Behavioral Corporate Finance: An Updated Survey*

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Abstract: We survey the theory and evidence of behavioral corporate finance, which generally takes one of two approaches. The market timing and catering approach views managerial financing and investment decisions as rational managerial responses to securities mispricing. The managerial biases approach studies the direct effects of managers' biases and nonstandard preferences on their decisions. We review relevant psychology, economic theory and predictions, empirical challenges, empirical evidence, new directions such as behavioral signaling, and open questions.

Keywords: Behavioral, Corporate Finance, Sentiment, Catering, Market Timing, Irrational, Bias, Overconfidence, Optimism, Signaling

JEL Codes: G14, G30, G31, G32, G34, G35

· This survey updates and extends a survey coauthored with Rick Ruback that was published in the *Handbook in Corporate Finance: Empirical Corporate Finance*, edited by Espen Eckbo, in 2007. We thank him for his many contributions that carried over to this version, and we thank Milt Harris for extensive and helpful comments. Baker gratefully acknowledges financial support from the Division of Research of the Harvard Business School.

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1. Introduction

Corporate finance aims to explain the financial contracts and the real investment behavior that emerge from the interaction of managers and investors. A complete explanation of financing and investment patterns therefore requires a correct understanding of the beliefs and preferences of these two sets of agents. The majority of research in corporate finance makes broad assumptions that these beliefs and preferences are fully rational. Agents are supposed to develop unbiased forecasts about future events and use these to make decisions that best serve their own interests. As a practical matter, this means that managers can take for granted that capital markets are efficient, with prices rationally reflecting public information about fundamental values. Likewise, investors can take for granted that managers will act in their self-interest, rationally responding to incentives shaped by compensation contracts, the market for corporate control, and other governance mechanisms.

Research in behavioral corporate finance replaces the traditional rationality assumptions with behavioral foundations that are more evidence-driven. The field is no longer a purely academic pursuit, as behavioral corporate finance is increasingly the basis of discussions in mainstream textbooks.[1] We divide the literature into two broad groups and organize the survey accordingly. Roughly speaking, the first approach emphasizes the effect of investor behavior that is less than fully rational. The second considers *managerial* behavior that is less than fully rational. For each line of research, we review the basic theoretical frameworks, the main empirical challenges, and the evidence. Of course, in practice, multiple channels of irrationality may operate at the same time; our taxonomy is meant to fit the bulk of the existing literature.

[1] For example see Damodaran (2011), Shefrin (2006), Shefrin (2008), and Welch (2009).

The "market timing and catering approach" assumes that arbitrage in securities markets is imperfect, and as a result prices can be too high or too low. We review the market inefficiency literature insofar as it is relevant. Rational managers are assumed to perceive these mispricings, and to make decisions that exploit or further encourage mispricing. While their decisions may maximize the short-run value of the firm, they may also result in lower long-run values as prices correct to fundamentals. In the simple theoretical framework we outline, managers balance three objectives: fundamental value, catering, and market timing. Maximizing fundamental value has the usual ingredients. Catering refers to any actions intended to boost share prices above fundamental value. Market timing refers to financing decisions intended to capitalize on temporary mispricings, generally by issuing overvalued securities and repurchasing undervalued ones.

Empirical tests of the irrational investors model face the challenge of measuring mispricing. We discuss how this issue has been tackled. A few papers use clever approaches that can identify mispricing fairly convincingly, but in many cases ambiguities remain. Overall, despite some unresolved questions, the evidence suggests that the irrational investors approach has a considerable degree of descriptive power. We review studies on investment behavior, merger activity, the clustering and timing of corporate security offerings, capital structure, corporate name changes, nominal share prices, dividend policy, earnings management, and other managerial decisions. We also point out gaps that remain between the theory and the evidence.

The second approach that we discuss is the "managerial biases" approach. It assumes that managers have behavioral biases, but retains the rationality of investors, albeit limiting the governance mechanisms they can employ to constrain managers. Following the emphases of the current literature, our discussion centers on the biases of optimism and overconfidence. A simple model shows how these biases, in leading managers to believe their firms are undervalued, encourage overinvestment from internal resources, and a preference for internal to external

finance, especially internal equity. We note that the predictions of the optimism and overconfidence models typically look very much like those of agency and asymmetric information models.

In this approach, the main obstacles for empirical tests include distinguishing predictions from standard, non-behavioral models, as well as empirically measuring managerial biases. Again, however, creative solutions have been proposed. The effects of optimism and overconfidence have been empirically studied in the context of corporate and entrepreneurial financing and investment decisions, merger activity, and the structure of financial contracts.

We also cover a newer approach that we call "behavioral signaling." This is a response to the many sophisticated signaling models in corporate finance theory that make two questionable assumptions. They assume full rationality and standard preferences; and, they use the destruction of firm value as the credible signaling mechanism—the better firm is the one that destroys more value, a notion rejected by managers in surveys. Behavioral signaling models instead base the signaling mechanism on some distortion in beliefs or preferences. We describe a model of dividends where investors are loss-averse over the level of dividends, so that a manager that ratchets up dividends today can signal that he can likely meet or exceed that level tomorrow. Following this, we speculate about other topics that might be addressed when asymmetric information is combined with nonstandard preferences or biased expectations.

Sprinkled throughout the survey are discussions of research that is hard to categorize into just one paradigm. For example, mergers are arranged by bankers and two sets of managers and approved by shareholders; behavioral biases that affect the outcome are difficult to attribute to one party. They may well be shared across parties. Complications like these suggest why the real economic losses associated with behavioral phenomena in corporate finance are hard to quantify, although some evidence suggests that they are considerable.

Behavioral corporate finance, and behavioral finance more broadly, received a boost from the spectacular rise and fall of Internet stocks between the mid-1990s and 2000. It is hard to explain this period, both at the level of market aggregates and individual stocks and other securities, without appealing to some degree of investor and managerial irrationality.

The more recent financial crisis is more complex, as we discuss. The mispricing did not involve a new technology, but rather more mundane mortgage finance made opaque through financial innovation and the creation of seemingly low-risk derivatives. The buyers were not retail investors, but banks and money market mutual funds. Most importantly, the systemically important banks that created these securities had some of the largest exposures. It was as if Bank of America had held on to a large fraction of the Internet stocks that were underwritten in the late 1990s. There were equal parts traditional corporate finance frictions, like agency problems, signaling, and debt overhang, and behavioral distortions that led to both the credit bubble and the challenges of resetting bank balance sheets. The economic damage was further multiplied because banks themselves shouldered the losses.

Taking a step back, it is important to note that the approaches take very different views about the role and quality of managers, and have very different normative implications as a result. For example, when the primary source of irrationality is on the investor side, as in the market timing and catering approach and in our implementation of behavioral signaling, long-term value maximization and economic efficiency requires insulating managers from short-term share price pressures. Managers need the flexibility necessary to make decisions that may be unpopular in the marketplace. This may imply benefits from internal capital markets, barriers to takeovers, and so forth—many of the institutions that are disdained by an agency perspective. On the other hand, if the main source of irrationality is manifested through managerial biases, efficiency requires

reducing discretion and obligating managers to respond to market price signals—as standard agency theory and asymmetric information models would have it.

The stark contrast between the normative implications of different approaches to behavioral corporate finance is one reason why the area is fascinating, and why more work in the area may lead to important insights. Our ever-improving understanding of the economic implications of social psychology and the ever-increasing availability of micro data will continue to present new research opportunities. In that vein, we close the survey with some open questions.

And at this point we would also like to point the reader to excellent recent surveys of individual topics in behavioral corporate finance: Ben-David (2010) on dividend policy, Derrien (2010) on IPOs, Dong (2010) on mergers and acquisitions, Gider and Hackbarth (2010) on financing decisions, Gervais (2010) on investment decisions, and Morck (2010) on governance.

2. Market timing and catering

The most developed framework in behavioral corporate finance and longest section in this survey involves rational managers interacting with irrational investors.

2.1. Background on investor behavior and market inefficiency

There are two key building blocks in the market timing and catering framework. The first is that irrational investors must influence securities prices. In other words, that securities markets are not entirely informationally efficient. Otherwise, it is not obvious that managers would take much care to please such investors. For irrational investors to affect prices, rational investors must be limited in their ability to compete and arbitrage away mispricings. We discuss the limited arbitrage literature below since this is such a critical assumption.

Irrational traders' biases must be systematic, as well, or else their own trading might simply cancel out, leaving arbitrageurs with little to do anyway. We discuss a few well-documented and robust deviations from standard utility and Bayesian beliefs from the psychology, economics, and finance literatures. The particular deviations that are most immediately applicable to corporate finance involve categorization and reference-dependent behavior. Combined with limited arbitrage, these biases lead to market inefficiencies.[2]

The second key building block of the market timing and catering view is that managers must be "smart" in the sense of being able to distinguish market prices and fundamental value—to recognize the mispricings that irrational investors have created, especially in extreme circumstances. We review several reasons why this assumption is plausible.

2.1.1. Limited arbitrage

Securities prices reflect fundamental values when informed investors compete aggressively to eliminate mispricings. Classical finance theory, including the Modigliani-Miller theorem, holds that they will do so because mispricings between two companies with the same operating cash flows but different capital structures, in a setting of complete and frictionless securities markets, present arbitrage opportunities. The assumption of market efficiency has for decades permitted corporate finance theory to develop independently of asset pricing theory.

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[2] The literature on market inefficiency is vast. It includes fairly convincing evidence of inefficiencies including the January effect; the effect of trading hours on price volatility; post-earnings-announcement drift, positive autocorrelation in quarterly earnings announcement effects, and more generally delayed reaction to news; momentum; Siamese twin securities that have identical cash flows but trade at different prices; negative "stub" values; closed-end fund pricing patterns; bubbles and crashes in growth stocks; related evidence of mispricing in options, bond, and foreign exchange markets; and interesting new patterns every year. This list excludes anomalies related to securities issuance that we discuss later. See Barberis and Thaler (2003) and Shleifer (2000) for classic surveys of the behavioral finance and asset pricing literature more broadly.

The literature on limited arbitrage, however, concludes that securities market mispricings often do not present opportunities for true arbitrage. As a result, mispricings can exist and persist. As just one example, the fact that stocks added to market indexes see their prices jump has been viewed as prima facie proof of limits to arbitrage in the stock market (Shleifer (1986) and Harris and Gurel (1986)). A deeper study of specific arbitrage costs and risks is useful, however, because when these costs are measurable, they may lead to empirical strategies for measuring mispricing, as we discuss later.

Early contributions to the literature include Miller (1977), who points out that short-sale constraints can lead to securities being overpriced. DeLong, Shleifer, Summers, and Waldmann (1990) highlight the risk that irrational traders push prices further away from fundamentals after a would-be arbitrageur takes a position. Shleifer and Vishny (1997) point out that professional investment managers, the enforcers of market efficiency in classical theory, in fact have a special incentive to avoid this noise trader risk: in the realistic case where investors cannot distinguish between returns earned by luck and skill, they may assume the worst and withdraw funds when faced with losses.

There are a number of additional costs and risks of arbitrage. An important one is fundamental risk, which makes relative-value arbitrage risky because a mispriced security's cash flows are not spanned by those of other assets (Pontiff (1996) and Wurgler and Zhuravskaya (2002)). Liquidity risk arises when everyone wants to sell at the same time (Acharya and Pedersen (2004)). Finally, real-world investors must bear simple transaction costs, search costs, and information-gathering costs to exploit mispricings.

The idea that securities prices are affected by more than just fundamentals has been examined in markets from penny stocks to government bonds. Krishnamurthy (2002) finds that on-the-run Treasury issues trade at a premium to other bonds, while Duffee (1996) connects the

supply of individual bills to non-fundamental variation in the Treasury yield curve. At a higher level of aggregation, Hu, Pan, and Wang (2010) use anomalous patterns in the shape of the yield curve to quantify how well capitalized or effective is bond market arbitrage. At the broadest level, Greenwood and Vayanos (2010) argue that the overall shape of the yield curve is causally affected by the maturity structure of government debt issues. This assertion implies mispricings of far greater size than those evidenced by relative-value distortions within the yield curve—large enough, perhaps, to catch the attention of managers, or their investment bankers, and affect corporate maturity structure choices.

In summary, a body of theory and evidence indicates that capital markets have a limited capacity to absorb demand shocks that are independent of fundamental news. The next task is to understand the investor psychology that is behind some of these demand shocks.

2.1.2. Categorization and investor sentiment

A basic feature of human cognition is simplification through categories. For example, the label "Behavioral Corporate Finance" defines a set of papers with similar methodological themes and frees us from having to enumerate the individual members of the set (except in the case of a survey article, of course). The classic treatment is Rosch (1973), but the principle is obvious and needs no theoretical preamble.

Investors and analysts simplify the investment universe through categories (Barberis and Shleifer (2003)). Some categories, such as small-caps, value stocks, high-yield stocks, and junk bonds, are fairly timeless. Others are ephemeral. The "Nifty Fifty" is a forgotten moniker from the early 1970s for a set of large-capitalization firms with solid earnings growth. These days, "Internet firms" is becoming a less useful label. It once denoted firms with the essential feature that their success depended on the adoption of a new technology; that technology is now established, so the determinants of these firms' prospects have become more individualized.

Investment categories become interesting for us when investors trade at the category level. Index funds provide an example of category-level investing and its consequences: When a stock is added to the S&P 500 Index, its returns become more correlated with existing Index members (Barberis, Shleifer, and Wurgler (2005)). It is now traded in sync with them, and—arbitrage being limited—it acquires a common factor in returns. Over time, this can lead to a detachment of category members from the rest of the market (Morck and Yang (2001), Wurgler (2011)). The most dramatic cases are from bubbles and crashes. In the Internet bubble, some investors didn't have the time or expertise to investigate individual tech stocks and apparently just threw money at anything Internet-related. The crash involved equally indiscriminate selling. A qualitative review of stock market history suggests that investor sentiment often concentrates at the level of categories.

For our purpose, categorization will be particularly relevant to the discussion of catering behavior, in which managers take actions to move their firm into the in-vogue category and boost its valuation. This boost may, in turn, facilitate opportunistic securities issuance.

2.1.3. Prospect theory, reference points, loss aversion, and anchoring

In the prospect theory preferences of Kahneman and Tversky (1979), utility is defined not as a smoothly increasing function of the level of consumption or wealth but in terms of changes relative to a reference level. Via a kink at the origin, the value function also embodies loss aversion—the empirical phenomenon that losses, even small ones, are particularly painful. See Tversky and Kahneman (1991) for a survey of loss aversion research.

The disposition effect of Shefrin and Statman (1985) refers to the pattern that investors are more likely to realize gains than losses. A typical explanation invokes elements of prospect theory: the reference point is the purchase price, and the investor strains to avoid selling at a loss despite

the tax advantage to doing so.[3] Other salient reference prices, and, importantly, ones that are common across investors, are recent high prices, such as a stock's all-time or 52-week high, and recent low prices. Huddart, Lang, and Yetman (2009) find that trading volume and return patterns change as recent highs are approached for seasoned issues, and Kaustia (2004) finds that trading volume behavior changes as IPOs reach new maxima and minima.

Tversky and Kahneman (1974) also review the concept of anchoring. Anchoring refers to a deviation from Bayesian beliefs, not a departure from standard preferences. In anchoring, the subject forms beliefs by adjusting from a potentially arbitrary starting point, and the bias is that the final belief is biased toward this anchor; adjustment away from it is insufficient. For example, Tversky and Kahneman asked subjects to guess what fraction of African countries were members of the United Nations. Those who were first asked "is it more or less than 10%?" guessed a median of 25%, while those who had been asked "is it more or less than 65%" guessed a median of 45%. Offering payoffs for accuracy did not reduce these effects. Another example comes from Strack and Mussweiler (1997), who asked subjects to estimate when Einstein first visited the United States. Implausible anchors like 1215 and 1992 produced effects as large as anchors of 1909 and 1939.

Studies involving reference point thinking, loss aversion, and anchoring are featured at several points in this survey. These phenomena have been used to shed light on dividends, earnings management, merger offer prices, equity issuance timing, hurdle rates, the cost of debt, and other patterns.

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[3] Barberis and Xiong (2009) and Kaustia (2010b) show that empirical features of the disposition effect make it hard to connect to prospect theory per se, which also specifies curvature in the value function. See Kaustia (2010a) for a thorough survey of the disposition effect literature.

2.1.4. Smart managers

But even if limited arbitrage and systematic investor biases add up to inefficient markets, why is it reasonable to assume that corporate managers are "smart" in the sense of being able to identify mispricing? One can offer several justifications. First, corporate managers have superior information about their own firm. This is evidenced by the abnormally high returns on illegal insider trading in Muelbroek (1992) and even legal insider trading in Seyhun (1992).

