TWO ESSAYS IN BEHAVIORAL CORPORATE FINANCE

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The two essays in my dissertation are broadly related to the behavior and decision-making of firm managers and directors, and how those variables are associated with firm outcomes and firms' relationship with investors.

The first essay examines the disagreement within the executive team. The model shows the negative effect of disagreement on firm outcomes via executives' reduced effort and the positive effect via decision enhancement. In a novel manner, I identify disagreement through information-based insider trades in opposing directions. The outcome I analyze is firm investments including capital expenditures, acquisitions, and R&D expenses. I uncover negative effects of disagreement on capital expenditures, which is statistically and economically significant. Decision enhancing effects are measured as reduction in a firm's tendency to overinvest, but the results are weaker. Disagreement also hurts firm valuation especially when firms need quick decisions. Overall, disagreement is found to have more harmful than beneficial effects on firms.

The second essay, coauthored with Orhan Erdem, examines the effect of piety on individual investor and corporate decision-making, and on the interactions between the two types of agents. We use Turkey as our experimental setting, where piety is likely to have an important effect on financial outcomes due to the country's unique political and religious background. We have proprietary individual investor trading data for a random sample of 25,000 investors, and importantly, we have a number of strong identifiers for

investor piety. One of them is a binary variable that indicates whether investors are trading through an Islamic brokerage house. Similarly, we have a few strong variables capturing firm piety. One such variable identifies whether firm executives are affiliated with a secular or a conservative executive club. Our results indicate that religious investors display conservative trading behavior, in particular, they display less overconfidence and higher local bias. Results on firms indicate that apparently religious firms grow their assets faster and are highly valued but have lower operating profitability. We also find that upon events that stir religious sentiment in the country, conservative investors increase their holdings of apparently religious firms.

BIOGRAPHICAL SKETCH

Cagri Berk Onuk was born in Turkey and lived there through high school. He received his bachelor's degree in Electrical Engineering from Princeton University where he also earned certificates in Finance, Computing, and Engineering and Management Systems. Since 2017, he has worked at UC Riverside and Ohio University as visiting faculty in Finance.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

How Does Executive Disagreement Affect Individual and Corporate Decisions?

Abstract

I illustrate, both theoretically and empirically, how executive disagreement affects individual effort decisions and CEO decision-making, ultimately influencing corporate investment decisions. The model shows that disagreement reduces aggregate effort yet improves the accuracy of CEO decisions. Disagreement is empirically identified through information-driven insider trades within the same firm in opposite directions. I test the model by studying corporate investments and acquisitions. The results indicate reduced investment following disagreement episodes and support the diminished effort channel. Further tests reveal adverse effects of disagreement on firm value when quick decision-making is needed. The mostly negative effects of disagreement on investment projects suggest that corporate and regulatory efforts to reduce executive disagreement can boost corporate investment levels.

1. Introduction

Disagreement is ubiquitous in executive circles: it is observed in both the management team and in the boardroom. Despite its abundance, each disagreement episode affects the executive team's decision-making process dramatically and in a variety of ways, from executives' self-seeking tactical behavior to the final decision itself. Disagreement among executives can be about preferences, such as the amount of risk to be taken in the firm's growth strategy, or values, such as the extent of layoffs as part of a cost cutting strategy. Disagreement can also concern future forecasts for the firm's prospects, business environment, and the broad economic situation. This paper is concerned with the latter type.

The late 2016 disagreement between Jack Dorsey, the CEO of Twitter, and Evan Williams, the firm's ex-CEO and current board member, is a relevant example.[1] While Jack Dorsey wanted the company to stay independent, Evan Williams wanted to consider the sale of the company to potential acquirers, perhaps being worried about stagnant user growth. The two executives presumably had different opinions concerning the future prospects of Twitter. An interesting question is how such disagreement affects individual and corporate decision-making.

As another example, Durk Jager, a long-serving director at Chiquita Brands International resigned from his position in November 2010 citing his loss of confidence in the firm's ability to reverse deteriorating performance[2]. One could argue that he was in disagreement with other directors and officers who chose to stay at the company regarding Chiquita's prospects. Furthermore, in December 2011, an officer and a

[1] http://www.cnbc.com/2016/10/05/twitter-ceo-dorsey-faces-company-discord-report.html
[2] https://dealbook.nytimes.com/2010/12/01/not-a-happy-split-from-chiquita/

director executed "opportunistic"[3], that is, informed insider trades in opposing directions. This is corroborating evidence on disagreement since people appear to have conflicting viewpoints regarding firm prospects as evidenced through their trades. Figure 1 shows Chiquita's share price. return on assets (ROA), and capital expenditures around December 2011. Share prices as well as ROA are gradually declining, where the latter becomes negative. Capital expenditures drop significantly right after the disagreement episode. Disagreement seems to be associated with changes in firm outcomes, and the effect on capital expenditures will be the focus of this paper.

The purpose of my paper is to develop a simple theoretical model on how executive disagreement affects individual effort decisions and CEO decision-making and test it on corporate decisions related to investment. I show that disagreement reduces aggregate effort yet improves the accuracy of CEO decisions. I test the model empirically by studying investment and M&A actions.

In my model, different levels of optimism among a firm's executives result in differences in how they process information. I show that when the number of pessimists is large enough to cause disagreement, aggregate effort will be reduced. Insufficient effort will lead to inadequate or unsuccessful implementation of projects. However, on the upside, when there is high disagreement, the CEO listens more to the views of other executives and incorporates their opinions into her own. This information collection and processing helps her attain a better decision.

What this means, for example, for investment actions is that firms experiencing disagreement in their executive team sometimes see contraction in their investment level

[3] The term, opportunistic insider trades, is borrowed from Cohen, Malloy, and Pomorski (2012) and will be explained in detail later in the text.

as new projects are not implemented. If disagreement is not debilitating, however, it helps bring the level of investment closer to optimal as the CEO incorporates more of the information processing in the executive team.

Empirical tests show support for disagreement's effect on inadequate implementation of projects as measured by reduced investments. For instance, disagreement episodes are associated with about a 6 percent reduction for capex. Results for other components of investments such as acquisitions and R&D expenses are weaker although results seem to depend on the choice of empirical specification. Disagreement is associated with reduced investments even when the CEO is powerful or heavy-handed. CEO power is proxied by measures like dual CEO-chairman position (Finkelstein 1992) and CEO compensation and tenure (Bebchuk and Fried 2003; Hermalin and Weisbach 1998). Arguably even a powerful CEO cannot prevent disagreement from disheartening the executive team.

Notwithstanding the detrimental effects of disagreement, under certain circumstances, it is found to weakly improve firm investments. In particular, it cuts down overinvestment for firms that are prone to investing excessively. Similar to Biddle, Hilary, and Verdi (2009), I proxy the tendency to overinvest by high cash holdings and low leverage. When in disagreement, the executive team is more likely conduct nuanced debates and careful thought processes that can curtail an innate tendency to make errors in the investment decision. However, for firms that need quick decisions, disagreement can delay and impair decision-making even if it does not ultimately lead to reduced effort. Lehn, Patro, and Zhao (2009) find that firms with high growth opportunities choose smaller boards since such boards are more conducive to

quicker decisions. In a difference-in-differences specification, I show that firms with high growth opportunities, as captured by a high market-to-book ratio, see further reduction in their annual stock returns following disagreement episodes. Further, it is shown that not only investments but also the number of employees is reduced following disagreement episodes.

There is already work in the literature relating employee disagreement to individual and corporate outcomes. The paper closest to mine in the consequences of disagreement, Landier, Sraer, and Thesmar (2009), theoretically show that, while disagreement leads to more profitable and objective projects, it results in less intrinsically motivated agents. Yet, to the best of my knowledge, my paper is the first to empirically confirm a model of executive disagreement on project implementation and CEO decision-making.

There is a large volume of work on executive, or more generally, employee disagreement both in the finance and the management literatures. A pioneering work on disagreement in the management literature, Pondy (1967), argues that disagreement disturbs the equilibrium of an organization, and the way in which the organization deals with disequilibrium affects its productivity. He suggests that, when disagreements are intense, they can unsettle the balance between the costs and benefits for an individual to be part of an organization, and can lead the individual to drop out. Using a survey of real work groups and management teams, Jehn (1995) shows that whether conflict is beneficial or not depends on its type and the structure of the group experiencing conflict. She further demonstrates that as the work becomes less routine, disagreement is more likely to yield a favorable outcome. Her work can have implications on corporate

investments wherein acquisitions and R&D investments can be thought as being more complicated than capex and thus less exposed to the detrimental effects from disagreement. Indeed, my results generally show that disagreement has more negative effects on the relatively simple capex decision.

In the theoretical finance literature, Van den Steen (2010) illustrates that shared beliefs among employees lead to more delegation, less monitoring, higher satisfaction, higher execution effort, and faster coordination, but less experimentation and less information collection. As alluded to earlier, Landier, Sraer, and Thesmar (2009) model the disagreement between a decision maker and a laborer, and show the trade-off between project profitability and employee motivation. Similar to these two works, in my model disagreement has negative consequences on employee motivation and effort. Nonetheless, I also test these implications empirically in corporate investment decisions.

On the empirical side, Dewally and Peck (2010) focus on the disagreement directors experience with their board or the CEO that is exposed when directors make their resignation public. They show that such disagreements are more likely to happen in firms with weak boards, that is, boards that are less independent, smaller, and dominated by the CEO, and firms with recent declines in operating performance. Using individual director voting data from China, Jiang, Wan, and Zhao (2015) reveal that director dissension is related to career concerns. Younger and highly reputed directors, shown to be more career conscious in the models of Holmstrom (1999) and Diamond (1989), are more likely to dissent. In line with motives to dissent, such directors end up receiving more outside directorships. Schwartz-Ziv and Weisbach (2013) look at the

inner workings of boards by using proprietary data on board minutes of a small set of government-controlled firms in Israel. They find boards to disagree with the CEO only 2.5% of the time, however, they still find evidence that boards are active monitors: in a considerable number of cases boards took an initiative, such as defining the steps that should be taken, or requested an update. My empirical findings also show that disagreement happens infrequently, however, when it does, it is associated with declines in investment levels. Agrawal and Chen (2017) also find that disagreement frequency is correlated with board and executive characteristics as well as firm performance. For example, disputes are more likely to occur at firms founded by the CEO or companies with shorter CEO tenures, higher independent block holdings, or bigger or less independent boards. They further find that firms undergoing dispute exhibit poor operating and stock price performance in the years surrounding a dispute episode.

Unlike the empirical corporate finance literature, which tracks disagreement via corporate filings, news stories, or board minutes, I identify disagreement, in a novel manner, through insider trades. In a nutshell, my argument is that insider buys signal optimism whereas insider sells signal pessimism, so if we find insiders within the same firm who place trades in opposite directions, the firm is likely to go through disagreement. There is a voluminous literature on insider trading and the earlier papers (for instance, Seyhun (1986)) find that insider trades have predictive power for future returns. However, insiders can trade for various reasons and many trades are not linked to information, such as those associated with liquidity or diversification motives. Indeed, the more recent literature is ambivalent about the predictive power of insider trades (Lakonishok and Lee 2001). In order to filter out the non-informative trades, I

use the methodology in Cohen, Malloy, and Pomorski (2012) to filter out the routine trades and focus on the informative trades which do have high predictive power. My main disagreement variable is discrete: it takes the value of one if there simultaneously is a buyer and a seller, zero otherwise. In a robustness check, I use a continuous disagreement measure where it indicates the ratio of buyers and sellers in a firm's executive team to the overall size of the team. Inferences remain similar.

In addition to disagreement among executives, there is a large related literature on disagreement among stock investors or analysts which is relevant to our understanding of executive disagreement. Miller (1977) illustrates that, in the presence of short sale restrictions, when investors have differing opinions about expected returns on securities, security prices will reflect the opinion of optimists. Confirming Miller's (1977) argument, Diether, Malloy, and Scherbina (2002) empirically show that stocks with higher dispersion in analysts' earnings forecasts experience lower future returns. More dispersion in forecasts implies the presence of overly optimistic analysts as well as investors. When such investors have more influence on prices, price correction will be more dramatic. Asking why investors disagree in the first place, Harris and Raviv (1993) and Kandel and Pearson (1995) argue that many times they disagree not because they have access to differential information but because they interpret common information differently. Using such a model, Harris and Raviv (1993) explain many of the stylized facts between volume and price changes such as the positive correlation between volume and absolute price changes. Kandel and Pearson (1995) further explain why there is significant volume around earnings announcements even when price doesn't change much. Differences of opinion among investors usually have asset pricing

implications while that among executives has implications for corporate finance. Nonetheless, both involve tactical behavior among agents and dramatically shift equilibrium outcomes.

I apply Kandel and Pearson's (1995) insight for modeling investor behavior into characterizing executive conduct. Executives disagree not because they have access to different information but because they interpret it differently. At an abstract level, different degrees of optimism or pessimism drive people's differential interpretation of corporate matters. My setup is a simple static Bayesian model where people don't exactly know others' optimism levels. However, their inference into others' level of optimism drives their effort decision. The more optimistic they are and their inference of others become, the more likely they spend high effort. High levels of effort spent by a sufficient number of executives is a precondition for successful project implementation.

Finally, there is also work on the implications of disagreement between firm managers and shareholders. A paper that looks at the same outcome variable as mine, Thakor and Whited (2011) examine what happens to firm investments when managers and shareholders disagree. They find reduction in the face of disagreement: when shareholders do not like the projects managers undertake, they cash out and the resulting stock price decline will prevent managers from undertaking such projects in the first place. Although disagreement has a similar directional effect in my paper, the agents undergoing disagreement and the mechanism in which disagreement influences corporate investments are completely different.

The rest of the paper is organized as follows. Section 2 presents the model in detail. Section 3 develops testable hypotheses arising from the model. Section 4 introduces the data and the empirical procedure. Section 5 presents and interprets empirical results. Section 6 conducts robustness checks. Finally, Section 7 concludes.

2. Model

This paper characterizes disagreement among top managers and directors. For the most part, it treats managers, except for the CEO, and directors identically in the way each individual's effort enters into the firm's production function. "Executives" stands for both managers and directors.

The model has three time periods. Figure 2 summarizes the progression of events in each period. At time zero, each executive encounters a signal, $s \sim N(0, \sigma^2)$, about the firm's future prospects. Executives have access to the same reports and forecasts on the firm, the firm's industry, and the overall economy. However, each executive interprets the signal differently. Different levels of optimism among executives can drive a wedge between how each executive interprets the signal.

In the literature on investor disagreement, differences in interpretation is usually captured by different likelihood functions which investors use to update asset return probabilities. In Harris and Raviv's (1993) model, there are two final payoffs: high and low. The authors explicitly characterize the density functions that relate the signal level to the two outcomes for each investor type. Kandel and Pearson (1995), on the other hand, introduce difference in likelihood functions with a simple error term embedded in the signal. Every investor observes the same signal, however, when they extract the

future payoff information from the signal, their different interpretation, which is captured by a simple error term, leads them to different conclusions. I follow Kandel and Pearson (1995) in modeling difference in likelihood functions. Since this is a static model, unlike Kandel and Pearson (1995), I do not model the prior beliefs of agents.

Before making a decision, executives communicate among themselves and reach their final interpretation of the signal.[4] Let executive i's final interpretation be denoted as $s_i = s + \epsilon_i$, where $\epsilon_i \sim N(0, \sigma_{exec}^2)$. The ith executive is optimistic if $\epsilon_i > 0$, pessimistic otherwise. The way the CEO interprets the signal is the same except that she has higher precision, in particular, $\sigma_{CEO} < \sigma_{exec}$.

At time one, each executive has to decide how much effort to put into the implementation of a number of projects that is available to the firm. To keep things simple, suppose that executives can put in either high or low effort. Let $C^H(s_i)$ and $C^L(s_i)$ denote the cost of exerting each level of effort, respectively, when the executive has interpreted the signal as s_i. Putting in high effort is costlier. However, as the executive becomes more optimistic, the extra burden of high effort is reduced. In particular, for $s_i \in [\underline{s}, \overline{s}]$, $C^H(s_i) > C^L(s_i)$ and $dC^H/ds_i < dC^L/ds_i < 0$. One can imagine diminishing returns from interpreting a signal more optimistically, so that both C^H and C^L are convex. That is, $d^2C^T/ds_i^2 > 0$ for $T \in \{L, H\}$. The cost is positive for all possible values of the signal. The effort level is endogenously determined in equilibrium.

[4] Note that executives' reception of the signal and their communication are collapsed into the same period although in real life they happen over a period of time. The simplification allows focusing on executives' final interpretation of the signal rather than how the communication might change their initial interpretation.

At time two, individual benefits and firm profits are realized. Executives derive a payoff from project implementation, which I label the professional benefit, $B_{pro}(s_i)$. This can be thought of as higher pay or reputational benefit in case projects go through, compared to the no implementation case. It is the expectation of such benefits given the executive's signal interpretation, s_i. Intuitively the function is increasing in s_i. The function is positive as long as the executive thinks firm's potential projects have positive NPV as a whole. On a small number of occasions, for example when the firm's industry in distress, the function can also be negative. Nevertheless, the sign of the function does not affect the inferences of the model. In addition to the professional benefit, executives derive a private benefit from project implementation if they put in high effort. This can be thought of as a psychic benefit to a motivated executive who is happy to see the projects she cares about being implemented. Let $B_p(s_i)$ denote the private benefit function. This function is also increasing in s_i. Let $B_p(s_i)$ be expressed as

$$B_p(s_i) = qs_i \tag{1}$$

For simplicity, the private benefit is normalized to zero when the signal is interpreted as zero.

Suppose that more than half the executives have to put in high effort for impending projects to be implemented. This critical mass condition can easily be generalized. Executives put in high effort if it generates higher expected payoff than putting in low effort. The expectation depends on how likely they think the critical mass condition is satisfied. Suppose each executive believes that enough executives will put in high effort with probability,

$$p_i = p + v_i \tag{2}$$

The deviation of the subjective probability from the true probability is simply $v_i \sim N(0, \sigma_v)$. The true probability, p, will depend on the signal, s. If s goes higher, executives on average will expend more effort so p will increase. Since p is restricted between 0 and 1, let a generalized cumulative distribution function, $F_p(s)$, capture the relationship between s and p.

