Managerial Duties and Managerial Biases

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ABSTRACT

We propose a novel approach to evaluating the empirical importance of individual managerial characteristics: We analyze different managerial positions (CEO and CFO) jointly and ask whether a managerial bias (overconfidence) matters for decisions under the control of the manager, but not for decisions outside the manager's core duties. Using a new data set on CEO and CFO overconfidence, we show that financial outcome variables are primarily affected by CFO overconfidence while only CEO overconfidence affects non-financial decisions such as investment, R&D, and mergers. Our findings also point to potential confounds arising from interaction and peer effects among top managers.

A growing literature in corporate finance points to the central role of managers' individual characteristics and biases in explaining corporate outcome variables such as investment, mergers, or financing decisions. The spectrum of managerial traits ranges from managers' gender, risk-aversion, education, and childhood experiences to behavioral biases such as loss aversion, confirmation bias, or overconfidence.[1] Much of the literature focuses on chief executive officers (CEOs), given their role as the top decision-maker in the firm and their data availability (Carpenter (2011)). Other papers investigate the role of the CFO (Ben-David, Graham, and Harvey (2007, 2010)) or of the top-five managers jointly (Aggarwal and Samwick (1999); Datta, Iskandar-Datta and Raman (2002); Selody (2010)).

In this paper, we propose a different approach to assess the empirical importance of managers' personal traits: We differentiate between different managerial roles and test whether a managerial trait matters for decisions on which the manager does have influence, but does not matter for decisions on which manager has no (or less) influence. For example, a chief financial officer (CFO) should affect a firm's corporate financial policies but not necessarily determine the firm's acquisitiveness. We relate a manager's position to a range of corporate outcome variables, and then link the relevant manager's characteristics to the respective managerial decisions. This

[1] Musteena, Barker and Baeten (2006) find CEO gender and functional experience are associated with attitude toward change. Selody (2010) find board members' downward-biased beliefs about women's performance helps to explain the gender pay gap of top five executives in U.S.. Barker, and Mueller (2002) find CEO attributes like age, career experience, education background and tenure explain a significant proportion of the sample variance in firm R&D investment. Malmendier, Tate and Yan (2011) find overconfidence and early-life experience of CEOs significantly affect capital structure decisions. Shefrin (2001) presents cases studies of business failures due to behavioral biases like loss aversion, overconfidence and confirmation bias. Graham, Harvey and Puri (2012) find that risk aversion and behavioral traits of CEOs such as overconfidence are associated with corporate financial decisions. Malmendier and Tate (2005, 2008) find overconfident CEOs have higher investment-cash flow sensitivity and conduct more mergers and acquisitions.

approach serves both to test for the empirical importance of managerial traits beyond the CEO and to strengthen identification: Manager effects are estimated from within-firm changes in manager in more than one position, which renders unobserved firm-year specific correlations rather implausible, and they are estimated from within-firm variation in managerial duties between different positions.

We focus on two managerial positions whose roles are defined most consistently across firms and for which a broad set of finance variables are available: CEO and CFO. Both types of managers play a major role in corporate decision-making and their duties are roughly standardized across U.S. firms.[2]

In terms of managerial trait, we focus on one of the most-studied managerial biases, overconfidence.[3] Following the empirical analysis of hubris and mergers in Roll (1986) and the first theoretical analysis in Heaton (2002), the corporate finance literature has found that managerial overconfidence affects a broad set of corporate decisions such as financial policies (Ben-David, Graham and Harvey (2007, 2010); Malmendier, Tate and Yan (2011)), capital expenditure (Malmendier and Tate (2005)), innovation (Galasso and Simcoe (2011); Hirshleifer, Low and Teoh (forthcoming)) and, again, mergers and acquisitions (Malmendier and Tate (2008)). Differently from these prior contributions, we test, jointly and separately, the impact of both CEO and CFO overconfidence on both financial and non-financial corporate policies, with

[2] For other managerial positions, there is variation in titles across industries. For example, high-tech companies tend to have a chief technology officer (CTO) while pharmaceutical companies tend to have a chief medical officer (CMO).

[3] Baker, Ruback, and Wurgler (2007) note that most studies in behavioral corporate finance focus on managerial overconfidence, given that overconfidence has been well documented in many samples and its impact can be easily modeled and tested.

the goal of better assessing the empirical relevance of manager-specific biases on corporate decisions.

It is helpful to clarify the use of the term “overconfidence” in this paper, which is closely related to the "better-than-average" effect, documented in the psychology literature. Larwood and Whittaker (1977), Svenson (1981), and Alicke (1985) were among the first to show that individuals tend to overestimate their ability relative to the average. As a result, people are likely to be overly optimistic about outcomes they can control. In the context at hand, we can therefore expect overconfident managers to overestimate the outcomes of decisions under their control. We define overconfidence as the overestimation of mean returns to the outcome variable under the manager’s control.

We test the impact of CEO and CFO overconfidence both on financing decisions and on non-financing decisions such as investment, acquisitions, and innovation. An additional advantage of focusing on overconfidence is that it is a managerial trait on whose role we have clear (directional) theoretical predictions. Previous literature provides guidelines on the expected distortions: First, Malmendier, Tate and Yan (2011) argue an overconfident manager has a more pronounced pecking-order preference for financing, favoring debt over equity financing, conditional on choosing outside financing. This prediction should apply to both the CEO and the CFO, and CFO overconfidence might dominate because making financial decisions is the primary managerial duty of the CFO. With regards to investment policies, Malmendier and Tate (2005) show that managerial overconfidence increases investment-cash flow sensitivity, which

should apply only to CEOs, since CFOs have less influence on corporate investment decisions.[4] Galasso and Simcoe (2011) develop a model which predicts that CEO overconfidence increases innovation investment, which should apply only to CEOs, given that innovation decisions are less likely to be affected by CFOs. For acquisitions, Malmendier and Tate (2008) predict a higher volume of acquisitions when firms are rich in internal sources. This prediction should also apply to CEOs, not CFOs.

To identify the effect of managerial overconfidence, a majority of existing literature (Malmendier and Tate (2005, 2008); Galasso and Simcoe (2011); Malmendier, Tate and Yan (2011)) uses the same sample, a panel of large firms with a constructed CEO overconfidence measure from 1980 to 1994. Following Malmendier, Tate and Yan (2011) and similar to Otto (2012), we update and extend the data on CEO overconfidence and construct a novel data set on CFO overconfidence, using the Thomson Reuters insider filing dataset. This allows us to reconstruct the option-based "Longholder" measure developed by Malmendier and Tate (2005; 2008) for both the CEO and the CFO. Specifically, the "Longholder" measure is derived by solving a personal portfolio choice model. It identifies a manager as overconfident if the manager holds a fully-vested option sufficiently in-the-money until the year of expiration. We also conduct tests to explicitly address several alternative interpretations of the "Longholder" measure, for example, procrastination, insider information, signaling, risk tolerance and agency problems. Combining the Thomson Reuters insider filing dataset with Compustat, Execucomp

[4] We also recognize that through capital budgeting, CFOs might have an impact on investment policies and, hence, investment-cash flow sensitivity (Fabozzi, Drake and Polimeni (2007)). However, practitioner guides emphasize that such influence of CFOs tends to be indirect and small, compared to the powerful role of CEOs in investment and strategy decisions (Carpenter (2011)).

and CRSP, we construct a panel of 1,156 firms from the S&P 1500 index with measures for both CEO and CFO overconfidence from 1996 to 2010.

In terms of financing decisions, we find that both overconfident CEOs and CFOs are significantly more likely to issue debt when accessing external capital market than their non-overconfident peers. But, when using the financing-deficit specification, we find that only overconfident CFOs use significantly more debt financing when the financial deficit of the firm is high. At the same time, only overconfident CFOs are significantly less likely to issue equity when using external capital, while the same is not true for overconfident CEOs, in contrast to previous findings. Similarly, only firms with overconfident CFOs use less equity financing to cover their financial deficits.

As for investment decisions, we do not find any significant impact of CFO overconfidence on investment-cash flow sensitivity or R&D expenditure. CEO overconfidence, instead, significantly increases investment-cash flow sensitivity and R&D expenditure (normalized by assets and by the sum of R&D expenditure and capital expenditure). CEO and CFO overconfidence do, however, interact positively in the context of investment decisions (net investment normalized by assets).

Finally, overconfident CEOs in firms with abundant cash or low book leverage spend significantly more on acquisitions (normalized by asset), but there is no such effect for the CFO. For all results, the estimated coefficients of CEO and CFO overconfidence are quite robust, regardless of whether they are estimated separately or jointly.

Our findings contribute to the existing literature in several respects. Our findings provide new evidence that the individual characteristics of top manager matter for corporate decisions and that managerial overconfidence has a significant impact on a broad range of corporate decisions. We are the first to show that the influence of this type of overconfidence goes beyond the role of the CEO and applies to the CFO as well. Specifically, our findings also indicate the CFO is no less important than the CEO when considering financing decisions. In the case of equity financing, the role of the CFO even outweighs that of the CEO. Another merit of this methodological approach is that it allows a comparison to be drawn between the relative importance of the CEO overconfidence effect and the CFO overconfidence effect.

Our results also provide a partial out-of-sample test of the effects of CEO overconfidence, again largely confirming prior findings and hence strengthening the credibility of the results. The analysis includes the construction of a clean and consistent overconfidence measure for both CEOs and CFOs in a larger and updated sample.

One important caveat to our results goes back to the issue of identification. As discussed above, our empirical approach improves identification by moving from variation in overconfidence in "one type of manager" (CEO) and for "one set of decisions" (those made by the CEO) to a "two-by-two" analysis: variation of overconfidence among CEOs and CFOs within a given firm, and variation in decisions being or not being made by the manager. The main concern about identification affecting the prior literature was unobserved within-firm time variation: unobserved time-variant firm effects may explain both the variation in CEO overconfidence and the variation in the relevant outcome variables, such as investment or merger

choices. More concretely, boards choose CEOs based on their business expertise and personal traits, and may take self-confidence into account. For example, Hirshleifer, Low and Teoh (forthcoming) find that overconfident CEOs achieve greater innovative outputs in innovative industries, and this may help to explain why so many overconfident CEOs are hired by growth firms. At the same time, CEOs might also self-select into firms given observable firm-level characteristics.

This alternative interpretation becomes exceedingly unlikely when analyzing several C-level managers within the same firm in the same time period. Moreover, as in previous literature, we address these endogeneity concerns further by including additional control variables. We show our results are not driven by year effects, industry effects, firm effects (where possible), observable firm characteristics as well as their interacted effects with year effects or industry effects (where possible). Finally, as in the previous literature, we would like to emphasize that even in the presence of endogeneity, the main puzzle remains: If the CEO or the CFO is chosen because of his overconfidence, the board should be aware that overconfidence might result in distorted investment, financing, or acquisition behavior. They should take actions which curtail the negative aspects and maximize the benefits of managerial overconfidence.