Second, managers can manufacture their own information advantage by managing earnings or with the help of conflicted analysts, as in Bradshaw, Richardson, and Sloan (2006). They may also be able to shape investor demand through investor relations, by marketing their shares in Gao and Ritter (2010), or allocating IPO shares in Zhang (2004).

Third, corporate managers have fewer constraints than equally "smart" money managers. Consider two classic models of limited arbitrage introduced above: DeLong et al. (1990) is built on short horizons and Miller (1977) on short-sales constraints. CFOs tend to be judged on longer horizon results than are money managers, allowing them to take a view on market valuations in a way that most money managers cannot.[4] Short-sales constraints also prevent money managers from mimicking CFOs. When a firm or a sector becomes overvalued, corporations are the natural candidates to expand the supply of shares.[5] Money managers are not.

In addition, managers might just follow intuitive rules of thumb that allow them to identify mispricing even without any real information advantage. In Baker and Stein (2004), one such

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[4] For example, suppose the manager issues equity at $50 per share. Should those shares subsequently double, the manager might regret not delaying the issue, but he will surely not be fired, having presided over a rise in the stock price. In contrast, imagine a money manager sells (short) the same stock at $50. This might lead to considerable losses for the firm and the executive, an outflow of funds, and, if the bet is large enough, perhaps the end of a career.

[5] Conversely, when the shares crash, firms serve as *buyers* of last resort (Hong, Wang, and Yu (2008)).

successful rule of thumb is to issue equity when the market is particularly liquid, in the sense of a small price impact upon the issue announcement. In the presence of short-sales constraints—more on this below—unusually high liquidity is symptomatic of an overvalued market dominated by irrationally optimistic investors.

Finally, in the case of debt maturity, firms may have a comparative advantage in exploiting distortions in the yield curve. Greenwood, Hanson, and Stein (2010) develop this logic. In a Modigliani-Miller world, firms are indifferent to their debt maturity, freeing them to fill in the gap in supply at various maturities created by restructuring of the Treasury debt maturity structure or other non-fundamental supply and demand effects on the yield curve. By contrast, mutual fund and institutional investment managers often have less flexibility, by mandate and other limits of arbitrage, to be opportunistic in their maturity choice.

2.2. Theoretical framework: Rational managers in irrational markets

We use the assumptions of inefficient markets and smart managers to develop a simple theoretical framework for the market timing and catering approach. The framework has roots in Fischer and Merton (1984), De Long, Shleifer, Summers, and Waldmann (1989), Morck, Shleifer, and Vishny (1990b), and Blanchard, Rhee, and Summers (1993), but our particular derivation borrows most from Stein (1996). Newer models, such as Bolton, Chen, and Wang (2011), add dynamic considerations to this static framework.

In the market timing and catering approach, the manager balances three conflicting goals. The first is to maximize fundamental value. This means selecting and financing investment projects to increase the rationally risk-adjusted present value of future cash flows. To simplify the analysis, we do not explicitly model taxes, costs of financial distress, agency problems or asymmetric information. Instead, we specify fundamental value as

$$f(K,\cdot) - K,$$

where *f* is increasing and concave in new investment *K*. To the extent that any of the usual market imperfections leads the Modigliani-Miller (1958) theorem to fail, financing may enter *f* alongside investment.

The second goal is to maximize the current share price of the firm's securities. In perfect capital markets, the first two objectives are the same, since the definition of market efficiency is that price equals fundamental value. But once one relaxes the assumption of investor rationality, this need not be true, and the second objective is distinct. In particular, the second goal is to "cater" to short-term investor demands via particular investment projects or otherwise packaging the firm and its securities in a way that maximizes appeal to investors. Through such catering activities, managers influence the temporary mispricing, which we represent by the function

$$\delta(\cdot),$$

where the arguments of δ depend on the nature of prevailing investor sentiment. The arguments might include investing in a particular technology, assuming a conglomerate or single-segment structure, changing the corporate name, managing earnings, initiating a dividend, splitting shares, and so on. In practice, the determinants of mispricing may well vary over time.

The third goal is to exploit the current mispricing for the benefit of existing, long-run investors. Managers achieve this by a "market timing" financing policy which supplies securities that are temporarily overvalued and repurchases those that are undervalued, or at least less overvalued. This policy transfers value from the new or the outgoing investors to the ongoing, long-

run investors; the transfer is realized as prices correct in the long run.[6] For simplicity, we focus here on temporary mispricing in the equity markets, and so δ refers to the difference between the current price and the fundamental value of equity. More generally, each of the firm's securities may be mispriced to some degree. By selling a fraction of the firm *e*, long run shareholders gain

$$e\delta(\cdot).$$[7]

We leave out the budget constraint and lump together the sale of new and existing shares. Instead of explicitly modeling the flow of funds and any potential financial constraints, we will consider the reduced form impact of *e* on fundamental value.

It is worth noting that other capital market imperfections can lead to a sort of catering behavior. For example, reputation models in the spirit of Holmstrom (1982) can lead to earnings management, inefficient investment, and excessive swings in corporate strategy even when the capital markets are not fooled in equilibrium.[8] Viewed in this light, the framework here is relaxing the assumptions of rational expectations in Holmstrom, in the case of catering, and Myers and Majluf (1984), in the case of market timing.

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[6] Of course, we are also using the market inefficiency assumption here in assuming that managerial efforts to capture a mispricing do not fully and instantly destroy it in the process, as they do in the rational expectations world of Myers and Majluf (1984). In other words, investors underreact to corporate decisions designed to exploit mispricing because of limited arbitrage, attention, etc.

[7] For long run shareholders to benefit, we are implicitly thinking of something like three-period model. In the first period, investment and financing decisions are made, and prices are above fundamental value by an amount δ. There is an intermediate period where prices do not change, but short-run investors sell their shares, and a final period where fundamental value is realized. Issuing equity will the effect of reducing prices in the first and second periods if $\delta_e < 0$, while increasing the value per share in the third period from where it would otherwise be.

[8] For examples, see Stein (1989) and Scharfstein and Stein (1990). For a comparison of rational expectations and inefficient markets in this framework, see Aghion and Stein (2008).

Putting the goals of fundamental value, catering, and market timing into one objective function, we have the manager choosing investment and financing to

$$\max_{K,e} \lambda\left[f\left(K,\cdot\right) - K + e\delta\left(\cdot\right)\right] + \left(1 - \lambda\right)\delta\left(\cdot\right),$$

where λ is greater than zero and less than or equal to one and specifies the manager's horizon. When λ equals one, the manager cares only about creating value for existing, long-run shareholders, the last term drops out, and there is no distinct impact of catering. However, and interestingly, even an extremely long-horizon manager cares about short-term mispricing for the purposes of market timing, and thus may cater to short-term mispricing to further this objective. With a shorter horizon, maximizing the stock price becomes an objective in its own right, even without any concomitant equity issues.

We take the managerial horizon as exogenously set by personal characteristics, career concerns, and the compensation contract. If the manager plans to sell equity or exercise options in the near term, his portfolio considerations may lower λ. Career concerns and the market for corporate control can also combine to shorten horizons: if the manager does not maximize short-run prices, the firm may be acquired and the manager fired.

Differentiating with respect to *K* and *e* gives the optimal investment and financial policy of a rational manager operating in inefficient capital markets:

$$f_K\left(K,\cdot\right) = 1 - \left(e + \tfrac{1-\lambda}{\lambda}\right)\delta_K\left(\cdot\right), \text{ and}$$

$$-f_e\left(K,\cdot\right) = \delta\left(\cdot\right) + \left(e + \tfrac{1-\lambda}{\lambda}\right)\delta_e\left(\cdot\right).$$

The first condition is about investment policy. The marginal value created from investment is weighed against the standard cost of capital, normalized to be one here, net of the impact that

this incremental investment has on mispricing, and hence its effect through mispricing on catering and market timing gains. The second condition is about financing. The marginal value lost from shifting the firm's current capital structure toward equity is weighed against the direct market timing gains and the impact that this incremental equity issuance has on mispricing, and hence its effect on catering and market timing gains. This is a lot to swallow at once, so we consider some special cases.

Investment policy. Investment and financing are separable if both δ_K and f_{eK} are equal to zero. Then the investment decision reduces to the familiar perfect markets condition of f_K equal to unity. Note that, if f_e is equal to zero, there is no optimal capital structure. Real consequences of mispricing for investment arise in two ways. Either capital structure has a real effect on value, when f_e and f_{eK} are not equal to zero, or investment has a direct effect on mispricing, when δ_K is not equal to zero. The simplest situation to evaluate in the first case has δ_K and δ_e equal to zero. The simplest situation to evaluate in the second case is when f_e is equal to zero. Both channels are likely present, but analyzing the two at the same time reduces transparency.

In Stein (1996) and Baker, Stein, and Wurgler (2003), f_e and f_{eK} are not equal to zero. There *is* an optimal capital structure, or at least an upper bound on debt capacity. The benefits of issuing or repurchasing equity in response to mispricing are balanced against the reduction in fundamental value that arises from too much (or possibly too little) leverage and the indirect effect on firm value through investment, when f_{eK} is greater than zero. Somewhat more formally, equity issues e are increasing in an exogenous level of mispricing δ. (This also requires the assumption that f_{ee} is less than zero, which is necessary for an interior solution for optimal capital structure.) To match Baker, Stein and Wurgler (2003), consider the case of an undervalued firm. The more undervalued the firm, the less equity the manager sells. This constrains investment when f_{eK} is greater than zero, i.e. K is increasing in e. (Constraints of this type also require the assumption that f_{KK} is less than zero,

which is necessary for an interior solution for investment.) In sum, because of undervaluation and financial constraints, the manager chooses a combination of lower equity issues e and lower investment K than he would in the situation of no mispricing.

In Polk and Sapienza (2009) and Gilchrist, Himmelberg, and Huberman (2005), there is no optimal capital structure, but δ_K is not equal to zero: mispricing is itself a function of investment. The potential to create mispricing distorts investment in a simple, direct way. Polk and Sapienza focus on catering effects and do not consider financing (e equal to zero in this setup), while Gilchrist et al. model the market timing decisions of managers with long horizons (λ equal to one).

Financial policy. The demand curve for a firm's equity slopes down under the natural assumption that δ_e is negative, e.g., issuing shares partly corrects mispricing.[9] When investment and financing are separable, managers act like monopolists. This is easiest to see when managers have long horizons, and they sell down the demand curve until marginal revenue δ is equal to marginal cost $-e\delta_e$. Note that price remains above fundamental value even after the issue: "corporate arbitrage" moves the market toward, but not all the way to, market efficiency.[10] Managers sell less equity when they care about short-run stock price (λ less than one, here). For example, in Ljungqvist, Nanda, and Singh (2005), managers expect to sell their own shares soon after the IPO and so issue less as a result. Managers also sell less equity when there are costs of suboptimal leverage. To some extent, the shape of the demand curve may be endogenous. Gao and Ritter (2010) argue that firms actively market their shares in anticipation of an equity offering with this in mind.

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[9] Gilchrist et al. (2005) model this explicitly with heterogeneous investor beliefs and short-sales constraints. See also Hong, Wang, and Yu (2008)).

[10] Total market timing gains may be even higher in a dynamic model where managers can sell in small increments down the demand curve.

Other corporate decisions. This framework can be expanded to accommodate decisions beyond investment and issuance. Consider dividend policy. Increasing or initiating a dividend may simultaneously affect both fundamental value, through taxes, and the degree of mispricing, if investors categorize stocks according to payout policy as they do in Baker and Wurgler (2004a). The tradeoff is

$$-f_d(K,\cdot) = \left(e + \tfrac{1-\lambda}{\lambda}\right)\delta_d(\cdot),$$

where the left-hand side is the tax cost of dividends, for example, and the right-hand side is the market timing gain, if the firm is simultaneously issuing equity, plus the catering gain, if the manager has short horizons. In principle, a similar tradeoff governs the earnings management decision or corporate name changes; however, particularly in the latter case, the fundamental costs of catering would presumably be small.

2.3. Empirical challenges

The market timing and catering framework features the role of securities mispricing in investment, financing, and other corporate decisions. The main challenge for empirical tests in this area is measuring mispricing, which by its nature is hard to pin down. Researchers have operationalized empirical tests in a few different ways.

***Ex ante* misvaluation.** One option is to take an *ex ante* measure of mispricing, for instance a scaled-price ratio in which a market value in the numerator is related to some measure of fundamental value in the denominator. Perhaps the most common choice is the market-to-book ratio: A high market-to-book suggests that the firm may be overvalued. Consistent with this idea, and the presumption that mispricing corrects in the long run, market-to-book is found to be inversely related to future stock returns in the cross-section by Fama and French (1992) and in the time-series by Kothari and Shanken (1997) and Pontiff and Schall (1998). Also, extreme values of

market-to-book are connected to extreme investor expectations by Lakonishok, Shleifer and Vishny (1994), La Porta (1996), and La Porta, Lakonishok, Shleifer, and Vishny (1997).

One difficulty that arises with this approach is that the market-to-book ratio or another *ex ante* measure of mispricing may be correlated with an array of firm characteristics. Book value is not a precise estimate of fundamental value, but rather a summary of past accounting performance. Thus, firms with excellent growth prospects tend to have high market-to-book ratios, and those with agency problems might have low ratios—and perhaps these considerations, rather than mispricing, drive investment and financing decisions. Dong, Hirshleifer, Richardson, and Teoh (2003) and Ang and Cheng (2005) discount analyst earnings forecasts to construct an arguably less problematic measure of fundamentals than book value.

Another factor that limits this approach is that a precise *ex ante* measure of mispricing would represent a profitable trading rule. There must be limits to arbitrage that prevent rational investors from fully exploiting such rules and trading away the information they contain about mispricing.

***Ex post* misvaluation.** A second option is to use the information in future returns. The idea is that if stock prices routinely decline after a corporate event, one might infer that they were inflated at the time of the event. However, as detailed in Fama (1998) and Mitchell and Stafford (2000), this approach is also subject to critique.

The most basic critique is the joint hypothesis problem: a predictable "abnormal" return might mean there was misvaluation *ex ante*, or simply that the definition of "normal" expected return (e.g., CAPM) is wrong. Perhaps the corporate event systematically coincides with changes in risk, and hence the return required in an efficient capital market. Another simple but important critique regards economic significance. Market value-weighting or focusing on NYSE/AMEX firms may reduce abnormal returns or cause them to disappear altogether.

There are also statistical issues. For instance, corporate events are often clustered in time and by industry—IPOs are an example considered in Brav (2000)—and thus abnormal returns may not be independent. Barber and Lyon (1997) and Lyon, Barber, and Tsai (1999) show that inference with buy-and-hold returns (for each event) is challenging. Calendar-time portfolios, which consist of an equal- or value-weighted average of all firms making a given decision, have fewer problems here, but the changing composition of these portfolios adds another complication to standard tests. Loughran and Ritter (2000) also argue that such an approach is a less powerful test of mispricing, since the clustered events have the worst subsequent performance. A final statistical problem is that many studies cover only a short sample period. Schultz (2003) shows that this can lead to a small sample bias if managers engage in "pseudo" market timing, making decisions in response to past rather than future price changes.

Analyzing aggregate time series resolves some of these problems. Like the calendar time portfolios, time series returns are more independent. There are also established time-series techniques, e.g. Stambaugh (1999), to deal with small-sample biases. Nonetheless, the joint hypothesis problem remains, since rationally required returns may vary over time.

But even when these econometric issues can be solved, interpretational issues may remain. For instance, suppose investors have a tendency to overprice firms that have genuinely good growth opportunities. If so, even investment that is followed by low returns need not be *ex ante* inefficient. Investment may have responded to omitted measures of investment opportunities, not to the misvaluation itself.

There are a variety of ways to improve the identification of a channel that connects capital market mispricing to corporate finance. Baker (2009) outlines an approach based on instrumenting for mispricing with investor tastes or other shocks to the supply of capital, and approaches involving the interaction of measures of valuation or mispricing with limits to arbitrage or

corporate incentives to time the market. Of course, even in these approaches using interaction terms, one still has to proxy for mispricing with an *ex ante* or *ex post* method. To the extent that the hypothesized cross-sectional pattern appears strongly in the data, however, objections about the measure of mispricing lose some steam.