With these parameters, an executive will put in high effort if

$$p_i \left(B_{pro}(s_i) + B_p(s_i)\right) - C^H(s_i) \geq p_i B_{pro}(s_i) - C^L(s_i) \tag{3}$$

$$p_i B_p(s_i) - C^H(s_i) \geq -C^L(s_i)$$

Intuitively, if the expected private benefit exceeds the extra cost of putting in high effort, the executive will exert high effort. This condition is more likely to be satisfied as s_i increases. First, an increase in s_i reduces the cost differential between high and low effort, and second, it increases the private benefit. Specifically, after inserting the functional forms of each term, we find that executive *i* will exert high effort if

$$s_i \geq \frac{C^H(s_i) - C^L(s_i)}{q\left(F_p(s) + v_i\right)} \tag{4}$$

The signal interpreted by the executive has to be above a certain threshold for him to put in high effort. v_i introduces some noise around the threshold, in particular, if the subjective probability of the executive for the critical mass condition is higher than the true value, a slightly lower signal could result in high effort.

In real firms, one can imagine that most of the time the majority of the executive team is optimistic. Only occasionally a considerable number are pessimistic, and with

different viewpoints comes disagreement. Pessimistic executives are those that interpret a low s_i that is not enough to satisfy condition (4). If not enough executives put in high effort, projects are not implemented. In short, disagreement episodes result in suspension of projects.

Unlike other executives, the CEO always puts in high effort. This can be justified with the CEO having more responsibility and her career being jeopardized if things do not go well especially due to low effort. In terms of the previous modeling parameters, one can think that the private benefit of the CEO is higher than the cost difference between high and low effort at any signal level. Her decision instead is to optimally choose the number of projects taken, in other words, adjusting the investment rate. If the future looks bright, the CEO should perhaps boost investment. Otherwise, she should maintain the current investment level or reduce it. Therefore the optimal investment level positively correlates with the true signal, s. CEO's investment decision happens simultaneously with other executives' effort decision.

Tjosvold and Johnson (1977) and Tjosvold (1982) experimentally show that when people experience disagreement, they are motivated to understand others' positions. The same can be true for a CEO when she experiences disagreement with the executive team. Being loyal to the parameters of the previous model, suppose that the benefit (sum of B_{pro} and B_p in equation 3) to the CEO is composed of two parts: (1) The CEO derives a benefit of control by following her own interpretation of the signal; (2) She tries to hit the right investment level. Let w denote the weight the CEO puts to her own interpretation of the signal. She puts weight $1 - w$ to the mean of the other executives' interpretation. The benefit of the CEO as a function of w is as follows

$$w^{1/2} - k[w\epsilon_{CEO} + (1-w)(\epsilon_{CEO} + d)] \quad (5)$$

The first term is the CEO's control benefit of following her own signal interpretation. I assume the relationship is concave. The second term is the cost of being a certain distance away from the true signal realization. d denotes the distance between ϵ_{CEO} and the mean of ϵ_i. k is simply a proportionality factor between the two sources of CEO benefit.

Disagreement between the CEO and other executives increases if *d* increases (decreases) in case *d* is positive (negative). The question is how should the CEO optimally choose *w* given a change in *d*. Taking the derivative of (5) with respect to *w* and solving for the optimal *w* yields

$$w^* = \frac{1}{4k^2d^2} \quad (6)$$

It is indeed the case that as disagreement increases, w^* is reduced, that is, the CEO puts a higher weight on other executives' interpretation of the signal. Incorporating others' interpretation to her own increases the accuracy of the CEO's decision. Even though she interprets the signal most precisely, the larger noise in other executives' signals gets reduced through aggregation. Listening more to the other executives leads the CEO to choose a more accurate investment level given what the future holds for the company. Here, investment can be generalized to other firm decisions whose level should be adjusted according to future expectations.

In summary, disagreement leads to a lower likelihood of project implementation, however, in the event that projects are implemented, disagreement improves the accuracy of the decision variable.

3. Hypothesis Development

My hypotheses are structured around two main alternatives that parallel how my model distinguishes between the effect of disagreement on (a) the executives' choice of effort and (b) the CEO's choice of investment level. The first alternative relates project implementation to disagreement through executives' choice of effort:

Ha: In the presence of executive disagreement, projects are less likely to be implemented.

To make Ha testable, one needs a proxy for executive disagreement. The large literature on insider trading suggests that the times at which insiders buy (sell) their own company's stock can signal times when they are optimistic (pessimistic) about their firm (Seyhun 1988; Ke, Huddart, and Petroni 2003). Although insiders sometimes trade for liquidity or diversification reasons (Jenter 2005), information based trading is common. I use the methodology in Cohen, Malloy, and Pomorski (2012)[5] to focus on trades that are likely to be information driven. Disagreement is then defined as time periods during which a firm has both net buyers and net sellers. For the outcome variable, inadequate implementation of projects is measured via a contraction in the firm's investment level. Hence, a testable version of Ha is as follows:

[5] The methodology is explained in Section 5.

Ha.1: The degree to which insiders within the same firm display information-based trades in opposite directions is positively associated with the extent of reduced investment.

A powerful or heavy-handed CEO can mitigate the association between disagreement and reduced investment predicted by Ha.1 and other propositions derived from Ha. Such a CEO can intimidate or threaten executives with job termination in case they put in low effort even if the project turns out to be successful. In terms of the modeling parameters, in Equation (3), $B_{pro}(s_i)$ is lower if the executive spends low effort compared to high effort, assuming the project is successful. Therefore, the executive has more incentives to put in high effort.

Ha.2: The presence of a more powerful or heavy-handed CEO mitigates the negative relationship between executive disagreement and project implementation rate.

Common proxies used for CEO power include dual CEO-chairman position (Finkelstein 1992), founder status of CEO (Adams, Almeida, and Ferreira 2005), CEO tenure (Hermalin and Weisbach 1998), and CEO compensation (Bebchuk and Fried 2003). Additionally, certain CEO behavioral characteristics can make the CEO look more powerful. For example, Chatterjee and Hambrick (2007) relate CEO narcissism (measured with the prominence of the CEO in various company disclosures) to strategic grandiosity and submission in the executive team. In their study of within-firm power and politics, Eisenhardt and Bourgeois (1988) interview CEOs and executive teams and

characterize a heavy-handed or autocratic CEO as one that takes decisions in an authoritarian manner, as opposed to one who consults the executive team or who allows for consensus decision-making. Heavy-handedness is also likely to be correlated with some of the variables indicating CEO power such as dual CEO-chairman position. Using such CEO level variables, I test whether a powerful or heavy-handed CEO prevents disagreement among executives from affecting the firm's investment level[6].

The alternative to Ha focuses on the effect of disagreement on the level of investment through the CEO's decision. Equation (5) illustrates that with higher disagreement, the CEO puts a higher and more proper weight to other executives' signal interpretation. Putting a higher weight on other executives' interpretation is appropriate because the noise in their interpretation gets reduced through aggregation. Therefore, the final investment decision gets closer to optimal. It is consistent with the experimental findings of Schweiger and Sandberg (1989) who find that the consensus that emerges from disagreement is usually superior to the individual perspectives themselves. Hence, the alternative to Ha is:

> Hb: Disagreement leads to more optimal investment and acquisition decisions, given the economic environment.

Note that in the model, executives' choice of effort and the CEO's choice of investment level happen simultaneously. One can argue that the effort choice dominates the

[6] It is worth mentioning that a heavy-handed and overly optimistic CEO can change the investment patterns of her company in an alternative manner. Equation (5) illustrates that the weight the CEO puts on the competing objectives of following her own voice versus minimizing signal noise is governed by the parameter, k. One can imagine that a heavy-handed CEO derives higher benefit from following her own voice, thus k is smaller for such a CEO. If the CEO is also overly optimistic, she can follow her own rosy forecasts while ignoring more realistic forecasts from the executive team and indulge in wasteful investments (Jensen 1986).

investment decision: no matter how close to the optimal investment level the CEO gets due to disagreement, if not enough effort is spent by the executive team, investment projects will not be adequately implemented. However, it is an empirical issue to find out the frequency at which disagreement leads to severe cuts in investment as in Ha, or alternatively, leads to more optimal investment decisions as in Hb.

In the model, the CEO chooses the investment level. If the CEO's signal interpretation is too high (low), lack of disagreement can result in over (under)-investment. As shown by Equation (6), disagreement induces the CEO to put a proper weight on other executives' signals. Hence, disagreement and the resulting more informed decision-making by the CEO can avoid over or under-investment. Deviations from optimal investment happen for a variety of reasons. Jensen (1986) and Myers and Majluf (1984) illustrate such deviations in the presence of agency issues. In my model, deviations from optimal investment happen due to the CEO's limited information set. Disagreement and the ensuing information collection and further processing by the CEO brings the investment level closer to optimal. Using a methodology similar to Biddle, Hilary, and Verdi (2009), I check whether disagreement helps pare down excess investment for firms that are prone to over-investment, such as firms with higher cash holdings or lower leverage (Jensen 1986; Myers 1977). Acquisition decisions can be susceptible to similar CEO biases wherein a CEO with high signal interpretation can make an inflated offer for a target. In such a case, disagreement can cut down the acquisition premium and lead to a more optimal offer.

As proposed in Hb, disagreement can increase the quality of a firm's decisions. However, this sometimes comes at the expense of slowing down the decision-making

process. Hambrick, Cho, and Chen (1996) find delays in a firm's response to competitors' moves as the executive team becomes more heterogeneous. As with a heterogeneous team, disagreement causes long response times through excessive deliberation and personal frictions. Certain firms can sacrifice a bit of quality in their decisions but a slowdown is too costly. For example, Lehn, Patro, and Zhao (2009) find that firms with high growth opportunities endogenously choose smaller boards because they need a nimbler decision-making process to navigate the quickly changing investment environment. Larger boards can generate more information about the firm's product market, compliance with regulations, and so forth, however, it lengthens the firm's response time, which is critical for a high growth firm. Likewise, a firm in financial distress oftentimes needs to make quick decisions. In a study of firms experiencing negative earnings that later become profitable through voluntary restructuring, John, Lang, and Netter (1992) find that these firms cut their employment by about 5% and reduce their debt to assets ratio by 8% in the first year after negative earnings. Furthermore, managers in firms that file for Chapter 11 bankruptcy have only 180 days to obtain creditor and shareholder approval for their reorganization plan (Wruck 1990). In yet another context, Bernile, Bhagwat, and Yonker (2016) find that board diversity impairs firm value in times of high market volatility when quick decision-making is helpful. Note that here disagreement reduces firm value even if executives' effort and implementation decisions don't eventually get impaired as in Ha.

Hb.1: Disagreement hurts firm value when quick decision-making is needed.

I measure executive disagreement via insider trading behavior, however, executives can behave differently in their personal trading versus corporate decisions.

Slovic (1972) demonstrates that individuals can display inconsistent behavior if relatively similar tasks are introduced in different contexts. Similarly, a pessimistic executive who makes insider trades according to her beliefs may not exhibit pessimism in corporate decisions due to the dynamics of group decision-making. The absence of a relationship between individual and corporate decision-making forms the null hypothesis:

H_0: Insider trading behavior is not correlated with corporate investment policy.

4. Data and Empirical Procedure

I start by looking for executive disagreement in insider trading. Although insiders could trade for liquidity reasons, information-based trading is very common (Allen and Ramanan 1995, Pettit and Venkatesh 1995, Seyhun 1988, Ke, Huddart, and Petroni 2003). Net purchases by insiders can signal executive optimism while net sells signal pessimism. Firms that have both net purchasers and net sellers in a certain time interval can be classified as firms with disagreement. In their net purchase measure, Lakonishok and Lee (2001) use a six-month interval, arguing that a one-month interval can yield in many companies having no trades. I use three-month intervals to identify firms that simultaneously have net purchasers and net sellers. I look for effects on investment levels for the quarter of disagreement as well as the next three quarters.

I use insider trades from January 1986 to December 2016. Daily insider trades are obtained from Thomson Reuters Insider Filing database. Insiders, which include officers with decision-making authority, board members, and owners of more than 10% of a company's stock, are required to file SEC Form 4 for each insider transaction they

make. These filings are recorded in Table 1 of the Insider Filing database. Similar to previous literature (for example, Cohen, Malloy, and Pomorski (2012)), I focus on open market purchases and sales by insiders, and exclude options exercises.

In order to increase the likelihood that the insider trades I investigate are information-based, I follow the screening procedure in Cohen, Malloy, and Pomorski (2012). They label certain insiders routine traders if there is an observable pattern in their trading behavior, for instance, trading in the same month every year. Insiders for whom no apparent pattern is observed are labelled as opportunistic. Unlike earlier papers (such as Lakonishok and Lee (2001)) who don't find return predictability for insider sales, Cohen, Malloy, and Pomorski (2012) are able to find strong predictive power for both opportunistic buys and sells.

I collect data on firm fundamentals including capital and non-capital investment from Compustat. For data on institutional ownership, I refer to Thomson Reuters 13F database.

Hypothesis Ha.1 predicts a negative relationship between disagreement and investment levels. I test this prediction on both total investment levels and its constituents, which include capital expenditures, R&D expenses, and acquisition expenses. Following Biddle, Hilary, and Verdi (2009), I scale capital expenditures by lagged property, plant, and equipment. Total investment is defined as the sum of capital expenditures, R&D expenditures, and acquisitions minus sales of PPE, scaled by lagged total assets.

A second method to uncover executive, especially director, disagreement is to use individual firm Form 8-Ks. Agrawal and Chen (2017) and Bar-Hava, Huang, Segal,

and Segal (2015) make use of this form, part of which is a written correspondence between companies and departing directors. If directors depart due to disagreement, such instances could be used to test above hypotheses. In Agrawal and Chen's (2017) sample from 1995 to 2006 of 168 disagreement episodes, only 43 of them were related to corporate strategy. The remaining were about board functioning, agency problems, or other issues. Since my paper is focused on disagreements on firm prospects, a caveat of examining Form 8-Ks would be limited sample size.

A third method to uncover executive disagreement is to conduct textual analysis on various firm disclosures, a method that has recently become quite popular in the finance literature (Tetlock, Saar-Tsechansky, and Macskassy, 2008; Loughran and McDonald, 2011; Dikolli, Keusch, Mayew, and Steffen, 2014; Green, Jame, and Lock, 2016). These disclosures can take the form of firm 10-Ks, shareholder letters, CEO conference calls, or simply news stories. I look for words related to executive disagreement in such documents and associate their occurrence with investment levels. A potential concern with this method is that CEOs can avoid mentioning their disagreement in the executive team unless the disagreement has already facilitated positive outcomes.

5. Empirical Results

Table 1 displays summary statistics on investment and control variables across firm-years differentiated by whether the year in question is preceded by a disagreement period. The table shows whether disagreement periods affect the outcome variable, investment, and at least as importantly, it shows whether other explanatory variables are

influenced by disagreement. If the effect of disagreement on other explanatory variables is weak, this would mitigate concerns about endogeneity.

The first two rows on capex and total investment show that disagreement periods are associated with generally lower investment levels. However, the difference in means test indicates that this observation is not statistically significant. About half of the explanatory variables seem not to be affected by the presence of disagreement. However, years following disagreement are associated with larger firm assets, higher leverage and higher asset tangibility. These three variables suggest that disagreement as measured by insider trades is more likely to happen in larger firms. Furthermore, the number of insiders is higher for firm-years associated with disagreement. To make sure that disagreement is not simply picking up the effect of a larger executive team, variables that proxy firm or executive team size will be controlled in most specifications below.

Table 2 exhibits the test of Ha.1 for investment levels. Specifications 1 to 3 in Panel A examine total investment levels, which is defined as:

$$Total\ investment = \frac{R\&D\ Expense + Capital\ Expenditures + Acquisition\ Expenditures - Sale\ of\ PP\&E}{Lagged\ Assets} \quad (7)$$

All specifications include Fama-French 49 industry by year fixed effects to control for time-varying industry shocks on investment levels. Furthermore, all specifications cluster standard errors by firm and by year. It is plausible that there is non-random variation in disagreement frequency or in investment levels across firms or years. Specification 1 does not include control variables whereas specification 2 includes common control variables used in the literature to explain firm investment. These

variables are market-to-book ratio, cash flow, leverage, and total assets (Lang, Ofek, and Stulz, 1996; Kaplan and Zingales, 1997; Cleary, 1999). Given the way I measure insider trades, I also include the number of firm insiders as a control variable. Specification 3 runs the investment regression with additional control variables including *Z-score*, *Tangibility*, *Slack*, *Dividend*, *Age*, *Loss*, and *Institutions*. *Slack* is the ratio of cash to PP&E. *Dividend* is an indicator variable that takes the value of one if the firm paid a dividend. *Loss* is an indicator variable that takes the value of one if net income before extraordinary items is negative. Finally, *Institutions* is the percentage of firm shares held by institutional investors. In all three specifications even though the coefficient on lagged disagreement is negative, it is not statistically significant. Nevertheless, to give an idea of economic magnitudes, disagreement episodes are associated with a 5.2 (8.0) percent decline from the mean (median) level of total investment. It is worthwhile to note that although disagreement is negatively, albeit insignificantly, associated with investment, *Number of Insiders* has a positive coefficient. This demonstrates that disagreement is not simply capturing the size of the executive team.

Although disagreement seems not strongly related to total investment levels, it can differentially affect the various components of investments. As alluded to in the introduction, Jehn (1995) illustrates that disagreement is more harmful for routine decisions. Acquisition decisions are generally perceived as complex (Duhaime and Schwenk 1985) so it is plausible that disagreement adversely affects the simpler capex decision. Table 2 Panel B displays regressions of capex, acquisitions, and R&D

expenditures on executive disagreement. Specifications 1 to 3 has the capex specifications, where it is defined as[7]:

$$Capex = \frac{Capital\ Expenditures}{Lagged\ PP\&E} \tag{8}$$

Results indeed turn out to be stronger for capex. Especially, the simple and partial models generate negative and statistically significant coefficients. In terms of economic significance, the partial model implies that disagreement is associated with about a 5.8 (8.4) percent decrease from its mean (median) level. Consistent with prior expectations, *Market-to-Book* ratio is positively, and *Leverage* is negatively associated with capital expenditures. Specifications 4 to 6 and 7 to 9 do the same exercise for acquisitions and R&D expenditures, respectively. When defining these variables, lagged assets is in the denominator for acquisitions and lagged intangible assets is in the denominator for R&D. Acquisition results are negative but statistically insignificant. In terms of economic magnitude, the full specification implies that lagged disagreement is associated with a 10 percent reduction from the mean level in acquisition expenditures. Results on R&D expenditures are inconclusive. Results in Table 2 perhaps demonstrate the main contribution of the paper wherein executive disagreement is shown to reduce corporate investments, especially those that pertain to capital expenditures. The mechanism that I propose which links disagreement and lower levels of investment is executives' reduced effort and stalled projects. The results demonstrate the negative consequences when executives have differing views for the future of their company.