In addition to the behavioral corporate finance literature mentioned, our paper relates to several other strands of literature. Starting with Fazzari, Hubbard and Peterson (1988), investment-cash flow sensitivity has been studied extensively in the field of corporate finance. Distorted investment decisions are attributed to financial constraints, though there is an ongoing controversy about this interpretation (Kaplan and Zingales (1997, 2000)). Conversely, Jensen's

free cash flow theory suggests investment-cash flow sensitivity could be a result of the agency problem. The problem is further exacerbated by the empirical difficulty of controlling investment opportunities and the lack of exogenous variation of cash flows. Rauh (2006) bypasses the problem by exploiting the exogenously required pension contributions to identify the sensitivity of capital expenditures to internal capital. Alternatively, Almeida and Campello (2007) test the dependence of investment–cash flow sensitivities on assets tangibility, separately in the financially constrained firms and in the financially unconstrained firms, to mitigate the Kaplan and Zingales's critiques. The findings of Rauh (2006) and Almeida and Campello (2007) both confirm that financial frictions affect capital investment. Following the overconfidence literature (Heaton (2002); Malmendier and Tate (2005)), our paper offers a complementary explanation: increased investment-cash flow sensitivity could result from managerial overconfidence, even when there is no agency problem or financial constraints.

Meanwhile, due to the fast pace of modern technological development, innovation has become a more and more component of investment. Brown and Peterson (2009) report that the average firm R&D expenditure has become comparable to the average firm capital expenditure. Based on a sample of Forbes 500 firms from 1980 to 1994, Galasso and Simcoe (2011) find that firms with overconfident CEOs invest more in innovation and are more likely to lead their firms towards new technology directions. The effects are more prominent in more competitive industries. Hirshleifer, Low and Teoh (forthcoming) identify that CEO overconfidence has a positive impact on innovation input and improves innovation output in innovative industries, based on a sample of S&P 1500 firms from 1993 to 2003. Our paper revisits the impact of CEO

overconfidence on R&D expenditure by using a different sample, a panel of S&P 1500 firms from 1996 to 2010, and including measurements of the CFO overconfidence effect. In addition, we test the impact of CEO and CFO overconfidence on the innovativeness of firm investment, which is measured by R&D expenditure divided by the sum of R&D and capital expenditure.

Finally, a puzzling finding in M&A literature is that a majority of mergers and acquisitions are value destroying, yet firms continue to pursue them. Moeller, Schlingemann, and Stulz (2005) find that acquiring firm shareholders collectively lost more than 220 billion dollars when merger bids were announced from 1980 to 2001. Both practitioners (like Warren Buffett) and researchers (Roll (1986); Malmendier and Tate (2008)) have cited managerial overconfidence as a possible explanation for the large number of value-destroying deals. Our paper provides additional evidence that managerial overconfidence increases acquisitions expenditures when firms have abundant cash holdings or low leverage levels.

The remainder of this paper is organized as follows. Section I lays out the empirical predictions. Section II describes the data. Section III presents the empirical findings for financial policies. Section IV presents the empirical findings for investment, innovation and acquisition decisions. Section V concludes.

I. Testable Predictions

As in previous literature, we define managerial overconfidence as the biased belief that the future returns of the manager's firm are greater than they actually are.[5] When determining capital budget decisions, overconfident managers must account for both the overestimated future returns of their investment or mergers projects and the perceived (overestimated) costs of external financing. As a result, financial policies and investment decisions made by overconfident managers deviate from those made by their rational peers.

A. Financial Policies

Internal capital, debt financing and equity financing are three key financing sources for firms. As shown before,[6] in a simple capital-structure model with two kinds of frictions, tax-deductibility of interest payments and financial distress costs, overconfidence induces managers to overinvest if they can finance investment with internal capital or risk-free debt. However, when internal capital or risk-free debt is insufficient, overinvestment by overconfident managers is limited by the perceived cost of external financing. The intuition is simple: As rational creditors have unbiased expectations about future firm cash flows, they demand higher interest rates in default states than what overconfident managers perceive as appropriate. Similarly, rational shareholders demand higher equity shares in return for providing new capital than what overconfident managers perceive to be appropriate. If the overestimated investment returns are greater than a manager's misperceived cost of external financing, overconfident managers choose to finance

[5] This follows Malmendier and Tate (2005, 2008) and Malmendier, Tate, and Yan (2011); cf. also Heaton (2002), Hackbarth (2008), Sen and Tumarkin (2009), Galasso and Simcoe (2011), Otto (2012), and Hirshleifer, Low and Teoh (forthcoming).
[6] See the model in the Online Appendix in Malmendier, Tate, and Yan (2011).

the investment with external capital when necessary. Otherwise, overconfident managers will choose to forgo some investment opportunities.

Conditional on a firm seeking external capital, the perceived cost of risky debt financing is generally smaller than that of equity financing. This is because the misperceived cost of issuing risky debt, resulting from differences in opinions between rational creditors and overconfident managers about future investment returns, only matters for default states. In contrast, when issuing equity, the misperceived cost of equity financing matters for all states. As a result, ceteris paribus, overconfident managers generally prefer risky debt over equity when seeking external capital. The key predictions can be summarized as follows:

Prediction 1: Conditional on accessing external capital markets, overconfident managers are more likely to issue debt than equity.

Prediction 2: Conditional on a given financial deficit, overconfident managers prefer debt financing to equity financing.

B. Investment Decisions and Mergers

The same modeling framework also provides two insights about corporate investment decisions.[7] Since overconfident managers overestimate both the future returns to their investment projects and the cost of external financing, they tend to overinvest whenever they have sufficient internal capital. If they are financially constrained, however, they may choose to forgo some investment projects. This occurs if the (overestimated) future returns are less than the misperceived cost of

[7] See also Malmendier and Tate (2005).

external financing. Therefore, the investment expenditures made by overconfident managers are predicted to be correlated with cash flows:

Prediction 3: Overconfident managers have a higher level of investment-cash flow sensitivity than their rational peers.

Turning to acquisition expenditure decisions, managerial overconfidence can be interpreted as an overestimation of the future cash flow, or "synergies", generated by acquiring other companies. Therefore, similar to the intuition about internal investment, overconfident managers are more acquisitive than their rational peers when they can finance acquisitions with internal capital or riskless debt. However, when acquisitions require external financing and the overestimated acquisition synergy is less than the misperceived external financing cost, overconfident managers choose to forgo some acquisitions, even if they would be value-creating. We test the following prediction[8]:

Prediction 4: Overconfident managers with sufficient internal capital have larger acquisition expenditures than their rational peers.

II. Data

A. Longholder_Thomson Measure

Measuring managerial overconfidence is a challenge to empirical researchers. The existing methodologies could be roughly categorized into four categories: the option-based approach, the earnings-forecast-based approach, the survey-based approach and the press-based

[8] See also the model in Malmendier and Tate (2004).

approach. The option-based approach aims to capture managerial belief about the own company from managers' personal investments in their companies. Examples include the "Longholder" and the "Holder 67" measures in Malmendier and Tate (2005, 2008), which are derived from the timing of option exercise by the CEO. Galasso and Simcoe (2011), Malmendier, Tate and Yan (2011), Otto (2012) and Hirshleifer, Low and Teoh (forthcoming) also adopt this measurement approach. Another example is Sen and Tumarkin (2009), in which the overconfidence measure is derived from the share retention rate of stocks obtained from an option exercise. The earnings-forecast-based approach has been proposed by Otto (2012) and infers overconfidence from overstated earnings forecasts. As an example of the survey-based approach, Ben-David, Graham, and Harvey (2007, 2010) construct CFO overconfidence proxies based on miscalibrated stock-market forecasts by CFOs who participated in the Duke/CFO Business Outlook survey. For the media-based approach, Malmendier and Tate (2005) and Hirshleifer, Low and Teoh (forthcoming) construct CEO overconfidence measures based on the characteristization of CEOs reported in the press. Overall, the option-based measures are by far the most wide-spread approach, also since the implied "revealed beliefs" provide for rather convincing identification.

We follow the option-based approach and replicate the "Longholder_Thomson" measure in Malmendier, Tate and Yan (2011), which uses the timing of option exercise as a proxy for managerial overconfidence. It is helpful to highlight the underlying idea and major features of the "Longholder_Thomson" measure. The measure is based on a benchmark model of option exercise for managers, where the optimal schedule for option exercise depends on individual wealth, degree of risk aversion and diversification. Given that stock options granted to managers

are not tradable and short-selling of company stock is prohibited, managers holding stock and option grants are highly exposed to the idiosyncratic risk of their companies. In the benchmark model, risk-averse managers facing under-diversification problems generally choose to exercise options early. However, overconfident managers with overestimated mean future firm cash flows choose to postpone exercising the in-the-money option in order to tap expected future gains.

Based on the theoretical model, Malmendier and Tate (2005) define a binary variable called "Longholder" as a proxy for managerial overconfidence, where 1 signifies the overconfident manager at some point of his tenure held an option until the last year before expiration, given the option was at least 40% in-the-money. Empirically, Malmendier and Tate (2005) use CEO option-package-level data from a sample of 477 large publicly traded U.S. firms from 1980 to 1994 to identify CEO option exercise.

An accurate replication of the original Longholder measure for longer and more recent time periods and a broader set of managers and firms requires complete option-package-level data for firm managers. In order to construct overconfidence measures for both the CEO and the CFO, we reconstruct the Longholder_Thomson measure in Malmendier, Tate and Yan (2011) for the years 1996 to 2010, which has the same definition as the original Longholder measure, but uses the Thomson insider filing dataset to identify the option exercise by managers in public U.S. firms. The control group consists of managers for whom at least one option exercise is observed in the Thomson database but who do not meet the criteria of overconfidence.

The Thomson insider filing dataset includes forms 3, 4 and 5 reported by insiders to the SEC. Option exercise data is contained in Table II of the database which illustrates reports from

form 4 since 1996. We keep only those records with a very high degree of confidence (Thomson cleanse indicators R, H and C) or a reasonably high degree of confidence (Thomson cleanse indicators L and I). We drop those records which are an amendment to previous records. We further drop records with obvious errors, such as an indicated maturity date that is earlier than the exercise date and options with missing exercise date (because the days remaining until maturity cannot be calculated). To reduce the effect of extreme outliers, we keep only those records for which the exercise price of the option is within the range of 0.1 to 1000. To calculate the in-the-money percentage for each option, we obtain stock price data from CRSP. We use the Execucomp database to obtain tenure as well as stock and option holdings of the CEOs and CFOs in the Thomson database. The last step limits our firm sample to the intersection of the Execucomp database and the Thomson database, a subset of S&P 1500 U.S. firms including small, medium and large cap firms from 1996 to 2010.

B. Alternative Interpretations

Before turning to our main empirical analysis, we address potential alternative interpretations of the Longholder_Thomson measure and their implications for the financial policies and investment and merger decisions analyzed in this paper.

Procrastination. The Longholder_Thomson overconfidence measure captures a persistent tendency of managers to delay option exercise. One might argue managers hold exercisable options until expiration due to their "inertia" or "procrastination". We find, however, that 88% of overconfident CEOs and 87% of overconfident CFOs conduct portfolio transactions

one year prior to the year when options expire. Meanwhile, if "inertia" is a personality feature, an "inertial" manager should not actively borrow more debt when the financing deficit is high. We will find, however, that the higher the financing deficit, the more debt is issued by overconfident CEOs and CFOs.

Insider Information. Managers may choose to hold exercisable options because they have positive insider information about future stock prices. However, positive insider information should be transitory (rather than persistent), but managers who are classified as overconfident persistently hold exercisable options for about five years or longer. The key distinction between overconfidence and information is whether or not the overconfident mangers earn positive abnormal returns from holding options until expiration. We calculate the actual returns of overconfident CEOs and CFOs from holding options until their expiration, given that these options were at least 40% in-the-money ("Longhold" transactions). Then we calculate hypothetical returns from exercising these options 1, 2, 3 or 4 years earlier and investing in the S&P 500 Index until these options were actually exercised. We find that approximately 45%-49% of the "Longhold" transactions do not earn positive abnormal returns. [9] We also find that overconfident managers on average do not beat the S&P 500 index by holding these in-the-money options until expiration.