Non-fundamental investor demand. The first approach is to identify supply effects with shifts in investor demand. The idea is to find empirical measures that are correlated with sentiment or the supply of capital but not with fundamentals. This is simple enough to write, but hard to implement. If it were possible to identify mispricing so clearly, such mispricing might not arise in the first place. Some examples are measures of investor inertia (Baker, Coval, and Stein (2007)), inattention (DellaVigna and Pollet (2009)), local demand (Becker, Ivkovic, and Weisbenner (2011)), overconfidence (combined with short sales constraints in Gilchrist, Himmelberg, and Huberman (2005)), or index additions (Massa, Peyer, and Tong (2005)). More broadly, shocks to the capital of intermediaries, while not necessarily behavioral, can be used to assess the impact of capital market inefficiency on corporate finance. This is too large a literature to survey here. This approach comes down to replacing a direct measure of valuation with an *instrument for investor demand*.

Cross-sectional interactions: Limits to arbitrage. In situations where trading on mispricing is limited by short-sales constraints, transaction costs, margin requirements, regulation, and fundamental risk, prices are likely to be further from fundamental value, making the impact of capital market inefficiencies on corporate finance more likely. For example, Baker, Foley, and Wurgler (2009) argue that the limits on arbitrage are more severe in some countries than others, leading to a differential effect of valuations of FDI. Lamont and Stein (2006) and Greenwood (2007) make similar arguments about relative efficiency the impact on stock issuance and mergers and acquisitions, and stock splits in Japan, respectively. This approach comes down to *identifying market conditions* where mispricing will have the strongest effect.

Cross-sectional interactions: Corporate opportunism. The effect of capital market inefficiencies on corporate finance should be most pronounced among those firms exhibiting the means and the incentive to be opportunistic. In this spirit, Baker, Stein, and Wurgler (2003) consider the prediction that if f_e is positive, mispricing should be more relevant for financially constrained firms. More generally, managerial horizons or the fundamental costs of catering to sentiment may vary across firms in a measurable way. For example, Bergstresser and Phillipon (2006) show that earnings management is more pronounced when managers are compensated with stock and options. Gaspar, Massa, and Matos (2005) argue that managers inherit their investors' incentives, which may not be chosen optimally to match firm fundamentals. This approach comes down to *identifying firms* where mispricing will have the strongest effect.

2.4. Investment policy

Of paramount importance are the real consequences of market inefficiency. It is one thing to say that investor irrationality has an impact on capital market prices, or even financing policy, which leads to transfers of wealth among investors. It is another to say that mispricing leads to underinvestment, overinvestment, or the general misallocation of capital and deadweight losses for the economy as a whole. In this subsection we review research on how market inefficiency affects real investment, mergers and acquisitions, and diversification.

2.4.1. Real investment

In the market timing and catering framework, mispricing influences real investment in two ways. First, investment may itself be a characteristic that is subject to mispricing (this happens when δ_K is greater than zero above). Investors may overestimate the value of investment in particular technologies, for example. Second, a financially constrained firm (this can happen when f_{eK} is greater than zero above) may be forced to pass up fundamentally valuable investment opportunities if it is undervalued.

Most research has looked at the first type of effect. Of course, anecdotal evidence of this effect comes from bubble episodes; it was with the late 1920s bubble fresh in mind that Keynes (1936) argued that short-term investor sentiment is, at least in some eras, a major or dominant determinant of investment. More recent US stock market episodes generally viewed as bubbles include the electronics boom in 1959-62, growth stocks in 1967-68, the "nifty fifty" in the early 1970s, gambling stocks in 1977-78, natural resources, high tech, and biotechnology stocks in the 1980s, and the Internet in the late 1990s; see Malkiel (1990) for an anecdotal review of some of these earlier bubbles, and Ofek and Richardson (2003) on the Internet. See Kindleberger (2000) for an attempt to draw general lessons from bubbles and crashes over several hundred years, and for anecdotal remarks on their sometimes-dramatic real consequences.

An early wave of studies in this area tested whether investment is sensitive to stock prices over and above direct measures of the marginal product of capital, such as cash flow or profitability. If it is not, they reasoned, then the univariate link between investment and stock valuations likely just reflects the standard, efficient-markets Q channel. This approach did not lead to a clear conclusion, however. For example, Barro (1990) argues for a strong independent effect of stock prices, while Morck, Shleifer, and Vishny (1990b) and Blanchard, Rhee, and Summers (1993) conclude that the incremental effect is weak.

The more recent wave of studies takes a different tack. Rather than controlling for fundamentals and looking for a residual effect of stock prices, they try to proxy for the mispricing component of stock prices and examine whether it affects investment. In this spirit, Chirinko and Schaller (2001, 2004), Panageas (2003), Polk and Sapienza (2009), Gilchrist, Himmelberg, and Huberman (2005), Massa, Peyer, and Tong (2005), and Schaller (2011) all find evidence that investment is sensitive to proxies for mispricing. Of course, the generic concern is that the mispricing proxies are still just picking up fundamentals. To refute this, Polk and Sapienza as well

as Massa et al., for example, consider the finer prediction that investment should be more sensitive to short-term mispricing when managerial horizons are shorter. Polk and Sapienza find that investment is indeed more sensitive to mispricing proxies when share turnover is higher, i.e., where the average shareholder's horizon is shorter; the Massa et al. test is similar.

The second type of mispricing-driven investment is tested in Baker, Stein, and Wurgler (2003). Stein (1996) predicts that investment will be most sensitive to mispricing in equity-dependent firms, i.e. firms that have no option but to issue equity to finance their marginal investment, because long-horizon managers of undervalued firms would rather underinvest than issue undervalued shares. Using several proxies for equity dependence and mispricing, Baker et al. confirm the prediction.

Overall, there is some evidence that some portion of the effect of stock prices on investment is a response to mispricing, but key questions remain. The actual magnitude of the effect of mispricing has not been pinned down, even roughly. The efficiency implications are also unclear. Titman, Wei, and Xie (2004) and Polk and Sapienza (2009) find that high investment is associated with lower future stock returns in the cross section, and Lamont (2000) finds a similar result for planned investment in the time series. However, sentiment and fundamentals seem likely to be correlated, and so, as mentioned previously, even investment followed by low returns may not be *ex ante* inefficient.[11] Even granting an empirical link between overpricing and investment, it is hard to determine the extent to which managers are rationally fanning the flames of overvaluation, as in catering, or are simply just as overoptimistic as their investors. We shall return to the effects of managerial optimism.

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[11] As an example of this complication, Campello and Graham (2007) find that financially strapped non-tech firms issued equity during the Internet bubble and used it to invest. The unconstrained non-tech firms did not show this pattern. This suggest that bubbles driven by one category can have positive spillover effects on relatively unrelated firms.

2.4.2. Mergers and acquisitions

Shleifer and Vishny (2003) propose a market-timing model of acquisitions. They assume that acquirers are overvalued, and the motive for acquisitions is not to gain synergies, but to preserve some of their temporary overvaluation for long-run shareholders. Specifically, by acquiring less-overvalued targets with overpriced stock (or, less interestingly, undervalued targets with cash), overvalued acquirers can cushion the fall for their shareholders by leaving them with more hard assets per share. Or, if the deal's value proposition caters to a perceived synergy that causes the combined entity to be overvalued, as might have happened in the late 1960s conglomerates wave (see below), then the acquirer can still gain a long-run cushion effect, while offering a larger premium to the target.

The market timing approach to mergers helps to unify a number of stylized facts. The defensive motive for the acquisition, and the idea that acquisitions are further facilitated when catering gains are available, help to explain the time-series link between merger volume and stock prices, e.g., Golbe and White (1988).[12] The model also predicts that cash acquirers earn positive long-run returns while stock acquirers earn negative long-run returns, consistent with the findings of Loughran and Vijh (1997) and Rau and Vermaelen (1998).

Recent papers have found further evidence for market timing-motivated mergers. Dong, Hirshleifer, Richardson, and Teoh (2003) and Ang and Cheng (2005) find that market-level mispricing proxies and merger volume are positively correlated, and (within this) that acquirers tend to be more overpriced than targets.[13] They also find that offers for undervalued targets are

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[12] See Rhodes-Kropf and Viswanathan (2004) for a somewhat different misvaluation-based explanation of this link.

[13] A related prediction of the Shleifer-Vishny framework is that an overvalued acquirer creates value for long-term shareholders by acquiring a fairly valued or simply less overvalued target. Savor and Lu (2009) tests this proposition by comparing the returns of successful acquirers to those that fail for exogenous reasons,

more likely to be hostile, and that overpriced acquirers pay higher takeover premia. Rhodes-Kropf, Robinson, and Viswanathan (2005) also link valuations and merger activity. Bouwman, Fuller, and Nain (2003) find evidence suggestive of a short-term catering effect. In high-valuation periods, investors welcome acquisition announcements, yet the subsequent returns of mergers made in those periods are the worst. Baker, Foley, and Wurgler (2009) find that foreign direct investment (FDI), which is often cross-border acquisitions, increase with the current aggregate market-to-book ratio of the source country stock market and decrease with subsequent returns on that market. All of these patterns are consistent with overvaluation-driven merger activity.

An unresolved question in the Shleifer-Vishny framework is why managers would prefer a stock-for-stock merger to an equity issue if the market timing gains are similar. One explanation is that a merger more effectively hides the underlying market timing motive from investors, because the equity issue and investment decision are bundled. Baker, Coval, and Stein (2007) consider another mechanism that can also help explain a generic preference for equity issues via merger.[14] The first ingredient is that the acquiring firm faces a downward sloping demand curve for its shares. The second ingredient is that some investors follow the path of least resistance, passively accepting the acquirer's shares as consideration even when they would not have actively participated in an equity issue. With these two assumptions, the price impact of a stock-financed merger can be much smaller than the price impact of an SEO. Empirically, inertia is a major feature in institutional and especially individual holdings data that is associated with smaller merger announcement effects.

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such as a regulatory intervention. Successful acquirers perform poorly, as in Loughran and Vijh (1997), but unsuccessful acquirers perform even worse.

[14] For example, in the case of S&P 100 firms over 1999-2001, Fama and French (2005) find that the amount of equity raised in mergers is roughly 40 times that raised in SEOs.

2.4.3. Diversification and focus

Standard explanations for entering unrelated lines of business include agency problems or synergies, e.g., internal capital markets and tax shields. Likewise, moves toward greater focus are often interpreted as triumphs of governance. While our main task is to survey the existing literature, the topics of diversification and focus have yet to be considered from a perspective where investors are less than fully rational. So, we take a short detour here. We ask whether the evidence at hand is consistent with the view that the late-1960s conglomerate wave, which led to conglomerates so complex they were still being divested or busted up decades later, was in part driven by efforts to cater to a temporary investor appetite for conglomerates.

Investor demand for conglomerates does appear to have reached a peak in 1968. Ravenscraft and Scherer (1987, p. 40) find that the average return on 13 leading conglomerates was 385% from July 1965 to June 1968, while the S&P 425 gained only 34%. Diversifying acquisitions were being greeted with a positive announcement effect, while other acquisitions were penalized (Matsusaka (1993)). Klein (2001) finds a "diversification premium" of 36% from 1966-68 in a sample of 36 conglomerates. Perhaps responding to these valuation incentives, conglomerate mergers accelerated in 1967 and peaked in 1968 (Ravenscraft and Scherer, pp. 24, 161, 218).

Conglomerate valuations started to fall in mid-1968. Between July 1968 and June 1970, the sample followed by Ravenscraft and Scherer lost 68%, three times more than the S&P 425. Announcement effects also suggest a switch in investor appetites: diversification announcements were greeted with a flat reaction in the mid- to late-1970s and a negative reaction by the 1980s (Morck, Shleifer, and Vishny (1990a)). Klein finds that the diversification premium turned into a discount of 1% in 1969-71 and 17% by 1972-74, and a discount seems to have remained through the 1980s (Lang and Stulz (1994), Berger and Ofek (1995)). Again, possibly in response to this shift in catering incentives, unrelated segments began to be divested, starting a long trend toward focus

(Porter (1987), Kaplan and Weisbach (1992)).[15] Overall, while systematic evidence is lacking, the drivers of the diversification and subsequent re-focus wave could be related to catering.

2.5. Financial policy

The simple theoretical framework suggests that long-horizon managers may reduce the overall cost of capital paid by their ongoing investors by issuing overpriced securities and repurchasing underpriced securities. Next, we survey the evidence on the extent to which market timing affects equity issues, repurchases, debt issues, cross-border issues, financial intermediation (with thoughts on the recent financial crisis), and capital structure.

2.5.1. Equity issues

Several lines of evidence suggest that overvaluation is a motive for equity issuance. Most simply, in the Graham and Harvey (2001) anonymous survey of CFOs of public corporations, two-thirds state that "the amount by which our stock is undervalued or overvalued was an important or very important consideration" in issuing equity (p. 216). Several other questions in the survey also ask about the role of stock prices. Overall, stock prices are viewed as more important than nine out of ten factors considered in the decision to issue common equity, and the most important of five factors in the decision to issue convertible debt.

Empirically, equity issuance is positively associated with plausible *ex ante* indicators of overvaluation. Pagano, Panetta, and Zingales (1998) examine the determinants of Italian private firms' decisions to undertake an IPO between 1982 and 1992, and find that the most important is the market-to-book ratio of seasoned firms in the same industry. Lerner (1994) finds that IPO

[15] In a case study of the diversification and subsequent refocus of General Mills, Donaldson (1990) writes that the company spent some effort "to verify the dominant trends in investor perceptions of corporate efficiency, as seen in the company study of the impact of excessive diversification on the trend of price-earnings multiples in the 1970s" (p. 140).

volume in the biotech sector is highly correlated with biotech stock indexes. Loughran, Ritter, and Rydqvist (1994) find that aggregate IPO volume and stock market valuations are highly correlated in most major stock markets around the world. Similarly, Marsh (1982) examines the choice between (seasoned) equity and long-term debt by UK quoted firms between 1959 and 1974, and finds that recent stock price appreciation tilts firms toward equity issuance. In US data, Jung, Kim, and Stulz (1996), Hovakimian, Opler, and Titman (2001), and Erel, Julio, Kim, and Weisbach (2010) also find a strong relationship between stock prices and seasoned equity issuance.

There are many non-mispricing reasons why equity issuance and market valuations should be positively correlated, of course. More specific evidence for equity market timing comes from the pattern that new issues earn low subsequent returns. In one of the earliest modern tests of market efficiency, Stigler (1964) tried to measure the effectiveness of the S.E.C. by comparing the *ex post* returns of new equity issues (lumping together both initial and seasoned) from 1923-28 with those from 1949-55. If the S.E.C. improved the pool of issuers, he reasoned, then the returns to issuers in the latter period should be higher. But he found that issuers in both periods performed about equally poorly relative to a market index. Five years out, the average issuer in the pre-S.E.C. era lagged the market by 41%, while the average underperformance in the later period was 30%.

Other sample periods show similar results. Ritter (1991) examines a sample of IPOs, Spiess and Affleck-Graves (1995) examine SEOs, and Loughran and Ritter (1995) examine both.[16] And, Ritter (2003) updates these and several other empirical studies of corporate financing activities. The last paper's sample includes 7,437 IPOs and 7,760 SEOs between 1970 and 1990. Five years out, the average IPO earns lower returns than a size-matched control firm by 30%, and the average SEO underperforms that benchmark by 29%. Gompers and Lerner (2003) fill in the gap between

[16] Updated data on the long-run returns of IPOs is available on Jay Ritter's website at http://bear.warrington.ufl.edu/ritter/ipodata.htm.

the samples of Stigler (1964) and Loughran and Ritter (1995). Their sample of 3,661 IPOs between 1935 and 1972 shows average five-year buy-and-hold returns that underperform the value-weighted market index by 21% to 35%.[17] Thus, a series of large and non-overlapping samples suggests that, on average, US equity issues underperform the market somewhere in the ballpark of 20-40% over five years.

In a test that speaks especially closely to opportunistic market timing of equity sales to new investors, Burch, Christie, and Nanda (2004) examine the subsequent performance of seasoned equity issued via rights offers, which are targeted to a firm's ongoing shareholders, and firm commitment offers, which are targeted to new shareholders. In their 1933 to 1949 sample, a period in which rights offers were more common, they find underperformance concentrated entirely in the latter group. This fits the framework above, which emphasizes the opportunistic timing of equity sales to *new* investors.

Much evidence suggests that investor sentiment varies over time in its strength and nature. For example, stock market bubbles can grow and pop within certain industries. Greenwood and Hanson (2011) exploit this observation. They find that net equity issuance by firms with different characteristics—size, share price, distress status, payout policy, industry, and profitability—helps to predict returns on portfolios defined on those characteristics. Their paper is also an interesting contribution to behavioral asset pricing and shows the value of a unified perspective. That is, the paper suggests how the misvaluation of firm characteristics at any given point in time, an otherwise difficult concept to measure, is betrayed by the financing activity and market timing motives of firms. We will see more results of this sort in the catering section.