[7] When the ratio is taken over lagged assets, results are similar but quantitatively weaker.

These negative consequences become more severe especially when the firm is facing a relatively routine task.

Table 3 displays results for the test of Hb. In particular, it tests whether disagreement helps firms avoid over-investment, especially for those firms that are prone to investing excessively. Following Biddle, Hilary, and Verdi (2009), I characterize firms that have high cash holdings and low leverage as those that are prone to over-investment. The variable *OverTendency* is the average decile score of cash holdings and negative leverage (to make sure the latter variable increases with excess investment) of a firm in a given year. I use the following regression to estimate the relationship between disagreement and investment levels for firms that are prone to over-investment:

$$\begin{aligned} Investment_{i,t} = {} & \beta_0 + \beta_1 Disagreement_{i,t-1} + \beta_2 OverTendency_{i,t} \\ & + \beta_3 Disagreement_{i,t-1} * OverTendency_{i,t} \\ & + \sum \gamma_j Control_{j,i,t} + \varepsilon_{i,t} \end{aligned} \quad (9)$$

If, as predicted by Hb, disagreement mitigates excessive investment for firms prone to over-investment, the estimate for the interaction term should be negative. Results are reported in Table 3. Specifications 1-3 present results for total investment and 4-6 for capex. Specifications 1 and 4 simply repeat the corresponding specifications in Table 2. Specifications 2 and 5 show the simple model with only the interaction results between lagged disagreement and susceptibility to over-investment added. The interactive term is negative but insignificant for both specifications[8].

[8] Results are similarly weak when overinvestment tendency is measured across industry-years.

Specifications 3 and 6 further include control variables. Specification 6 generates a negative and statistically significant coefficient on the interactive term between lagged disagreement and *OverTendency*. In terms of economic significance, when we go from the decile of firms with the lowest tendency to overinvest to the decile with the highest tendency, disagreement episodes are associated with a 28 percent further decline in the mean level of capex. Therefore, there is some indication that for firms that are prone to over-investment, lagged disagreement reduces the level of excessive investment. Hence, disagreement seems to improve firm governance around the investment decision and curb wasteful investments for firms prone to over-investment. It can be taken as suggestive evidence confirming Hb. However, the hypothesis is not confirmed when investment is measured as the level of total investment. While specification 6 generates some support for Hb, results are short of providing strong validation. Interestingly, both hypotheses, Ha and Hb, seem to be confirmed when tests are conducted on capital expenditures.

Given that there is some support for hypotheses Ha and Ha.1, the next logical step is to test Ha.2, that is, whether CEO power or heavy-handedness mitigates the negative relationship between executive disagreement and the level of investment. Using three different proxies for CEO power, Table 4 displays how a powerful CEO can affect the disagreement-investment relationship. The specification used is the following:

$$Investment_{i,t} = \beta_0 + \beta_1 Disagreement_{i,t-1} + \beta_2 Powerful\ CEO_{i,t} + \beta_3 Disagreement_{i,t-1} * Powerful\ CEO_{i,t} + \sum \gamma_j Control_{j,i,t} + \varepsilon_{i,t} \quad (10)$$

The test is done on both total investments and capital expenditures. The first proxy used for CEO power is dual CEO-chairman position (Finkelstein 1992). The presence of a CEO with a dual role does not affect how much disagreement episodes lower investment. The second proxy used is the level of CEO compensation, especially the ratio between CEO pay and the pay of the second-highest paid executive (Chatterjee and Hambrick 2007). I form quintiles of the pay ratio and take the highest quintile as CEOs with high relative compensation. The interaction term between lagged disagreement and high CEO compensation dummy is again insignificant. The third proxy for CEO power is the tenure of the CEO. Like the first two variables, it does not affect the relationship between disagreement and the level of investment. There seems to be no strong evidence that CEO power weakens the relationship between disagreement and reduced investment. This suggests that even if a CEO is relatively powerful, disagreement with other executives still leads to reduced investment. Even a powerful CEO is subject to disruption in the face of disagreement.

Hypothesis Hb.1 links the effect of disagreement to circumstances in which quick decision-making is needed. Recall that Hypothesis Hb takes disagreement as a deliberation process through which better decisions can be generated. If promptness is more important than decision quality, disagreement can backfire. Three proxies are used to capture the circumstances that make quick decisions favorable: firms with growth opportunities (Lehn, Patro, and Zhao 2009), firms nearing financial distress (John, Lang, Netter 1992), and times with high market volatility (Bernile, Bhagwat, and Yonker 2018). Table 5 displays the results for the three proxies. It uses a difference-in-

differences specification, where annual stock returns are observed before and after disagreement periods for treatment and control firms:

$$Return = \beta_0 + \beta_1 Disagreement + \beta_2 Treatment + \beta_3 Disagreement * Treatment + Controls \quad (11)$$

In each specification, treatment firms are those that need quick decision-making. *Disagreement* is one for years following disagreement episodes.

The first column corresponds to growth opportunities, which is captured by a high market-to-book (MB) ratio. Instead of classifying firms as having high versus low MB, MB is taken as a continuous variable. One unit increase in the market-to-book ratio corresponds to significantly lower risk-adjusted annual returns of -7.8 percent after disagreement episodes. This illustrates that disagreement is more harmful for firms with more growth opportunities. The proxy in the second column is financial distress. A firm is in financial distress if net income before extraordinary items is negative. For this specification, the coefficient on the interactive term is negative but not statistically significant. Although firms with negative earnings are hurt by disagreement periods more than firms with positive earnings, the difference is not significant. Still the coefficient is similar in magnitude to that in the first specification. The third proxy, stock market volatility measured by VIX, generates a negative and statistically significant coefficient. Rather than separating low-VIX and high-VIX environments, VIX is treated as a continuous variable. Disagreement hurts firm value more in highly volatile stock market environments. In terms of economic magnitude, a one-standard deviation increase in VIX is associated with 4.25 percent lower annual returns when the firm faces disagreement. Overall the results in Table 5 suggest that firms that need quick

decisions have significantly poorer performance when they experience disagreement. This is consistent with hypothesis Hb.1 and shows that disagreement not only reduces investment but also has serious ramifications for firm value.

Executives are more likely to depart the firm when they are in disagreement (Dewally and Peck 2010, Agrawal and Chen 2017). Looking at executive departures can thus be a good way to empirically validate my measure of disagreement. When a disagreement episode is observed in a firm through the behavior of insider traders, I check for departures in Execucomp. The first test involves looking at the average years to departure for firm executives experiencing disagreement versus those that do not. Across all firms, average departure time for executives after disagreement episodes is 4.43 years versus 4.08 years following non-disagreement periods. The difference is statistically significant. The results are opposite to what one would expect. One possibility is that disagreements my methodology picks up are not too extreme to lead to departure. Executives also depart for reasons other than disagreement such as family/health issues or outside commitments. Furthermore, matching insider trading with Execucomp leads to a small sample size. When I look into whether executives in general depart their firm within the next year, the probability is 45.5 percent following disagreement and 47.9 percent following non-disagreement episodes. Results are counterintuitive and similar to the first set of findings.

Although my model examines the relationship between executive disagreement and corporate investment decisions, a preliminary extension can be made to labor and innovation outcomes. Such an extension can be useful given the importance of these variables in gauging the productivity and health of the real economy. If hypothesis Ha.1

holds and disagreement leads to suboptimal and insufficient investments, a firm can shrink in the long run thus reducing its number of employees. Table 6 provides support for this linkage where disagreement is associated with a 2.2 percent reduction in the number of employees over the course of a year. To give a comparison, the median value for the change in employees is 1.6 percent.

How many patents a firm generates a year and how many citations those patents receive are important indicators of a firm's innovative output. Table 6 examines whether disagreement hampers innovative productivity. There is no support for such a prediction. As expected, firm size is positively correlated with the extent of innovative output.

6. Robustness Checks

Cohen, Malloy, and Pomorski (2012) illustrate that return predictability of insider trades is especially strong for local insiders. They label an insider local if the insider lives in the state of company headquarters. If insider trades have better information value for local insiders, one can expect to see the main results of this paper get stronger within the subset of such insiders. Table 7 divides the set of insider trades into local and non-local and tracks the occurrence of disagreement within each set. Test of hypothesis Ha.1 is repeated on total investments and capital expenditures. Disagreement hurts capex in the local insider specification similar to results in Table 2. Economic significance is also very similar to those earlier results. However, results are insignificant for non-local insider specifications. Results are supportive of Cohen, Malloy, and Pomorski (2012) and point to the informativeness of local insider trades. It

is the local insiders that demonstrate their pessimism or optimism through their trades, which then gets reflected in corporate investment behavior.

Main specifications in Table 2 are run with industry by year fixed effects. Arguably the effect of disagreement should be measured within firms, otherwise, results could be driven by firm-specific time-invariant omitted variables. To see if my main results on hypothesis Ha.1 are robust, I repeat tests on total investments and its constituents with firm and industry-year fixed effects. Surprisingly, results with the total investment specification become marginally significant for the partial and full models. In economic terms, lagged disagreement is associated with a 4.7 percent reduction in investment levels, that is, 0.33 percent reduction where the mean level of investment is 6.98 percent. This time, however, results are driven by the negative effect of disagreement on acquisition expenditures. Mean level of acquisition expenditures as a ratio of previous quarter's assets is 0.02 percent and the coefficient estimate of -0.003 with the full set of controls implies a 17 percent reduction from the mean level. Previously strong results on capex disappear with the stronger set of controls. The premise that disagreement would hamper the more routine capex decision is not robustly supported. Results on R&D expenditures are still insignificant.

I define disagreement when a firm has net buyers and net sellers, where the trades are information-driven, within a three-month window. One can argue that such an approach would favor large firms with many insiders. In my empirical specifications, I control for the number of insiders yet, for robustness, I construct an alternative continuous measure of disagreement. In particular, I define disagreement as $\min(\%buyers, \%sellers)$. A single net buyer in a five-person executive team would

have the same effect as two net buyers in a ten-person team. The minimum operator makes sure that there is both buyers and sellers in the firm at the same time.

Insider trades are retrieved from Thomson Reuters Insider Filing database for the entire universe of US public firms whereas executive rosters can only be obtained from Execucomp for S&P 1500 firms for a more limited sample period. Matching with Execucomp results in a largely contracted sample with insufficient number of disagreement episodes. In order to preserve sample size, I retrieve the executive roster also from the Insider Filing database. In my main specifications, I only consider open market purchases and sales by insiders but insiders can appear on Insider Filings for other reasons such as stock grants and option exercises. I treat as if insiders that appear on Insider Filings are a good representation of the firm's entire executive team. The continuous disagreement measure has a mean of 3.2 percent and a median of 0.

Regression results are given in Table 9. Sample sizes have greatly expanded as it is no longer required that a firm has a net buyer and seller within a three-month window. Total investment specification generates significance in the simple and partial models. Economic magnitudes have risen significantly possibly being affected by outliers. Results on capex and acquisitions are not statistically significant. Interestingly, results on R&D are stronger compared to previous specifications but are still not at conventional significance levels. In terms of economic magnitude, a one-standard deviation increase in disagreement is associated with a 12 percent reduction from the mean level of R&D expenditures.

As a final robustness check, I orthogonalize the disagreement variable against the number of insiders in order to purge disagreement from the size of the executive

team. Table 10 shows that results are statistically significant only for capex specifications. Economic significance levels are very similar to Table 2 for total investments and its constituents.

7. Conclusion

This paper attempts to uncover the relationship between executive disagreement and firm investment. I show that investments, especially capital expenditures, decline following disagreement in the executive team. The relationship is both statistically and economically significant. I propose that reduced effort in the executive team that follows disagreement is the culprit for reduced investments. As less effort is spent by pessimistic as well as optimistic executives, projects are not implemented adequately and lower investment levels follow. The same relationship is true even when a powerful CEO is in place. Nevertheless, there can be factors other than reduced effort in play. Disagreement can also lead to gridlock and prevent progress on the part of the executive team.

I find weak support for the decision enhancing effects of disagreement. Although there is some indication that disagreement lowers excessive capital expenditures, results for total investment are inconclusive. The effort-reducing dark side of disagreement is plausibly more dominant compared to the decision-enhancing bright side. However, the finding that disagreement hurts capital expenditures more than acquisitions indirectly hints at the decision enhancing effects of disagreement. Acquisitions are complex decisions so disagreement can have a dual effect in which the positive and negative effects cancel out. According to the positive channel, disagreement is initially predicted to have a beneficial effect on the final decision given

that it is a deliberation process through which better decisions can be reached. However, this comes at the cost of slowing down the decision-making process. Results show that the slowdown is costly for firms in need of quick decisions, especially firms with high growth opportunities and in times of high market risk.

Results associating disagreement with reduced investments is sometimes not robust to stronger empirical specifications. It could be due to measurement error when identifying disagreement episodes. Executives can also have different motives when they carry out insider trades versus when they act within the executive team.

My paper's contribution is twofold. It is the first paper to measure executive disagreement through insider trades. Extracting information-driven trades helps infer which executives are optimistic and which are pessimistic, making it plausible to detect disagreement among executives. The second contribution is the empirical validation of a theory of executive disagreement. There is some support for the effort-reducing effects of disagreement, and that channel seems to dominate the optimal decision-enhancing channel. In that sense, disagreement is found to be more harmful than helpful to firms.

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Figure 1: Disagreement at Chiquita Brands International and Effects on Firm Outcomes

This graph plots the share price, ROA, and capital expenditures around December 2011 when an executive disagreement episode is detected through information-driven insider trades in opposing directions. Capital expenditures is defined as the ratio of the level of capex divided by lagged property, plant, and equipment.

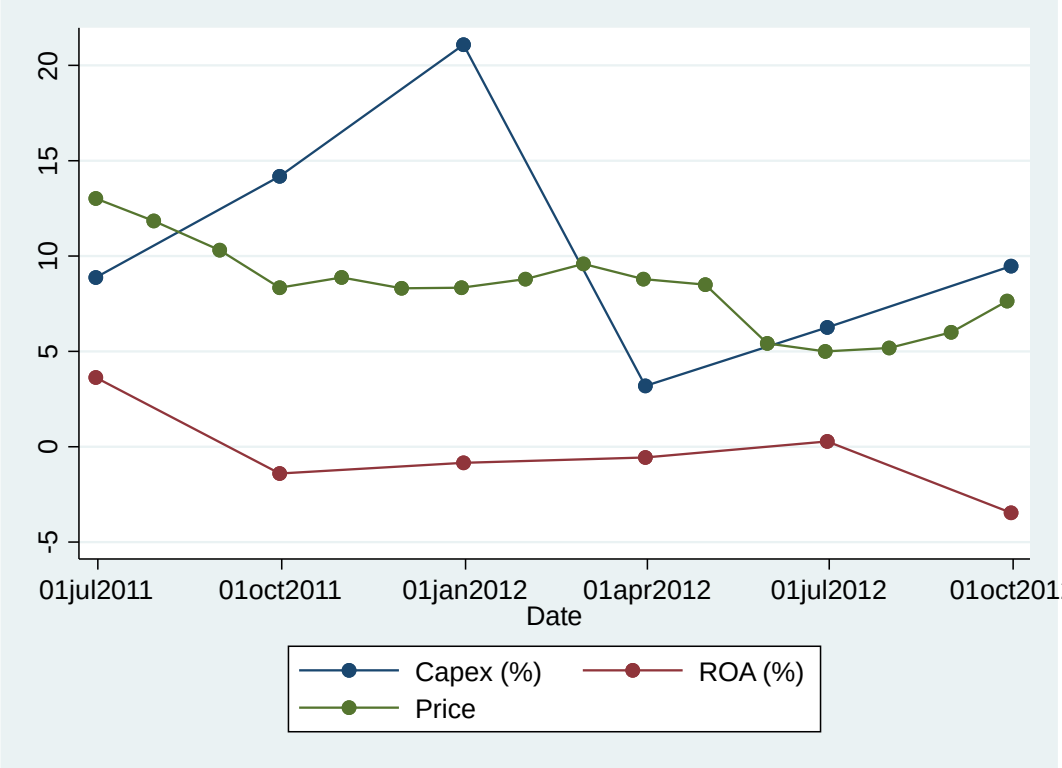

Figure 2: Timeline of the Model

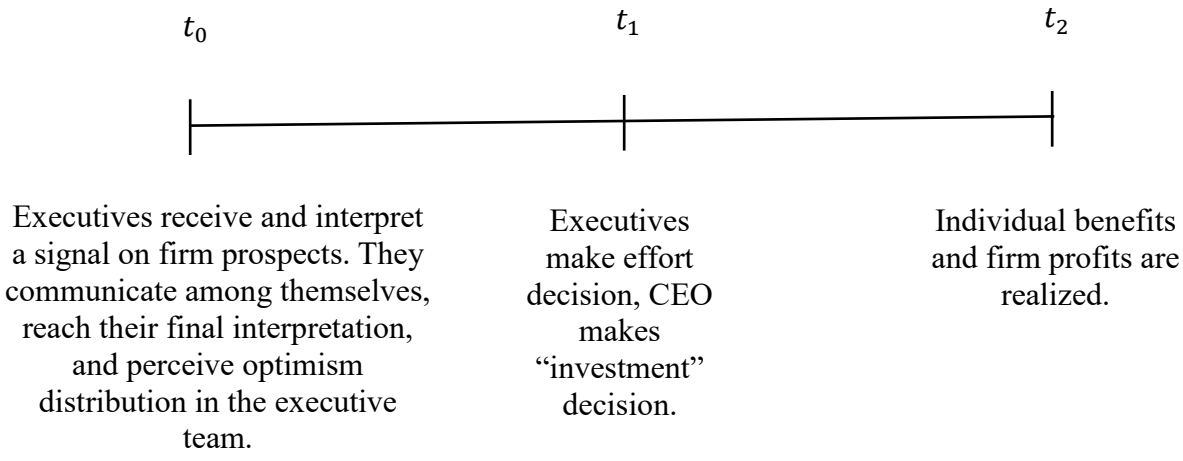

Table 1: Firm Fundamentals in Years Following Disagreement vs. Non-Disagreement

This table compares firm fundamentals in each firm-year following a disagreement or non-disagreement period. The definition of a disagreement period is given in the text. The table shows means and medians as well as the p-value from a difference in means test between disagreement and non-disagreement years. *Cash Flow* is net income plus depreciation and amortization plus change in deferred taxes divided by lagged assets. *Z-score* is a measure of distress computed following the methodology in Altman (1968). Lower scores indicate higher distress. *Slack* is the ratio of cash to PPE. *Dividend* is an indicator variable that takes the value of one if the firm paid a dividend. *Loss* is an indicator variable that takes the value of one if net income before extraordinary items is negative. *Institutions* is the percentage of firm shares held by institutional investors. The last row shows the number of distinct firms appearing in each year type.