Signaling. One might argue that managers' persistent holding of exercisable options serves to signal to the capital market indicating their firms have better prospects than other similar firms do. The signaling idea is hard to reconcile with the subsequent underperformance

[9] Abnormal returns are actual returns minus hypothetical returns.

of those firms (and managers not earning positive abnormal returns from holding options until expiration). Moreover, even a story of costly signaling does not predict heightened investment - cash flow sensitivity or positive correlation between acquisition expenditures and cash holdings among the firms in which CEOs hold their options, as we find in our data. Rather, signaling would need to alleviate informational asymmetries and convey a higher quality of firms, in contrast to our empirical findings.

Risk Tolerance. The Longholder_Thomson overconfidence measure also captures a habitual tendency of managers to hold company risk. One might claim that risk-tolerant or risk-seeking managers prefer to hold exercisable options longer and therefore appear to be overconfident under the Longholder_Thomson measure. However, risk tolerance does not predict aversion to equity financing. Moreover, risk tolerance does not predict that CEOs who hold their options should have more net investment or more innovation input. Thus, our results of equity financing policies, net investment and innovation decisions help to rule out this interpretation.

Agency Problems. At least for part of the analysis, the predicted behavior of overconfident CEOs coincides with the predicted behavior of insufficiently incentivized CEOs. For example, over-spending on acquisition expenditures might be caused by agency problems: entrenched managers with rich internal capital are more likely to make value-destroying investments or acquisitions (Harford, 1999). However, while overconfident managers believe they are acting in line with the interests of shareholders, empire-building CEOs are aware that they destroy shareholder value. Therefore, only an overconfident acquisitive manager would

keep holding stock and options of his firm while an empire-building acquisitive manager would reduce his stock and option holdings of the firm. Hence, the overconfidence measure should be negatively correlated with the empire-building proxy.

C. Sample

To control for firm and industry characteristics, we retrieve firm-level financial variables from Compustat. Financial firms and regulated utilities (SIC codes 6000 - 6999 and 4900 - 4999) are excluded. For financial policy regressions, we construct three key variables: Net Debt Issues, Net Equity Issues and Net Financing Deficit, using the same definitions as Malmendier, Tate and Yan (2011). Net Debt Issues is long-term debt issues (item 111) minus long-term debt reductions (item 114). Net Equity Issues is sales of common stock (item 108) minus stock repurchases (item 115). Net Financing Deficit is cash dividends plus investment plus the change in working capital minus cash flow after interest and taxes.[10] Net Debt Issues, Net Equity Issues and Net Financing Deficit are normalized by assets at the beginning of the year.

We also construct standard firm-level control variables including q, profitability, tangibility, size, book leverage and annual changes in these variables. Q is the ratio of market value of assets to the book value of assets. The market value of assets is measured by the book

[10] Net financing deficit is cash dividends (item 127) plus investment plus change in working capital minus cash flow after interest and taxes. Investment is items 128 + 113 + 129 + 219 - 107 - 109 for firms with cash flow format code 1 to 3; and is items 128 + 113 + 129 - 107 - 109 - 309 – 310 for firms with cash flow format code 7; and is 0 for other firms. Change in working capital is items 236 + 274 + 301 for firms with cash flow format code 1; and is items −236 + 274 – 301 for firms with cash flow format code 2 and 3; and is items −302 − 303 − 304 − 305 − 307 + 274 − 312 – 301 for firms with cash flow format code 7; and is 0 for other firms. Cash flow after interest and taxes is items 123 + 124 + 125 + 126 + 106 + 213 + 217 + 218 for firms with cash flow format code 1 to 3; and is items 123 + 124 + 125 + 126 + 106 + 213 + 217 + 314 for firms with cash flow format code 7; and is 0 for other firms.

value of assets plus the market value of equity minus book value of equity and deferred taxes.[11] Profitability is operating income before depreciation (item 13) normalized by assets (item 6) at the beginning of the year. Tangibility is property, plants and equipment (item 8) normalized by assets (item 6) at the beginning of the year. Size is the natural logarithm of sales (item 12). Book leverage is the sum of debt in current liabilities (item 34) and long term debt (item 9) divided by the sum of debt in current liabilities (item 34), long term debt (item 9) and common equity (item 60).

For the analysis of investment-cash flow sensitivity, we measure cash flow as earnings before extraordinary items (item 18) and depreciation (item 14), normalized by assets (item 6) at the beginning of the year. Similar to Malmendier and Tate (2005), we trim (normalized) cash flow at 1% level.

We combine firm-level variables with manager-level variables to form the whole sample, a panel of 1,156 S&P 1500 firms from 1996 to 2010. Table I reports summary statistics for firms, CEOs and CFOs. Detailed variable descriptions are provided in Appendix-Table A-I.

Compared to the sample of Forbes 500 firms from 1980 to 1994 used in Malmendier and Tate (2005, 2008), Malmendier, Tate and Yan (2011), Galasso and Simcoe (2011), Hirshleifer, Low and Teoh (forthcoming) and the survey sample from 2001 to 2010 of Ben-David, Graham and Harvey (2010) , our sample differs in two ways. First, it covers a different time period and it considers small and median firms in addition to large firms. Second, it includes overconfidence

[11] Q is assets (item 6) plus price (item 199) times common shares outstanding (item 25) minus common equity (item 60)) minus balance sheet deferred taxes and investment tax credit (item 35), divided by assets (item 6).

measures for both the CEO and the CFO, which fills a gap in the existing literature by providing a way to estimate the effects of CEO overconfidence and CFO overconfidence separately and jointly.

III. Decisions about Financial Policies

A. Debt and Equity Issues

We first test whether overconfident managers are more likely to issue debt than equity when using external capital (Prediction 1). To control for the different baseline frequencies of debt and equity issues by overconfident managers and their rational peers, we condition the regression analysis on accessing external capital. Therefore, the regression sample only includes observations with either positive net debt issues or positive net equity issues. We test whether, conditional on using external financing, overconfident managers prefer debt over equity using the following logit models:

$$\Pr(\mathrm{NDI}_{it} = 1 | \text{ external capital}, \mathrm{LTCEO}_{it}, \mathrm{LTCFO}_{it}, \mathrm{X}_{it}) \quad (1)$$
$$= \mathrm{G}(\beta_1 + \beta_2 \mathrm{LTCEO}_{it} + \beta_3 \mathrm{LTCFO}_{it} + \mathrm{X}'_{it}\mathrm{B} + \varepsilon_{it})$$

$$\Pr(\mathrm{NEI}_{it} = 1 | \text{ external capital}, \mathrm{LTCEO}_{it}, \mathrm{LTCFO}_{it}, \mathrm{X}_{it}) \quad (2)$$
$$= \mathrm{G}(\beta_1 + \beta_2 \mathrm{LTCEO}_{it} + \beta_3 \mathrm{LTCFO}_{it} + \mathrm{X}'_{it}\mathrm{B} + \varepsilon_{it})$$

In Specification 1, the dependent variable is NDI, an indicator of positive net debt issues, and in Specification 2, the dependent variable is NEI, an indicator of positive net equity issues. For both specifications, the regression sample only keeps observations with either NDI equal to 1 or NEI equal to 1, which are firm-years with external financing. LTCEO and LTCFO represent the

Longholder_Thomson measure for managerial overconfidence of the CEO and the CFO, respectively. X is a set of standard firm-level and manager-level control variables. Firm-level control variables include book leverage, ln(Sales), profitability, q and tangibility. Manager-level control variables are option-excluded stock ownership and vested options, which control for the incentive effect. These control variables reflect traditional determinants of capital structure. Year fixed effects and two-digit SIC industry fixed effects (following Ben-David, Graham and Harvey (2010)) are included. All standard errors are adjusted for firm-level clustering.

For each specification, we start by only including the CEO overconfidence measure to test whether the documented effects of CEO overconfidence are robust to our new data sample. We then replace the CEO overconfidence measure with the CFO overconfidence measure and run through the same set of regressions. Given that the primary managerial duty of the CFO is making financial decisions, we expect the overconfident CFO has a significant impact on capital structure decisions. Finally, we jointly add the CEO and CFO overconfidence measures to the regressions to determine which managerial overconfidence leads to a more pronounced pecking-order preference and whether the separately estimated impacts of CEO and CFO overconfidence are robust when estimated jointly. This procedure is applied to all empirical specifications in this paper.

Table II reports the results for Specification 1 with the net debt issues indicator as the dependent variable. Column 1 is a baseline logit regression which only includes the CEO overconfidence proxy and industry dummies. The coefficient of CEO overconfidence is positive and significant at the 1% level. The estimated coefficient is 0.306 (p-value < 0.001), which

means that the odds ratio of debt issues for overconfident CEOs is 36% higher than that of rational CEOs.[12] In column 2, we include the standard firm-level control variables from the capital structure literature to capture the cross-sectional determinants of net debt issues: q, size, profitability, tangibility and book leverage. We also include the manager control variables: stock and option holdings, all measured at the beginning of the year. We continue to control for industry effects and add year dummies to remove cyclical effect of debt issues. The estimated coefficient of CEO overconfidence decreases but is still positive and significant at the 1% level (coefficient = 0.223, p-value = 0.010), which indicates the odds ratio of debt issues for overconfident CEOs is 25% higher than that of rational CEOs.

In column 3 and column 4, we replace the CEO overconfidence measure with the CFO overconfidence measure. For the baseline regression, the estimated coefficient of the CFO overconfidence measure is slightly lower than the CEO, significant at the 1% level (coefficient = 0.297, p-value<0.001). It indicates that the odds ratio of debt issues for overconfident CFOs is 35% higher than that of rational CFOs. In column 4, controlling for CFO-level variables, firm-level variables, industry dummies and year dummies, the estimated coefficient of CFO overconfidence decreases but is still significant at the 1% level (coefficient = 0.225, p-value = 0.010). This indicates a 25% increase in odds ratio of debt issues by overconfident CFOs.

In columns 5 and 6, we include both CEO and CFO overconfidence measures in the baseline regression as well as the regression with the full set of control variables. We find that

[12] To calculate the percentage change in odds ratio due to CEO overconfidence, we exponentiate the coefficient of CEO overconfidence and subtract 1, 36%=exp(0.306)-1.

both the coefficient estimate of CEO and of CFO overconfidence from columns 1 to 4 are robust. That is, both the CEO and the CFO have a significant impact on debt financing decisions.

Turning to firm-level control variables, the estimated coefficients are generally similar to those found in the existing capital-structure literature. Profitability, tangibility and firm size significantly increase the likelihood of debt issues, reflecting easier access to bank loans or bond markets for firms with stable cash flow (profit) and sufficient collateral (tangible asset and size). We also find that q is negatively correlated with debt issues. One possible explanation is that a high value of q captures the overvaluation of the firm by the stock market. Hence the firm would time the market by issuing stock at favorable conditions. Indeed, in the tests reported below, we will find that q is positively correlated with equity issues.

Table III reports the results for Specification 2 which uses net equity issues indicator as the dependent variable and otherwise the same independent variables as in columns 1 to 7 in Table II. As for CEOs, we fail to find a significant effect of CEO overconfidence on equity issues: through all regressions, the coefficients of CEO overconfidence are not significant and the signs are indeterminate. Turning to CFO overconfidence, the estimated coefficients are significantly negative in all regressions and robust when controlling for CEO overconfidence, manager control variables, year fixed effects and industry fixed effects. Firm-level control variables also affect the likelihood of equity issues. As discussed above, a higher q predicts more equity issues, consistent with market-timing theories. Equity issues decrease in profitability and size.