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[17] Gompers and Lerner also confirm what Brav and Gompers (1997) found in a later sample: while IPOs have low absolute returns, and low returns relative to market indexes, they often do not do worse than stocks of similar size and book-to-market ratio. One interpretation is that securities with similar characteristics, whether or not they are IPOs, tend to be similarly priced (and mispriced) at a given point in time.

If equity issues cluster when the market as a whole is overvalued, the net gains to equity market timing may be even larger than the underperformance studies suggest. Baker and Wurgler (2000) examine whether equity issuance, relative to total equity and debt issuance, predicts aggregate market returns between 1927 and 1999. They find that when the equity share was in its top historical quartile, the average value-weighted market return over the next year was negative 6%, or 15% below the average market return. Henderson, Jegadeesh, and Weisbach (2006) find a similar relationship in several international markets over the period 1990 to 2001. In 12 out of the 13 markets they examine, average market returns are higher after a below-median equity share year than after an above-median equity share year.[18]

The equity market timing studies continue to be hotly debated. Some authors highlight the usual joint hypothesis problem, implicitly proposing that IPOs and SEOs deliver low returns because they are actually far *less* risky (and priced accordingly by investors). This notion strikes us as fanciful, but for more on this perspective, see Eckbo, Masulis, and Norli (2000),and Eckbo and Norli (2004). On a statistical point, Schultz (2003) highlights a small-sample "pseudo market timing" bias that can lead to exaggerated impressions of underperformance when abnormal performance is calculated in "event time." The empirical relevance of this bias is unclear. Schultz (2003, 2004) argues that it may be significant, while Ang, Gu, and Hochberg (2007), Dahlquist and de Jong (2004), and Viswanathan and Wei (2008) argue that it is minor.[19] The key issue concerns

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[18] Note that these aggregate predictability results should probably not be interpreted as evidence that "managers can time the aggregate market." A more plausible explanation is that broad waves of investor sentiment lead many firms to be mispriced in the same direction at the same time. Then, the *average* financing decision will contain information about the *average* (i.e., market-level) mispricing, even though individual managers are perceiving and responding only to their *own* firm's mispricing.

[19] Butler, Grullon, and Weston (2005) take Schultz's idea to the time-series and argue that the equity share's predictive power is due to an aggregate version of the pseudo market timing bias. Baker, Taliaferro, and Wurgler (2006) reply that the tests in Butler et al. have little actual relevance to the bias and that standard econometric techniques show that small-sample bias can account for only one percent of the equity share's actual predictive coefficient.

the variance in the number of security issues over time. Schultz assumes a nonstationary process for this time series. This means that the number of security issues can explode or collapse to zero for prolonged periods of time, and his simulated variance of equity issuance exceeds the actual experience in the U.S.

In any case, the returns studies, having by nature low power, should not be considered in isolation. Survey evidence was mentioned above. Other relevant results include Teoh, Welch, and Wong (1998a,b), who find that the equity issuers who manage earnings most aggressively have the worst post-issue returns. Jain and Kini (1994), Mikkelson, Partch, and Shah (1997), and Pagano et al. (1998) find that profitability deteriorates rapidly following the initial offering, and Loughran and Ritter (1997) document a similar pattern with seasoned issues. Insider selling also coincides with seasoned offerings, Jenter (2005) finds. In a roundabout but novel approach, DellaVigna and Pollet (2011) hypothesize that managers but not investors recognize the effect of demographic shifts on stock prices in the next five to ten years. Under a market timing policy, managers will wait for those shifts to push up (down) prices to issue (repurchase) equity; perhaps surprisingly, they find evidence for such an effect.

Market timing can help resolve a puzzle of how or why issuers are able to raise outside equity when potential agency costs are high. In the traditional view of Jensen and Meckling (1976), existing owners bear future agency costs up front when they raise new equity, potentially rendering outside equity prohibitively costly. This assumes of course that outside investors are rationally computing these costs. Chernenko, Greenwood, and Foley (2010) find that Japanese firms with the highest agency costs appear to raise capital when *perceptions* of agency costs are low. After listing, their subsequent performance is very poor, as if investors periodically ignored potential agency problems.

Viewed as a whole, the evidence indicates that market timing and attempted market timing play a considerable role in equity issuance decisions. That said, DeAngelo, DeAngelo, and Stulz (2010) remind us that seasoned equity issuance that is not associated with mergers is still an infrequent event.

2.5.2. Repurchases

Undervaluation is a very important motive for repurchases. Brav, Graham, Harvey, and Michaely (2005) survey 384 CFOs regarding payout policy, and "the most popular response for all the repurchase questions on the entire survey is that firms repurchase when their stock is a good value, relative to its true value: 86.6% of all firms agree" (p. 26). Anecdotally, repurchases cluster after unusual market crashes: Hong, Wang, and Yu (2008) highlight the repurchase waves that followed after crashes in October 1987 and September 11, 2001.

At the firm level, repurchasers earn positive abnormal returns on average, suggesting that managers are on average successful in timing them. Ikenberry, Lakonishok, and Vermaelen (1995) study 1,239 open market repurchases announced between 1980 and 1990. Over the next four years, the average repurchaser earned 12% more than firms of similar size and book-to-market ratios. Ikenberry, Lakonishok, and Vermaelen (2000) find similar results in a sample of Canadian firms. Note that these returns are benchmark-adjusted and therefore do not count any successful timing of repurchases from, for example, the rebound from the October 1987 crash.[20]

The evidence is that managers tend to issue equity before low returns, on average, and repurchase before higher returns. Without knowing just how the "rational" cost of equity varies over time, it is difficult to know how much this activity actually reduces the cost of equity for the average firm. However, suppose that rationally required returns are constant. By following

[20] Baker and Wurgler (2000) also study the ability of net equity issuance to predict market returns.

aggregate capital inflows and outflows into corporate equities, and tracking the returns that follow these flows, Dichev (2004) reports that the average "dollar-weighted" return is lower than the average buy-and-hold return by 1.3% per year for the NYSE/Amex, 5.3% for Nasdaq, and 1.5% (on average) for 19 stock markets around the world. Put differently, if NYSE/Amex firms had issued and repurchased randomly across time, then, holding the time series of realized returns fixed, they would have paid 1.3% per year more for the equity capital they employed.

Of course, this reduction in the cost of equity capital is not evenly distributed in the cross section of firms. The composition of firms in position to repurchase, for example, varies over time, as shown by Greenwood and Hanson (2011), in accord with valuation. The static difference between Nasdaq and NYSE/Amex also gives a hint of this. For the many mature firms that rarely raise external equity, the gains may be negligible. For other firms that access the capital markets repeatedly through seasoned equity issues and stock-financed mergers, the gains may be much larger.

2.5.3. Debt issues

A few papers have examined *debt* market timing—raising debt when its cost is unusually low. Survey evidence offers support for market timing being a factor in debt issuance decisions. Graham and Harvey (2001) find that interest rates are the most cited factor in debt policy decisions: CFOs issue debt when they feel "rates are particularly low." Expectations about the yield curve also appear to influence the *maturity* of new debt. Short-term debt is preferred "when short-term rates are low compared to long-term rates" and when "waiting for long-term market interest rates to decline." While the former statement would be consistent with the preference for a low interest rates to pump up earnings (Stein (1989)), the latter clearly indicates a skepticism in the textbook expectations hypothesis, which posits that the cost of debt is equal across maturities. At

the same time, CFOs do not confess to exploiting their private information about credit quality, instead highlighting general debt market conditions.

On the empirical side, Marsh (1982), in his sample of UK firms, finds that the choice between debt and equity does appear to be swayed by the level of interest rates. Guedes and Opler (1996) examine and largely confirm the survey responses regarding the effect of the yield curve. In a sample of 7,369 US debt issues between 1982 and 1993, they find that maturity is strongly negatively related to the term spread (the difference between long- and short-term bond yields), which fluctuated considerably during this period.

Is there any evidence that debt market timing is successful? In aggregate data, Baker, Greenwood, and Wurgler (2003) examine the effect of debt market conditions on the maturity of debt issues and, perhaps more interestingly, connect the maturity of new issues to subsequent bond market returns. Specifically, in US Flow of Funds data between 1953 and 2000, the aggregate share of long-term debt issues in total long- and short-term debt issues is negatively related to the term spread, just as Guedes and Opler find with firm-level data. Further, because the term spread is positively related to future excess bond returns—i.e. the difference in the returns of long-term and short-term bonds, or the realized relative cost of long- and short-term debt—so is the long-term share in debt issues. Perhaps simply by using a naïve rule of thumb, "issue short-term debt when short-term rates are low compared to long-term rates," managers may have timed their debt maturity decisions so as to reduce their overall cost of debt. Of course, such a conclusion is subject to the usual risk-adjustment caveats.

Greenwood, Hanson, and Stein (2008) go deeper into the effect of debt market efficiency on maturity structure, and while it falls within the market timing spirit it has the appealing feature that it does not require that firms have a debt market forecasting ability. Specifically, they argue that there are shocks to supply of bonds at different points in the yield curve, for example changes in the

maturity structure of government debt, that introduce corresponding mispricings along the yield curve. Anyone can observe these. Given limited arbitrage on the investor side, firms that are indifferent to their debt maturity (in this otherwise Modigliani-Miller world) can supply debt at the mispriced term, limited only by their size.

Unfortunately, the data on individual debt issues and their subsequent returns does not approach the level of detail of the IPO and SEO data. But one intriguing pattern that has been uncovered is that debt issues, much like equity issues, are followed by low *equity* returns. Spiess and Affleck-Graves (1999) examine 392 straight debt issues and 400 convertible issues between 1975 and 1989. The shares of straight debt issuers underperform a size- and book-to-market benchmark by an insignificant 14% over five years (the median underperformance is significant), while convertible issuers underperform by a significant 37%. There is also a suggestion that the riskiest firms may be timing their idiosyncratic credit quality, despite the survey answers on this point: the shares of unrated issuers have a median five-year underperformance of 54%. If the equity did so poorly, the debt issues presumably also did poorly. In a much broader panel, Richardson and Sloan (2003) also find that net debt issuance is followed by low stock returns.

There are several potential explanations for this pattern. Certainly, equity overvaluation would be expected to lower the cost of debt directly, because credit risk models routinely include stock market capitalization as an input, so the relationship with subsequent stock returns may reflect debt market timing *per se*. Or, perhaps managerial and investor sentiment is correlated; managers may tend to be most optimistic precisely when capital is cheap, and thus raise and invest as much as they can from any source. This story combines investor and managerial irrationality and so does not fit neatly within the market timing framework, but may have some truth. A third possibility, outlined in Baker, Stein, and Wurgler (2003), is that equity overvaluation relaxes a

binding leverage constraint, creating debt capacity that subsequently gets used up. But debt is always correctly priced in this setting, so debt market timing *per se* is not possible.

2.5.4. Cross-border issues

The study of dual-listed shares by Froot and Dabora (1999) shows that even highly liquid markets such as the US and the UK can attach different prices to the same cash flow stream. This raises the possibility of timing across international markets. Along these lines, Graham and Harvey (2001) find that among US CFOs who have considered raising debt abroad, 44% implicitly dismissed covered interest parity in replying that lower foreign interest rates were an important consideration in their decision.[21]

In practice, most international stock and bond issues are made on the US and UK markets. Henderson, Jegadeesh, and Weisbach (2006) find that when total foreign issues in the US or the UK are high, relative to respective GDP, subsequent returns on those markets tend to be low, particularly in comparison to the returns on issuers' own markets. In a similar vein, and consistent with the survey evidence mentioned above, foreign firms tend to issue more debt in the US and the UK when rates there are low relative to domestic rates.

2.5.5. Financial intermediation

Our focus is mostly on the financing decisions of firms, but financial intermediaries often play a critical role between firms and the ultimate investors. To the extent that capital market inefficiencies affect corporate finance, an interesting question is how intermediaries affect issuance and investment patterns and whether they play a stabilizing or destabilizing role. The role of financial intermediaries in behavioral corporate finance is an interesting question in its own right that deserves more research attention. We mention papers in the area of banking, private equity,

[21] Almost all equity raised by US corporations is placed in domestic markets, so Graham and Harvey do not ask about the determinants of international stock issues.

and venture capital. These questions obviously loom large in light of the recent financial crisis, which we discuss next.

Banks are not dissimilar to firms in that they have the same market timing motives to sell overvalued securities and buy back securities that are undervalued. Motivated by the crisis, Shleifer and Vishny (2010) model how financial intermediaries can take advantage of investor sentiment in this way through securitized lending—creating and selling overpriced assets. This creates a channel for banks to transmit sentiment-driven mispricing into real effects. In their model, banks retain a fraction of their loans. After a haircut, the value of these loans determines how much they can borrow short-term. When loan values are high, borrowing to make more of them and expand the balance sheet and finance more real investment is so profitable that it is worth the risk of having to liquidate their holdings if and when prices fall below fundamentals. As Charles Prince, the CEO of Citigroup, famously said in July 2007, "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." As a result, far from being in a position to buy underpriced loans and stabilize the market, or finance new investment, banks can deepen a crisis.

Fang, Ivashina, and Lerner (2010) find evidence of opportunism in bank involvement in private equity. In particular, banks' share of private equity transactions peaks when the private equity market is experiencing large inflows. Moreover, transactions done at market peaks are more likely to turn out poorly. A broader view of private equity is that it profits from the imperfect integration between credit and equity markets. Occasionally, borrowing to finance the purchase of public or private firms is cheap relative to the cost of equity capital, enticing the share of private equity in mergers and acquisitions to cheap. Because this is purely a time series view, and private equity has a short history, it is difficult to prove. However, Axelson, Jenkinson, Stromberg, and Weisbach (2010) provide corroborating evidence of a link between financing costs and deal pricing.

It has been suggested that intermediaries can cause financial market "dislocations" to propagate from one set of firms to another, affecting real activity. Townsend (2011) considers the case of venture capital, where information asymmetry can lead to the portfolio firm being locked into a relationship with one capital provider, e.g. as in Rajan (1992). He finds that after the Internet bubble burst, non-tech firms had difficulty getting follow-on funding if their venture capitalists had high tech exposure. The question is why venture capitalists do not respond by diversifying their portfolios or reserving capital for follow-on offerings. This is in the same spirit as the Shleifer-Vishny model, where in this case the lure of reselling Internet firms to a frothy market is so profitable that it is worth the risk of being short of capital in the event of a collapse.

The recent financial crisis has many different elements, from the decisions of individual borrowers to the ultimate purchasers of mortgage backed securities, and the involvement of numerous intermediaries, including mortgage brokers, mortgage banks, investment banks and other underwriters of mortgage-backed and other collateralized debt obligations (CDOs), ratings agencies, bond insurers, and the government-sponsored entities, Fannie Mae and Freddie Mac. It is no surprise that there is not a tidy behavioral, or rational, explanation to its causes or its ultimate real consequences. Barberis (2011) makes significant progress in this direction. We do not have room to fully survey the burgeoning literature on the crisis here.

A behavioral view of the crisis starts with the observation that less than fully rational demand was the underpinning of twin bubbles in real estate and the debt contracts underlying real estate and other similar assets. There are a variety of explanations. For example, investors and ratings agencies neglected a rare but not zero probability bad state and overvalued quasi-AAA securities in Gennaioli, Shleifer, and Vishny (2011). Real estate and credit instruments were difficult to short, so differences of opinion may have led to overvaluation. Or, most simply, investors extrapolated short histories of high real estate returns and low default probabilities. Greenwood

and Hanson (2010) find predictability in a much longer time series of returns on credit. A period of high returns on risky debt and loosened credit standards is predictably followed by lower returns.

Institutions played a role, catering to investor demand for safe assets. Investment banks created seemingly low risk assets with pooling and tranching. This combined in some cases with bond insurance increased the supply for AAA securities. Coval and Stafford (2010) argue that ratings agencies focused on default probabilities, neglecting the price of risk for senior tranches of CDOs. This is a more subtle argument than the conflicts of interest of issuers paying the ratings agencies for an opinion that have been highlighted by politicians and the media.