	Disagreement Years			Non-Disagreement Years			
	Mean	Median	Observations	Mean	Median	Observations	p-value difference in means
Investment (%)	6.635	4.249	2,503	6.906	4.290	50,978	0.577
Capex (%)	15.958	11.418	2,497	18.820	12.336	50,811	0.284
Log(Assets)	6.617	6.541	2,498	6.460	6.502	50,963	less than 0.001
Market-to-Book	2.342	1.676	2,484	2.515	1.772	50,662	0.107
Cash Flow (%)	0.021	0.027	2,324	0.013	0.026	47,992	0.292
Number of Insiders	2.660	2.000	4,387	1.859	1.000	66,476	less than 0.001
Z-score	1548.134	220.615	2,365	1826.523	227.442	48,172	0.091
Tangibility	0.315	0.238	2,491	0.273	0.199	50,873	less than 0.001
Leverage	0.183	0.111	2,447	0.156	0.089	50,233	less than 0.001
Slack	1.782	0.226	2,491	5.784	0.454	50,746	0.217
Dividend	0.487	0.000	2,505	0.421	0.000	51,101	less than 0.001
Age	21.993	18.000	2,395	21.588	17.000	49,360	0.258
Losses	0.182	0.000	2,502	0.210	0.000	50,993	0.001
Institutions	0.545	0.594	2,377	0.550	0.625	48,694	0.459
Number of distinct firms			947			6,945	

Table 2: Investment Regressions (Ha.1)

This table presents regressions of investment on *Lagged Disagreement* and controls. The dependent variable in Panel A is *Total investment*. Total *investment* is defined as the sum of capital expenditures, R&D, and acquisition expenses net of PP&E sales, all scaled by lagged assets. The dependent variables in Panel B are constituents of investment, which are *Capex, Acquisitions, and R&D expenditures.* All specifications use Fama-French 49 industry by year fixed effects, and cluster standard errors by firm and year. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Panel A

	Dependent variable		
	Total investment		
	(1)	(2)	(3)
$Disagreement_{t-1}$	-0.173	-0.216	-0.363
	(-0.586)	(-0.708)	(-1.361)
Log(Assets)		0.243**	0.100*
		(2.337)	(1.902)
Market-to-Book		-0.041	0.355***
		(-1.323)	(3.880)
Cash Flow		-34.682***	-6.025
		(-3.804)	(-1.133)
Leverage		-0.909	0.941
		(-0.958)	(0.958)
Number of Insiders		0.253***	0.133**
		(4.297)	(2.482)
Z-score			0.000***
			(-6.359)
Tangibility			7.935***
			(12.691)
Slack			0.000*
			(-1.881)
Dividend			-0.798***
			(-4.439)
Age			-0.037***
			(-7.074)
Loss			0.416
			(1.024)
Institutions			1.274***
			(4.320)
Industry-Year FE	Yes	Yes	Yes
Firm and Year Cluster	Yes	Yes	Yes
Observations	53,446	46,925	43,055
R^2	0.0359	0.2673	0.1301

Table 2 (Continued)

Panel B

	Dependent variable								
	Capex			Acquisitions			R&D		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$Disagreement_{t-1}$	-1.704***	-1.065**	-0.640	-0.001	-0.002	-0.002	0.102	-0.020	0.113
	(-3.375)	(-2.330)	(-1.449)	(-0.357)	(-1.188)	(-1.295)	(0.299)	(-0.052)	(0.281)
Log(Assets)		-1.223***	-0.722***		0.002***	0.002***		-0.330**	-0.224**
		(-7.110)	(-4.141)		(6.197)	(6.110)		(-2.584)	(-2.690)
Market-to-Book		0.359**	0.769***		0.000*	0.000*		-0.029	0.164
		(2.602)	(3.658)		(-1.844)	(-1.836)		(-1.239)	(1.558)
Cash Flow		3.302	9.709		0.001*	0.021*		-7.113**	-11.938
		(1.124)	(1.443)		(1.749)	(1.709)		(-2.441)	(-1.450)
Leverage		-12.633***	-11.007***		0.034***	0.051***		-0.557	0.397
		(-11.985)	(-9.047)		(4.851)	(5.545)		(-0.409)	(0.255)
Number of Insiders		0.027	-0.026		0.001**	0.001*		0.028	0.036
		(0.221)	(-0.223)		(2.231)	(1.999)		(0.333)	(0.361)
Controls	No	No	Yes	No	No	Yes	No	No	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Cluster	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Cluster	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	53,273	46,790	43,052	50,974	44,937	41,221	15,230	13,863	13,341
R^2	0.0107	0.0698	0.0843	0.0509	0.0635	0.0778	0.0305	0.0426	0.0769

Table 3: Over-investment

This table presents regressions of *Total investment* and *Capex* on the interaction of *Lagged Disagreement*, susceptibility to over-investment (*OverTendency*), and controls. Controls are the same as in Table 3 except *Leverage* is no longer present since *OverTendency* is constructed as a decile average of *Leverage* and *Cash*. All specifications use Fama-French 49 industry by year fixed effects, and cluster standard errors by firm and year. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

	Dependent variable					
	Total investment			Capex		
	(1)	(2)	(3)	(4)	(5)	(6)
$Disagreement_{t-1}$	-0.173	0.117	-0.938	-1.704***	0.692	2.163*
	(-0.586)	(0.172)	(-1.420)	(-3.375)	(0.476)	(1.720)
OverTendency		-0.029	-0.249***		1.785***	1.238***
		(-0.203)	(-2.843)		(3.640)	(6.268)
$Disagreement_{t-1}$ * OverTendency		-0.052	0.107		-0.374	-0.548**
		(-0.418)	(0.771)		(-1.335)	(-2.041)
Controls	No	No	Yes	No	No	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Year Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Observations	53,446	52,564	43,055	53,273	52,400	43,052
R^2	0.0359	0.0359	0.1313	0.0107	0.0115	0.0849

Table 4: CEO Power

This table presents regressions of *Total investment* and *Capex* on disagreement, a proxy for CEO power, and their interaction. *High CEO Compensation* is one for CEOs whose pay relative to the second-highest paid executive is in the top quintile. All specifications use Fama-French 49 industry by year fixed effects, and cluster standard errors by firm and year. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

	Dependent variable					
	Total investment			Capex		
	(1)	(2)	(3)	(4)	(5)	(6)
$Disagreement_{t-1}$	0.056	-0.206	-0.400	-0.648	-0.664	0.371
	(0.180)	(-0.654)	(-0.791)	(-0.976)	(-1.462)	(0.332)
Dual CEO-Chairman	0.129			-0.114		
	(0.869)			(-0.312)		
$Disagreement_{t-1}$ * Dual CEO-Chairman	-0.689			-0.047		
	(-1.089)			(-0.040)		
High CEO Compensation		0.247			-0.371	
		(1.399)			(-1.144)	
$Disagreement_{t-1}$ * High CEO Compensation		0.506			0.015	
		(0.753)			(0.017)	
CEO Tenure			0.004			0.219
			(0.043)			(1.272)
$Disagreement_{t-1}$ * CEO Tenure			0.131			-0.572
			(0.478)			(-0.984)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Year Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Observations	26459	26380	23752	26459	26345	23752
R^2	0.1461	0.0952	0.1476	0.2569	0.2566	0.2558

Table 5: Disagreement When Quick Decision-Making Is Needed

This table regresses annual firm stock returns on a proxy for firm-level demand for quick decision-making, disagreement periods, and their interaction. *Disagreement* is one if it corresponds to a year after a disagreement episode. *Treatment* is one for those firms for which quick decision making is favorable in the category denoted at the top of the table. Growth opportunities are proxied by the market-to-book ratio. A firm is classified as being in financial distress if net income before extraordinary items is negative. Market volatility is measured by VIX. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

	Treatment		
	Growth Opportunities	Financial Distress	Market Volatility
Rm-Rf	0.008***	0.007***	0.007***
	(11.205)	(12.153)	(10.773)
SMB	0.005***	0.004***	0.004***
	(4.286)	(3.565)	(4.074)
HML	0.001	0.002***	0.002**
	(0.702)	(2.672)	(2.150)
Disagreement	0.101***	-0.031	0.108
	(3.241)	(-1.263)	(1.342)
Treatment	0.056***	-0.039	0.001
	(8.536)	(-0.046)	(0.257)
Disagreement * Treatment	-0.078***	-0.087	-0.007*
	(-7.973)	(-1.388)	(-1.890)
Observations	2,948	3,749	3,777
R^2	0.0812	0.0531	0.0520

Table 6: Labor and Innovation

The dependent variable is the annual change in the number of firm employees in specifications (1) and (2), patents that a firm generates annually in specifications (3) and (4), and citations that those patents receive in specifications (5) and (6). All specifications use Fama-French 49 industry by year fixed effects, and cluster standard errors by firm and year. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

	Dependent variable					
	Change in Employees		Patents		Citations	
	(1)	(2)	(3)	(4)	(5)	(6)
$Disagreement_{t-1}$	-0.032*	-0.022**	2.499	-0.531	95.912	85.963
	(-1.982)	(-2.172)	(0.131)	(-0.037)	(0.651)	(0.580)
Log(Assets)		0.014***		26.173***		142.482**
		(2.770)		(3.485)		(2.365)
Market-to-Book		0.015***		-0.925		0.580
		(4.539)		(-0.424)		(0.068)
Cash Flow		0.000		-0.003		-0.107
		(0.751)		(-0.148)		(-1.105)
Z-score		0.000		0.003		0.006
		(-0.989)		(1.019)		(0.529)
Age		-0.003***		0.370		1.878
		(-5.492)		(0.812)		(0.694)
Loss		-0.020		3.727		-50.960
		(-1.230)		(0.250)		(-0.675)
Institutions		-0.022		-120.604		-575.329
		(-0.726)		(-1.656)		(-1.394)
R&D Expense				0.050		0.297
				(0.726)		(0.992)
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Year Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Observations	27,215	23,445	1,395	1,067	1,395	1,067
R^2	0.0389	0.0471	0.1493	0.5513	0.1952	0.4092

Table 7: Local vs. Non-Local Executives

Total investment and *Capex* are regressed on *Lagged Disagreement* and controls, separately for local (Panel A) and non-local (Panel B) executives. An executive is local if she resides in the state of company headquarters. All specifications use Fama-French 49 industry by year fixed effects, and cluster standard errors by firm and year. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Panel A

	Local executives					
	Total investment			Capex		
	(1)	(2)	(3)	(4)	(5)	(6)
$Disagreement_{t-1}$	-0.043	-0.098	-0.085	-1.795**	-1.315**	-0.445
	(-0.118)	(-0.255)	(-0.269)	(-2.681)	(-2.189)	(-0.827)
Log(Assets)		0.222*	0.122*		-1.100***	-0.552***
		(1.945)	(1.835)		(-7.565)	(-3.872)
Market-to-Book		0.027	0.326***		0.341**	1.298***
		(0.156)	(5.390)		(2.057)	(10.840)
Cash Flow		-37.145***	0.154		6.679*	4.542
		(-3.601)	(0.172)		(1.986)	(1.545)
Leverage		-0.479	1.102		-13.214***	-9.861***
		(-0.348)	(0.986)		(-11.617)	(-8.838)
Number of Insiders		0.204***	0.098*		0.064	-0.016
		(3.228)	(2.027)		(0.508)	(-0.144)
Controls	No	No	Yes	No	No	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Year Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Observations	37,838	33,748	31,262	37,740	33,667	31,260
R^2	0.0399	0.2888	0.1562	0.1106	0.1598	0.2035

Table 7 (Continued)

Panel B

	Non-local executives					
	Total investment			Capex		
	(1)	(2)	(3)	(4)	(5)	(6)
Disagreement$_{t-1}$	0.614	0.543	-0.306	2.008	1.401	0.525
	(0.676)	(0.569)	(-0.365)	(1.199)	(0.745)	(0.299)
Log(Assets)		0.110	0.175		-1.745***	-1.842**
		(1.144)	(1.101)		(-3.705)	(-2.111)
Market-to-Book		0.393**	0.340***		0.916**	1.170***
		(2.144)	(5.451)		(2.422)	(3.626)
Cash Flow		-12.878	6.730		2.478	30.610
		(-1.353)	(1.250)		(0.504)	(0.685)
Leverage		1.994	2.693*		-10.926***	-7.056**
		(1.301)	(1.736)		(-3.924)	(-2.612)
Number of Insiders		0.199**	0.162*		-0.380	-0.749
		(2.422)	(1.711)		(-1.069)	(-1.180)
Controls	No	No	Yes	No	No	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Year Cluster	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,725	10,106	9,081	11,670	10,068	9,080
R^2	0.1342	0.2271	0.1881	0.0838	0.1014	0.1665

Table 8: Firm Fixed Effects

Total investment (Panel A), *Capex, Acquisitions*, and *R&D expenses* (Panel B) are regressed on *Lagged Disagreement* and controls. All specifications use firm and industry-year fixed effects and cluster standard errors by firm and year. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Panel A

	Dependent variable		
	Total investment		
	(1)	(2)	(3)
$Disagreement_{t-1}$	-0.349	-0.430*	-0.325*
	(-1.565)	(-1.823)	(-1.795)
Log(Assets)		1.385***	1.572***
		(3.930)	(9.877)
Market-to-Book		0.011	0.174***
		(0.067)	(2.689)
Cash Flow		-46.659***	-1.845
		(-4.047)	(-0.956)
Leverage		0.993	3.689**
		(0.797)	(2.530)
Number of Insiders		0.188**	0.119**
		(2.329)	(2.206)
Controls	No	No	Yes
Firm FE	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes
Firm Cluster	Yes	Yes	Yes
Time Cluster	Yes	Yes	Yes
Observations	52,726	46,187	42,399
R^2	0.209	0.3221	0.3235

Table 8 (Continued)

Panel B

	Dependent variable								
	Capex			Acquisitions			R&D		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$Disagreement_{t-1}$	0.187	0.151	0.331	-0.003*	-0.004**	-0.003**	0.038	0.084	0.088
	(0.358)	(0.258)	(0.450)	(-1.970)	(-2.550)	(-2.478)	(0.433)	(1.035)	(0.452)
Log(Assets)		2.492*	1.862		0.018***	0.018***		-0.404	-0.171
		(1.936)	(1.422)		(10.944)	(10.316)		(-1.180)	(-0.513)
Market-to-Book		0.326**	0.234		0.000*	0.000		0.012	0.135
		(2.191)	(0.890)		(1.977)	(1.487)		(0.586)	(1.249)
Cash Flow		7.925**	18.684*		0.001	0.018		-4.530**	-6.719*
		(2.402)	(1.891)		(1.699)	(1.489)		(-2.683)	(-1.805)
Leverage		-9.283***	-7.335***		0.057***	0.065***		-1.663**	-1.025
		(-5.344)	(-3.815)		(4.313)	(4.332)		(-2.193)	(-1.462)
Number of Insiders		0.177	0.140		0.001	0.000		0.048	0.032
		(1.594)	(1.174)		(1.451)	(0.977)		(0.671)	(0.439)
Controls	No	No	Yes	No	No	Yes	No	No	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Cluster	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Cluster	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	52,558	46,056	42,395	50,245	44,181	40,549	14,903	13,532	13,032
R^2	0.1545	0.2866	0.2888	0.2157	0.2363	0.242	0.649	0.6676	0.5089

Table 9: Continuous Measure of Disagreement

An alternative continuous measure of disagreement is constructed as $\min(\%buyers, \%sellers)$. To calculate percentage buyers (sellers), the number of executives with information-driven buys (sells) is divided by the total number of executives appearing on Insider Filings data within a three-month window. The dependent variable is *Total investment* in Panel A and *Capex, Acquisitions,* or *R&D expenses* in Panel B. All specifications use Fama-French 49 industry by year fixed effects, and cluster standard errors by firm and year. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Panel A

	Dependent variable		
	Total investment		
	(1)	(2)	(3)
$Disagreement_{t-1}$	-10.173*	-10.577**	-10.280
	(-1.947)	(-2.042)	(-1.599)
Log(Assets)		-4.947*	-8.040***
		(-1.910)	(-3.965)
Market-to-Book		0.002	31.538**
		(0.502)	(2.584)
Cash Flow		5.026	1326.171***
		(0.494)	(8.057)
Leverage		-5.670	85.040***
		(-0.399)	(2.845)
Controls	No	No	Yes
Industry-Year FE	Yes	Yes	Yes
Firm Cluster	Yes	Yes	Yes
Year Cluster	Yes	Yes	Yes
Observations	378,637	338,573	288,914
R^2	0.0019	0.0036	0.8936

Table 9 (Continued)

Panel B

	Dependent variable								
	Capex			Acquisitions			R&D		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$Disagreement_{t-1}$	0.296	0.846	-11.979	-0.056	-0.042	-0.105	-1.102	-1.572	-2.078
	(0.023)	(0.056)	(-1.467)	(-1.104)	(-0.744)	(-1.659)	(-1.058)	(-1.357)	(-1.610)
Log(Assets)		-4.572***	-1.605		-0.024	-0.077***		-0.462***	-0.391***
		(-2.920)	(-1.605)		(-1.027)	(-3.892)		(-5.333)	(-3.113)
Market-to-Book		-0.001	0.034		0.000	0.296**		0.032*	0.511*
		(-0.858)	(0.068)		(0.961)	(2.592)		(1.869)	(1.795)
Cash Flow		-1.187	-5.156		0.101	12.621***		-0.099*	-4.299*
		(-1.076)	(-1.288)		(1.000)	(8.238)		(-2.045)	(-1.828)
Leverage		-28.239	-38.126		-0.115	0.845***		-2.053**	-1.105
		(-1.262)	(-1.157)		(-0.993)	(3.040)		(-2.110)	(-1.421)
Controls	No	No	Yes	No	No	Yes	No	No	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Cluster	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Cluster	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	375,175	335,887	288,789	359,665	323,521	275,927	69,648	66,085	60,187
R^2	0.003	0.0031	0.0038	0.0016	0.0095	0.8971	0.0033	0.0037	0.0042

Table 10: Disagreement Orthogonalized with Respect to Number of Insiders

Total investment (Panel A), *Capex, Acquisitions*, and *R&D expenses* (Panel B) are regressed on *Orthogonalized Lagged Disagreement* and controls. *Lagged Disagreement* is orthogonalized by regressing it against *Number of Insiders* and extracting the residuals from the regression. All specifications use Fama-French 49 industry by year fixed effects, and cluster standard errors by firm and year. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Panel A