One concern about the approach in Specification 1 and 2 is that, as in Malmendier, Tate, and Yan (2011), we cannot include firm fixed effects, which would allow us to separate managerial overconfidence from unobserved (time-invariant) firm characteristics. CEO and CFO overconfidence effects become insignificant, likely because the regression sample is limited to firm-years with net external financing. Thus, the variations within firms are not sufficient for the firm fixed-effects test. In the following test of Prediction 2, we follow the net financing deficit framework of Shyam-Sunder and Myers (1999), which allows us to use the whole sample. There, we will find a robust effect of CFO overconfidence on both debt and equity financing even when controlling for firm effects.

Overall, Table II and Table III suggest the CFO plays an important role in making capital structure decisions, but that the CEO also has significant influence on financial policies, especially on debt financing. Managerial overconfidence leads to a pronounced preference for debt over equity. However, at least for equity issues, we find a robust influence only of CFO overconfidence, while coefficient estimate of CEO overconfidence points only qualitatively in the right direction. To investigate further the lack of a significant CEO overconfidence effect, we graph the year by year equity-issuance behavior of firms with overconfident and non-overconfident CEOs (Figure 1a) and CFOs (Figure 1b) from 1996 to 2010. In every year, we split the total issuance volume into the percentages of firms with net equity issues by overconfident managers (black) and with non-overconfident managers (light grey). The percentages of firms with net equity issues that have overconfident CEOs are around 50% but fluctuate widel. In contrast, the percentages of firms with net equity issues by overconfident

CFOs are within the range of 30% to 40% in most years (Figure 1b). Spikes in 1998 and shortly before the financial crisis appear to drive the lack of a significantly negative effect.

B. Net Financing Deficit

We turn to testing Prediction 2: Given a financial deficit, overconfident managers prefer debt financing over equity financing. We repeat the standard 'financing deficit framework' of Shyam-Sunder and Myers (1999), which is also used in Malmendier, Tate and Yan (2011). The net financing deficit variable, by construction, measures the amount of financing needed in a given year. As overconfident managers and their rational peers might have a different baseline rate for using debt or equity financing, the appropriate approach when testing Prediction 2 is to examine the impact of managerial overconfidence on the correlation between the net financing deficit and external financing. An advantage to this approach is a larger sample size, as the full sample can be used in the regression. The specification for the OLS regression is as follows:

$$D_{it} = \beta_1 + \beta_2 FD_{it} + \beta_3 LTCEO_{it} + \beta_4 LTCFO_{it} + \beta_5 LTCEO_{it} * FD_{it} + \beta_6 LTCFO_{it} * FD_{it} + X_{it}'B + FD_{it} * X_{it}'B + \varepsilon_{it} \quad (3)$$

$$E_{it} = \beta_1 + \beta_2 FD_{it} + \beta_3 LTCEO_{it} + \beta_4 LTCFO_{it} + \beta_5 LTCEO_{it} * FD_{it} + \beta_6 LTCFO_{it} * FD_{it} + X_{it}'B + FD_{it} * X_{it}'B + \varepsilon_{it} \quad (4)$$

where D is Net Debt Issues, E is Net Equity Issues, and FD is the Net Financing Deficit. LTCEO and LTCFO are measures for managerial overconfidence. X is the usual set of manager-level and

firm-level control variables including executive stock and option holdings, changes in q, profitability, tangibility and size.

Table IV and Table V report results for Specification 3 and Specification 4 respectively. We control for firm effects throughout all regressions. The first two columns in Table IV show results for CEO overconfidence. Column 1 is a baseline OLS regression, which only includes the CEO overconfidence measure, its interaction with the net financing deficit and firm fixed effects. Column 2 adds a set of control variables including CEO stock and option holdings, firm-level variables, and year fixed effects to the set firm fixed effects. In column 3, we further add 2 the interaction effects of Net Financing Deficit with the control variables including the manager control variables, the firm-level control variables and year fixed effects.

In contrast with the results of Table II, we do not find a significant effect of CEO overconfidence on the sensitivity of net debt issues to the net financing deficit. The coefficients of CEO overconfidence interacted with net financing deficit are positive but insignificant. The regressions in columns 4 to 6 replace the CEO overconfidence measure with the CFO overconfidence measure and are otherwise identical to the regressions in columns 1 to 3. We find that CFO overconfidence increases the sensitivity of net debt issues to the net financing deficit significantly. The coefficient of the interaction of the CFO overconfidence measure and net financing deficit is between 0.115 and 0.209, and all coefficient estimates are significant at the 5% level (coefficient = 0.209, p-value = 0.045 in the baseline regression; coefficient = 0.207, p-value = 0.044 with control variables; coefficient = 0.115, p-value = 0.025 with control variables and all their interactions with net financing deficit). Then, we jointly add CEO and CFO overconfidence

measures to the regressions (columns 7 to 9). The estimated results remain very similar and robust. From the baseline regression to the regression with a full set of control variables, the estimated effects of CFO overconfidence on the sensitivity of net debt issues to net financing deficit are between 0.133 and 0.235 all significant at the 5% level. But the effects of CEO overconfidence remain all insignificant.

Table V reports the corresponding results for net equity issues. Similarly to the debt results, we do not find a significant impact of CEO overconfidence on the sensitivity of equity issues to the net financing deficit in all regressions. In contrast, the estimated coefficients of overconfident CFOs interacted with the net financing deficit are all negative, between -0.252 to -0.111, and significant at the 5% level (coefficient = -0.212, p-value = 0.064 in the baseline regression; coefficient = -0.212, p-value = 0.061 with control variables; coefficient = -0.111, p-value = 0.029 with control variables and all their interactions with net financing deficit). The estimated effects are robust to controlling for CEO overconfidence, manager-level variables, firm-level variables, year fixed effects, the interacted effects of all control variables with the net financing deficit and firm fixed effects.

These results are not consistent with Malmendier, Tate and Yan (2011), which find CEO overconfidence affects the sensitivity of net debt issues and net equity issues to net financing deficit significantly. We investigate whether specific subsets of firms or years are driving the results by estimates of the corresponding year-by-year coefficients of the sensitivity of Net Debt Issues to Net Financing Deficit of overconfident managers using Specification (3) and controlling for manager-level variables, firm-level variables, year fixed effects and 2-digit-SIC

industry fixed effects.[13] We find that the effects of overconfident CEOs on net debt issues and net equity issues are fairly consistent with the prediction of Malmendier, Tate and Yan (2011) (Prediction 2) in the years between 1998 and 2003 and in the years of 2009 and 2010, but not in other years. In contrast, the effects of CFO overconfidence are consistent with the model predictions in most sample years. In other words, our CFO results are not driven by specific firms or years but, beyond the general difference in sample period and sample composition, there is no clear explanation emerging for the difference in results.

The results regarding net equity issues (Table III and Table V) suggest that, for our sample period and in our sample firms, CEOs have a limited impact on equity financing policies while that CFO's influence is significant. The results of Table IV and Table V combined with previous results from Table II and Table III provide strong evidence that CFO traits matter for capital structure decisions and that the CFO is more important than the CEO in the case of equity financing. In other words, it is important to consider all relevant top managers when analyzing how top managers affect corporate decisions.

IV. Decisions about Investment and Mergers

A. Investment Expenditure – Cash Flow Sensitivity

We test whether overconfident managers have a higher level of investment-cash flow sensitivity (Prediction 3) using the following empirical framework:

[13] We do not include firm fixed effects because the size of subsamples is not large enough, which is between 200 and 550. Tables are available upon request.

$$I_{it} = \beta_1 + \beta_2 C_{it} + \beta_3 LTCEO_{it} + \beta_4 LTCFO_{it} + \beta_5 LTCEO_{it} * C_{it} + \beta_6 LTCFO_{it} * C_{it} + X_{it}'B + C_{it} * X_{it}'B + \varepsilon_{it} \quad (5)$$

where I is capital expenditure, C is cash flow, and both variables are normalized by assets at the beginning of the year. LTCEO and LTCFO are the managerial overconfidence measures. LTCEO*C and LTCFO*C are the interacted effects of managerial overconfidence and cash flow. X is a set of manager-level and firm-level control variables including managers' stock and vested options holdings, q and the natural logarithm of sales. C*X are the interacted effects of control variables with the cash flow.

As capital expenditure decisions are primarily determined by the CEO but not the CFO, we expect that only CEO overconfidence has a significant impact on capital expenditure - cash flow sensitivity but not the CFO overconfidence. However, we also note that the role of the CFO has broadened in recent years. Ben-David, Graham and Harvey (2010) report CFOs often have an MBA degree and participate in analyzing new investment projects. They find that firms with CFOs who miscalibrate stock market return volatilities and hold optimistic views of stock market returns have more net investment. In addition, the CFO might affect capital expenditure decisions indirectly by making financial forecasts for the CEO or helping the CEO prepare a capital budget.

Table VI reports the results for Specification 5. We control for firm fixed effects in all regressions. Standard errors are clustered at the firm level. Columns 1 to 3 estimate the impact of

CEO overconfidence on capital expenditure-cash flow sensitivity. In the baseline regression in column 1, we only add cash flow, CEO overconfidence measure and its interaction with cash flow and firm fixed effect. The estimated coefficient on the interaction of CEO overconfidence measure with cash flow is significantly positive at the 5% level (coefficient = 0.067, p-value = 0.036). The estimated result is robust to adding executive control variables, firm level control variables and year dummies in column 2 (coefficient = 0.062, p-value = 0.042), and to further adding interaction effects of the full set of control variables with cash flow in column 3 (coefficient = 0.068, p-value = 0.021), consistent with prior findings.

In columns 4 to 6, we replace the CEO overconfidence measure with the CFO overconfidence measure. In contrast to the findings for CEOs, CFO overconfidence does not increase the sensitivity of investment to cash flow. The estimated coefficients of CFO overconfidence interacted with cash flow is around zero and insignificant. Finally, in columns 7 to 9, we estimate the impact of CEO and CFO overconfidence jointly. The results are robust: only CEO overconfidence significantly increases the investment-cash flow sensitivity but not CFO overconfidence. The estimated effect of CEO overconfidence remains very similar (coefficient = 0.073, p-value = 0.018), controlling for cash flow, CFO overconfidence effects, managers' stock and vested option holdings, q, size, year fixed effects, the interacted effects of all control variables with cash flow and firm fixed effects.

In light of the findings by Ben-David, Graham and Harvey (2010) that CFO miscailibration and optimism affect firms' net investment, we also perform the corresponding

test on our sample using our measure of overconfidence.[14] We examine whether CEO or CFO overconfidence increase firm net investment. The results are presented in Appendix-Table A-II. We do not find significant effects of CFO overconfidence on net investment. However, we find firms with overconfident CEOs tend to have more net investment.

We also tested whether there might be a more pronounced CFO effect in more recent years, given that the role of the CFO has been expanding into a more operational and strategic direction (Fabozzi, Drake and Polimeni (2007)). Specifically we split our sample into 1996-2002, and 2003-2010 or, alternatively, into 1996-2000 and 2001-2005 and 2006-2010. However, in neither case we find a significant effect of CFO overconfidence.

