial set of leads. Recent research has begun to model social transmission biases (Han & Hirshleifer 2015) and test for their financial effects (Kaustia & Knüpfer 2012, Simon & Heimer 2014).

Analysis of social interactions promises to provide greater insight into where heuristics come from (because they are far from entirely innate) and to offer a foundation for understanding shifts in investor sentiment. As such, it can potentially offer a deeper basis for understanding the causes and consequences of financial bubbles and crises as well as the role of both media and individual-level interactions. Even more fundamentally, understanding how financial ideas spread may eventually suggest theories of how investment and corporate ideologies, such as value versus

growth philosophies or the belief that indebtedness is bad, evolve. Behavioral finance has focused primarily on individual-level biases. Social finance promises to offer equally fundamental insights and to be a worthy descendant of behavioral finance.

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# Contents

Finance, Theoretical and Applied <i>Stewart C. Myers</i> .....	1
Consumption-Based Asset Pricing, Part 1: Classic Theory and Tests, Measurement Issues, and Limited Participation <i>Douglas T. Breeden, Robert H. Litzenberger, and Tingyan Jia</i> .....	35
Consumption-Based Asset Pricing, Part 2: Habit Formation, Conditional Risks, Long-Run Risks, and Rare Disasters <i>Douglas T. Breeden, Robert H. Litzenberger, and Tingyan Jia</i> .....	85
Behavioral Finance <i>David Hirshleifer</i> .....	133
Contributions to Defined Contribution Pension Plans <i>James J. Choi</i> .....	161
The Value and Risk of Human Capital <i>Luca Benzoni and Olena Chyruk</i> .....	179
Asset Price Bubbles <i>Robert A. Jarrow</i> .....	201
Disaster Risk and Its Implications for Asset Pricing <i>Jerry Tsai and Jessica A. Wachter</i> .....	219
Analytics of Insurance Markets <i>Edward W. Frees</i> .....	253
The Role of Risk Management in Corporate Governance <i>Andrew Ellul</i> .....	279
The Axiomatic Approach to Risk Measures for Capital Determination <i>Hans Föllmer and Stefan Weber</i> .....	301
Supervisory Stress Tests <i>Beverly Hirtle and Andreas Lebnert</i> .....	339
Financial Stability Monitoring <i>Tobias Adrian, Daniel Covitz, and Nellie Liang</i> .....	357

An Overview of Macroprudential Policy Tools <i>Stijn Claessens</i> .....	397
A Review of Empirical Research on the Design and Impact of Regulation in the Banking Sector <i>Sanja Jakovljević, Hans Degryse, and Steven Ongena</i> .....	423
Financing Innovation <i>William R. Kerr and Ramana Nanda</i> .....	445
Peer-to-Peer Crowdfunding: Information and the Potential for Disruption in Consumer Lending <i>Adair Morse</i> .....	463
Hedge Funds: A Dynamic Industry in Transition <i>Mila Getmansky, Peter A. Lee, and Andrew W. Lo</i> .....	483
Recent Advances in Research on Hedge Fund Activism: Value Creation and Identification <i>Alon Brav, Wei Jiang, and Hyunseob Kim</i> .....	579
Private Equity Performance: A Survey <i>Steven N. Kaplan and Berk A. Sensoy</i> .....	597
Real Estate Price Indices and Price Dynamics: An Overview from an Investments Perspective <i>David Geltner</i> .....	615
Governance of Family Firms <i>Belén Villalonga, Raphael Amit, María-Andrea Trujillo, and Alexander Guzmán</i> ....	635

## Indexes

Cumulative Index of Contributing Authors, Volumes 1–7 .....	655
Cumulative Index of Articles Titles, Volumes 1–7 .....	658

## Errata

An online log of corrections to *Annual Review of Financial Economics* articles may be found at <http://www.annualreviews.org/errata/financial>