	Dependent variable		
	Total investment		
	(1)	(2)	(3)
Ortho. Disagreement$_{t-1}$	-0.360	-0.262	-0.388
	(-1.195)	(-0.858)	(-1.466)
Log(Assets)		0.290***	0.121**
		(2.753)	(2.287)
Market-to-Book		-0.039	0.359***
		(-1.207)	(3.971)
Cash Flow		-34.683***	-5.991
		(-3.804)	(-1.130)
Leverage		-1.096	0.867
		(-1.149)	(0.880)
Controls	No	No	Yes
Industry-Year FE	Yes	Yes	Yes
Firm Cluster	Yes	Yes	Yes
Year Cluster	Yes	Yes	Yes
Observations	50,583	46,925	43,055
R^2	0.0369	0.2672	0.1298

Table 10 (Continued)

Panel B

	Dependent variable								
	Capex			Acquisitions			R&D		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ortho. Disagreement$_{t-1}$	-1.137*	-1.064**	-0.631	-0.002	-0.002	-0.002	0.274	-0.033	0.097
	(-1.956)	(-2.315)	(-1.433)	(-1.156)	(-1.263)	(-1.371)	(0.807)	(-0.085)	(0.244)
Log(Assets)		-1.224***	-0.730***		0.002***	0.002***		-0.325**	-0.218**
		(-6.754)	(-3.977)		(7.035)	(6.572)		(-2.688)	(-2.769)
Market-to-Book		0.359**	0.767***		0.000*	0.000*		-0.029	0.166
		(2.603)	(3.669)		(-1.806)	(-1.754)		(-1.243)	(1.602)
Cash Flow		3.301	9.697		0.001*	0.021*		-7.110**	-11.941
		(1.125)	(1.445)		(1.704)	(1.708)		(-2.444)	(-1.449)
Leverage		-12.630***	-10.980***		0.033***	0.050***		-0.574	0.385
		(-11.906)	(-8.859)		(4.791)	(5.511)		(-0.420)	(0.245)
Controls	No	No	Yes	No	No	Yes	No	No	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Cluster	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Cluster	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	50,420	46,790	43,052	48,289	44,937	41,221	14,511	13,863	13,341
R^2	0.0111	0.0698	0.0843	0.0502	0.0634	0.0777	0.0307	0.0426	0.0769

CHAPTER 2

Piety, Politics, and Portfolio Selection*

Abstract

We examine the impact of piety, a psychological trait that can influence economic behavior, on investor and corporate decision-making and performance. Turkey's dominant religion is Islam, but investors and corporations present varying degrees of religiosity. Across 25,000 individual investors, we measure religiosity with choice of brokerage house, extent of holdings in an index of religiously-compliant firms, and voting patterns in the investor's place of residence. Across almost 500 corporations listed on Istanbul's stock exchange, we measure piety with inclusion in religiously-compliant indexes, managerial membership of executive clubs (one secular, the other religious), use of Islamic financial instruments, and involvement with religious sponsorship activities. We characterize associations between investor religiosity and behavioral biases, associations between corporate religious and political positioning and performance, and the motivation and consequences of changes in corporate positioning.

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1. Introduction

Exploring investor behavior is increasingly important in the finance literature. Even though conventional finance theory assumes that people act rationally, numerous experiments and empirical studies document biases in investor decisions. The biases uncovered in these studies are driven by psychological and belief-based factors. In particular, some studies demonstrate that certain religious attitudes have a substantial impact on economic decision-making.

This paper studies the relationship between religious leanings and financial decisions of investors and the corporations they invest in. Using the unique economic, cultural, and political setting of the Republic of Turkey, we focus on "Islamic" investors among individuals participating in the Istanbul stock market. These investors are interesting for a number of reasons. In the last decade, financial institutions and products that operate by Islamic principles have become increasingly popular.[9] In the wake of the global financial crisis, there is growing interest in Islamic financial institutions and products because their structure is believed to reduce default risk arising from weak economic conditions. At the same time, Islamic finance principles can impose constraints on investors and financial institutions. They can forbid interest-bearing bank accounts, conventional bonds, and ownership of shares in banks, which are often among the most liquid in developing economies. Thus, Islamic investors can be disadvantaged since they access fewer investment products than conventional investors.

[9] For example, Standard & Poor's Rating Services "Islamic Finance Outlook 2017" anticipates Islamic finance assets reaching $2.1 trillion by the end of 2016. A handful of Islamic finance courses of study have been developed at universities in western countries. See, for example, http://www.masterstudies.com/MSc-Islamic-Finance/UK/DUBS/.

Turkey is an interesting setting for a study of investor behavior. The securities market lists hundreds of common stocks, market capitalization is about one-quarter trillion US dollars or almost one-third of GDP, and annual turnover is several times market capitalization. Attitudes toward religion as well as political orientation are likely to exert more influence on portfolio decisions than in typical developed countries. When the Justice and Development Party (Adalet ve Kalkınma Partisi, abbreviated "AKP") came to power with the general election of 3rd November 2002, socially conservative people, who were historically excluded from many aspects of public activity, gained a stronger foothold in politics, economics, and finance. AKP has emphasized the conservative, religious values of its supporters, exacerbating the polarization of Turkish society in recent years. This was compounded by the policy record of its main competitor, the Republican People's Party (Cumhuriyet Halk Partisi, abbreviated "CHP"), which historically excluded the socially conservative. The divide between the supporters of these two parties correlates with the country's geography. Figure 1 shows voting patterns in 2011, with CHP votes concentrated around Istanbul and nearby coastal areas while AKP predominates in more conservative Anatolia.

Thus, the Turkish population divides on observable religious, political, and geographic characteristics. Furthermore, the extent of these divisions can vary as the political power of the AKP has varied across recent elections. We hypothesize that both the psychological and social effects of religion influence individual investor decision making. We also predict that firms rearrange their alignment with political forces over time. With data from the Turkish stock market (Borsa Istanbul), we can measure differences in the investment decisions and performance of Islamic and conventional

investors. Thus, we can study the impact of piety, an important facet of psychology, on decision making. We can also study differences in apparent piety across the listed companies that Turkish investors choose from, and differences in performance and other operating characteristics of those companies. When combined with our understanding of Islamic and conventional portfolio selection, we can assess the costs of following Islamic investing principles and detect any clientele effects or catering by the listed companies. We also examine the effect of the social and political environment in Turkey on individual investors and corporations with event studies of decisive moments in the country's recent history. Aside from our primary goal of detecting behavioral biases related to religiosity in a novel setting, our work sheds light on the workings of Islamic finance and the costs and benefits of portfolio strategies such as so-called socially responsible investing.[10]

2. Literature review and empirical predictions

The interplay between economic decision making and characteristics like religiosity and political attitudes has been investigated in the economics and finance literatures from several aspects. Guiso, Sapienza, and Zingales (2006) report that religiosity is associated with good economic outcomes (higher GDP per capita and growth) but is also correlated with lower participation in the workforce by women. Stulz and Williamson (2003) report associations between religion and the legal rights of financial claimants. In particular, the predominant religion in a country is correlated with the nature and enforcement of creditor rights. Grinblatt and Keloharju (2001)

[10] See, for example, Teoh, Welch, and Wazzan (1999).

document how language and culture influence the investment choices of individual investors in Finland, where individuals and corporate managers can be classified on their Finnish or Swedish language and culture. In contrast, Bhattacharya and Groznik (2008) find few associations between portfolio investment choices and the national origins of US immigrants. Morse and Shive (2011) find that patriotic sentiments are correlated with home bias in portfolios. Hong and Kostovetsky (2012) find that the extent to which mutual fund managers select socially responsible stocks is related to political preferences as expressed by political donations. Shu, Sulaeman, and Yeung (2012) find that mutual fund outcomes are related to the prevailing religious character of the headquarters region and the manager's college. Gao, Wang, and Zhao (2017) report associations between local religiosity and the decisions and performance of hedge fund managers.

There are only a few papers that consider how religion can influence the decisions of individual investors. Renneboog and Spaenjers (2012) show that religious households consider themselves more trusting, have a longer planning horizon, and have a higher propensity to save. Using an experimental survey from Germany, Noussair, Trautmann, van de Kuilen, and Vellekoop (2013) show that risk aversion of individuals increases with their degree of religiosity. These findings suggest that religion restrains risk-taking behavior. However, Kumar, Page, and Spalt (2011) find that the use of lotteries and investment in risky "lottery-type" stocks varies with religious characteristics of US states. Furthermore, Iannaccone (1998) reports that individuals with more education exhibit less religiosity. If education in general correlates with

financial sophistication, it can subsume the apparently positive effect of religiosity on financial decision-making.

There is a small but growing literature on associations between personal characteristics of corporate managers and corporate decision-making and performance. For example, Hutton, Jiang, and Kumar (2014) classify top managers of US corporations using public records of personal political donations. Firms headed by managers identified as Republicans typically have lower debt, less expenditure on capital, research, and development, and higher profits. A study of links between religiosity and corporate decision making, Hilary and Hui (2009), finds that US corporations located in US counties that score high on religiosity are associated with less risk-taking and more credible information releases as measured by stock market responses.

We can also imagine reasons why religiosity can adversely affect investment performance. First, religious investors tend to avoid "sin stocks", which can prevent them from maximizing return (Hong and Kacperczyk, 2009). Second, as Peifer (2013) asserts, religion can stimulate investor loyalty and increase willingness to hold a religiously-acceptable investment in spite of its poor performance.

Given the goals of our work and the literature, we offer several predictions regarding what the data might reveal. We begin with a simple null hypothesis:

H0: There are no measurable differences in the behavior or performance of Islamic versus conventional investors.

Next, we expect to find higher risk-aversion among religious investors:[11]

H1: Religious investors exhibit higher risk aversion in their trading behavior than conventional investors.

A classic association between piety and risk-aversion is known as "Pascal's wager" after the seventeenth century French philosopher who devised it. The idea is that the expected benefit from believing in a religion surpasses any harm since belief insures against eternal punishment in case God exists. More generally, religion can reflect a risk management strategy with which religious people find refuge from the uncertainties of life (Miller and Hoffman, 1995). Holloway (1979) shows that risk-averse people tend to use more traditional methods for dealing with uncertainty whereas risk takers seek more innovative methods. Thus, religion can be a traditional method for dealing with uncertainty, at least for the majority of its adherents. We also expect such risk-averse behavior in the investment decisions of religious people.[12]

A second, related hypothesis predicts "loyalty" in the stock holdings of religious investors relative to other investors:

H2: Religious investors display lower turnover of their stock holdings, particularly for stocks of apparently religious companies.

[11] See Noussair, Trautmann, van de Kuilen, and Vellekoop (2012) for experimental work.
[12] There is evidence of this correlation in individual decisions regarding gambling (Diaz, 2000) and insurance (Halek and Eisenhauer, 2001).

A religious investor can be more optimistic about the prospects of apparently religious firms, underestimate its downside potential, and retain a position for a relatively long time. A religious investor can finance an apparently pious company even if it may not be economically advantageous. Given the presumed correlation between conservativeness and piety, we similarly predict that religious investors display more local bias (Grinblatt and Keloharju, 2001), prefer high dividend yield stocks (Graham and Kumar, 2006), avoid lottery-type stocks (Kumar, 2009), and display other biases that are consistent with a cautious or conservative style of decision-making.

We also offer competing predictions about associations between religiosity and individual investor performance:

H3a: Religious investors display enhanced risk-adjusted performance relative to conventional investors because their conservative investment strategies avoid overconfidence and other aggressive and suboptimal investing styles.

H3b: Religious investors experience inferior risk-adjusted performance because they limit the range of securities that are acceptable for their portfolios and take overly cautious decisions.

Related to aggressive versus cautious investment styles, we also have a specific prediction about the extent to which different types of investors trade in what Kumar (2009) describes as "lottery-type stocks:

H4: Religious investors avoid lottery-type stocks, and this contributes positively to their portfolio performance.

Since gambling is prohibited in Islam, some among the pious will avoid gambling or investment vehicles that, in effect, emulate gambling. Thus, we predict less participation into lottery-type stocks among pious investors and less gambling-related portfolio underperformance. We detail below how we identify lottery-type stocks and characterize the extent to which a particular sample investor deals in them. These competing performance hypotheses parallel some established but conflicting facts in the empirical behavioral finance literature. Odean (1999) and Barber and Odean (2000) present evidence that aggressive trading strategies typically result in underperformance. On the other hand, Bailey, Kumar, and Ng (2011) find that some conservative uses of mutual funds by older or local-biased investors can underperform.

We also offer competing predictions concerning the performance and behavior of Turkish corporations based on their apparent religiosity:

H5a: Corporations that score high on religiosity enjoy superior valuation and performance as they are managed carefully.

H5b: Corporations that score high on religiosity experience relatively weak valuation and performance since they cannot take full advantage of all investing and financing options.

Paralleling the individual investor literature, we can imagine that conservative values can either enhance or detract from corporate performance.

Finally, we consider how corporations respond to the characteristics of their investor clientele:

> H6: Corporations abuse the trust of religious investors by feigning religiosity and managing corporate assets and policies against the interests of outside shareholders.

H6 hypothesizes a link between the religiosity of individual investors, their investment choices, and the choices and performances of listed companies.

An implication we will pursue eventually concerns the performance of new stock issues from the initial public offering price to the first day of trading. Lowry and Shu (2002) describe and test implications of litigation risk for IPO returns. In particular, an issuer can choose to set the IPO offer price relatively low to reduce both the potential loss that unhappy investors might sue and the probability of such lawsuits.

In the context of our setting and H6 in particular, we can imagine the following competing predictions. If apparently pious corporations are indeed more trustworthy than other issuers, there is less litigation risk, less underpricing of IPOs, lower IPO returns relative to IPOs of other issuers, and average longer-run post IPO returns. We refer to this hypothesis as "trust anticipated". It also implies a relatively low number of investor lawsuits and government regulatory actions directed at the firm after the IPO. A variation on "trust anticipated" is "trust confirmed": the IPO price is set low because

the market does not anticipate the good managerial behavior and performance of pious corporations and, thus, the IPO return is high, but longer-run post IPO returns are normal and the number of lawsuits and regulatory actions is low. If, on the other hand, apparently pious corporations abuse investors but are somewhat immune from legal and regulatory discipline, we predict "trust betrayed": Investors bid aggressively for shares of apparently pious corporations, the IPO return is relatively high, but post IPO returns are poor, the number of lawsuits is high but they are unsuccessful in court, and the number of regulatory actions is low given government favoritism towards apparently pious firms. For all three predictions we expect relatively larger holdings by religious investors relative to other investors.

3. Experimental design

3.1 Data sources

The key to our experiment is individual investor data recorded and stored by the Central Securities Depository Institution (MKK) of Borsa Istanbul, Turkey's stock market. A random sample of approximately twenty-five thousand individual investors trading in the stock market includes daily trades from 2008 to 2012 plus other investor characteristics. Specifically, we have daily trades and positions from 2008 through 2012 for 24,993 individual investors buying, selling, or holding shares of 417 Turkish firms listed on Borsa Istanbul. The stock exchange data also includes individual investor characteristics data such as age, gender, and city of residence. Stock price information on the listed firms comes from Datastream, or if unavailable, from Bloomberg.[13]

[13] We screened the data for potential problems. We found only a handful of cases where there is zero trading volume recorded for a particular price. We found a slightly higher than expected (1/10) proportion

Furthermore, information on bank loan, bond, and equity financing of listed firms comes from Dealscan, Thomson One, and SDC. The bank loan and bond data allow us to characterize one dimension of the "Islamic-ness" of listed companies because each debt instrument's data includes descriptive fields to suggest whether the style of the financing is conventional or Islamic. Other sources that we detail later are used to characterize other dimensions of corporate decision-making, performance, and religious and political positioning. Additional sources such as voting records are used to categorize each individual investor as "Islamic" or "conventional" using several alternative schemes.

3.2 Construction of investor and corporate characteristics

Disposition effect is defined as an investor's relative willingness to sell winners rather than losers (Shefrin and Statman, 1985; Odean, 1998). A winning stock is one whose current price is higher than its purchase price. Similarly, a losing stock is one whose price is lower than its purchase price. Simply looking for the number of winning stocks the investor sells will not give us a reliable estimate of disposition effect if, for example, the stock market is in an upward trend. Therefore, we need to check the frequency with which an investor sells winners and losers relative to her opportunity to sell each. This leads us to the concept of paper gains and losses versus realized gains and losses (Odean, 1998). We observe a paper gain if a stock appreciates but an investor does not pocket the gain by selling the stock. In contrast, a realized gain occurs when

of prices in tenths of a lira rather than hundredths, which reflects the market's price tick range (http://www.borsaistanbul.com/en/products-and-markets/markets/equity-market/price-bands). Our end-of-day prices as reported by the exchange to Datastream and Bloomberg are either the last trade price or an official price-fixing.

the stock appreciates and an investor sells the stock. Similar definitions apply for paper and realized losses.

We define the Proportion of Gains Realized (PGR) as realized gains divided by the sum of realized gains and paper gains. Similarly, the Proportion of Losses Realized (PLR) equals realized losses divided by the sum of realized losses and paper losses. PGR measures the propensity to realize a profit opportunity that arises while PLR measures the propensity to realize a loss. We then define the disposition effect as PGR minus PLR. Odean (1998) notes that, to compute the disposition effect, we can compare the current price to the average purchase price, the highest purchase price, the first purchase price, or the most recent purchase price. We use the most recent purchase price.

Narrow framing is defined as an investor's inability to frame her investment decisions broadly. It is shown in the psychology literature that people tend to consider each decision unique, often isolating the current choice from their other choices (Kahneman and Lovallo, 1993; Kahneman, 2003). In financial investing, this corresponds to an investor making decisions separately from each other, thus ignoring the portfolio context. Narrow framing is implied by a lack of **trade clustering** (Kumar and Lim, 2008). Put another way, the more clustered in time an investor's trades are, the more likely the investor thinks about the interaction between trades and her existing portfolio and hence the less narrowly framed are her trades. Trade clustering is an index between zero and one equal to one minus the ratio of the number of days an investor trades stock to the number of stock trades. For example, if an investor makes only a single trade every trading day, the number of trades equals the number of trading days

and the trade clustering measure is zero, indicating this investor displays no clustering, that is, severe narrow framing. If another investor makes ten trades in different stocks every trading day, this second investor's trade clustering measure is 0.9, indicating much lower narrow framing. As this investor makes multiple trades on different stocks every day, she presumably better calculates the interaction between her trades and her other holdings.