A defining feature of the financial crisis was that systemically important banks retained a significant exposure to all types of mortgage securities. There are a number of explanations. One is that they simply carried inventory of mortgages and were left with these securities on their balance sheets at the start of the financial crisis. Unlike Internet IPOs, CDOs required time and bank capital to assemble. A second explanation is that they intentionally took risks with limited bank capital, intentionally gambling on a positive outcome in the mortgage markets. This moral hazard view has shaped the debate in financial reform. A challenge to this view is that the leadership of Bear Stearns and Lehman Brothers who were in a position to change leverage had a lot at stake, and indeed lost much of their wealth in 2008. A third explanation is that there were agency problems within the firm and the structured finance groups with the most information about these markets did not share with management. A final explanation is that they were convinced by their own marketing or, relatedly, they were focused on short-term performance and the high prices of mortgage securities that changed hands prior to the crisis. This belongs to the section on less than fully rational managers. Whether this was overconfidence, cognitive dissonance, or a larger sociological phenomenon is hard to pin down.

A few general observations are worth making about recent financial crises. Both the Internet crash and the financial crisis started with significant asset price bubbles, both also involved the active or at least complicit participation of financial intermediaries, but the financial crisis involved much more direct exposure within the banking system—and hence larger real consequences. Moreover, both seem to involve equal parts of agency problems within institutions and investor sentiment.

2.5.6. Capital structure

As an accounting identity, a firm's capital structure is the cumulative outcome of a long series of incremental financing decisions, each driven by the need to fund some investment project, consummate a merger, refinance or rebalance, or achieve some other purpose. To the extent that market timing is a determinant of any of these incremental financing decisions, then, it may help to explain the cross-section of capital structure. In particular, if market timing-motivated financing decisions are not quickly rebalanced away, low-leverage firms will tend to be those that raised external finance when their stock prices were high, and hence those that tended to choose equity to finance past investments and mergers, and vice-versa for high leverage firms.[22]

Such a market timing theory of capital structure is outlined in Baker and Wurgler (2002). In an effort to capture the historical coincidence of market valuations and the demand for external finance in a single variable, they construct an "external finance weighted-average" of a firm's past market-to-book ratios. For example, a high value would mean that the firm raised the bulk of its external finance, equity *or* debt, when its market-to-book was high. If market timing has a persistent impact on capital structure, this variable will have a negative cross-sectional relationship

[22] Similarly, debt maturity structure could to some extent reflect the historical coincidence of debt-raising needs and debt market conditions like the term spread.

to the debt-to-assets ratio, even in regressions that control for the current market-to-book ratio. In a broad Compustat sample from 1968 to 1999, a strong negative relationship is apparent.

This evidence has inspired debate. On one hand, Hovakimian (2006) argues that equity issues do not have persistent effects on capital structure, and that the explanatory power of the weighted average market-to-book arises because it contains information about growth opportunities, a likely determinant of target leverage, that is not captured in current market-to-book. Leary and Roberts (2005), Kayhan and Titman (2004), Flannery and Rangan (2006) also argue that firms rebalance toward a target. Alti (2006) looks specifically at the time series variation in IPO leverage, finding that an initial and statistically significant response to hot issues markets is short-lived.

On the other hand, Huang and Ritter (2009) show that the tendency to fund a financing deficit with equity decreases when the cost of equity is low. Furthermore, Welch (2004) and Huang and Ritter (2009), like Fama and French (2002), argue that firms rebalance their capital structures much more slowly, so that shocks to capital structure are long lived. And, in any event, Chen and Zhao (2007) point out that mean reversion in leverage is not definitive evidence for a tradeoff theory. Leverage is a ratio, so shocks tend to cause mean reversion mechanically. In an analysis of the choice between equity and debt issues, which avoids this problem, Chen and Zhao (2005) find that deviation-from-target proxies have little explanatory power, while market-to-book and past stock returns are very important.

2.6. Other corporate decisions

In this subsection, we consider what the market timing and catering approach has to say about dividend policy, firm name changes, and earnings management.[23] We also discuss work that looks at executive compensation from this perspective.

2.6.1. Dividends

The catering idea has been applied to dividend policy. Long (1978) provides some early motivation for this application. He finds that shareholders of Citizens Utilities put different prices on its cash dividend share class than its stock dividend share class, even though the value of the shares' payouts are equal by charter. In addition, this relative price fluctuates. The unique experiment suggests that investors may view cash dividends *per se* as a salient characteristic, and in turn raises the possibility of a catering motive for paying them.

Baker and Wurgler (2004a) test a catering theory of dividends in aggregate US data between 1963 and 2000. They find that firms initiate dividends when the shares of existing payers are trading at a premium to those of nonpayers, and dividends are omitted when payers are at a discount. To measure the relative price of payers and nonpayers, they use an *ex ante* measure of mispricing they call the "dividend premium," which is just the difference between the average market-to-book ratios of payers and nonpayers. They also use *ex post* returns, and find that when the rate of dividend initiation increases, the future stock returns of payers (as a portfolio) are lower than those of nonpayers. This is consistent with the idea that firms initiate dividends when existing payers are relatively overpriced. Li and Lie (2006) find similar results for dividend changes.

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[23] We put dividend policy in this section and repurchases in the financing section, because, unlike a repurchase, pro-rata dividends do not change the ownership structure of the firm, and there is no market timing benefit or cost. For this reason, it fits more naturally with the category of corporate decisions that might influence the level of mispricing, but do not by themselves transfer value among investors.

Time-varying catering incentives shed much light on the "disappearance" of dividends. Fama and French (2001) document that the percentage of Compustat firms that pay dividends declines from 67% in 1978 to 21% in 1999, and that only a part of this is due to the compositional shift towards small, unprofitable, growth firms which are generally less likely to pay dividends. Baker and Wurgler (2004b) document that the dividend premium switched sign from positive to negative in 1978 and has remained negative through 1999, suggesting that dividends may have been disappearing in part because of the consistently lower valuations put on payers over this period. An analysis of earlier 1963-77 data also lends support to this idea. Dividends "appeared," "disappeared," and then "reappeared" in this period, and each shift roughly lines up with a flip in the sign of the dividend premium. In UK data, Ferris, Sen, and Yui (2006) find that dividends have been disappearing during the late 1990s, and that a dividend premium variable formed using UK stocks lines up with this pattern.

Supposing that dividend supply does respond to catering incentives, why does investor demand for payers vary over time in the first place? One possibility is that "dividend clienteles" vary over time, for example with tax code changes. However, in US data, the dividend premium is unrelated to the tax disadvantage of dividend income, as is the rate of dividend initiation. Shefrin and Statman (1984) develop explanations for why investors prefer dividends based on self-control problems, prospect theory, mental accounting, and regret aversion. Perhaps these elements vary over time. Baker and Wurgler (2004a) argue that the dividend premium reflects sentiment for "risky" nonpaying growth firms versus "safe" dividend payers, since it falls in growth stock bubbles and rises in crashes; Fuller and Goldstein (2011) show explicitly that payers outperform in market downturns. Anecdotal evidence suggests that some investors flock to the perceived safety of dividends in gloomy periods, and bid up payers' prices, at least in relative terms, in the process.

There are limitations to a catering theory of dividends. For one, it is a descriptive theory of whether firms pay dividends at all, not how much—in US data, at least, the dividend premium does not explain aggregate fluctuations in the level of dividends. DeAngelo, DeAngelo, and Skinner (2004) report that the aggregate dollar value of dividends has increased in real terms, as dividends have become concentrated in a smaller faction of traded firms. Also, the theory works better for explaining initiations than omissions, and it has little to say about the strong persistence in dividend policy. Catering, like agency or asymmetric information or taxes, is best viewed as one element in an overall theory of dividend policy. As we will see later, it is not even the only approach to dividends that behavioral corporate finance offers.

2.6.2. Earnings management

The quarterly net income figure that managers report to shareholders differs from actual economic cash flows by various non-cash accruals, some discretionary. This becomes interesting when, as documented in the survey by Graham, Harvey, and Rajgopal (2005), CFOs believe that investors care more about earnings per share than cash flows.

Indeed, certain patterns in reported earnings numbers are clearly shaped by catering concerns. Most prominent among these are the reference points documented by Degeorge, Patel, and Zeckhauser (1999). Earnings are managed to exceed three salient thresholds. In order of importance, these are positive earnings, past reported earnings, and analysts' expectations. Interestingly, the shape of the earnings distributions show that the threshold is generally met from below: firms near the thresholds stretch to meet them, not treating them as lower bounds and shifting earnings to the future.[24] Carslaw (1988) and Bernard (1989) find that reported earnings and earnings per share cluster at salient round numbers, such as multiples of five or ten cents.

[24] In the behavioral signaling section of the paper, we discuss a more dynamic model with both features.

These patterns do not hold for negative earnings, however; apparently, managers do whatever they can to distract attention from bad results.

These patterns have a flavor of catering to shareholder loss aversion relative to salient earnings reference points. At the same time, there are non-behavioral contributors to these patterns. First, earnings management can be a Nash equilibrium result (Stein (1989)) under asymmetric information. Second, managerial bonuses or debt contracts may be conditional on earnings performance relative to simple benchmarks. Of course, the use of such contracts begs the question why shareholders and financiers should care about salient benchmarks over continuous measures of performance in the first place.

Consistent with catering, managers with "short horizons" are especially likely to manage earnings. Bergstresser and Philippon (2006) find that accruals management is greater in companies whose CEO's compensation, via stock and options holdings, is sensitive to current share prices. Sloan (1996) finds that firms with high accruals earn low subsequent returns, which suggests that earnings management may be successful in boosting share price, or at least in sustaining overvaluation. Consistent with the view that managers use earnings management to fool investors and issue overvalued equity, Teoh, Welch, and Wong (1998a,b) find that initial and seasoned equity issuer underperformance is greatest for firms that most aggressively manage pre-issue earnings.

An important question is whether earnings management has significant consequences for investment. Graham, Harvey, and Rajgopal (2005) present CFOs with hypothetical scenarios and find that 41% of them would be willing to pass up a positive-NPV project just to meet the analyst consensus EPS estimate. Direct evidence of this type of value loss is difficult to document, but Jensen (2005) presents several anecdotes, and suggestive empirical studies include Teoh et al. (1998a,b), Erickson and Wang (1999), Bergstresser, Desai, and Rauh (2006), and McNichols and

Stubben (2008). One provocative finding is that earnings management activity increases prior to stock acquisitions.

2.6.3. Firm names

Name changes provide some of the simplest and most colorful examples of catering. In frictionless and efficient markets, of course, firm names are as irrelevant as dividends. But there is at least a modest fundamental cost of changing names, and perhaps through a name change a firm can create a salient association with a temporarily overpriced category of stocks.

Evidence of a catering motive for corporate names is most prominent in bubbles. In the 1959-62 era which Malkiel (1990) refers to as the "tronics boom," firms "often included some garbled version of the word 'electronics' in their title even if the companies had nothing to do with the electronics industry" (p. 54). Systematic evidence has been assembled for the Internet bubble. Cooper, Dimitrov, and Rau (2001) find that 147 (generally small) firms changed to "dotcom" names between June 1998 and July 1999, as Internet valuations were rapidly rising. Catering to Internet sentiment did seem to deliver a short-term price boost: Cooper et al. report a remarkably large average announcement effect of 74% for their main sample, and an even larger effect for the subset that had little true involvement with the Internet.

Interestingly, Cooper et al. (2005) document that names were later used to *dissociate* companies from the Internet sector when prices crashed. Between August 2000 and September 2001, firms that dropped their dotcom name saw a positive announcement effect of around 70%. The effect was almost as large for firms that dropped the dotcom name but kept an Internet business focus, and for the double dippers which dropped the name they had newly adopted just a few years earlier.

Mutual fund companies also appear to be aware of the power that names have on investor demand. Cooper, Gulen, and Rau (2005) find that fund names shift away from styles that experience

low returns and toward those with high returns. The authors find that name changes do not predict fund performance, yet inflows increase dramatically, even for cosmetic name changers whose underlying investment style remains constant. Presumably, then, the name change decision is driven in part by the desire to attract fund inflows and thus increase the fund's fee income. Indeed, Cooper et al. find that the inflow effect increases when money is spent to advertise the "new" styles.

2.6.4. Nominal share prices

The average share price has centered around $25 since the Depression, as noted by Dyl and Elliott (2006) and Weld, Benartzi, Michaely, and Thaler (2009). This is despite a dramatic deflation in the value of a dollar over the last century. In markets that are rising because of inflation or real growth, this average is maintained by splits. Weld et al. argue that standard explanations based on signaling or optimal trading ranges, which are most naturally thought of in real not nominal terms, are unable to explain the constancy of nominal prices, and several other related facts about active share price management. For example, both IPO prices and the share prices of open-end mutual funds have also remained relatively constant. They propose instead that managers are simply following norms, adhering to an arbitrary historical convention from which there is no particular reason to deviate given investor expectations.

Weld et al. study the stability of stock prices relative to the benchmark of no price management. Prices are not managed continuously, of course—on average and for individual stocks, prices are quite variable relative to the other extreme benchmark of a constant nominal price. Baker, Greenwood, and Wurgler (2009) study not the stationarity of average nominal prices but why they vary by a factor of two or more over time.

Baker et al. propose that share prices are used as another tool to cater to time-varying shareholder sentiment. In analogy to the dividend premium, they form a "low-price premium" as the average market-to-book ratio of stocks whose prices fall in the bottom three deciles minus the

average of those with prices in the top three deciles. They find that when existing low-price firms have high valuations, more firms split, and those splitters split to lower prices. IPOs also make for a powerful test, as they are free to list at almost any price. Consistent with catering, IPOs' average prices vary closely with the low-price premium.

This leaves a question of interpretation. One derives from the strong cross-sectional relationship between firm capitalization and nominal price. If shareholders take price as shorthand for size or growth potential, firms may split in order to "act small" when stocks that are small are especially highly valued. They cannot change capitalization, but they can change share price.

2.6.5. Executive compensation

In the framework at the beginning of this section, we assumed that managers have the incentive to cater to short-term mispricing. One question is why shareholders do not set up executive compensation contracts to force managers to take the long view.[25] Bolton, Scheinkman, and Xiong (2005) suggest that short horizons may be an equilibrium outcome. They study the optimal incentive compensation contract for the dynamic speculative market of Scheinkman and Xiong (2003), in which two groups of overconfident investors trade shares back and forth as their relative optimism fluctuates. The share price in this market contains a speculative option component, reflecting the possibility that nonholders might suddenly become willing to buy at a high price. Bolton et al. find that the optimal contract may induce the CEO to take costly actions that exacerbate differences of opinion, thus increasing the value of the option component of stock prices, at the expense of long-run value.

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[25] A separate but related question is how managers compensate lower-level employees. Bergman and Jenter (2007) argue that rational managers may minimize costs by paying optimistic employees in overvalued equity, in the form of options grants. Benartzi (2001) offers a foundation for this sort of optimism, showing that employees have a tendency to extrapolate past returns, and as a consequence hold too much company stock. See also Core and Guay (2001) and Oyer and Schaefer (2005).

3. Managerial Biases

A second strand of behavioral corporate finance studies the behavior of irrational managers operating in efficient capital markets. By irrational managerial behavior we mean behavior that departs from rational expectations and expected utility maximization of the manager. We are not interested in rational moral hazard behavior, such as empire building, stealing, or plain slacking off. We are concerned with situations where the manager believes that he is actually close to maximizing firm value—and, in the process, some compensation scheme—but is in fact deviating from this ideal.[26] We begin with a quick overview of the relevant psychology, then develop a simple theoretical framework, and follow with a review of this literature.

3.1. Background on managerial behavior

The psychology and economics literatures relevant to understanding managerial behavior are vast. For us, the main themes are that individuals do not always form beliefs logically, nor do they convert a given set of beliefs into decisions in a consistent and rational manner. These recall the definitions of investor sentiment and irrational behavior that are assumed in market timing and catering studies. Following a note about corporate governance, we introduce and motivate the biases and nonstandard preferences that have been investigated in the context of managerial decisions.

3.1.1. Limited governance

For less-than-fully-rational managers to have an impact, corporate governance must be limited in its ability to constrain them into making rational decisions. This is analogous to the requirement of limited arbitrage for the market timing approach.

[26] Our focus is on corporate finance. Camerer and Malmendier (2009) discuss the impact of less than fully rational behavior on other parts of organizations.

Assuming limited governance is no less reasonable than assuming limited arbitrage. Indeed, in the US, a significant element of managerial discretion is codified in the business judgment rule. Takeover battles and proxy fights are notoriously blunt tools. Boards may be more a part of the problem than the solution if they have their own biases or are pawns of management. For instance, Gompers, Ishii, and Metrick (2003) find that firms that elected policies to diminish shareholder rights experience lower stock returns. And unlike in a traditional agency problem, which arises out of a conflict of interest between managers and outside investors, standard incentive contracts have little effect, because an irrational manager may well think that he is maximizing value.