To further examine whether CFOs affect non-financial decisions, we analyze the impact of managerial overconfidence of CEOs and CFOs on firm innovation decisions. Hirshleifer, Low and Teoh (forthcoming) point out that people tend to be more overconfident about their performance on difficult than easy task, the 'difficulty effect' in Griffin and Tversky (1992) and show that overconfident CEOs invest more in innovative projects, obtain more patents and have more patent citations. Galasso and Simcoe (2011) have similar findings that overconfident CEOs have more R&D expenditure, more patents and more patent citations using the same overconfidence measure and sample of Malmendier and Tate (2005, 2008). Given the existing empirical evidence and the fact that innovation policies are far beyond the managerial duties and

[14] The independent variables in our test are very similar to those of Ben-David, Graham and Harvey (2010). However, there is some differences. Our overconfidence measures are based on the optimism of CEOs and CFOs about his own firm while theirs are based on the optimism of CFOs about stock market return. Besides, we cluster standard errors at firm level while they cluster standard error at the two-digit SIC level. Our sample includes small, median and large firms while their sample mainly consists of large firms.

business expertise of the CFO, it is interesting to test whether CFOs also have an impact on firm innovation decisions: Do overconfident CEOs choose a higher R&D intensity (R&D expenditure normalized by total assets) or a higher share of R&D expenditure (relative to total investment) than their rational peers? The results are presented in Appendix-Table A-III. Overconfident CEOs have higher R&D Intensity and their investment composition is more innovative, but CFO overconfidence does not affect innovation investment.

Overall our findings indicate that CEO overconfidence affects investment and innovation decisions significantly, consistent with existing managerial overconfidence literature. However, we do not find evidence that the role of the CFO transcends financial decisions. CFO overconfidence does not have a significant impact on investment or innovation decisions. These findings provide new evidence for how managerial duties affect the impact of top managers on corporate policies and offer, indirectly, a corroboration of the existing option-based approach to measuring overconfidence.

We also test whether the interacted effects of overconfident CEOs and overconfident CFOs on both financial and non-financial corporate decisions (Appendix-Table A-IV). We find the interaction of overconfident CEOs and overconfident CFOs strengthens the impact of biased belief in the case of net investment and of R&D investment. However, the interacted effects are not significant on financial decisions and investment-cash flow sensitivities.

B. Acquisitions

Overconfident managers are unambiguously more acquisitive only when they have abundant internal capital (Prediction 4). To test Prediction 4 and control for internal capital, we sort the whole sample according to a firm's cash and short-term investments at the beginning of the year. The top 20% are identified as cash-rich firms and the lowest 20% are identified as cash-poor firms.[15] Alternatively, given that debt financing is a popular financing source for acquisitions, we separate firms according to their book leverage at the beginning of the year, assuming that the debt financing capacity decreases with the book leverage. The lowest 20% are identified as firms with high debt financing capacity (low book leverage) and the top 20% are identified as firms with low debt financing capacity (high book leverage). The sample splits generated by these two sorting methods are positively correlated. The empirical specification is:

$$ACQ_{it} = \beta_1 + \beta_2 C_{it} + \beta_3 LTCEO_{it} + \beta_4 LTCFO_{it} + X_{it}'B + \varepsilon_{it} \quad (6)$$

Where ACQ is acquisition expenditures normalized by assets at the beginning of the year. LTCEO and LTCFO are the managerial overconfidence measures. X is a set of manager-level and firm-level control variables including stock ownership, vested options, q and ln(sales). Year fixed effects and firm fixed effects are also included. Standard errors are clustered at the firm level. As merger decisions are primarily determined by the CEO not the CFO, we expect that only overconfident CEOs in firms with sufficient internal capital or low book leverage have significantly greater acquisition expenditures, but not the CFO.

[15] We confirmed the results are robust when the threshold changes from 20% to either 25% or 30%.

Table VII shows the estimated results of Specification 6 for each of the two sample partitions. Panel A's sample partition is based on holdings of cash and short-term investment. Columns 1 to 3 report results for cash-rich firms. The estimated coefficient for CEO overconfidence is around 0.075, significant at the 10% level (p-value=0.070), robust to the CFO overconfidence effect, manager-level and firm-level control variables, year fixed effects and firm fixed effects. The estimated coefficient for CFO overconfidence is always insignificant. Turning to the results for cash-poor firms shown in columns 4 to column 6, we do not find any significant impact of CEO overconfidence or CFO overconfidence on firm acquisition expenditures, consistent with Prediction 4.

Panel B reports results from regressions using a sample partitioned by book leverage. The results are similar to Panel A. Only overconfident CEOs in firms with low book leverage (and thus high debt financing capacity) have a significant impact on acquisition expenditures. In column 3, the estimated coefficient for CEO overconfidence is around 0.028, significant at the 10% level (p-value=0.064), robust to the CFO overconfidence effect, manager-level and firm-level control variables, year fixed effects and firm fixed effects.

Finally, column 7 of both Panel A and Panel B estimate the coefficients for CEO and CFO overconfidence jointly using the full sample. The estimated coefficient for CEO overconfidence is still significantly positive, now at the 5% level (coefficient=0.021, p-value=0.037), which is consistent with Prediction 4. In all regressions, the estimated coefficients for CFO overconfidence are insignificant.

Overall, the findings of Table VII support Prediction 4: Only overconfident CEOs in firms with sufficient internal capital or low book leverage spend significantly more on acquisition, but not overconfident CFOs, consistent with the theoretical model of overconfidence and the differences in managerial duties between the role of the CEO and the CFO.

V. Conclusion

We test, separately and jointly, whether CEO overconfidence and CFO overconfidence affect various types of corporate decisions. We find that CFOs' behavioral traits are crucial for capital structure decisions while CEOs' behavioral traits are the key to investment, innovation and acquisitions policies as well as partially influential on financial policies. We find that firms with overconfident CFOs are more likely to issue debt and less likely to issue equity when accessing external capital, while overconfident CEOs only affect debt financing decisions. With regards to investment, innovation and acquisitions decisions, which are generally outside the managerial duties of the CFO, we show that only CEO overconfidence has a significant impact. CEO overconfidence is positively associated with investment-cash flow sensitivity, and more acquisition expenditures when internal capital is rich or leverage is low.

Our findings point to a significant role of managerial biases in corporate decisions beyond the person of the CEO. While the exact mechanism by which the personal traits of top managers affects corporate policies is still in the black box, this paper suggests that managerial duties affect how top managers influence corporate policies. The economic implications of

managerial characteristics are richer than what has been previously demonstrated, and future research of interaction and peer effects is warranted and necessary.

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Figure 1. Percentage of Net Equity Issues by Overconfident Managers

Figure 1a.

The figure shows year-by-year percentage of net equity issues, separately for overconfident CEOs (LTCEO) and the remaining sample of CEOs (NonLTCEO). The percentage for LTCEO (NonLTCEO) group is calculated as the number of overconfident CEOs (non-overconfident CEOs) who had net equity issues by the total number of CEOs with net equity issues in a given year. Years are fiscal years.

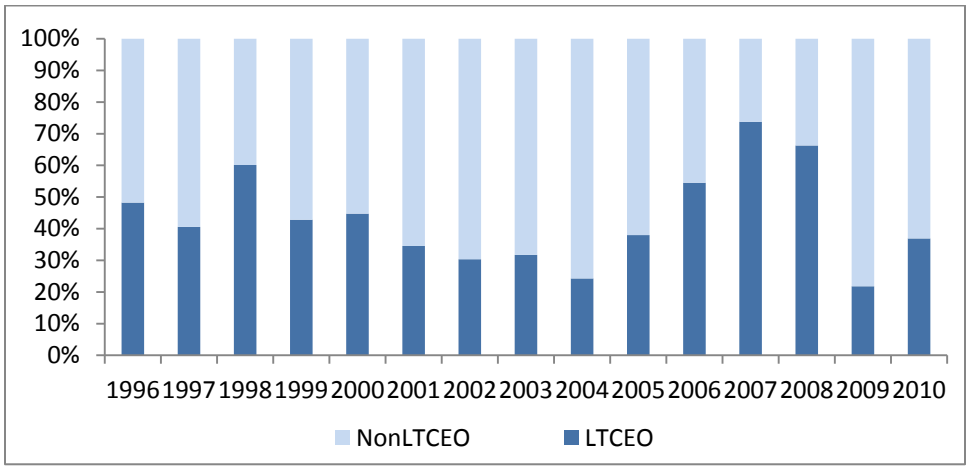

Figure 1b.

The figure shows year-by-year percentage of net equity issues, separately for overconfident CFOs (LTCFO) and the remaining sample of CFOs (NonLTCFO). The percentage for LTCFO (NonLTCFO) group is calculated as the number of overconfident CFOs (non-overconfident CFOs) who had net equity issues by the total number of CFOs with net equity issues in a given year. Years are fiscal years.

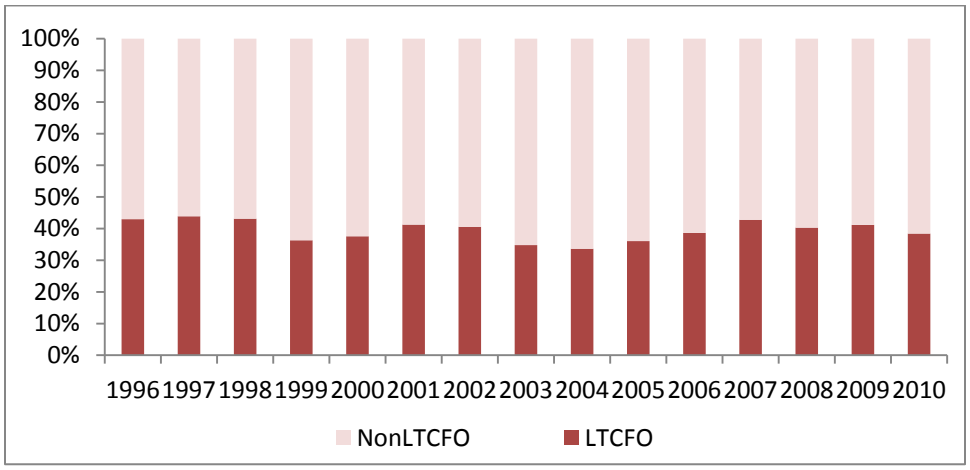

Table I. Summary Statistics

Table I present summary statistics of the sample. Panel A presents summary statistics of firm variables. The number of sample firms is 1,156. Panel B presents summary statistics of manager variables. The sample includes 1,458 CEOs and 1,466 CFOs. Variable definitions are provided in Appendix-Table A I.