Overconfidence. Overconfident investors overestimate the precision of their knowledge about the value of a security (Odean, 1998). Barber and Odean (2001) find that investors who trade frequently typically display poor performance. We follow Bailey, Kumar, and Ng (2011) and define overconfident investors as those with the most frequent trading and the worst performance. In particular, an investor in the first quintile of trading frequency and the last quintile of return performance is categorized as overconfident.

Gender. A number of papers have shown that men are more overconfident than women especially in stereotypically masculine domains such as knowledge of sports figures and politics (Deaux and Emswiller, 1974; Beyer and Bowden, 1997). A test of gender and overconfidence in investment decisions has been carried out by Barber and Odean (2001). Therefore, we use gender as an explanatory variable in our tests.

Lottery stock preference. Kumar (2009) shows that the investment decisions of some people resemble their lottery purchases. Furthermore, he describes socioeconomic factors that induce both greater expenditure on lotteries and greater investment in lottery-type stocks. Kumar (2009) identifies lottery-type stocks based on three characteristics. First, lottery tickets can be bought quite cheaply so lottery-type

stocks should have low nominal prices. Second, lottery holders hit the jackpot with a miniscule probability, so lottery-type stocks should have outsized returns with a very low probability. Stocks with a history of a few large positive return outliers will display high idiosyncratic skewness. Third, a lottery-type stock should have high idiosyncratic volatility. A stock that has yielded a very large return in the past but that normally has little variation in returns might appear to investors as unlikely to repeat its past bounty. For its large returns in the past to appear replicable to investors, it should have high idiosyncratic volatility. Following Kumar (2009), we define idiosyncratic volatility as the standard deviation of the residual from a Fama-French four-factor model implemented with market, SMB, HML, and WML factors local to Borsa Istanbul. Idiosyncratic skewness is defined as the skewness of the residual obtained by fitting a two-factor model with market return and squared market return terms. At the end of month t, both idiosyncratic volatility and skewness are computed using the previous 6 months of daily data. A lottery-type stock has below median price and above median idiosyncratic volatility and idiosyncratic skewness in a given month. Lottery-stock preference is then a measure of an investor's appetite for lottery-type stocks in her aggregate holdings. Specifically, we compute the ratio of the value of lottery-type stocks in an investor's portfolio to the value of the entire portfolio at the end of a given month. We then set lottery-stock preference for a given investor to the median of that ratio over all months that the investor is in the sample.

Local bias. Previous authors show that some investors tend to invest in companies that are geographically close to them, perhaps due to familiarity or an informational advantage. For each investor and month, we identify whether each

company in the investor's portfolio is headquartered in the city of residence of the investor. We then compare the share of such local companies the investor holds in her portfolio to the actual share of companies from the investor's city. The difference is our measure of local bias[14]. For a robustness check, we exclude the city of Istanbul from local bias calculations as more than half the companies in Borsa Istanbul are headquartered there. These companies usually have operations nationwide so investors in these companies may be less locally-minded.

Individual investor religiosity. To label an individual investor as "Islamic" or "conventional", we use five alternative approaches. First, we have proprietary data on individual investor codes that indicate whether each transaction is executed through Turkey's only Islamic-oriented brokerage house, Bizim Securities. Since "participation" (that is, Islamic) banks use this broker exclusively and other banks avoid it, one measure of whether an investor can be thought of as Islamic is a dummy variable set to one for investors who use this particular brokerage house and zero otherwise.

Second, we make use of the Katilim (Participation) 50 index and measure the extent to which each investor holds index component stocks. The Katilim index consists of listed Turkish firms that are deemed compliant with Islamic ways of doing commerce.[15] For one categorization, we label an investor Islamic if every trade of that investor is in a firm on the Katilim 50 index. As an alternative categorization, we label an investor Islamic if his average percent holding of Katilim 50 components is more

[14] An alternative local bias measure computed in terms of portfolio holdings of local companies has a highly significant correlation coefficient of 0.86 with our measure. We prefer our measure because, in a sense, we are measuring "attention to politically correct stocks". It can be signaled quite readily by the number of names the investor tracks, rather than the literal percentage of the portfolio.
[15] See Appendix A for details of the Katilim index.

than two standard deviations above the average for all investors. For a sense of the popularity of Katilim 50 index stocks among our sample investors, the mean (median) percentage of Katilim 50 index stock holdings to total holdings is 14.6% (2.9%) with a standard deviation of 23.6%.

Third, we infer the likely political leanings of each investor using the city-level[16] vote share for the ruling conservative AKP (Justice and Development Party) in the 2011 general election. Political preference is a good proxy for piety in Turkey. AKP has always branded itself as conservative, where in the context of Turkey, conservatism is usually defined in social- religious terms. For example, the party has fought to permit the wearing of headscarves by women, an Islamic symbol, in universities during a 2008 action in Turkey's Constitutional Court. Using records of general election votes, we sort cities based on their vote share for AKP. We compute two categorizations. Our first scheme labels an investor religious if she is from a city that has a higher percentage vote for AKP than Istanbul.[17] Our second scheme labels an investor as religious if she lives in a city which has a higher percentage AKP vote share than the 90th percentile city, Ordu. A secular investor then lives in a city with a lower percentage AKP vote share than the 10th percentile city, Izmir. Unfortunately, this political leaning approach cannot capture differences in piety within cities.

The last two measures for individual investor piety are also city-based. One of them is the city-by-city religiosity survey results by KONDA Research and

[16] In Turkey, "city" usually refers to a province so it encompasses rural areas that surround the urban center plus smaller towns. Given the electoral process in Turkey, this also coincides with an "electoral district".

[17] Istanbul is not the median city in terms of AKP vote share but it is close: 36 cities have lower AKP vote shares and 44 cities have higher AKP vote shares. Furthermore, there are so many investors from Istanbul that, when investors are sorted by their city's AKP vote share, Istanbul's AKP vote share becomes the median.

Consultancy. KONDA is a popular Turkish public opinion polling company. They were the most accurate in predicting the outcome of the June 2015 general elections results.[18] We have a survey-based sample from 2010 to 2015 that partially overlaps with our individual investor trading sample. The poll consists of asking people their involvement with religion that they express from a scale of 1 (non-believer) to 4 (devout). These scores are averaged for each city and year. The last individual investor religiosity proxy, Pupils, measures the number of young pupils attending Quranic schools per thousand people. The numbers are aggregated at a city per year basis. By utilizing variables of political (AKP) and religious (KONDA and Pupils) nature, we attempt to distinguish between the effect of these two strong forces in individuals' portfolio decisions.

Corporate religiosity. To label a listed corporation as "Islamic" or "conventional", we use several alternative approaches. First, we study each listed firm's balance sheet for evidence that the firm employs any Islamic bank loans or bond issues. Sources of this data are the descriptions in SDC, Thomson One, and Dealscan. We find eleven publicly listed firms that use Islamic financing.[19] Second, we judge each listed company's religiosity and political positioning with the conservative AKP voting share in its headquarters city. Third, we categorize each listed corporation based on the social connections of its CEO. Specifically, there are two competing clubs for top corporate

[18] https://en.wikipedia.org/wiki/KONDA_Research_and_Consultancy

[19] Two are Islamic banks, Bank Asya and Albaraka Turk. The other two Islamic banks in Turkey are privately owned. There are three non-financial institutions: Boyner (surprising because chairman, Cem Boyner, is an outspoken critic of AKP leader Erdogan), Ulker (expected, as the founding family is regarded as conservative), and Turkcell (a large telecoms firm that in recent years took in former members of AKP to its board: https://www.turkcell.com.tr/en/aboutus/investor-relations/corporate-governance). There are also six non-Islamic financial institutions: Is REIT, Is Leasing (considered secular because it was founded by Ataturk and the secular opposition party, CHP, has a large stake), TSKB (oldest Turkish development bank), Finans Leasing (part of Finans Bank founded by a secular banker), and Yapi Kredi Bank (owned by the Koc Family and Italian investors).

managers in Turkey. The Turkish Industrialists' and Businessmen's Association (TUSIAD) is traditionally aligned with secular thought and politicians while the Independent Industrialists' and Businessmen's Association (MUSIAD) is associated with conservative views and the AKP. Fourth, we identify any religious sponsorship activity that Turkish firms are involved in. Such activities can range from sponsoring a religious charity to organizing a Ramadan dinner.

3.3. Empirical specifications

We employ our data with fairly standard tests based on summary statistics or regressions. For some experiments, we will conduct event studies around firm specific, political, and macroeconomic events. As stated above, we will study the first use of Islamic style financing or the change in CEO political leaning as signaled by membership in one of the executive clubs. We will also examine the timing, frequency, and performance of initial public offerings of pious versus secular corporations.

Furthermore, while we view much of our work as exploratory and descriptive, it will be useful for us to state and implement a more formal identification strategy. Therefore, some of our tests will be centered on events which can support difference-in-difference analysis or other approaches to defining an identification strategy. These events should have implications for the strength of our empirical predictions yet should be exogenous, that is, should not have been designed to manipulate the individual investor and corporate decisions and characteristics that we study.

The first influential event we use is the Gaza flotilla raid that took place on 31 May 2010. Similar to the political situation today, the city of Gaza was at the time under

the blockade of Israeli authorities. A small fleet of civilian ships from Turkey tried to reach Gaza to annul the blockade. However, Israeli navy attacked the ships slightly outside of Israeli waters to prevent the de facto voiding of the blockade. The confrontation between the Turks and Israelis stirred religious sentiment in Turkey where there is a strong pro-Palestinian sentiment due to common religious and historical ties. We test whether the event incited religious and conservative investors in Turkey and made them increase their portfolio holdings of conservative firms. As a second event, we use one of the pivotal points in the Arab Spring. The popular uprisings started in Tunisia in December 2010 with the self-immolation of a street vendor who protested poverty and government oppression. An important impetus came in the following month when the incumbent Tunisian government stepped down and the revolts became international as the Egyptian people started protesting the Mubarak government. Hence, we use January 2011 as a pivotal moment in Arab Spring. It seems likely that these events increased the prospects and likely tenure of the AKP government in Turkey as various Middle Eastern nations aspired to have democratic yet Islamic governments of their own. We test whether religious investors in Turkey increased their allocation to conservative firms after Arab Spring promised large-scale change for the political fabric of the Middle East and validated the effectiveness of AKP's democratic and moderately Islamist model. In general, political events that strengthen or weaken the appeal of the AKP for voters, investors, and corporations can affect the strength of the relationships outlined in our testable hypotheses. As other potential examples, the AKP electoral

victory of 12 June 2011 and the resignation of key military leaders on 29 July 2011 increased the credibility and likely tenure of the AKP government.[20]

4. Results

4.1 Summary statistics

The majority of our investors are male (75.8%). The average age of investors is 46.0. The average female investor is about 2 years older than the average male investor. The mean (median) daily return of investors is 0.026% (0.044%) with a standard deviation of 0.168%. The annualized values for the mean (median) are roughly 6.52% (11.07%).

Table 1 displays correlations between each pair of behavioral bias proxies. In each cell of the table, the top number is the correlation coefficient and the bottom number is the p-value. All six proxies and age are typically significantly pairwise correlated with each other. For example, echoing earlier work in the behavioral finance literature, the gender dummy (indicating a male investor) is significantly correlated with the overconfidence dummy. Interestingly, with age, investors tend to become less prone to behavioral biases except narrow framing (that is, less clustering) and local bias.

Next, we summarize the bias proxies for Islamic and conventional investors separately. Table 2 categorizes investors as Islamic or conventional based on use of an account at an Islamic-oriented brokerage house. Comparing the two types of investors, we see that overconfidence, disposition effect, narrow framing (that is, less trade

[20] Recent events such as the Gezi Park protests (27 May 2013), and the onset of corruption allegations against key AKP figures (13 December 2013) reduced the credibility and likely tenure of the AKP government. However, these events occur beyond the end of the sample period for which we have data.

clustering), and lottery-stock preference are lower for Islamic investors whereas local bias is higher. Differences in overconfidence and narrow framing across the two types are quite strong and statistically significant at the 1% level while the difference for disposition effect is only marginally significant. Differences in lottery-stock preference and local bias are not statistically significant. There is a significantly higher proportion of male investors among those categorized as Islamic. Islamic investors are about 1.5 years younger on average than others, and this difference is strongly statistically significant. Although daily portfolio returns of Islamic investors are about one basis point per month higher than those of other investors, the difference is not statistically significant. For both categories of investors, daily portfolio returns are significantly positive. The two right-hand columns of the table report alternative matching-based tests of the significance of the difference between Islamic and Conventional investors. The inferences are typically similar to those from the conventional significance test.

Table 3 reports similar summary statistics in which investors are classified based on their holdings of Katilim 50 index component stocks. Specifically, an investor is classified as Islamic if her entire holdings are composed solely of Katilim 50 index component stocks. The signs of relationships are the same as in Table 2 except for narrow framing: Islamic investors now have higher narrow framing (that is, less trade clustering). This can be explained by the identification of those investors who only deal with the fifty Katilim index component stocks. This relatively small number of stocks may allow these investors to follow each individually, but at the cost of portfolio diversification. Interestingly, the investors who follow the “Katilim 50 only” strategy are proportionally more female and about four years older than other investors.

Furthermore, there is now a statistically significant difference in average daily portfolio returns across the two investor groups. The "Katilim 50 only" investors underperform relative to other investors, and their returns are not statistically different from zero[21]. Overall, the differences appear more statistically significant when Islamic versus conventional is measured with actual holdings (Table 3) rather than keeping a brokerage account at Turkey's sole Islamic brokerage firm (Table 2).

Table 4 reports similar tests for which Islamic versus conventional is identified using city-level AKP vote shares. We first briefly summarize city-level vote shares. Across 81 cities, AKP wins, on average, slightly more than half the votes, 50.85%. This is a large number given that Turkish politics are not dominated by only two major parties. However, there is a good deal of dispersion in AKP voting share across cities, with a standard deviation of 13.19%, a minimum of only 15.75%, and a maximum of 69.63%. This sizeable variation in AKP vote share across cities suggests substantial differences in political leaning and piety across cities.

As explained previously, Table 4 uses two classification schemes, one based on cities above versus below median city-level AKP vote share and another comparing top decile AKP voting share cities to bottom decile cities. Both schemes find statistically significant differences in Islamic and other investors in the gender dummy, local bias, and age characteristics. Cities with higher AKP vote share have a proportionally more male investor base. Similar to the previous two categorizations, Islamic investors

[21] The number of Islamic investors identified by "Katilim 50 only" strategy is relatively low (480). In untabulated results, we also consider investors whose percent Katilim 50 index component stock holdings are two standard deviations or more above the sample average. Results are essentially unchanged from Table 3, except Islamic investors' daily returns turn significantly positive and statistically indistinguishable from the daily returns of conventional investors.

display higher local bias. Put another way, in cities that vote heavily for AKP, investors typically favor the local firms more than other investors do. Similar to the brokerage house categorization (Table 2), Islamic investors are typically a few years younger than other investors. It may be the case that stock market participation is a relatively recent phenomenon among religious people, with early adopters being a bit younger. Note that, for this table, we are unable to offer the alternative matching-based tests because all residents of a particular city are classified identically so no matching is possible within city.

Next, we examine monthly portfolio performance of Islamic versus conventional investors in greater detail with cross sectional averages of raw returns, Sharpe ratios, single factor alpha, and Fama-French 4-factor alpha. Both alphas are computed with local stock market factors. In Table 5, "conventional" investors are defined as those that are not classified as Islamic by any of our three categorization schemes. There do not appear to be a consistent systematic difference between the mean raw monthly portfolio returns of Islamic and conventional investors. Although the performance of Islamic investors identified through holdings of Katilim index components seems relatively low, the performance of Islamic investors identified using the other two characterization schemes is statistically indistinguishable from the performance of conventional investors. These findings suggest that the performance of Katilim component stocks is relatively weak, an issue we will eventually address in the context of testable prediction H6.

Table 5 presents similar findings for performance measured with Sharpe ratios and alphas. Interestingly, the average Sharpe ratio of Katilim Index investors is not only

lower than that of conventional investors but it is also negative, indicating poor performance in an absolute sense. However, monthly alphas suggest that the performance of Katilim Index focused investors is not distinguishable from that of Islamic investors identified by other characterization schemes. This suggests that Katilim stocks have relatively low loadings on market wide systematic risk factors. Put another way, Katilim component stocks may be less risky in several dimensions. Nonetheless, Islamic investors identified by brokerage house display the lowest alphas from both one- and four-factor models. Intriguingly, four-factor alphas of every investor group, Islamic and conventional, are negative. This suggests that Turkish retail investors are typically unable to assess systematic risk versus return regardless of their degree of piety.

4.2 Individual investor piety and behavioral biases

Next, we assess the effect of piety on each behavioral bias while simultaneously accounting for controls such as investor age, gender, city of residence, wealth, and stock market experience. Our proxy for investor wealth is median total portfolio value over the sample period. Our proxy for stock market experience is the number of days from opening a brokerage account until the beginning of 2008, the start of our sample trading period. In Tables 6 through 8, each column corresponds to one of our three proxies for piety.

Table 6 studies overconfidence and confirms that pious investors are typically less overconfident. Furthermore, age and stock market experience attenuate overconfidence. Men are more overconfident than women, supporting Barber and

Odean (2001) and confirming their results for the Turkish stock market. Wealthier investors seem less affected by overconfidence.

Table 7 studies lottery-stock preference. The sign of the association with piety varies with the piety measure. Specifically, it is positive with AKP vote share, suggesting that the proportion of lottery-type stocks in an investor's portfolio is larger in areas where the religious conservative party is particularly popular. It is possible that this reflects heterogeneity in the population of Islamic investors if, for example, Islamic investors from Anatolia (captured by the AKP vote share proxy) like gambling in the stock market, while those from Istanbul (ignored by the AKP vote share proxy) avoid gambling behavior even in the stock market. In line with such a conjecture, the sign of the relationship between piety and lottery stock preference reverses for other categorizations of investors. Age and stock market experience are found to reduce investment in lottery-type stocks, while men have a tendency to overinvest in such stocks.

Table 8 studies local bias. Panel A includes all investors while Panel B excludes investors from Istanbul (the residence of most of our sample of investors) for a robustness check. Furthermore, as suggested earlier, firms headquartered in Istanbul often operate nationwide and may not be perceived as local in Istanbul or anywhere. Both panels of Table 8 indicate a positive relationship between piety and local bias. The relationship is particularly strong for the AKP vote share piety proxy, which implies that pious investors from Anatolia have even higher local bias. Older investors also

display relatively more local bias while more experienced investors are more likely to diversify geographically[22].