It is obvious from casual observation that top managers "matter," in that they have the power to make decisions that affect investment and financing policy and firm value. There is also systematic evidence. Bertrand and Schoar (2003) find that individual managers have investment and financing styles and preferences, possibly inherent and possibly based on beliefs shaped by beliefs, that they bring from previous to new employers. For example, CEOs that use bigger mortgages for their own home purchases also use more leverage in their firms (Cronqvist, Makhija, and Yonker (2011)), although part of this effect can be attributed to endogenous firm-manager matching. Kaplan, Klebanov, and Sorensen (2011) find that certain executive ability characteristics are correlated with firm performance. As one might expect, the expression of individual managerial decisions is stronger when the CEO is powerful or, similarly, when governance is weaker (Adams, Almeida, and Ferreira (2005) and Cronqvist et al.).

3.1.2. Bounded rationality

Perhaps the simplest deviation from the benchmark of full rationality goes by the name of bounded rationality, introduced by Simon (1955). Bounded rationality assumes that some type of cognitive or information-gathering cost prevents agents from making fully optimal decisions. Boundedly-rational managers cope with complexity by using rules of thumb that ensure an

acceptable level of performance and, hopefully, avoid severe bias. Conlisk (1996) reviews the older bounded rationality literature; see Gabaix (2011) for a more recent modeling approach. Bounded rationality offers a reasonably compelling motivation for the financial rules of thumb that managers commonly use. We note some of these and consider the distortions that they create.

3.1.3. Optimism, overconfidence and hubris

Most research in the managerial biases literature has focused on the illusions of optimism and overconfidence. Illustrating optimism, Weinstein (1980) finds that subjects believe themselves more likely than average to experience positive future life events (e.g. owning own home, living past 80) and less likely to experience negative events (being fired, getting cancer). Illustrating overconfidence in one's own skills, and possibly optimism as well, Svenson (1981) finds that 82% of a sample of students placed themselves among the top 30% safest drivers.

There are good reasons to focus on these particular biases in a managerial setting. First, they are strong and robust, having been documented in many samples, including samples of actual managers (Larwood and Whittaker (1977), March and Shapira (1987), and Ben-David, Graham, and Harvey (2010)). Second, managerial decisions tend to be highly complex, a setting where overconfidence is most pronounced, and idiosyncratic, which reduces the potential for debiasing through learning (Gervais (2010)). Third, these biases are also often fairly easy to integrate into existing models. Optimism is usually modeled as an overestimate of a mean ability or outcome and overconfidence as an underestimate of a variance. In this fashion we model the consequences of optimism, below, and also note situations in which an alternative assumption of overconfidence could lead to different conclusions.

Finally, overconfidence also leads naturally to more risk-taking. Even if there is no overconfidence on average in the population of *potential* managers, those that are overconfident are more likely to perform extremely well (and extremely badly), placing them disproportionately

in the ranks of upper (and former) management. And even if an individual manager is born without bias, an attribution bias—the tendency to take greater responsibility for success than failure (e.g., Langer and Roth (1975))—may lead successful managers to *become* overconfident, as modeled in Gervais and Odean (2001).

3.1.4. More on reference dependence

Reference points and anchoring are equally compelling psychological foundations, when compared to overconfidence, and offer some empirical advantages in identifying behavioral effects in corporate finance. Section 2.1 describes the psychological underpinnings of reference points and anchoring. These hold special interest within a firm. A firm is collection of implicit and explicit contracts between managers and employees, the firm and its customers, creditors, underwriters, shareholders, and other stakeholders. It is natural to think of these as forming reference points in negotiations, and determining *ex post* the satisfaction of the various parties. For example, whether the management is satisfied with the performance of its underwriters depends on their performance relative to a reference price. Whether shareholders are satisfied with a merger offer depends on the price relative to recent transaction prices; we will see specific evidence of this later.

Hart (2008) uses reference points more broadly as the underpinning for a theory of the firm. Using contracts as reference points to which parties feel entitled is a substitute for the assumptions of incomplete contracts and ex post bargaining over the surplus that drive the results in Grossman and Hart (1986) and Hart and Moore (1990). Because we do not observe this sort of bargaining within real firms, the reference point approach may outlive the existing architecture of the property rights theory of the firm. So far, however, much of the empirical evidence is focused on narrower applications of reference point preferences.

For the moment, we use overconfidence, instead of reference points, as an example of an organizing framework in the next section. The section on behavioral signaling at the end of the survey will develop a model using reference points.

3.2. Theoretical framework

The derivation below is in the spirit of Heaton (2002) and Malmendier and Tate (2005), modified to match the notation in the market timing and catering model as much as possible. We assume the manager is optimistic about the value of the firm's assets and investment opportunities. He balances two conflicting goals. The first is to maximize *perceived* fundamental value. To capture this, we augment fundamental value with an optimism parameter γ,

$$(1+\gamma)f(K,\cdot)-K,$$

where f is increasing and concave in new investment K. Note that here, the manager is optimistic about both the assets in place (f can include a constant term) and new opportunities. Once again, if traditional market imperfections cause the Modigliani and Miller (1958) theorem to fail, financing may enter f alongside investment.

The manager's second concern is to minimize the *perceived* cost of capital. We assume here that the manager acts on behalf of existing investors, because of his own stake in the firm and fiduciary duty. This leads to a similar setup to the market timing objective in Section 2.2, except that an optimistic manager never believes there is a good time to issue equity. In particular, since the capital market is efficient and values the firm at its true fundamental value of f-K, the manager believes that the firm is undervalued by γf, and thus in selling a fraction of the firm e he perceives that existing, long-run shareholders will lose

$$e\gamma f(K,\cdot).$$

Putting the two concerns together, the optimistic manager chooses new investment and financing to solve

$$\max_{K,e}(1+\gamma)f(K,\cdot)-K-e\gamma f(K,\cdot).$$

We do not explicitly include a budget constraint. Instead, again to keep the notation simple, we consider its reduced-form impact on *f*.

Differentiating with respect to *K* and *e* gives the optimal investment and financial policy of an optimistic manager operating in efficient capital markets:

$$f_K(K,\cdot)=\frac{1}{1+(1-e)\gamma}, \text{ and}$$

$$(1+\gamma)f_e(K,\cdot)=\gamma(f(K,\cdot)+ef_e(K,\cdot)).$$

The first condition is about investment policy. Instead of setting the marginal value created from investment equal to the true cost of capital, normalized to be one here, managers overinvest, to the point where the marginal value creation is less than one. The more optimistic (γ) is the manager and the less equity (*e*) he is forced to raise in financing investment, the greater the problem. To the extent that the manager has to raise capital by issuing equity, the cost of capital is scaled up by the same factor as the manager's over-optimism scales up the marginal product of capital, so raising equity offsets the distortion in investment caused by over-optimism. If 100% of the capital is raised by issuing equity, for example, investment is first-best. The second condition is about financing. The marginal value lost from shifting the firm's current capital structure away from equity is weighed against the perceived market timing losses. As in the analysis of irrational investors, we consider some special cases.

Investment policy. If there is no optimal capital structure, so that f_e is equal to zero, the manager will not issue equity, setting e to zero, and there is no interaction among financing, internal funds, and investment. In this case, the optimistic manager will clearly overinvest: f_K is less than unity. In Heaton (2002) and Malmendier and Tate (2005), there is an optimal capital structure, or more precisely an upper bound on debt. If the manager needs equity to invest (here, f_e greater than zero), the degree of overinvestment falls.

Needing equity is akin to having little cash or cash flow available for investment. Thus in this setup, investment can be strongly related to current cash flow and profits, controlling for investment opportunities. This leads to a behavioral foundation for the Jensen (1986) agency costs of free cash flow. But instead of receiving private benefits of control, managers are simply optimistic and overinvest from current resources as a result. Leverage reduces the degree of overinvestment by increasing f_e, thereby increasing equity issues e and reducing K.

In a more complex specification, these conclusions may change. One might have the manager optimistic only about assets in place, in which case there is no overinvestment, and there will typically be underinvestment as a firm approaches its debt capacity. Also, it is worth emphasizing that we are examining optimism in isolation here. Layering on other imperfections, such as risk aversion, may mean that optimism moves investment from an inefficiently *low* level toward the first best, as in Gervais, Heaton, and Odean (2010) and Goel and Thakor (2002). We will revisit some of these interactions when we discuss executive compensation. Hackbarth (2009) discusses another setting in which multiple biases can work in opposition, arguing that the combination of managerial optimism and overconfidence can reduce the underinvestment due to debt overhang (Myers (1977)).

Financial policy. An optimistic manager never sells equity unless he has to. If there is an upper bound on leverage (f_e greater than zero, here), optimism predicts a pecking order of

financing decisions: The manager relies on internal capital and debt and uses outside equity only as a last resort. Again, other imperfections may mitigate the aversion to equity. If the manager is risk averse with an undiversified position in the firm's equity, for example, he may wish to issue equity even though it is below what he thinks it to be worth.

Managerial overconfidence can have different effects on capital structure than optimism, Hackbarth (2009) argues. If overconfidence is modeled as underestimating the risk of earnings, managers may view their debt as undervalued and too expensive as a source of capital. The convexity of equity, on the other hand, leads managers to view their equity as overvalued. This reverses the pecking order that obtains under optimism. Suffice to say that theoretical predictions about the effect of optimism and overconfidence on capital structure are somewhat sensitive to the modeling framework.

Other corporate decisions. It is not as easy to incorporate other decisions into this framework. Consider dividend policy. If the manager is more optimistic about future cash flow and assets in place than outside investors, he might view a dividend payment as more sustainable. On the other hand, if he views future investment opportunities, and hence funding requirements, as greater, he might be reluctant to initiate or increase dividends and retain internal funds instead. This analysis requires a more dynamic model of investment and cash flow and a decomposition of firm value into assets in place and growth opportunities.

3.3. Empirical challenges

If the main obstacle to testing the irrational investors approach is finding a proxy for misvaluation, the challenge here is to identify optimism, overconfidence, or the behavioral bias of interest. Without an empirical measure, the irrational managers approach is typically difficult to distinguish from standard agency theory. That is, in Stein (2003), an empire-building manager will

$$\max_{K,e}(1+\gamma)f(K)-K-c(e),$$

where γ reflects the preference for or the private benefits that come with presiding over a larger firm, as in Jensen and Meckling (1976) or Grossman and Hart (1988), rather than optimism. Rational investors recognize the agency problem up front, so *c* reflects the cost of raising outside equity, and management and existing shareholders bear the agency costs.

This reduced form is almost identical to the objective function of an optimistic manager. Both can generate overinvestment, underinvestment, cash flow-investment sensitivities, pecking order financing, and so forth. Moreover, Stein points out that the agency model is itself hard to distinguish from models of costly external finance built on asymmetric information. Thus, to test the behavioral theories, one must separate the γ related to overconfidence and optimism from the γ that arises from agency or asymmetric information problems.

3.4. Investment policy

Despite the difficulty of obtaining direct, manager-level measures of optimism and overconfidence, evidence is accumulating that these biases do affect business investment.

3.4.1. Real investment

The evidence does suggest that entrepreneurial startups are often made under a halo of overconfidence and optimism. Cooper, Woo, and Dunkelberg (1998) find that 68% of entrepreneurs think that their startup is more likely to succeed than comparable enterprises, while only 5% believe that their odds are worse, and a third of entrepreneurs view their success as all but guaranteed. The survey of French entrepreneurs by Landier and Thesmar (2009) gives the same message: At startup, 56% expect "development" in the near future while only 6% expect "difficulty."

The actual performance of startup investments is more sobering. Landier and Thesmar find that when surveyed three years into their endeavor, only 38% of French entrepreneurs expect further "development" while 17% anticipate "difficulty." Leaving profitability aside entirely, only half of all startups survive more than three years (Scarpetta, Hemmings, Tressel, and Woo (2002)). Moskowitz and Vissing-Jorgensen (2002) argue more generally that the return on private equity in the US between 1952 and 1999 is lower than seems justified given the undiversified nature of entrepreneurial investment. As a whole, the evidence on startup investments seems consistent with the overconfidence that Camerer and Lovallo's (1999) experimental subjects display when making entry decisions.

Optimism also may influence investment in more mature firms. Merrow, Phillips, and Myers (1981) compare forecast and actual construction costs for pioneer process plants in the energy industry. There is a strong optimism bias in project cost forecasts, with actual costs typically more than double the initial estimates. Statman and Tyebjee (1985) survey several other studies of this sort, involving military hardware, drugs, chemicals, and other development projects, and conclude that optimistic biases in cost and sales forecasts are fairly widespread.

Malmendier and Tate (2005) perform cross-sectional tests of the effects of optimism on investment. They form a manager-level proxy for optimism based on the propensity for a manager to voluntarily hold in-the-money stock options in his own firm. Their intuition is that since the CEO's human capital is already so exposed to firm-specific risk, voluntarily holding in-the-money options is a strong vote of optimism.[27] Using this optimism proxy for a large sample of US firms

[27] Malmendier and Tate find that the propensity to voluntarily retain in-the-money options is not significantly related to future abnormal stock returns, supporting their assumption that such behavior indeed reflects optimism rather than genuine inside information. Sen and Tumarkin (2010) model the CEO's portfolio choice and option exercise problem in more detail and argue that a more robust measure of optimism is simply whether the CEO sells or retains the shares received upon exercise. See Gider and Hackbarth (2010) for an overview of optimism and overconfidence proxies.

between 1980 and 1994, Malmendier and Tate find that the sensitivity of investment to cash flow is higher for the more optimistic CEOs. It is especially high for optimistic CEOs in equity-dependent firms, that is, in situations where perceived financial constraints are most binding. Their results support the predictions of the basic optimism model.

Ben-David, Graham, and Harvey (2010) test whether survey-based measures of overconfidence and optimism help to explain the level of investment as opposed to its sensitivity to cash flow. They ask financial executives to estimate the mean and variance of their firm's stock return. This allows them to form separate optimism and overconfidence measures. A striking result is that financial executives are, indeed, extremely overconfident: their subjective 80% confidence intervals about the firm's one-year stock return contains the realized return only 33% of the time. They also connect these measures to the level of investment, and find that both optimism and overconfidence are associated with higher investment.

One category of investment that would seem particularly inviting to overconfident managers is research and development, where the payoff is inherently quite uncertain. Hirshleifer, Low, and Teoh (2010) find that overconfident managers—measured using options-based proxies, as above, and the character of descriptions of the CEO in the press, similar to Malmendier and Tate (2004)—invest more in R&D and translate this to higher patent and patent citation count. At the same time, there is little relationship between their overconfidence measures and financial or stock market performance.

In addition to the evidence above, keep in mind that optimism, as discussed earlier, shares many predictions with more established theories, and thus is a candidate to explain various earlier results. For example, the fact that managers invest rather than pay out cash windfalls (Blanchard, Lopez de Silanes, and Shleifer (1994)) looks like a moral hazard problem, but is also consistent with optimism. Likewise, some investment patterns that look like adverse-selection-driven costly

external finance may simply reflect a mistaken managerial belief that external finance is costlier. A possible example is the higher investment-cash flow sensitivities of younger entrepreneurial firms (Schaller (1993)), which as noted above appear to be run by especial optimists.

Moving away from optimism and overconfidence, a "bias" of bounded rationality appears to be a plausible explanation for some common capital budgeting criteria. For example, while the net present value criterion is the optimal capital budgeting rule (in efficient markets), real managers tend to employ simpler rules. Surveying practice in the 1970s, Gitman and Forrester (1977) find that less than 10% of 103 large firms use NPV as their primary technique, while over 50% use the IRR rule, which avoids a cost of capital calculation. The Graham and Harvey (2001) survey of CFOs also finds that the IRR rule is more widely used than NPV. Over 50% of CFOs actually use the payback period rule, an even less sophisticated rule that requires neither a cost of capital input nor cash flow forecasts beyond a cutoff date.

Graham and Harvey also find that among managers who do use a discounting procedure tend to apply a firm-wide discount rate rather than a project-specific rate, again in contrast to normative principles.[28] Kruger, Landier, and Thesmar (2011) suggest that this practice introduces significant investment distortions. Taking the project-specific Capital Asset Pricing Model as a normative benchmark, Kruger et al. point out that multidivision firms that simply apply a weighted-average discount rate to all projects will overinvest in high beta divisions and underinvest in low beta divisions. Consistent with this prediction, they document that division-level investment is positively related to the spread between the division's market beta and the firm's average beta.