Panel A. Firm Variables (Full Sample)

Variables	Obs.	Mean	Median	SD
Asset($m)	6229	5169	1289	15151
Sales($m)	6229	5238	1306	17599
Capital($m)	6229	1829	269	6561
Net Financing Deficit($m)	6229	37	6	1016
Capital Expenditure($m)	6229	324	55	1207
R&D Expenditure($m)	6229	107	4	434
Acquisition Expenditures($m)	6229	125	1	601
Cash Flow($m)	6229	573	125	1934
Net Financing Deficit/assets(t-1)	6229	0.044	0.008	0.209
Net Debt Issues/Assets(t-1)	6229	0.024	0.000	0.137
Net Debt Issues Indicator	6229	0.329	0.000	0.470
Net Equity Issues/Assets(t-1)	6229	-0.006	0.000	0.142
Net Equity Issues Indicator	6229	0.503	1.000	0.500
Capital expenditure /Assets(t-1)	6229	0.069	0.046	0.077
Net Investment Intensity	6229	0.119	0.078	0.189
R&D Intensity	6229	0.037	0.004	0.062
R&D Shares	6229	0.278	0.075	0.325
Capital intensity	6229	5.493	5.478	1.078
Acquisitions Intensity	6229	0.045	0.001	0.132
Cash Flow/Asset(t-1)	6229	0.124	0.121	0.088
Book Leverage	6229	0.290	0.274	0.348
Market Leverage	6229	0.170	0.122	0.181
Market to Book Ratio	6229	1.946	1.453	1.875
Q	6229	2.235	1.741	1.861
Change in Q	6229	-0.041	0.011	1.601
Profitability	6229	0.185	0.172	0.225
Change in Profitability	6229	-0.006	0.001	0.206
Tangibility	6229	0.331	0.243	0.448
Change in Tangibility	6229	-0.014	-0.004	0.374
ln(Sales)	6229	7.168	7.079	1.539
Change in ln(Sales)	6229	0.106	0.094	0.214

Table I. Summary Statistics

Panel B. CEO Variables

Overconfident CEOs are those who at some point during their tenure held exercisable options until the last year before expiration, given that the options were at least 40% in the money entering their last year. Stock Ownership is the option-excluded shares held by CEOs as a percentage of common shares outstanding. Vested Options is the number of exercisable options held by CEOs as a percentage of common shares outstanding.

	Full Sample					
	Number of CEOs = 1,458					
Variables	Obs.	Mean	Median	SD	Min.	Max.
Stock Ownership (%)	6229	2.05	0.36	5.44	0.00	81.13
Vested Options (%)	6229	0.98	0.61	1.22	0.00	18.57

	Overconfident CEO Sample					
	Number of Overconfident CEOs = 735					
Variables	Obs.	Mean	Median	SD	Min.	Max.
Stock Ownership (%)	3595	2.21	0.44	5.55	0.00	81.13
Vested Options (%)	3595	1.09	0.71	1.33	0.00	18.57

Panel C. CFO Variables

Overconfident CFOs are those who at some point during their tenure held exercisable options until the last year before expiration, given that the options were at least 40% in the money entering their last year. Stock Ownership is the option-excluded shares held by CFOs as a percentage of common shares outstanding. Vested Options is the number of exercisable options held by CFOs as a percentage of common shares outstanding.

	Full Sample					
	Number of CFOs = 1,466					
Variables	Obs.	Mean	Median	SD	Min.	Max.
Stock Ownership (%)	6229	0.17	0.05	0.77	0.00	22.90
Vested Options (%)	6229	0.25	0.14	0.35	0.00	4.39

	Overconfident CFO Sample					
	Number of Overconfident CFOs = 475					
Variables	Obs.	Mean	Median	SD	Min.	Max.
Stock Ownership (%)	2525	0.23	0.07	1.03	0.00	22.90
Vested Options (%)	2525	0.29	0.18	0.38	0.00	4.16

Table II. Financial Policies: Net Debt Issues

Table II has logit regressions with the Net Debt Issues Indicator as the dependent variable. Coefficients are reported as log odds ratios. The Net Debt Issues Indicator is a binary variable which equals 1 if Net Debt Issues during the year are positive. Net Debt Issues is long term debt minus long term debt reduction. LTCEO/LTCFO is a binary variable where 1 signifies that the CEO/CFO at some point during his tenure held exercisable options until the last year before expiration, given that the options were at least 40% in the money entering their last year. Stock Ownership is option-excluded shares held by the CEO/CFO as a percentage of common shares outstanding. Vested Options is the number of exercisable options held by the CEO/CFO as a percentage of common shares outstanding. Q is the book value of assets plus the market value of equity minus the book value of equity minus deferred tax, divided by the book value of assets. Profitability is operating income before depreciation divided by assets at the beginning of the year. Tangibility is property, plants and equipment divided by assets at the beginning of the year. Book Leverage is the sum of current liabilities and long term debt divided by the sum of current liabilities, long term debt and book equity. Stock Ownership, Vested Options, Q, Profitability, Tangibility, ln(Sales), and Book Leverage are measured at the beginning of the year. The 2-digit SIC level industry fixed effects are included in all regressions. All standard errors are adjusted for clustering at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LTCEO	0.306***	0.223***			0.251***	0.287***	0.178**
	(0.084)	(0.086)			(0.086)	(0.090)	(0.089)
Stock Ownership CEO		-0.006				-0.021*	-0.006
		(0.009)				(0.011)	(0.009)
Vested Options CEO		0.021				-0.071	0.031
		(0.037)				(0.045)	(0.041)
LTCFO			0.297***	0.225***	0.237***	0.251***	0.193**
			(0.087)	(0.087)	(0.089)	(0.094)	(0.090)
Stock Ownership CFO				-0.042		-0.080	-0.034
				(0.067)		(0.105)	(0.066)
Vested Options CFO				0.012		-0.468***	-0.025
				(0.129)		(0.165)	(0.142)
Q		-0.149***		-0.150***			-0.149***
		(0.035)		(0.035)			(0.035)
Profitability		2.134***		2.132***			2.134***
		(0.430)		(0.432)			(0.432)
Tangibility		0.446*		0.436*			0.442*
		(0.245)		(0.246)			(0.246)
ln(Sales)		0.425***		0.425***			0.422***
		(0.036)		(0.036)			(0.037)
Book Leverage		-0.008		-0.015			-0.009
		(0.073)		(0.071)			(0.072)
Year Fixed Effects		Yes		Yes		Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,246	4,246	4,246	4,246	4,246	4,246	4,246

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table III. Financial Policies: Net Equity Issues

Table III contains the results for logit regressions with the Net Equity Issues Indicator as the dependent variable. Coefficients are reported as log odds ratios. The Net Equity Issues Indicator is a binary variable which equals 1 if Net Equity Issues during the year are positive. Net Equity Issues is sales of common stock minus stock repurchases. LTCEO/LTCFO is a binary variable where 1 signifies that the CEO/CFO at some point during his tenure held exercisable options until the last year before expiration, given that the options were at least 40% in the money entering their last year. Stock Ownership is option-excluded shares held by the CEO/CFO as a percentage of common shares outstanding. Vested Options is the number of exercisable options held by the CEO/CFO as a percentage of common shares outstanding. Q is the book value of assets plus the market value of equity minus the book value of equity minus deferred tax, divided by the book value of assets. Profitability is operating income before depreciation divided by assets at the beginning of the year. Tangibility is property, plants and equipment divided by assets at the beginning of the year. Book Leverage is the sum of current liabilities and long term debt divided by the sum of current liabilities, long term debt and book equity. Stock Ownership, Vested Options, Q, Profitability, Tangibility, ln(Sales), and Book Leverage are measured at the beginning of the year. The 2-digit SIC level industry fixed effects are included in all regressions. All standard errors are adjusted for clustering at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LTCEO	-0.147	-0.035			-0.096	-0.136	0.016
	(0.103)	(0.109)			(0.103)	(0.107)	(0.108)
Stock Ownership CEO		0.012				0.032**	0.011
		(0.012)				(0.016)	(0.012)
Vested Options CEO		-0.045				0.082	-0.061
		(0.043)				(0.056)	(0.047)
LTCFO			-0.248**	-0.196*	-0.226**	-0.263**	-0.213*
			(0.109)	(0.115)	(0.109)	(0.116)	(0.116)
Stock Ownership CFO				0.159*		0.295**	0.139
				(0.094)		(0.133)	(0.095)
Vested Options CFO				-0.019		0.687***	0.071
				(0.165)		(0.240)	(0.188)
Q		0.139***		0.143***			0.142***
		(0.044)		(0.044)			(0.045)
Profitability		-3.234***		-3.225***			-3.251***
		(0.516)		(0.520)			(0.525)
Tangibility		0.713**		0.732**			0.717**
		(0.311)		(0.310)			(0.312)
ln(Sales)		-0.555***		-0.543***			-0.547***
		(0.047)		(0.047)			(0.048)
Book Leverage		0.154		0.138			0.146
		(0.144)		(0.143)			(0.144)
Year Fixed Effects		Yes		Yes		Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,239	4,239	4,239	4,239	4,239	4,239	4,239

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table IV. Financial Policies: Financing Deficit and Net Debt Issues

Table IV presents the results for OLS regressions with Net Debt Issues normalized by assets at the beginning of the year as the dependent variable. Net Debt Issues is long term debt minus long term debt reduction. LTCEO/LTCFO is a binary variable where 1 signifies that the CEO/CFO at some point during his tenure held exercisable options until the last year before expiration, given that the options were at least 40% in the money entering their last year. FD is Net Financing Deficit which is cash dividends plus investment plus change in working capital minus cash flow after interest and taxes, normalized by assets at the beginning of the year, which is identical to that in Malmendier, Tate and Yan (2011). Manager-level control variables include Stock Ownership and Vested Options. Stock Ownership is option-excluded shares held by the CEO/CFO as a percentage of common shares outstanding. Vested Options is the number of exercisable options held by the CEO/CFO as a percentage of common shares outstanding. Firm-level control variables include changes in Q, Profitability, Tangibility and ln(Sales). Q is the book value of assets plus the market value of equity minus the book value of equity minus deferred tax, divided by the book value of assets. Profitability is operating income before depreciation divided by assets at the beginning of the year. Tangibility is property, plants and equipment divided by assets at the beginning of the year. Manager-level and firm-level control variables are all measured at the beginning of the year. Firm fixed effects are included in all regressions. All standard errors are adjusted for clustering at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FD	0.465***	0.463***	0.401***	0.410***	0.408***	0.314***	0.432***	0.430***	0.357***
	(0.088)	(0.087)	(0.104)	(0.066)	(0.066)	(0.104)	(0.087)	(0.086)	(0.104)
LTCEO	0.001	0.001	-0.001				0.002	0.001	0.000
	(0.006)	(0.006)	(0.006)				(0.006)	(0.007)	(0.006)
LTCEO*FD	0.047	0.046	0.001				-0.056	-0.057	-0.058
	(0.114)	(0.111)	(0.051)				(0.099)	(0.097)	(0.051)
LTCFO				-0.014	-0.015	-0.006	-0.015	-0.015	-0.007
				(0.010)	(0.010)	(0.008)	(0.011)	(0.010)	(0.008)
LTCFO* FD				0.209**	0.207**	0.115**	0.235**	0.233**	0.133**
				(0.104)	(0.103)	(0.051)	(0.098)	(0.097)	(0.052)
Manager Variables		Yes	Yes		Yes	Yes		Yes	Yes
Manager Variables*FD			Yes			Yes			Yes
Firm Variables		Yes	Yes		Yes	Yes		Yes	Yes
Firm Variables*FD			Yes			Yes			Yes
Year Fixed Effects		Yes	Yes		Yes	Yes		Yes	Yes
Year Fixed Effects*FD			Yes			Yes			Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,229	6,229	6,229	6,229	6,229	6,229	6,229	6,229	6,229
R-squared	0.480	0.504	0.626	0.500	0.523	0.629	0.501	0.524	0.632

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table V. Financial Policies: Financing Deficit and Net Equity Issues