To summarize associations between measures of religiosity and other individual investor characteristics, Table 9 presents the results of factor analysis that show how certain characteristics tend to coincide in individual investors. Across brokerage account, Katilim holdings, and AKP vote share proxies for religiosity, some common patterns emerge. For each factor, we offer a label to summarize the nature of the factor. The first factor represents an investor who trades too frequently (overconfidence) and sells winners too quickly (disposition effect). We label this investor “Impatient”. Impatient tends to be young and is less likely to be religious. The second factor represents an investor who is older, experienced with stocks, is less likely to suffer behavioral biases, and is less likely to be religious. We label this investor “Experienced”. The third factor represents an investor who is likely to be religious, has a relatively large brokerage account, avoids most behavior biases, but suffers local bias perhaps due to his or her conservative nature. We label this investor "Pious". Finally, the fourth factor represents an investor who is young, likely male and is not afraid to invest far from home. We label this investor “Gambler” because of a strong preference for lottery type stocks. The patterns are sensible, broadly consistent with the findings of other papers that study US data, and, in particular, highlight the associations between religiosity and conservative decision-making.

Table 10 presents results of regressing portfolio outcomes, both performance-based and religious, on individual characteristics. Especially noteworthy are

[22] Regarding other behavioral biases, in untabulated results, we find that piety has a negative effect on disposition bias. Findings on trade clustering are inconclusive.

characteristics related to individual investor piety. In addition to the AKP-based measure, we use two other measures based on the city the investor is coming from: (i) KONDA, a survey-based measure of piety and (ii) Pupils, which measure the number of pupils attending religious schools in the investor's city. We complement the AKP-based measure in order to distinguish between the effect of religious and political affiliations in determining individual portfolio outcomes. We also account for the fact that many of our estimated individual characteristics have errors by conducting an errors-in-variables estimation. Particularly, except for the variables *Age*, *Gender*, and *Stock Market Experience*, which are measured accurately, we allow for errors in other characteristics. We allow for errors by letting the reliability of explanatory variables, which is defined as $1 - \frac{error\ variance}{total\ variance}$ to be less than one. We only show regressions with reliability one, which correspond to no errors, and reliability 0.8 for brevity. We check for any difference in coefficients on AKP, KONDA, and Pupils. Coefficients on AKP and Pupils generate the largest difference hinting at differences between how religion and politics determine portfolio outcomes. When errors in characteristics are accounted for, the differences usually get attenuated but sometimes remain statistically significant.

4.3 Corporate piety

Next, we compare the characteristics of secular and apparently religious firms. Table 11 summarizes corporate characteristics where perceived corporate piety is characterized by the CEO's membership of secular (TUSIAD) or conservative (MUSIAD) business organizations. This is a meaningful measure of political and social

orientation as each firm consciously chooses whether to align with overtly secular or conservative organizations. We determine membership of TUSIAD from an annual publicly available list. [23] We determine membership of MUSIAD from online searches for hints of an association displayed in news stories, company or MUSIAD reports, and similar sources. While some memberships are explicitly stated, others are more tacit, as in the case of a company manager leading a MUSIAD panel. The numbers in brackets in the table indicate the number of observations that fall into each category. It is evident that there are many observations in both secular and conservative categories, but many listed firms are not associated with either club. [24]

Reading across the columns, there are many substantial differences in comparing secular (TUSIAD member) firms, conservative (MUSIAD member) firms, and those that are not associated with either club. Measured by the book value of total assets, secular firms are significantly larger than conservative firms, and both types of firms are several times larger than firms that are not associated with either group. Sales and market capitalization are larger for conservative firms than for secular firms. However, book measures of profitability are significantly higher for secular firms. Book asset growth is significantly greater for conservative firms. Price-earnings ratios are typically highest for conservative firms. Thus, it appears that members of the conservative MUSIAD group are expanding their investments rapidly and, based on price-earnings ratios, the stock market believes these firms are expected to produce growing profits.

[23] TUSIAD lists its entire membership in its annual report (http://www.tusiad.org.tr/bilgi-merkezi/tusiad-faaliyet-raporlari/).

[24] A handful of firms appear to maintain membership in both groups. They are included in the medians for all groups but are placed in the MUSIAD conservative group for the purpose of difference-in-medians tests.

However, average raw and risk-adjusted excess returns are not distinguishable by TUSIAD versus MUSIAD membership.

A second characterization of firm piety is based on sponsorship activities. These activities range from sponsoring a sports club to organizing a community dinner. Sponsorship activities are uncovered through Google searches and these activities are characterized as either secular or conservative. Activities deemed conservative are either religious in nature or linked to the conservative AKP government. Examples to such conservative activities include sponsoring a religious foundation, sponsoring a religious event such as a Ramadan dinner, or sponsoring a conference organized by a government ministry.

Unlike the characterization by executive club affiliation, sponsorship activities do not give us a time-series for conservative versus secular positioning. A single conservative sponsorship is enough for us to label the firm as conservative throughout our sample period. That's why, in Table 12, each observation is a firm not a firm-quarter. Conservative firms are compared to firms that only sponsor secular activities. As another specification we also compare conservative firms to firms that are not found to be involved with conservative activities. However, this second set of firms also include firms without any observable sponsorship activities and are likely to be smaller. Making comparisons along the same lines as in Table 11, conservative firms are found to have higher asset growth than secular firms which supports our previous results. Nevertheless, shares of conservative firms have lower 4-factor alphas indicating that secular firms can be a better investment opportunity for investors despite these firms not displaying growth characteristics.

4.4. Interactions between individual and corporate piety

As a first attempt to show interactions between individual and corporate piety, Table 13 displays results of a difference-in-differences specification around two influential events that plausibly affected people's perceptions regarding the prospects of religiously oriented firms. As mentioned earlier, the first event is the Gaza flotilla raid that took place on May 31, 2010. The confrontation between Turkey and Israel stirred religious sentiment in the former country. An interesting question is whether we can observe religious investors preferring apparently religious firms more than they normally do after the event. To test this conjecture, we run the following diff-in-diff setup:

$$MUSIAD\ Percentage\ Holdings_{it} = \alpha + \beta_1 Event_t + \beta_2 KONDA_i + \beta_3 AKP_i + \beta_4 Pupils_i + \beta_5 Event_t * KONDA_i + \beta_6 Event_t * AKP_i + \beta_7 Event_t * Pupils_i + Controls + \varepsilon_{it}$$

The dependent variable measures the proportion of an investor's holdings in MUSIAD, that is, conservative firms. Essentially, we are testing whether investors hold more of conservative firm stock after the flotilla raid. *Event* is one for the twelve months following the flotilla raid and is zero for the twelve months prior to the raid. There are three city-based variables that stand for investor conservatism. First one is *KONDA*, which is a survey-based measure of piety in an investor's city. The second one is the

AKP vote share in an investor's city. The third one is the number of pupils attending religious schools per population. The main goal in having multiple measures of conservatism is to separate the effects of investors' piety and political orientation. Even though AKP brands itself as socially conservative and pious, it is important and interesting to split the effects of religion and politics to the extent possible. The coefficients of interest are β_{5-7}, which would indicate whether conservative investors shift their holdings of apparently religious firms following the flotilla raid.

Specification 1 in Table 13 shows that the interactive term associated with AKP vote share is positive while that associated with *Pupils* is negative where both results are statistically significant. It appears that while the confrontation between Turkey and Israel stirred religious sentiment in the country, it was mostly politically conservative people that oriented themselves with conservative firms following the event. Corroborating evidence is shown in specification 2 where the event is the change in government in Tunisia and start of popular uprisings against the Mubarak regime in Egypt in January 2011 as part of Arab Spring. The examination of interactive terms gives the same inference in which it is the politically conservative investor that orients herself with conservative firms after events that change the prospects for apparently religious firms.

5. Summary and conclusions

Our findings thus far suggest that Islamic investors are less prone to overconfidence and disposition effect, and more prone to local bias. There is mixed evidence on narrow framing, lottery-stock preference and gender, although the bulk of

the evidence suggests that Islamic investors have higher narrow framing, lower lottery-stock preference, and are more likely to be male. There is no clear evidence on whether individual portfolio returns are higher or lower for Islamic investors, although there is a weak evidence that monthly alpha is higher for conventional investors.

Comparisons of firms based on religiosity produce substantially different results depending on the method of identifying pious versus other firms. Firms with Islamic financing on their balance sheets tend to be large while firms headquartered in more electorally religious cities tend to be small. When categorized based on the fraction of votes going to the conservative AKP, the headquarters city findings suggest that apparently religious firms enjoy higher valuation due to investor loyalty. Perhaps most interesting is the categorization based on CEO membership of executive clubs TUSIAD and MUSIAD. In contrast to trying to infer corporate piety from the balance sheet or the conservative vote share in the headquarters city, membership of these clubs is an explicit political and religious positioning selected by each firm. It appears that the conservative club members grow their assets more aggressively, use those assets less profitably, and trade in the stock market as growth stocks. This is a result that is corroborated with findings on firms involved with sponsorships of religious nature.

Preliminary results on the interaction and feedback between religious investors and firms demonstrate that such investors adjust their allegiance to religious firms after momentous events that stir up conservative sentiment. Particularly, it is the politically conservative investor that increases her holdings of conservative firms upon such events. The fact that religious investors do not respond as much can be taken as suggestive evidence that investors are not necessarily increasing their religious loyalty.

Instead, they are increasing their holdings in anticipation of a more favorable business environment for conservative firms.

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Table 1. Cross correlations of behavioral bias proxies

This table shows pairwise correlations for the six behavioral bias proxies as well as age. Each cell contains the correlation coefficient with its p-value beneath. Disposition, Clustering, Lottery, and Local are disposition effect, trade clustering, lottery-stock preference, and local bias respectively. Higher trade clustering indicates lower narrow framing bias. The sample contains 24,996 investors. Missing values reduce the number of observations for some cells. '***', '**', and '*' denote statistical significance at the 1%, 5%, and 10% levels respectively.

	Overconfidence	Disposition	Clustering	Gender	Lottery	Local
Disposition	0.222***					
	(0.000)					
Clustering	0.155***	0.197***				
	(0.000)	(0.000)				
Gender	0.068***	0.030***	0.086***			
	(0.000)	(0.000)	(0.000)			
Lottery	0.042***	0.016**	0.002	0.036***		
	(0.000)	(0.034)	(0.742)	(0.000)		
Local	-0.005	-0.012	-0.043***	-0.002	0.002	
	(0.432)	(0.136)	(0.000)	(0.736)	(0.734)	
Age	-0.103***	-0.058***	-0.100***	-0.069***	-0.084***	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.877)

Table 2. Summary statistics on investor characteristics and daily portfolio performance with individuals categorized by use of Islamic brokerage firm

Investors are classified as "Islamic" or "Conventional" depending on account kept at an Islamic brokerage house. Disposition, Clustering, Lottery, and Local are disposition effect, trade clustering, lottery-stock preference, and local bias respectively. Higher trade clustering indicates lower narrow framing bias. The first p-test tests whether the difference in mean of Islamic versus other investors is statistically significant. The second and third p-tests are alternative tests of the difference or distance between Islamic and other investors. Propensity score matching is based on a logit regression and reduces characteristics to a single-dimensional score. Mahalanobis distance is a multi-dimensional "nearest neighbor" method which is non parametric and allows perfect matching on discrete characteristics.

				z-test for difference between treated and control groups	
	Mean	Observations	p-test difference in means	Propensity score matched	Mahalanobis distance
Islamic Investors					
Overconfidence	0.045	665	0.007	-1.888	-2.602
Disposition	0.030	614	0.052	-2.582	-1.500
Clustering	0.342	665	0.000	3.940	3.427
Gender	0.866	665	0.000		
Lottery	0.033	665	0.163	-1.471	-0.887
Local	0.063	571	0.351	1.582	0.247
Age	44.486	665	0.001		
Daily return	0.00035	665	0.146	0.694	0.389
Conventional Investors					
Overconfidence	0.073	24,302			
Disposition	0.036	17,131			
Clustering	0.282	24,282			
Gender	0.755	24,331			
Lottery	0.042	24,281			
Local	0.053	21,125			
Age	46.037	24,331			
Daily return	0.00026	24,302			

Table 3. Summary statistics on investor characteristics and daily portfolio performance with individuals categorized by exclusive holdings of component stocks of an Islamic-compliant index

Investors are classified as "Islamic" rather than "Conventional" if all holdings are component shares of the Katilim 50 index of Islamic-compliant companies. Disposition, Clustering, Lottery, and Local are disposition effect, trade clustering, lottery-stock preference, and local bias respectively. Higher trade clustering indicates lower narrow framing bias. The first p-test tests whether the difference in mean of Islamic versus other investors is statistically significant. The second and third p-tests are alternative tests of the difference or distance between Islamic and other investors. Propensity score matching is based on a logit regression and reduces characteristics to a single-dimensional score. Mahalanobis distance is a multi-dimensional "nearest neighbor" method which is non parametric and allows perfect matching on discrete characteristics.

				z-test for difference between treated and control groups	
	Mean	Observations	p-test difference in means	Propensity score matched	Mahalanobis distance
Islamic Investors					
Overconfidence	0.029	480	less than 0.001	-3.214	-3.264
Disposition	0.011	116	less than 0.001	-3.106	-5.372
Clustering	0.025	480	less than 0.001	-19.227	-18.403
Gender	0.688	480	less than 0.001		
Lottery	0.019	480	less than 0.001	-2.025	-1.738
Local	0.130	427	less than 0.001	3.034	3.182
Age	49.681	480	less than 0.001		
Daily return	0.00003	480	less than 0.001	-1.633	-1.108
Conventional Investors					
Overconfidence	0.073	24487			
Disposition	0.036	17629			
Clustering	0.288	24467			
Gender	0.759	24516			
Lottery	0.042	24466			
Local	0.049	21269			
Age	45.923	24516			
Daily return	0.00027	24487			

Table 4. Summary statistics on investor characteristics and daily portfolio performance with individuals categorized by AKP vote share of city of residence

Investors are classified as "Islamic" ("Conventional") if living in cities with above (below) median or top (bottom) decile AKP vote share. Disposition, Clustering, Lottery, and Local are disposition effect, trade clustering, lottery-stock preference, and local bias respectively. Higher trade clustering indicates lower narrow framing bias. The p-test tests whether the difference in mean of Islamic versus other investors is statistically significant. We do not include the alternative propensity score and Mahalanobis distance test because all residents of a particular city are classified identically on religiosity so that no within-city comparisons of religious and secular are possible.

	Islamic		Conventional		p-test difference in means
	Mean	Observations	Mean	Observations	
Median cutoff					
Overconfidence	0.074	5,548	0.076	10,756	0.622
Disposition	0.035	4,025	0.037	7,560	0.065
Clustering	0.281	5,545	0.276	10,746	0.208
Gender	0.826	5,556	0.762	10,768	less than 0.001
Lottery	0.052	5,543	0.041	10,746	less than 0.001
Local	0.089	3,684	0.013	9,340	less than 0.001
Age	44.816	5,556	46.574	10,768	less than 0.001
Daily Return	0.00028	5,548	0.00025	10,756	0.434
Decile cutoff					
Overconfidence	0.085	2,447	0.088	1,700	0.750
Disposition	0.039	1,798	0.039	1,215	0.972
Clustering	0.302	2,445	0.278	1,701	0.002
Gender	0.853	2,449	0.796	1,703	less than 0.001
Lottery	0.049	2,444	0.049	1,700	0.981
Local	0.017	929	0.006	977	0.027
Age	44.138	2,449	45.068	1,703	0.009
Daily Return	0.00024	2,447	0.00022	1,700	0.747

Table 5. Summary statistics on monthly portfolio returns, Sharpe ratios, and alphas for Islamic and Conventional Investors

This table summarizes monthly unadjusted returns, Sharpe ratios, and one and four-factor alphas for Islamic and conventional investors. Islamic investors are identified by account at an Islamic brokerage house, holdings in component stocks of the Katilim index, or AKP vote share in city of residence. Conventional investors are those that are non-Islamic on all dimensions. T-statistics are shown in parentheses. Number of observations is shown in square brackets. '***', '**', and '*' denote statistical significance at the 1%, 5%, and 10% levels, respectively. '[a]' denotes the number in question is statistically significantly different from the number for conventional investors at the 1% level.

	Islamic investors			Conventional investors
	Brokerage house	Katilim index	AKP vote share	
Monthly raw return	0.014***	0.006**,[a]	0.012***	0.012***
	(13.828)	(2.435)	(20.948)	(42.441)
	[665]	[470]	[5,513]	[18,449]
Sharpe ratio	0.035***	-0.036**,[a]	0.016***	0.019***
	(6.071)	(-2.450)	(5.353)	(10.046)
	[665]	[457]	[5,469]	[18,334]
1-factor alpha	0.0003[a]	0.003***	0.003***	0.003***
	(0.429)	(3.723)	(10.953)	(20.250)
	[665]	[470]	[5,513]	[18,449]
4-factor alpha	-0.008***,[a]	-0.006***	-0.006***	-0.005***
	(-9.914)	(-7.129)	(-18.574)	(-30.791)
	[665]	[470]	[5,513]	[18,449]

Table 6. Regressions to explain individual investor overconfidence

This table presents regressions to explain individual estimated overconfidence with measures of piety and controls. T-statistics are shown in parentheses. '***', '**', and '*' denote statistical significance at the 1%, 5%, and 10% levels respectively.

Dependent variable: Overconfidence			
	Brokerage house	Katilim index	AKP vote share
Piety	-0.036***	-0.047***	-0.008**
	(-3.568)	(-3.988)	(-1.956)
Age	-0.002***	-0.002***	-0.002***
	(-11.789)	(-11.498)	(-9.561)
Gender	0.038***	0.038***	0.037***
	(10.088)	(9.880)	(7.367)
Wealth (x10-6)	-0.006*	-0.006*	-0.004
	(-1.66)	(-1.761)	(-0.903)
Stock Market Experience (x10-3)	-0.156***	-0.159***	-0.150***
	(-16.074)	(-16.332)	(-12.231)
City fixed effects	Yes	Yes	No
Number of observations	24,967	24,967	16,304
R^2	0.0305	0.0306	0.0215

Table 7. Regressions to explain individual investor lottery stock preference

This table presents regressions to explain individual estimated lottery stock preference with measures of piety and controls. T-statistics are shown in parentheses. '***', '**', and '*' denote statistical significance at the 1%, 5%, and 10% levels respectively.