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[28] A good question is whether the use of such rules is better understood as an agency problem than as bounded rationality. That is, executives might use simple rules to shorten the workday and save time for golf. However, Graham and Harvey find that high-ownership managers are if anything *less* likely to use NPV and *more* likely to use the payback period rule.

Loss aversion has also appeared as an explanation for certain investment patterns, such as in the widely asserted, but less documented, managerial propensity to "throw good money after bad." Such behavior is most relevant for us to the extent that it reflects something more than rational career concerns, e.g. a situation where the manager tries to distort the updating process to maintain high compensation. Shefrin (2001) offers several anecdotes concerning major corporate investments that have the flavor of good money after bad. Statman and Sepe (1989) find that the market reaction to the termination of historically unprofitable investment projects is positive, suggesting that investors recognize that executives have a tendency to continue poor projects. Related evidence comes from the Guedj and Scharfstein (2008) study of drug development decisions. They find that single-product early stage firms appear highly reluctant to abandon their only viable drug candidates, even when the results of clinical trials are less than promising. Some combination of agency, managerial optimism, and a gambling-to-get-back-to-even attitude seems like a plausible explanation for these results.

3.4.2. Mergers and acquisitions

In a seminal contribution to behavioral corporate finance, Roll (1986) outlines a hubris-based theory of acquisitions. He suggests that successful acquirers may be optimistic and overconfident in their own valuation of deal synergies, and fail to properly account for the winner's curse. Roll interprets the evidence on merger announcement effects, surveyed by Jensen and Ruback (1983), Andrade, Mitchell, and Stafford (2001), and Moeller, Schlingemann and Stulz (2005), as well as the lack of evidence of fundamental value creation through mergers, as consistent with this theory.

Malmendier and Tate (2004) develop this argument and use their options-based proxy for CEO optimism to test it. They find patterns consistent with optimism and overconfidence. First, optimistic CEOs complete more mergers, especially diversifying mergers, typically suggested as

being of dubious value. Second, optimism has its biggest effect among the least equity dependent firms—when managers do not have to weigh the merger against an equity issue that they, as optimists, would perceive as undervalued. Third, investors are more skeptical about bid announcements when they are made by optimistic CEOs. Schneider and Spalt (2010) find similar results, including that offer prices are higher, but acquirer announcement returns are lower, when the target has (had) skewed returns. The announcement returns evidence is consistent with the theme of irrational managers operating in efficient markets.[29]

Managerial biases research has taken a Freudian turn with Aktas, de Bodt, Bollaert, and Roll's (2010) study of CEO narcissism. They measure narcissism, a trait related to but distinct from overconfidence, as the ratio of first person singular pronouns to total first person pronouns used in CEOs' transcribed speeches. Thusly-defined narcissist CEOs are more likely to be acquirers, and more likely to have initiated their transactions. This is interpreted as consistent with the high-stakes activity required to maintain the narcissistic ego. Targets run by narcissists, meanwhile, secure higher bid premia. Aktas et al. speculate that this arises because narcissistic CEOs demand extra compensation for the loss of ego associated with losing control.

If managerial biases affect decisions because governance is limited, cross-sectional variation in governance may be useful for identifying the effect. Yermack (1996) finds that firms with smaller boards of directors have higher firm value; Kolasinski and Li (2010) find that small boards dominated by independent directors reduce the impact of CEO overconfidence on acquisition frequency. They use negative future returns on CEO purchases as ex post evidence of ex ante overconfidence.

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[29] For more anecdotal evidence on the role of hubris in takeovers, see Hietala, Kaplan, and Robinson (2003) and Shefrin (2000, chapter 16).

To be useful in empirical work, these governance mechanisms need to be exogenous. Unfortunately, as Hermalin and Weisbach (2003) and Harris and Raviv (2008) point out, these are typically endogenous to firm performance. Nonetheless, the predictions here are typically concerning coefficients on interaction terms, so the endogeneity problem could be mitigated.

Reference point thinking, in particular involving the offer price, also plays a role in merger activity. An offer must be made at a premium to the target's current price, and the most salient and specific such prices are recent peaks, such as the target's 52-week high. There are a number of ways such salient but economically unremarkable prices could enter the psychology of merger negotiations. Valuing a company is a subjective task, and valuing a combination is doubly so. One could easily imagine that recent peak prices serve as anchors in such calculations on both the bidder and the target side. The target may use peak prices as a starting point for negotiations. Or, target shareholders may resist selling at a "loss" to a recent peak, akin to a disposition effect.[30]

Baker, Pan, and Wurgler (2011) find that deal participants do indeed focus on recent price peaks. There is a spike in the distribution of offer prices at the target's 52-week high and other historical peaks. Bidding-firm shareholders react negatively to the component of the offer price that is driven by the 52-week high, which suggests that they rationally view this portion as overpayment. The probability that an offer goes through increases discontinuously when the offer exceeds the 52-week high. This is an important result in that it represents unusually clean evidence of the real effects of behavioral corporate finance.

Finally, Baker et al. find that reference point thinking may help to explain why mergers and stock market valuations are positively correlated: the offer premium required to exceed a recent price peak is smaller when valuations have increased. Conversely, when valuations have

[30] Note that while some of these effects involve managerial biases, others represent investor biases and thus the evidence below could also be included in our earlier sections about investor irrationality.

plummeted, targets may fail to adjust from prior peak anchors and, as a result, ask for valuations that are simply implausible to bidders.

3.5. Financial policy

There is a growing body of evidence that managerial biases affect financing patterns. Existing work addresses the timing and pricing of equity issues, features of IPOs, capital structure and dividend policy, and financial contracting. Reference dependence plays a prominent role in these studies.

3.5.1. Equity issues

Does the CEO drive a firm's stock returns? If so, then a CEO would rightly be proud, and shareholders should take notice, when she has created value and raised the share price above the level that prevailed when she took the helm. If not, for example if share prices are dominated by aggregate moves, then that historical price does not serve as a particularly meaningful reference point for CEO-specific value creation.

Baker and Xuan (2011) find evidence that CEO-specific share price performance does indeed affect financing activity. Equity issuance is responsive to recent stock returns, but considerably more so when they occur during the current CEO's tenure. In particular, the probability of equity issuance in a follow-on offering increases discontinuously when the share price exceeds the inherited price.

Apparently, some market participants involved in equity issuance attribute "value creation" to the CEO and her team. To be clear, this by itself is not necessarily a behavioral phenomenon; the intriguing result is the effect of the inherited share price level even though subsequent market-level movements beyond the CEO's control complicate the attribution of value creation. The attribution error could be on the investor side, with management having to wait until this point in order to

convince investors that issue terms were appealing. Instead of that effect, or in addition to it, the management team may view crossing the inherited price threshold as an opportunity to time the equity market.

3.5.2. IPO prices

IPO underpricing can also be understood from the perspective of reference-point managerial preferences. Loughran and Ritter (2002) develop an explanation that combines reference-point preferences and mental accounting (Thaler (1980, 1985)). An important facet of IPO pricing is that the investment bankers underwriting the offering form an initial *file price range*, as they shop the deal to institutional investors. If demand for the new shares is high, the bankers will price the offering at the high end of this range. If it is low, they will price the offering at the midpoint, or sometimes lower. On the first day, prices are a market outcome of the new supply and demand.

Loughran and Ritter assume that issuing managers mentally account for two quantities in judging an offering's success: the (perceived) gain from the gap between the first day closing price and a natural reference point, the midpoint of the file price range; and the (real) loss from the dilutive effect of the underpricing. If the gain is judged to outweigh the loss, where each is evaluated separately with the prospect theory value function, the executives are satisfied. Intuitively, they may be too overwhelmed by the "windfall gain" to complain much about underpricing.[31]

This setup is designed, in part, to explain the pattern that underpricing is greater when the offer price is above the initial file price range. Loughran and Ritter (2002) find that in issues where the offer price is below the minimum of the file price range, first-day returns are a relatively small

[31] Loughran and Ritter assume that the underwriter prefers underpricing, perhaps because it generates profitable rent-seeking activities among investors, e.g. trading with the underwriter's brokerage arm, or because it reduces marketing costs.

4%, on average, while those priced above the maximum have average first-day returns of 32%. This is consistent with issuers acquiescing in severe underpricing only when they are simultaneously getting good news in the form of upward revisions from the filing range.[32]

Ljungqvist and Wilhelm (2005) test some of the behavioral underpinnings of the Loughran and Ritter view. Using data on the ownership stakes of executives in IPO firms, they crudely proxy for the proposed notion of issuer satisfaction by taking the dollar amount of executives' perceived "gain" from revisions from the midpoint of the file price range and subtracting the dollar amount of dilution due to underpricing. They find that executive teams that are more "satisfied" with their IPOs by this criterion are more likely to use the same underwriter for seasoned offerings, and to pay higher fees for those transactions.

3.5.3. Raising debt

Borrowers and lenders use past terms as anchors or reference points for current terms. Dougal, Engelberg, Parsons, and Van Wesep (2011) find that the nominal level of historical borrowing costs exerts a strong influence on the time *t* cost of debt, controlling for a variety of time *t* borrower characteristics. The effect appears for all credit rating categories. For example, firms that took out credit from a banking syndicate between 2005 and 2007 saw the influence of the 2008 financial crisis have a muted impact on their 2008 borrowing costs from the same source. For firms whose credit rating remained constant over this period, one-third received exactly the same borrowing rates as in the pre-crisis period. Comparable firms that hadn't established such anchor terms saw higher borrowing costs.

[32] See Benveniste and Spindt (1989) for an alternative explanation for this asymmetry based on information gathering in the book-building process, and Edelen and Kadlec (2003) for one based on sample truncation bias related to the withdrawl of IPOs whose prospects deteriorate during the waiting period.

It is easy to understand how prior terms are natural starting points for thinking about and negotiating new terms. The need for a fixed starting point could be particularly high in periods of dramatic change in the financial environment. Dougal et al. find additional patterns that further tie their results to anchoring: specific managers and bankers appear to form relationships that are most affected by the bias; when a firm changes lead banks, the effect of past terms deteriorates; and, when a firm changes CEO or CFO, the effect of past terms deteriorates. [33]

Similar to how reference point prices affect merger activity or manager-specific reference point prices on equity issues, this experiment provides further evidence that highly sophisticated actors—in this case, managers, bankers, and investors jointly—are unable to "integrate out" the past. Future research may better identify the real effects of this. A natural hypothesis, for example, is that borrowers who are being offered a deal because of the happenstance of favorable past terms will raise more and invest more.

3.5.4. Capital structure

The most basic optimism model predicts a pecking order financing policy, as pointed out by Heaton (2002). Thus, much of the existing evidence of pecking-order policies, from Donaldson (1961) to Fama and French (2002), is at face value equally consistent with pervasive managerial optimism. And the notion of pervasive managerial optimism does not seem farfetched. In Graham's (1999) survey, almost two-thirds of CFOs state their stock is undervalued while only three percent state it is overvalued. Such responses are all the more striking given that the survey was taken shortly *before* the Internet crash.

To distinguish optimism from other explanations of pecking order behavior, such as adverse selection as in Myers and Majluf (1984), a natural test would use cross-sectional variation

[33] The authors argue that costly renegotiation of terms cannot explain these results.

in measured optimism to see whether such behavior is more prevalent in firms run by optimists. To our knowledge, exactly this test has not been conducted, but certain results in Malmendier and Tate (2004, 2005) have a related flavor. First, and as noted above, firms run by optimists (as identified by their options-based proxies for optimism) display a higher sensitivity of investment to internal cash flow. Second, managers classified as optimistic show a differentially higher propensity to make acquisitions when they are not dependent on external equity.

Bounded rationality also makes an appearance in financial policy in the form of the use of simple targets for capital structures and payouts. Graham and Harvey (2001) find that 10% of the CFOs in their sample use a "very strict" target debt-equity ratio and 34% use a "somewhat tight" target or range. Such leverage targets are typically defined in terms of book values of equity and debt, and Welch (2004) confirms that market leverage is largely allowed to float with stock prices. Whether this is a rule of thumb, a boundedly rational focus on slower moving book values, or a rational recognition that book values are a better proxy for liquidation value than market value is hard to prove. Likewise, and as mentioned before, Lintner's (1956) field interviews reveal a set of common rules of thumb in payout policy that lead to a reasonably accurate empirical specification for dividends. Brav, Graham, Harvey, and Michaely (2005) find that some of these rules still apply fifty years later.

3.5.5. Contracting and executive compensation

Landier and Thesmar (2009) examine financial contracting between rational investors and optimistic entrepreneurs.[34] They highlight two aspects of contracting with optimists. First, because optimists tend to inefficiently persist in their initial business plan, the optimal contract transfers control when changes are necessary. (Kaplan and Stromberg (2003) find that contingent transfers

[34] Manove and Padilla (1999) also consider how banks separate optimists and realists. They focus on the overall efficiency of the credit market.

of control are common features of venture capital contracts.) Second, because optimists believe good states to be more likely, they are willing to trade some control and ownership rights in bad states for greater claims in good ones; in this sense, the optimal contract "pays the entrepreneur with dreams." Ultimately, optimists may self-select into short-term debt, as it transfers payments and control to the investor in states that they think are unlikely, while realistic entrepreneurs prefer less risky long-term debt.

Landier and Thesmar find some empirical evidence of this separation in data on French entrepreneurs. Among other results, they find that the use of short-term debt is positively related to an *ex post* measure of optimistic expectations, the difference between realized growth and initial growth expectations. They also find that the use of short-term debt is positively related to psychologically-motivated instruments for expectations, such as regional sunlight exposure and rates of mental depression.

Some related phenomena appear in the context of biased executives' compensation contracts. Standard contracting models seem unable to explain basic aspects of CEO compensation. For example, Hall and Murphy (2002) and Dittman and Maug (2007) point out that convex incentives are commonly induced through stock options. Yet these turn out to be hard to calibrate to standard models with risk-neutral shareholders and risk-averse, undiversified executives. Dittman and Maug argue that such setups actually tend to predict negative base salaries.

Gervais, Heaton, and Odean (2010) derive the optimal compensation contract for a risk-averse but overconfident manager. The manager overweights his private information, so the optimal contract balances the standard issue of overcoming his risk aversion with the need to avoid rash investments. The most basic effect is that if the manager is highly overconfident, shareholders' wealth-maximizing contract is highly convex, because the manager overvalues it. This effect is reminiscent of paying with dreams.

The prospect theory value function provides another explanation for stock options and positive base salaries as optimal contracts. Dittman, Maug, and Spalt (2010) show that implausible parameters are not required; for example, the manager's reference wage can be close to last year's salary and bonus. The manager's risk tolerance is near zero around the reference point but increases rapidly as payout increases. This necessitates high-powered, convex contracts even with optimal risk sharing. This is consistent with high salaries and positive stock and stock option holdings that we observe.

4. Behavioral Signaling

Another behavioral approach to corporate finance is in an embryonic stage. We include it alongside more mature research frameworks because of its theoretical distinctiveness and seeming promise. We also happen to find it interesting ourselves; our discussion here will focus on Baker and Wurgler (2011). The model involves quasi-rational investors, so in a conceptual sense it falls between the market timing and catering research, which assumes irrational investors, and the managerial biases research, which assumes fully rational investors.

The core idea of signaling models since Spence (1973) is that "good" types can separate themselves by taking some action that is less costly for them than it is for "bad" types. In corporate finance, classic applications include the capital structure models of Leland and Pyle (1977), Ross (1977), and Myers and Majluf (1984); the dividend models of Bhattacharya (1979), John and Williams (1985), and Miller and Rock (1985); the convertible debt model of Harris and Raviv (1985); and, the IPO underpricing models of Allen and Faulhaber (1989), Grinblatt and Hwang (1989), and Welch (1989). Although the nature of the signaling mechanism varies, all of these models feature participants with standard preferences and rational expectations.

The defining characteristic of behavioral signaling models is that the signaling mechanism derives from nonstandard preferences or judgmental biases. The model of dividend policy we discuss below is an example. It relies on prospect theory preferences and narrow framing.

4.1. Theoretical Framework

There is no standard theoretical framework to outline here at this time. Indeed, there are many behavioral distortions one could imagine basing a signaling model upon, and each might have a somewhat different implementation and application. We will review a specific model of dividend signaling based on Baker and Wurgler (2011).

The main goal of this dividend-signaling model is, as usual, to explain why firms pay dividends at all. Secondary goals are to shed light on other facts of dividend policy. These include the fact that dividends are often not raised or lowered for long stretches; that dividend cuts are greeted very negatively; and, that dividends can be described using the Lintner (1956) partial-adjustment model. We outline the model and then return to more detailed empirical implications.