Table V presents the results for OLS regressions with Net Equity Issues normalized by assets at the beginning of the year as the dependent variable. Net Equity Issues is sales of common stock minus stock repurchases. LTCEO/LTCFO is a binary variable where 1 signifies that the CEO/CFO at some point during his tenure held exercisable options until the last year before expiration, given that the options were at least 40% in the money entering their last year. FD is Net Financing Deficit which is cash dividends plus investment plus change in working capital minus cash flow after interest and taxes, normalized by assets at the beginning of the year, which is identical to that in Malmendier, Tate and Yan (2011). Manager-level control variables include Stock Ownership and Vested Options. Stock Ownership is option-excluded shares held by the CEO/CFO as a percentage of common shares outstanding. Vested Options is the number of exercisable options held by the CEO/CFO as a percentage of common shares outstanding. Firm-level control variables include changes in Q, Profitability, Tangibility and ln(Sales). Q is the book value of assets plus the market value of equity minus the book value of equity minus deferred tax, divided by the book value of assets. Profitability is operating income before depreciation divided by assets at the beginning of the year. Tangibility is property, plants and equipment divided by assets at the beginning of the year. Manager-level and firm-level control variables are all measured at the beginning of the year. Firm fixed effects are included in all regressions. All standard errors are adjusted for clustering at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FD	0.419***	0.422***	0.459***	0.489***	0.491***	0.556***	0.454***	0.457***	0.507***
	(0.099)	(0.100)	(0.095)	(0.074)	(0.074)	(0.094)	(0.098)	(0.099)	(0.096)
LTCEO	-0.002	-0.004	-0.000				-0.003	-0.004	-0.002
	(0.007)	(0.007)	(0.006)				(0.007)	(0.007)	(0.006)
LTCEO*FD	-0.023	-0.025	0.024				0.087	0.086	0.085
	(0.125)	(0.124)	(0.055)				(0.108)	(0.107)	(0.054)
LTCFO				0.015	0.016	0.006	0.016	0.018*	0.008
				(0.011)	(0.010)	(0.007)	(0.011)	(0.010)	(0.007)
LTCFO* FD				-0.212*	-0.212*	-0.111**	-0.252**	-0.251**	-0.143***
				(0.114)	(0.113)	(0.051)	(0.106)	(0.104)	(0.049)
Manager Variables		Yes	Yes		Yes	Yes		Yes	Yes
Manager Variables*FD			Yes			Yes			Yes
Firm Variables		Yes	Yes		Yes	Yes		Yes	Yes
Firm Variables*FD			Yes			Yes			Yes
Year Fixed Effects		Yes	Yes		Yes	Yes		Yes	Yes
Year Fixed Effects*FD			Yes			Yes			Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,229	6,229	6,229	6,229	6,229	6,229	6,229	6,229	6,229
R-squared	0.394	0.423	0.601	0.420	0.448	0.605	0.423	0.452	0.610

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table VI. Investment-Cash Flow Sensitivity

Included in Table VI are results for OLS regressions with capital expenditure normalized by assets at the beginning of the year as the dependent variable. CF is Cash Flow, which is earnings before extraordinary items plus depreciation normalized by assets at the beginning of the year. Cash Flow is trimmed at 1% level. LTCEO/LTCFO is a binary variable where 1 signifies that the CEO/CFO at some point during his tenure held exercisable options until the last year before expiration, given that the options were at least 40% in the money entering their last year. Manager-level control variables include Stock Ownership and Vested Options. Stock Ownership is option-excluded shares held by the CEO/CFO as a percentage of common shares outstanding. Vested Options is the number of exercisable options held by the CEO/CFO as a percentage of common shares outstanding. Firm-level control variables include Q and ln(Sales). Q is the book value of assets plus the market value of equity minus the book value of equity minus deferred tax, divided by the book value of assets. Q and ln(Sales) are measured at the beginning of the year. Firm fixed effects are included in all regressions. All standard errors are adjusted for clustering at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Cash Flow	0.160***	0.108***	0.309***	0.206***	0.151***	0.382***	0.172***	0.121***	0.360***
	(0.020)	(0.019)	(0.115)	(0.020)	(0.019)	(0.106)	(0.021)	(0.020)	(0.114)
LTCEO	-0.001	-0.004	-0.005				-0.003	-0.006	-0.007
	(0.005)	(0.004)	(0.004)				(0.005)	(0.004)	(0.004)
LTCEO* CF	0.067**	0.062**	0.068**				0.080**	0.071**	0.073**
	(0.032)	(0.030)	(0.029)				(0.033)	(0.031)	(0.031)
LTCFO				0.000	0.001	0.001	0.002	0.002	0.003
				(0.006)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)
LTCFO* CF				-0.030	-0.030	-0.025	-0.051	-0.047	-0.044
				(0.035)	(0.032)	(0.030)	(0.036)	(0.033)	(0.032)
Manager Control Variables		Yes	Yes		Yes	Yes		Yes	Yes
Manager Control Variables * CF			Yes			Yes			Yes
Firm Control Variables		Yes	Yes		Yes	Yes		Yes	Yes
Firm Control Variables * CF			Yes			Yes			Yes
Year Fixed Effects		Yes	Yes		Yes	Yes		Yes	Yes
Year Fixed Effects * CF			Yes			Yes			Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,229	6,229	6,229	6,229	6,229	6,229	6,229	6,229	6,229
R-squared	0.082	0.172	0.186	0.079	0.171	0.187	0.084	0.175	0.190

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table VII. Acquisitions

The results below are for OLS regressions with acquisition expenditures normalized by assets at the beginning of the year as the dependent variable. LTCEO/LTCFO is a binary variable where 1 signifies that the CEO/CFO at some point during his tenure held exercisable options until the last year before expiration, given that the options were at least 40% in the money entering their last year. Manager-level control variables include Stock Ownership and Vested Options. Stock Ownership is option-excluded shares held by the CEO/CFO as a percentage of common shares outstanding. Vested Options is the number of exercisable options held by the CEO/CFO as a percentage of common shares outstanding. Q is the book value of assets plus the market value of equity minus the book value of equity minus deferred tax, divided by the book value of assets. Q and ln(Sales) are measured at the beginning of the year. Firm fixed effects are included in all regressions. Firm fixed effects are included in all regressions. All standard errors are adjusted for clustering at the firm level.

Panel A. Split Sample by Cash and Short-Term Investments

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Cash-Rich Firms			Cash-Poor Firms			Full Sample
LTCEO	0.075*		0.075*	0.013		0.007	0.021**
	(0.041)		(0.041)	(0.019)		(0.016)	(0.010)
LTCFO		-0.053	-0.055		0.024	0.027*	-0.007
		(0.061)	(0.061)		(0.018)	(0.016)	(0.009)
Q	-0.001	-0.001	-0.001	0.071***	0.068***	0.068***	0.004**
	(0.001)	(0.001)	(0.001)	(0.020)	(0.020)	(0.020)	(0.002)
ln(Sales)	-0.015	-0.011	-0.013	-0.030	-0.042	-0.039	-0.034***
	(0.020)	(0.020)	(0.020)	(0.026)	(0.026)	(0.026)	(0.010)
Manager Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,232	1,232	1,232	1,232	1,232	1,232	6,157
R-squared	0.031	0.027	0.034	0.071	0.082	0.086	0.018

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Panel B. Split Sample by Book Leverage

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Low-Leveraged Firms			High-Leveraged Firms			Full Sample
LTCEO	0.030*		0.028*	0.011		0.009	0.021**
	(0.018)		(0.015)	(0.016)		(0.017)	(0.010)
LTCFO		0.014	0.009		0.031	0.030	-0.007
		(0.021)	(0.020)		(0.027)	(0.026)	(0.009)
Q	-0.000	0.000	0.000	0.001	-0.000	-0.001	0.004**
	(0.001)	(0.001)	(0.001)	(0.021)	(0.021)	(0.021)	(0.002)
ln(Sales)	0.016	0.021*	0.019	-0.083***	-0.086***	-0.085***	-0.034***
	(0.012)	(0.012)	(0.012)	(0.031)	(0.031)	(0.030)	(0.010)
Manager Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,232	1,232	1,232	1,231	1,231	1,231	6,157
R-squared	0.042	0.047	0.049	0.051	0.054	0.054	0.018

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Appendix-Table A-I. Variable Definitions

Manger Variables	Constructed from Thomson Insider Filing Dataset, CRSP and Execucomp
LHCEO/LHCFO	a binary variable where 1 signifies that the CEO/CFO at some point during his tenure held exercisable options until the last year before expiration, given that the options were at least 40% in the money entering their last year.
Stock Ownership	option-excluded shares held by the CEO/CFO as a percentage of common shares outstanding.
Vested Options	the number of exercisable options held by the CEO/CFO as a percentage of common shares outstanding.
Firm Variables	Constructed from Compustat
Net Debt Issues ($m)	long term debt issuance (item 111) - long term debt reduction (item 114).
Net Debt Issues Indicator	a binary variable where 1 signifies that Net Debt Issues during the year is positive.
Net Equity Issues ($m)	sales of common stock (item 108) - stock repurchases (item 115).
Net Equity Issues Indicator	a binary variable where 1 signifies that Net Equity Issues during the year is positive.
Net Financing Deficit($m)	cash dividends (item 127) + investment + change in working capital – cash flow after interest and taxes. Investment is items 128 + 113 + 129 + 219 - 107 - 109 for firms with cash flow format code 1 to 3; and is items 128 + 113 + 129 - 107 - 109 - 309 – 310 for firms with cash flow format code 7; and is 0 for other firms. Change in working capital is items 236 + 274 + 301 for firms with cash flow format code 1; and is items −236 + 274 – 301 for firms with cash flow format code 2 and 3; and is items −302 − 303 − 304 − 305 − 307 + 274 − 312 – 301 for firms with cash flow format code 7; and is 0 for other firms. Cash flow after interest and taxes is items 123 + 124 + 125 + 126 + 106 + 213 + 217 + 218 for firms with cash flow format code 1 to 3; and is items 123 + 124 + 125 + 126 + 106 + 213 + 217 + 314 for firms with cash flow format code 7; and is 0 for other firms.
Capital Expenditure($m)	item 128. Missing values are replaced with 0.
R&D Expenditure($m)	item 46. Missing values are replaced with 0.
Acquisition Expenditures($m)	item 129. Missing values are replaced with 0.
Cash Flow($m)	Earnings before extraordinary items (item 18) + depreciation (item 14). Cash flow normalized by lagged assets (item 6) is trimmed at 1% level.
Net Investment Intensity	net investment / lagged assets = (capital expenditure (item 128) + increase in investments (item 113) + acquisitions (item 129) - sales of property, plant and equipment (item 107) - sale of investments (item 109)) / lagged assets (item 6).

R&D Intensity	R&D expenditure (item 46) / lagged assets (item 6).
R&D Share	R&D expenditure (item 46) / (R&D expenditure (item 46) + (item 128)).
Capital intensity	ln (1+ assets (item 6) / employees (item 146)).
Book Leverage	(long-term debt (item 9) + debt in current liabilities item 34)) / (long-term debt (item 9) + debt in current liabilities (item 34) + common equity (item 60)).
Market Leverage	(long-term debt (item 9) + debt in current liabilities item (34)) / (price (item 199) * common shares outstanding (item 25) + debt in current liabilities (item 34) + long-term debt (item 9) + preferred stock-liquidating value (item 10) - deferred taxes and investment tax credit (item 35)).
Market to Book Ratio	(price (item 199) * common shares outstanding (item 25) + debt in current liabilities (item 34) + long-term debt (item 9) + preferred stock-liquidating value (item 10) - deferred taxes and investment tax credit (item 35)) / assets (item 6).
Q	(assets (item 6) + price (item 199) * common shares outstanding (item 25) – common equity (item 60) - balance sheet deferred taxes and investment tax credit (item 35)) / assets (item 6).
Profitability	operating profit (item 13) / lagged assets (item 6).
Changes in Profitability	profitability - lagged profitability.
Tangibility	property, plants and equipment (item 8) / lagged assets (item 6).
Changes in Tangibility	tangibility - lagged tangibility.
ln(Sales)	ln(sales (item12)).
Changes in ln(Sales)	ln(sales) - lagged ln(sales).
Repurchases	a binary variable where 1 signifies repurchased common and preferred stock (item 115) is positive and 0 otherwise.
Dividends	a binary variable where 1 signifies declared dividends (item 21) is positive and 0 otherwise.
Past 12 Month Returns	stock-level cumulative value-weighted firm monthly returns over the past 12 months from CRSP.