Dependent variable: Lottery stock preference			
	Brokerage house	Katilim index	AKP vote share
Piety	-0.011*	-0.021***	0.009***
	(-1.918)	(-2.989)	(3.375)
Age	-0.001***	-0.001***	-0.001***
	(-11.247)	(-11.039)	(-9.231)
Gender	0.009***	0.009***	0.008***
	(4.057)	(3.928)	(2.796)
Wealth (x10-6)	-0.002	-0.002	-0.001
	(-1.082)	(-1.124)	(-0.507)
Stock Market Experience (x10-3)	-0.032***	-0.033***	-0.037***
	(-5.585)	(-5.795)	(-5.090)
City fixed effects	Yes	Yes	No
Number of observations	24,946	24,946	16,289
R^2	0.0167	0.0169	0.0100

Table 8. Regressions to explain individual investor local bias

This table presents regressions to explain individual estimated local bias with measures of piety and controls. T-statistics are shown in parentheses. '***', '**', and '*' denote statistical significance at the 1%, 5%, and 10% levels respectively.

Dependent variable: Local bias			
	Brokerage house	Katilim index	AKP vote share
All investors			
Piety	0.011	0.086***	0.077***
	(1.130)	(8.007)	(21.356)
Age	0.0003***	0.0002**	0.0007***
	(2.751)	(2.273)	(4.971)
Gender	-0.004	-0.003	0.003
	(-1.085)	(-0.875)	(0.653)
Wealth (x10-6)	0.003	0.003	0.005
	(0.948)	(0.874)	(1.509)
Stock Market Experience (x10-3)	-0.033***	-0.027***	-0.024**
	(-3.623)	(-2.982)	(-2.359)
City fixed effects	Yes	Yes	No
Number of observations	21,696	21,696	13,024
R^2	0.0887	0.0909	0.0358
Excluding Istanbul			
Piety	-0.0004	0.126***	0.077***
	(-0.043)	(12.339)	(21.356)
Age	0.0006***	0.0004***	0.0007***
	(4.451)	(3.559)	(4.971)
Gender	-0.002	-0.001	0.003
	(-0.477)	(-0.179)	(0.653)
Wealth (x10-6)	0.006**	0.006**	0.005
	(1.993)	(2.077)	(1.509)
Stock Market Experience (x10-3)	-0.029***	-0.020**	-0.024**
	(-3.237)	(-2.190)	(-2.359)
City fixed effects	Yes	Yes	No
Number of observations	13,024	13,024	13,024
R^2	0.1979	0.2079	0.0358

Table 9: Investor stereotypes produced by factor analysis

This table summarizes factor analysis applied to the characteristics of the individual investors in our sample. Because of missing observations, sample size is 15,351 out of total possible 24,996 individual investors. The ‘‘varimax’’ method is used to produce ten factors but only the first four are reported given variance explained.

	Investor classified as Islamic based on											
	Islamic brokerage account				Holdings in Katilim Islamic				AKP vote share in city of residence			
	Factor1	Factor2	Factor3	Factor4	Factor1	Factor2	Factor3	Factor4	Factor1	Factor2	Factor3	Factor4
Factor Characteristics:												
Eigenvalue	1.537	1.188	1.064	1.021	1.546	1.210	1.046	1.021	1.538	1.195	1.075	1.025
Variance explained	0.154	0.119	0.106	0.102	0.155	0.121	0.105	0.102	0.154	0.120	0.108	0.103
Rotated Factor Loadings:												
Islamic brokerage account	-0.082	-0.099	0.695	0.075								
Katilim_holdings					-0.101	-0.134	0.664	-0.080				
AKP vote share									-0.020	-0.017	0.701	0.222
Age	-0.072	0.718	-0.044	-0.183	-0.081	0.697	0.034	-0.190	-0.109	0.669	-0.123	-0.241
Pre 2008 experience	-0.074	0.765	0.058	0.144	-0.108	0.734	-0.171	0.107	-0.112	0.749	-0.059	0.129
Gender	0.117	0.029	0.379	0.562	0.091	0.057	-0.004	0.751	0.131	0.171	0.085	0.710
Portfolio size	0.060	0.132	0.578	-0.209	0.126	0.291	0.656	0.314	0.089	0.324	0.203	0.013
Clustering	0.648	0.080	0.165	0.190	0.636	0.101	-0.193	0.211	0.651	0.135	-0.003	0.213
Disposition effect	0.710	-0.043	-0.063	-0.068	0.708	-0.059	-0.007	-0.095	0.707	-0.044	-0.028	-0.094
Local bias	-0.085	-0.196	0.247	-0.537	-0.067	-0.066	0.330	-0.133	-0.052	-0.006	0.717	-0.245
Lottery stock preference	-0.078	-0.243	-0.084	0.560	-0.124	-0.305	-0.154	0.523	-0.088	-0.255	-0.092	0.574
Overconfidence	0.664	-0.174	-0.082	-0.014	0.657	-0.193	0.013	-0.019	0.663	-0.168	-0.008	-0.018
Stereotype	Impatient	Experienced	Pious	Gambler	Imp.	Exp.	Pious	Gam.	Imp.	Exp.	Pious	Gam.

Table 10. Portfolio characteristics on individual investor characteristics

This table presents errors-in-variables regressions where portfolio outcomes, both performance-based and religious, are regressed on individual investor characteristics. Investor characteristics are standardized for ease of comparison between variables. We show regressions for reliability equal to 1 and 0.8, where reliability is defined as $1 - \frac{error\ variance}{total\ variance}$. Reliability equal to one corresponds to the case with no errors. At the bottom of the table, p-values from t-tests comparing coefficients on zAKP, zKONDA, and zPupils are shown. '***', '**', and '*' denote statistical significance at the 1%, 5%, and 10% levels respectively.

	Dependent variable			
	Sharpe		MUSIAD	
	Reliability		Reliability	
	1	0.8	1	0.8
zAge	0.005**	0.006**	-0.004**	-0.005**
	(2.346)	(2.544)	(-1.985)	(-2.379)
zGender	-0.000	0.002	0.013***	0.011***
	(-0.042)	(0.772)	(6.740)	(5.467)
zExperience	0.017***	0.014***	-0.018***	-0.018***
	(8.468)	(6.929)	(-9.819)	(-9.756)
zWealth	0.003	0.002	0.001	0.002
	(1.589)	(1.049)	(0.888)	(1.111)
zAKP	0.007*	0.124	0.000	-0.102
	(1.751)	(1.625)	(0.058)	(-1.407)
zKONDA	-0.004	-0.096	-0.005*	0.070
	(-1.158)	(-1.613)	(-1.683)	(1.240)
zPupils	-0.003	-0.057	0.024***	0.077**
	(-1.253)	(-1.617)	(9.834)	(2.302)
zOverconfidence	-0.078***	-0.099***	0.001	0.001
	(-41.937)	(-41.124)	(0.398)	(0.280)
zDisposition	-0.045***	-0.054***	0.000	0.001
	(-21.449)	(-20.129)	(0.168)	(0.289)
zClustering	0.032***	0.046***	-0.001	-0.000
	(14.019)	(15.061)	(-0.643)	(-0.012)
zLottery	-0.006***	-0.007**	0.002	0.002
	(-2.641)	(-2.502)	(1.194)	(1.007)
zLocal	-0.004*	-0.007**	0.006**	0.009***
	(-1.733)	(-2.200)	(2.796)	(3.134)
Observations	15,219	15,219	15,295	15,295
R^2	0.1629	0.2028	0.0211	0.0265
p-value (zAKP = zKONDA)	0.112	0.105	0.371	0.182
p-value (zAKP = zPupils)	0.082	0.104	0.000	0.091
p-value (zKONDA = zPupils)	0.839	0.115	0.000	0.784

Table 11. Median characteristics of Islamic and secular firms identified by managerial membership of secular and religious executive clubs

This table presents medians of corporate characteristics across firms categorized by social connections of its CEO. The Turkish Industrialists' and Businessmen's Association (TUSIAD) is traditionally aligned with secular thought and politicians while the Independent Industrialists' and Businessmen's Association (MUSIAD) is associated with conservative views and the AKP. An annual list of TUSIAD members is publicly available. MUSIAD does not publish a list of members so we collect mention of MUSIAD membership from the internet but are left with a third category of firms which are not TUSIAD but cannot be explicitly associated with MUSIAD. Leverage is debt as a fraction of assets. The number of observations (firm-quarters except firm-months for monthly raw return and firms for alpha) is given in brackets. A non-parametric equality of medians test is conducted for each corporate measure.

				p-value for test of equality of medians	
	Secular (TUSIAD) firm-quarters	Conservative (MUSIAD) firm-quarters	Other firm-quarters	Secular versus Conservative firm-quarters	Secular versus Other firm-quarters
Total assets	1002.05	779.44	164.42	0.087	0.000
	[1,914]	[778]	[4,090]		
Sales	481.97	705.91	150.41	0.000	0.000
	[1,715]	[660]	[3,560]		
Market capitalization	387.1	405.44	103.17	0.459	0.000
	[1,820]	[759]	[3,969]		
Return on assets	2.749	2.376	2.372	0.112	0.034
	[1,812]	[657]	[3,698]		
Return on equity	10.638	8.068	5.928	0.018	0.000
	[1,769]	[639]	[3,541]		
Asset growth	11.198	15.22	8.281	0.000	0.000
	[1,837]	[677]	[3,770]		
Leverage	0.542	0.553	0.424	0.493	0.000
	[1,914]	[778]	[4,089]		
Tobin's *q*	1.016	1.042	1.103	0.017	0.000
	[1,820]	[759]	[3,969]		
Price-earnings ratio	10.351	12.529	11.663	0.014	0.001
	[1,470]	[536]	[2,735]		
Monthly raw return	0.008	0.005	0.000	0.384	0.000
	[7,075]	[2,465]	[13,525]		
1-factor alpha	0.002	0.001	0.001	0.430	0.586
	[135]	[57]	[316]		
4-factor alpha	-0.003	-0.004	-0.006	0.430	0.047
	[135]	[57]	[316]		

Table 12. Median characteristics of conservative and secular firms identified by sponsorship activities

This table presents medians of corporate characteristics across firms categorized by the type of activities they sponsor. Sponsorship activities are labeled either secular or conservative. Conservative sponsorships are either linked to the conservative AKP government or are religious in nature. A firm that sponsors a single conservative activity during our sample period is identified as conservative. Leverage is debt as a fraction of assets. The number of observations (firms) is given in brackets. A non-parametric equality of medians test is conducted for each corporate measure.

				p-value for test of equality of medians	
	Conservative firms	Secular firms	Firms without conservative sponsorship	Conservative versus Secular firms	Conservative versus non-conservative firms
Total assets	366.59	521.71	190.11	0.691	0.021
	[30]	[160]	[331]		
Sales	391.65	388.30	155.80	0.974	0.111
	[28]	[151]	[309]		
Market capitalization	290.39	331.95	119.14	0.425	0.007
	[30]	[154]	[321]		
Return on assets	1.790	2.834	2.385	0.294	0.835
	[25]	[150]	[289]		
Return on equity	12.813	8.677	6.156	0.516	0.532
	[25]	[147]	[285]		
Asset growth	14.813	10.486	8.894	0.052	0.059
	[25]	[151]	[292]		
Leverage	0.455	0.492	0.444	0.691	0.987
	[30]	[160]	[331]		
Tobin's q	1.055	1.030	1.090	0.110	0.259
	[30]	[154]	[321]		
Price-earnings ratio	12.257	10.792	12.886	0.521	0.846
	[29]	[148]	[297]		
Monthly raw return	0.005	0.005	0.002	0.854	0.848
	[35]	[183]	[376]		
1-factor alpha	0.002	0.002	0.002	0.854	0.849
	[35]	[189]	[392]		
4-factor alpha	-0.010	-0.004	-0.006	0.098	0.386
	[35]	[189]	[392]		

Table 13. Examining religious portfolio holdings around influential events

This table provides difference-in-differences analysis of religious portfolio holdings around influential events. The event in specification (1) is the Gaza flotilla raid that took place on 31 May 2010. In specification (2), the event is the change in government in Tunisia and the outbreak of protests in Egypt in January 2011 as part of Arab Spring uprisings. We look at a one-year window before and after the month in question. *After Event* is one (zero) for the twelve months following (preceding) the event month. '***', '**', and '*' denote statistical significance at 10%, 5%, and 1% levels respectively.

	Dependent variable	
	MUSIAD Percentage Holdings	
	(1)	(2)
After Event	0.065	0.072
	(1.518)	(1.618)
KONDA	-0.049***	-0.046***
	(-3.854)	(-3.490)
AKP	0.000*	0.000
	(-1.949)	(-0.009)
Pupils	0.009***	0.008***
	(28.244)	(23.676)
After Event * KONDA	-0.029	-0.029
	(-1.606)	(-1.513)
After Event * AKP	0.001***	0.001**
	(3.769)	(2.178)
After Event * Pupils	-0.002***	-0.001**
	(-3.832)	(-2.201)
Age	-0.001***	0.000***
	(-11.701)	(-9.434)
Gender	0.032***	0.032***
	(24.302)	(23.147)
Experience	0.000***	0.000***
	(-27.753)	(-25.158)
Wealth	0.000	0.000
	(0.449)	(1.002)
Overconfidence	0.025***	0.010***
	(10.542)	(4.224)
Lottery	0.034	0.050
	(0.034)	(0.050)
Local	0.028***	0.032***
	(11.710)	(12.554)
Other controls	Yes	Yes
Observations	308,626	299,726
R^2	0.0150	0.0124

Appendix A: The Katilim 50 Index

The Katilim ("Participation") 50 Index is is an index of 50 publicly listed Turkish firms that are deemed sharia compliant. The governing board consists of representatives from the four members of the "Association of Participation Banks", Bizim Securities Inc. (this is the brokerage firm whose customers we characterize as Islamic), and Turkey's four Islamic banks. Bizim partners with four Islamic banks exclusively (http://www.bmd.com.tr/) and is the single Turkish brokerage considered Islamic. The index excludes certain industries regarded non-compliant such as financials (they involve interest income), alcohol, gambling, pork-based food, media, advertising, tourism, tobacco, defense, and futures (gold, silver, and currency trades). Index components must have limited interest-bearing liabilities (for example, interest bearing loans cannot exceed 30% of market capitalization), interest-bearing assets, and interest income. The index is composed of 50 largest firms by market cap that meet these criteria. Hence, index components are typically well known firms. The index is updated quarterly and changes are announced at http://www.katilimendeksi.org.

Appendix B: Description of behavioral bias proxies and other investor characteristics

Variable	Description	References	Calculation
Disposition Effect	Investor's propensity to sell winners too early and hold losers too long. Measured by the proportion of gains realized minus proportion of losses realized.	Shefrin and Statman (1985), Odean (1998), and Kumar and Lim (2008).	Proportion of gains realized (PGR) = realized gains/(realized gains+paper gains). Proportion of losses realized (PLR) = realized losses/(realized losses+paper losses).
Narrow Framing	Investor's propensity to select investments individually instead of considering the broad impact on her portfolio.	Kahneman and Lovallo (1993), Kahneman (2003), and Kumar and Lim (2008).	Trade clustering = 1 – (number of trading days/number of trades). It is inversely related to narrow framing.
Overconfidence	Investor's propensity to trade frequently but unsuccessfully. Measured with a dummy variable.	Barber and Odean (2001), and Bailey, Kumar, and Ng (2011).	Dummy variable equal to one for investors in the highest portfolio turnover quintile and lowest performance quintile for their individual common stock trading and zero otherwise.
Local Bias	Investor's propensity to select stocks with headquarters in their city of residence.	Coval and Moskowitz (1999), Bailey, Kumar, and Ng (2011).	Difference in ratios between the share of local firms in an investor's holdings and the share of Borsa Istanbul firms that are local to the investor.
Lottery Stock Preference	Investor's propensity to select stocks with lottery-like features (low price, volatile returns, and skewed returns).	Kumar (2009).	Investor's portfolio weight (relative to the weight in the market portfolio) assigned to stocks that have bottom

			quintile prices, top quintile idiosyncratic volatility, and top quintile idiosyncratic skewness.
Pious City Dummy (AKP)	Indicates piety of city as proxied by AKP vote share in 2011 general elections.	New in this paper.	Dummy variable equal to one for investors from cities that have higher votes for AKP than the median-vote city, Istanbul. Zero for investors from cities with below Istanbul AKP votes. Undefined for investors from Istanbul.
Pious City Measure (KONDA)	Indicates piety of city as measured by religiosity score from KONDA survey between 2010 and 2012.	New in this paper.	Average monthly score, which can range from 1 (non-believer) to 4 (devout), for each city between 2010 and 2012.
Pious City Measure (Pupils)	Indicates piety of city as proxied by the number of Quranic school pupils in that city.	New in this paper.	The number of Quranic school pupils in a given city per thousand people.
Gender	Investor's gender	Self-reported.	Dummy variable equal to one if the investor is male.
Age	Age of the investor.	Self-reported.	Age of the investor.
Wealth	Proxy for the wealth of investor.	Based on investment record.	Investor's median total asset value through sampling period.
Stock Market Experience	Proxy for investment experience of investor.	Based on investment record.	The number of days the investor had a brokerage account until 2008, the

			beginning of our sample period.
Daily Performance	Raw daily return of investor's portfolio.	Based on investment record.	Raw mean daily value-weighted return of investor's portfolio.
Monthly Raw Performance	Raw monthly return of investor's portfolio.	Based on investment record.	Raw mean monthly value-weighted return of investor's portfolio.
Stock Portfolio Alpha	Risk-adjusted excess return of investor's stock portfolio.	Based on investment record.	The intercept, alpha, from FF-4 Factor regression with the monthly common stock portfolio return as dependent variable.
Stock Portfolio Market Factor (Beta) Exposure	The beta of the investor's stock portfolio.	Based on investment record.	The loading of the stock portfolio on the market factor in a four-factor regression model with size, value, and momentum factors. Factors are local and constructed from scratch.
Stock Portfolio SMB Factor (Size) Exposure	The loading of the stock portfolio on the small-minus-big factor (SMB) in a four-factor model regression.	Based on investment record.	The loading of the stock portfolio on the size (SMB) factor in a four-factor regression model.
Stock Portfolio HML Factor (Value) Exposure	The loading of the stock portfolio on the high-minus-low book-to-market factor (HML) in a four-factor model regression.	Based on investment record.	The loading of the stock portfolio on the value (HML) factor in a four-factor regression model.
Stock Portfolio WML Factor (Momentum) Exposure	The loading of the stock portfolio on the winners-minus-losers factor (WML)	Based on investment record.	The loading of the stock portfolio on the momentum (WML) factor in a four-

	in a four-factor model regression.		factor regression model.

Figure 1: Recent voting patterns in Turkey

The map summarizes the results of the general election of 12th June 2011. See http://www.electoralgeography.com/new/en/countries/t/turkey/turkey-legislative-election-2011.html .