The signaling mechanism is based on nonstandard investor preferences, not willful destruction of firm value through investment distortions or taxes. In particular, it is based on the reference dependence and loss aversion features of the prospect theory value function of Kahneman and Tversky (1979). Reference dependence refers to the propensity to judge utility based on losses and gains relative to a context-specific reference point. Loss aversion denotes the tendency to perceive more disutility from losses than utility from equal-size gains. Suffice it to say that a great deal of research from psychology and economics supports these effects—see, e.g., Kahneman (2003).

The model's first key ingredient is that a reference point level of dividends appears in the investor's objective function. Per loss aversion, there is a kink in utility, so that the negative effect of

a $0.01 drop in dividends just below the reference point is greater than the positive effect of a $0.01 increase in dividends just above. The second key ingredient is that the manager cares about the current estimate of firm value as well as the long-term welfare of investors.

The model focuses on two periods: $t = 1$ and 2. There are two players: a benevolent manager and an investor to whom dividend cuts from the current reference point level are discontinuously painful. In the first period, the investor arrives with an exogenous reference point d^*. The manager also receives private information about cash earnings ε_1 and pays a dividend d_1 in the first period. Given this dividend, the investor learns something about the manager's private information and hence the value of the firm. This dividend, which may be below, above, or equal to d^*, in turn forms a new reference point for the liquidating dividend d_2. In some ways, this model can be viewed as a snapshot of a multi-period model.

In this model, reference points shape dividend policy in multiple ways. On the one hand, to the extent that today's dividend is the reference point against which future dividend payments will be judged, the manager would like to restrain current dividends, saving some resources for the next period to make up for a possible shortfall in future earnings. On the other hand, setting aside effects on future investor welfare, the manager would like to pay a dividend today that exceeds the current reference point. Moreover, because the manager also cares about the current estimate of firm value, which for simplicity we take to mean the estimate of first period cash earnings, he might also increase dividends beyond the current reference point to signal private information about the firm's ability to pay. This signaling mechanism works because firms with limited resources are unwilling to incur the expected future cost of missing an endogenous reference point. Coming back to the formalities, we have:

Manager utility. The manager cares about what the investor thinks about ε_1 today because that determines today's stock price. He also cares about the investor's long run utility. The simplified objective function is:

$$E_m\left[\lambda E_i\left[\varepsilon_1\right]+(1-\lambda)u\left(d_1,d_2 \mid d^*\right)\right],$$

where d_1 and d_2 are the period-specific dividends of the firm, u is the investor's utility function, given an exogenous initial reference point of d^*, and E_m and E_i are the expectations operators for the manager and the investor, respectively.[35]

Investor utility. The manager's objective is standard. The interesting aspect of this signaling model is that the investor has a kink in his preferences for dividends d_1 and d_2. The first kink is around an exogenous reference point for first period dividends d^* and the second kink is around an endogenous reference point for second period dividends:

$$u\left(d_1,d_2 \mid d^*\right)=d_1+b\left(d_1-d^*\right)\left\{d_1<d^*\right\}+d_2+b\left(d_2-d_1\right)\left\{d_2<d_1\right\}.$$

In other words, the investor cares about fundamental value, or total dividend payments, but with a twist. The level of the reference point comes from historical firm dividend policy, and b is greater than zero to incorporate loss aversion. This utility function is in the spirit of prospect theory with a kink at a reference point. The second period reference point equals first period dividends d_1 by assumption. In reality, the reference point and the intensity of the reference point b may be determined by a long history of levels and changes in dividend policy. The fact that each dividend payment forms a separate reference point also requires narrow framing. This is not a reference

[35] The fact that the investor's expectation of ε_1 appears directly into the manager's objective is an innocuous assumption, because in equilibrium the stock price will be a linear transformation of this expectation.

point applied to total ending wealth, but much more narrowly both across stocks and time, in the spirit of Barberis, Huang, and Thaler (2006).

Information. For simplicity, the manager has no control over the cash earnings of the firm. This is a bit different from a traditional signaling model where the manager must destroy firm value to impress the capital markets. There is also no agency problem; the manager is not able to keep the cash for himself, and no real value is created or destroyed with dividend policy. The fundamental value of the firm appears in two installments and totals $\varepsilon_1 + \varepsilon_2$. Think of these as cash earnings that are not observable to the investor. This is an extreme assumption of asymmetric information that highlights the intuition. For simplicity, assume that the second-period cash earnings have a uniform distribution, $\varepsilon_2 \sim U[0,2]$.

Budget constraint. There is no new equity or debt available to finance the payment of dividends and no excess cash balances available in the first period. The most the manager can pay in the first period is ε_1, and the most he can pay in the second period is ε_2 plus any savings from the first period. Given a benevolent manager and the absence of new financing, this implies constraints:

$$0 \le d_1 \le \varepsilon_1 \text{ and } d_2 = \varepsilon_1 + \varepsilon_2 - d_1.$$

Equilibrium. Combining the above, there are three important effects that appear in the manager's objective function. First, there is sometimes an advantage to paying out dividends immediately. Consider a first period dividend below the reference point d^*. Setting aside the effect on the second period reference point, these dividends will be valued on the margin at b+1 times the payout, instead of simply the payout. Above d^*, there is no marginal benefit from merely shifting payout from the second period forward. Second, by increasing the dividend today, the investor's estimate $E_i[\varepsilon_1]$ of the unobservable cash earnings rises through an equilibrium set of beliefs that map dividend policy to cash earnings. This enters into the manager's utility function directly. Third,

increasing the dividend in the first period, for either of these rationales, produces an expected future cost to investor utility that comes from the possibility of falling short of the reference point set for the second period.

These three motivations combine to simplify the manager's utility function:

$$(1-\lambda)b(d_1 - d^*)\{d_1 < d^*\} + \lambda E_i[\varepsilon_1 \mid d_1] - (1-\lambda)b\left(d_1 - \frac{\varepsilon_1}{2}\right)^2 \left\{d_1 > \frac{\varepsilon_1}{2}\right\}$$

The first term reflects striving to avoid falling short of the initial reference point. The second term reflects concern about share price. The third term reflects the expected cost of falling short of a new reference point; there is no cost if the manager adopts a very conservative dividend policy of paying half of first-period earnings. Given the uniform distribution of ε_2, the expected cost is quadratic as dividends rise from this point and increasing in the intensity of the reference point.

Intuitively, these considerations suggest three ranges of dividend policies in equilibrium. There is a high payout ratio for firms with the extra motivation due to signaling to clear the initial reference point of d^*. Next, managers cluster at d^* once this marginal effect drops out, i.e. they maintain their existing dividend level exactly. Finally, there is a lower payout ratio for firms with first-period earnings well above the initial reference point. These lucky firms nonetheless pay higher dividends to separate themselves from each other and from the pool at d^*. Specifically, there exists an equilibrium where:

$d_1 = \varepsilon_1$ if $\varepsilon_1 < d^*$,

$= d^*$ if $d^* < \varepsilon_1 < \varepsilon^*$, and

$= \frac{1}{2}\varepsilon_1 + \frac{\lambda}{1-\lambda} \cdot \frac{1}{b}$ if $\varepsilon_1 > \varepsilon^*$,

with ε^* satisfying $\lambda \frac{1}{2}\left(\varepsilon^* - d^*\right) - \left(1-\lambda\right) b\left(\left(\frac{\lambda}{1-\lambda} \cdot \frac{1}{b}\right)^2 - \left(d^* - \frac{1}{2}\varepsilon^*\right)^2\right) = 0$,

and equilibrium beliefs of:

$$E_i[\varepsilon_1 \mid d_1] = d_1 \text{ if } d_1 < d^*,$$

$$= \frac{1}{2}\left(\varepsilon^* + d^*\right) \text{ if } d_1 = d^*, \text{ and}$$

$$= 2\left(d_1 - \frac{\lambda}{1-\lambda} \cdot \frac{1}{b}\right) \text{ if } d_1 > \frac{1}{2}\varepsilon^* + \frac{\lambda}{1-\lambda} \cdot \frac{1}{b}.$$

There are intuitive comparative statics with respect to b, the cost of falling below the reference point. In this equilibrium, it can be shown that as b increases and λ decreases, there is more clustering of dividends at the reference point d^* (ε^* increases), and the market reaction to $d_1 < d^*$ increases, because there is more information revealed in a near miss.

4.2. Applications

We will discuss the empirical relevance of this dividend-signaling model and then speculate a bit about potential future applications of behavioral signaling.

4.2.1 Dividends

An important feature of the reference points model is that it is consistent with what managers say about dividend policy. In the Brav et al. (2004) survey, executives disavow the notion that they pay dividends because it destroys firm value and therefore signals strength. This is the basis, however, of numerous non-behavioral signaling models. At the same time, managers do agree with the notion that dividends are a "signal" of some sort. The behavioral signaling model with dividends as reference points can signal financial soundness without burning money.

Behavioral signaling can also give foundations to the Lintner (1956) model, which has proved a difficult task using traditional approaches. In the equilibrium described above, firms with good earnings realizations ($\varepsilon_1 > \varepsilon^*$) follow a partial-adjustment policy and are more generally smoothed relative to earnings. The Lintner model takes the previous dividend as the starting point for any adjustment in this period; the behavioral signaling model predicts that the dividend level will be constant for many firms and adjusted only when earnings are sufficiently extreme. On average for all firms, dividends increase less than one-for-one with earnings, consistent with partial adjustment.

The reaction to dividend changes is asymmetric, with cuts being particularly painful (Aharony and Swary (1980)). Most standard signaling models do not incorporate this asymmetry. On the other hand, it immediately follows from a model with loss-averse investors who use lagged dividends as a reference point—the relevant effect is that cutting dividends, even slightly, fully reveals that the firm's financial strength is low.

A fundamental theme of the model is that the level of dividends needs to be salient and memorable in order to maximize the strength of the signal. If investors don't notice their dividend or don't notice changes, the reference-point mechanism fails. In fact, similar to what Thomas (1989) finds in earnings levels, dividend levels and changes tend also to be in easy-to-digest round numbers, such as multiples of five and ten cents per share. This feature of dividend policy again has no natural interpretation within traditional signaling theories.

4.2.2. Other applications

Earnings management presents another potential application for behavioral signaling. Important features of the reported earnings process are reminiscent of the dividend process. Burgstahler and Dichev (1997) and Degeorge et al. (1999) find that earnings are managed to meet or exceed salient reference points. As discussed earlier, these include zero earnings, lagged

earnings, and analyst expectations. In addition, reported earnings are smoothed versions of true earnings, involving a partial-adjustment process not unlike the Lintner model.

A loss-aversion based mechanism isn't as natural in the earnings context, however. Reported earnings are less tangible and visible to the mass of investors than dividends; loss aversion to reported earnings *per se* is unnatural.[36] A more realistic signaling mechanism might be based on irrational *beliefs*.

For example, suppose that investors *overreact* if reported earnings fall below the threshold of prior earnings. (Skinner and Sloan (2002) find that growth firms, for which information opacity is highest and signaling most useful, do exhibit an asymmetric response to earnings surprises.) Reported earnings can then become a signal: Managers with favorable private information can aggressively manipulate earnings upward and establish higher reference points for future earnings. Distinguishing between two types of investors—noise traders with incorrect beliefs and arbitrageurs with rational expectations but limited capital and risk-bearing ability—allows one to preserve a rational expectations equilibrium concept. In this setup, managers are essentially signaling to the arbitrageurs; the noise traders provide the mechanism.

Stock splits have also been modeled as signals in rational expectations frameworks, without clear success. The costly signaling mechanisms in Brennan and Copeland (1988) and Brennan and Hughes (1991) involve transaction costs: roughly speaking, firms split to lower-priced shares to increase trading costs on their investors. Unfortunately, Baker and Powell (1993) survey managers and they say that splits are if anything an effort to *improve* liquidity.

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[36] On the other hand, Degeorge et al. propose that executives themselves may derive personal utility from meeting thresholds.

It is not hard to sketch a simple behavioral signaling model of splits that is more intuitive. For example, suppose that noise traders coarsely categorize low-nominal-price firms, all else equal, as growth firms (Baker, Greenwood, and Wurgler (2009)). In this environment, splitters can credibly separate themselves in the eyes of rational arbitrageurs because they know they can deliver higher earnings next period and not risk the wrath of the noise traders. Skinner and Sloan's (2002) results are also compatible with this simple model.

5. Some open questions

The behavioral corporate finance literature has matured to the point where one can now sketch out a handful of canonical theoretical frameworks and use them to organize many dozens of empirical studies. Our review of this evidence indicates that behavioral approaches offer a useful complement to the other corporate finance paradigms. They deliver intuitive and sometimes quite compelling explanations for important financing and investing patterns, including some that are difficult to reconcile with existing theory.

In its current state of flux, the field offers a number of exciting and important research questions. We close by highlighting just a few. In no particular order, we wonder:

- Are behavioral factors at the root of why managers do not more aggressively pursue the tax benefits of debt, as in Graham (2000)? Hackbarth (2009) develops a theoretical argument along these lines.

- While the existing literature has generally considered the two approaches separately, the irrational manager and irrational investor stories can certainly coexist. Would a model featuring a correlation between investor and managerial sentiment lead to new insights?

- What other phenomena can be modeled with behavioral signaling? How can such models be tested?

- What are the determinants of managerial "horizons," and how can they be measured and appropriately governed?

- To what extent should investment bankers be viewed as institutions whose business model is to identify and cater to emerging pockets of investor sentiment?

- To what extent should private equity funds be viewed as firms whose business model is to capitalize on equity and debt markets that are not fully integrated, with separate investor demand shocks and inconsistent pricing?

- What are the behavioral explanations for the recent financial crisis? Barberis (2011) starts to connect the dots.

- How is the banking system affected by inefficiencies in the capital markets? Should regulation aim to insulate banks from bubbles? Should this operate through broad capital regulations, or more narrowly?

- Are derivative instruments – most noteworthy in recent history, credit default swaps (CDS) and CDOs – prone to misvaluation? To what extent do they make corporate outcomes more efficient by lowering the ex ante cost of capital through efficient risk sharing or by predicting default? To what extent are they the source of mispricings that propagate into debt and equity prices?

- What determines investor sentiment, and how is it managed through corporate investor relations (Brennan and Tamarowski (2000))? Potential avenues to consider are interactions

with past stock market returns, technological change and the valuation of new industries, media coverage, financial analysts and financial reporting, and investment banking.

- Do equity and debt market timing reduce the overall cost of capital by a small amount or a large amount? Dichev (2004) offers an approach here.

- To what extent can features of financial contracts and securities be understood as a response to assorted behavioral biases? Williamson took first steps here. In the context of consumer contracts, Della Vigna and Malmendier (2004) suggest that credit cards and health club contracts are shaped by naïve expectations and time-inconsistent preferences.

- What is the impact of investor inertia and limited attention on corporate finance? Baker, Coval and Stein (2007) and Della Vigna and Pollet (2009) consider stock swaps and the timing of corporate disclosure. Hirshleifer and Welch (2002) develop implications for organizations.

- How should one approach the proper regulation of inefficient markets and financial reporting? The financial crisis has generated discussion about the role of the Fed and the SEC with regard to identifying and managing investor sentiment and bubbles.

- What are the limits of corporate arbitrage, including detecting and generating mispricing, maintaining reputation, and avoiding fraud?

- Can a catering approach help to explain the diversification and subsequent re-focus wave that has taken place in the US since the late-1960s?

- How significant is the economy-wide misallocation of capital caused by collected behavioral distortions, and in particular how do these distortions interact with traditional capital market imperfections? For example, if there is underinvestment due to agency or

asymmetric information, bubbles may bring investment closer to the efficient level—or overshoot.

- If bounded rationality or investor pressures lead managers to rely on specific performance metrics, will third parties exploit this? The marketing of takeovers and financing vehicles as EPS-improving transactions by investment banks is a potential example. More generally, what profit opportunities are created by behavioral biases of investors and managers?

- To what extent are corporate "hedging" policies actually directional bets? The evidence in Brown, Crabb, and Haushalter (2002) and Faulkender (2005) suggests that in many companies, interest rate risk management and the use of derivatives has little to do with textbook hedging.

- What are the normative, legal, and ethical implications of market-driven corporate finance? Should managers be encouraged to respond to movements in prices and interest rates that do not reflect underlying fundamentals? Jensen (2005) explores the agency problems that arise from overvalued equity.

- In the Introduction, we pointed out that the normative implication of assuming irrational investors is to insulate managers from short-term market pressures, while the implication of assuming irrational managers approach is to obligate them to follow market prices. What, in the real world, is the right balance between discretion and market pressure?

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