Appendix-Table A-II. Net Investment Intensity

The following table presents the results for OLS regressions with Net Investment Intensity as the dependent variable. Net Investment Intensity is capital expenditure plus increase in investments plus acquisitions minus sales of property, plant and equipment minus sales of investments, divided by lagged assets. LTCEO/LTCFO is a binary variable where 1 signifies that the CEO/CFO at some point during his tenure held exercisable options until the last year before expiration, given that the options were at least 40% in the money entering their last year. Manager-level control variables include Stock Ownership and Vested Options. Stock Ownership is option-excluded shares held by the CEO/CFO as a percentage of common shares outstanding. Vested Options is the number of exercisable options held by the CEO/CFO as a percentage of common shares outstanding. Firm-level control variables include Market to Book Ratio, ln(Sales), Profitability, Dividends, Stock Repurchases, Market Leverage and Past 12 Month Returns. Definitions of variables are provided in Appendix-Table A-I. Manager-level and firm-level control variables are all measured at the beginning of the year. Firm fixed effects are included in all regressions. All standard errors are adjusted for clustering at the firm level.

	(1)	(2)	(3)	(4)	(5)	(6)
LTCEO	0.027***	0.021*			0.028***	0.022*
	(0.010)	(0.011)			(0.010)	(0.011)
Stock Ownership CEO		0.001				0.001
		(0.001)				(0.001)
Vested Options CEO		0.001				0.003
		(0.003)				(0.003)
LTCFO			-0.019	-0.016	-0.020*	-0.017
			(0.011)	(0.011)	(0.011)	(0.011)
Stock Ownership CFO				0.004*		0.003
				(0.002)		(0.003)
Vested Options CFO				-0.008		-0.011
				(0.013)		(0.014)
Market to Book Ratio		0.011***		0.011***		0.011***
		(0.004)		(0.004)		(0.004)
ln(Sales)		-0.046***		-0.048***		-0.048***
		(0.011)		(0.012)		(0.011)
Profitability		0.020		0.020		0.020
		(0.019)		(0.019)		(0.019)
Dividends		0.003		0.004		0.003
		(0.009)		(0.008)		(0.009)
Stock Repurchases		0.010*		0.010*		0.010*
		(0.006)		(0.006)		(0.006)
Market Leverage		-0.373***		-0.371***		-0.372***
		(0.030)		(0.030)		(0.030)
Past 12 Month Returns		0.015***		0.015***		0.015***
		(0.003)		(0.003)		(0.003)
Year Fixed Effects		Yes		Yes		Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,178	6,178	6,178	6,178	6,178	6,178
R-squared	0.001	0.105	0.001	0.104	0.002	0.105

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Appendix-Table A-III. R&D Investment

Panel A presents the results for OLS regressions with R&D Intensity as the dependent variable. R&D Intensity is R&D expenditure normalized by lagged assets. LTCEO/LTCFO is a binary variable where 1 signifies that the CEO/CFO at some point during his tenure held exercisable options until the last year before expiration, given that the options were at least 40% in the money entering their last year. Manager-level control variables include Stock Ownership and Vested Options. Stock Ownership is option-excluded shares held by the CEO/CFO as a percentage of common shares outstanding. Vested Options is the number of exercisable options held by the CEO/CFO as a percentage of common shares outstanding. Firm-level control variables include Market to Book Ratio, ln(Sales), Profitability, Dividends, Stock Repurchases, Market Leverage, Tangibility and Capital Intensity. Definitions of variables are provided in Appendix-Table A-I. Manager-level and firm-level control variables are all measured at the beginning of the year. Firm fixed effects are included in all regressions. All standard errors are adjusted for clustering at the firm level.

Panel A. R&D Intensity

	(1)	(2)	(3)	(4)	(5)	(6)
LTCEO	0.003*	0.003			0.004*	0.003
	(0.002)	(0.002)			(0.002)	(0.002)
Stock Ownership CEO		-0.000				-0.000
		(0.000)				(0.000)
Vested Options CEO		0.001*				0.001
		(0.001)				(0.001)
LTCFO			-0.002	-0.002	-0.002	-0.002
			(0.002)	(0.002)	(0.002)	(0.002)
Stock Ownership CFO				0.001**		0.001**
				(0.000)		(0.000)
Vested Options CFO				0.003		0.001
				(0.002)		(0.002)
Market to Book Ratio		0.003***		0.003***		0.003***
		(0.001)		(0.001)		(0.001)
ln(Sales)		-0.006**		-0.006**		-0.006**
		(0.003)		(0.003)		(0.003)
Profitability		0.006		0.006		0.007
		(0.007)		(0.007)		(0.007)
Dividends		-0.000		-0.000		-0.000
		(0.002)		(0.002)		(0.002)
Stock Repurchases		0.001		0.001		0.001
		(0.001)		(0.001)		(0.001)
Market Leverage		0.000		0.000		0.000
		(0.004)		(0.004)		(0.004)
Tangibility		-0.004		-0.004		-0.004
		(0.004)		(0.004)		(0.004)
Capital Intensity		-0.033***		-0.033***		-0.033***
		(0.004)		(0.004)		(0.004)
Year Fixed Effects		Yes		Yes		Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,229	6,229	6,229	6,229	6,229	6,229
R-squared	0.001	0.144	0.000	0.143	0.001	0.144

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Appendix-Table A-III. R&D Investment

Panel B presents the results for OLS regressions with R&D Shares as the dependent variable. R&D Shares is R&D expenditure divided by the sum of R&D expenditure and capital expenditure. LTCEO/LTCFO is a binary variable where 1 signifies that the CEO/CFO at some point during his tenure held exercisable options until the last year before expiration, given that the options were at least 40% in the money entering their last year. Manager-level control variables include Stock Ownership and Vested Options. Stock Ownership is option-excluded shares held by the CEO/CFO as a percentage of common shares outstanding. Vested Options is the number of exercisable options held by the CEO/CFO as a percentage of common shares outstanding. Firm-level control variables include Market to Book Ratio, ln(Sales), Profitability, Dividends, Stock Repurchases, Market Leverage, Tangibility and Capital Intensity. Definitions of variables are provided in Appendix-Table A-I. Manager-level and firm-level control variables are all measured at the beginning of the year. Firm fixed effects are included in all regressions. All standard errors are adjusted for clustering at the firm level.

Panel B. R&D Shares

	(1)	(2)	(3)	(4)	(5)	(6)
LTCEO	0.006	0.014*			0.005	0.013*
	(0.008)	(0.008)			(0.008)	(0.008)
Stock Ownership CEO		-0.001*				-0.001
		(0.001)				(0.001)
Vested Options CEO		0.003				0.002
		(0.003)				(0.004)
LTCFO			0.017	0.016	0.017	0.015
			(0.011)	(0.010)	(0.011)	(0.010)
Stock Ownership CFO				-0.005*		-0.003
				(0.003)		(0.003)
Vested Options CFO				0.012**		0.010
				(0.006)		(0.008)
Market to Book Ratio		-0.005***		-0.004***		-0.004***
		(0.001)		(0.002)		(0.001)
ln(Sales)		-0.021***		-0.019***		-0.020***
		(0.007)		(0.007)		(0.007)
Profitability		0.001		-0.001		0.001
		(0.019)		(0.019)		(0.019)
Dividends		-0.013*		-0.012*		-0.013*
		(0.007)		(0.007)		(0.007)
Stock Repurchases		0.003		0.002		0.002
		(0.003)		(0.003)		(0.003)
Market Leverage		0.039***		0.037**		0.037***
		(0.014)		(0.014)		(0.014)
Tangibility		-0.003		-0.002		-0.002
		(0.010)		(0.010)		(0.010)
Capital Intensity		0.020**		0.022**		0.021**
		(0.009)		(0.009)		(0.009)
Year Fixed Effects		Yes		Yes		Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,229	6,229	6,229	6,229	6,229	6,229
R-squared	0.000	0.080	0.002	0.080	0.002	0.082

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Appendix-Table A-IV. Interacted Effects of Overconfident CEOs and Overconfident CFOs

Panel A presents estimated interacted effects of overconfident CEOs and overconfident CFOs on financial decisions. Adding interacted effect of CEO overconfidence and CFO overconfidence: column (1) and (2) reestimate column (6) and (7) of Table II respectively; column (3) and (4) reestimate column (6) and (7) of Table III respectively. Adding the interacted effect of CEO overconfidence and CFO overconfidence and its interaction with Net Financing Deficit, column (5) and (6) reestimate column (6) and (9) of Table IV respectively; column (7) and (8) reestimate column (6) and (9) of Table V respectively. Industry fixed effects are based on 2-digit SIC classification. All standard errors are adjusted for clustering at the firm level.

Panel A. Financial Decisions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variables	Net Debt Issues Indicator		Net Equity Issues Indicator		Net Debt Issues		Net Equity Issues	
LTCEO	0.301***	0.245**	-0.140	-0.053	0.005	-0.001	-0.010	-0.005
	(0.106)	(0.114)	(0.127)	(0.136)	(0.009)	(0.009)	(0.009)	(0.009)
LTCEO*NFD					-0.068	-0.048	0.072	0.057
					(0.126)	(0.066)	(0.140)	(0.065)
LTCFO	0.329**	0.311**	-0.303*	-0.329**	-0.010	-0.003	0.007	-0.001
	(0.139)	(0.143)	(0.156)	(0.162)	(0.010)	(0.008)	(0.010)	(0.007)
LTCFO*NFD					0.201*	0.106	-0.298**	-0.182**
					(0.122)	(0.074)	(0.118)	(0.075)
LTCEO*LTCFO	-0.142	-0.185	0.118	0.180	-0.007	-0.000	0.015	0.008
	(0.176)	(0.181)	(0.205)	(0.212)	(0.011)	(0.010)	(0.010)	(0.009)
LTCEO*LTCFO*NFD					0.046	0.016	0.062	0.057
					(0.173)	(0.097)	(0.179)	(0.093)
Manager Variables		Yes		Yes		Yes		Yes
Manager Variables*NFD						Yes		Yes
Firm Variables		Yes		Yes		Yes		Yes
Firm Variables*NFD						Yes		Yes
Year Fixed Effects		Yes		Yes		Yes		Yes
Year Fixed Effects*NFD						Yes		Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes				
Firm Fixed Effects					Yes	Yes	Yes	Yes
Observations	4,246	4,246	4,239	4,239	6,229	6,229	6,229	6,229

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Panel B presents estimated interacted effects of overconfident CEOs and overconfident CFOs on non-financial decisions. Adding the interacted effect of CEO overconfidence and CFO overconfidence and its interaction with Cash Flow, column (9) and (10) reestimate column (7) and (9) of Table VI respectively. Column (11) regresses acquisition expenditures normalized by lagged assets on CEO overconfidence, CFO overconfidence and their interaction effect, controlling for firm fixed effects. Column (12) reestimates column (7) of Table VII. Adding the interacted effect of CEO overconfidence and CFO overconfidence: column (13) and (14) reestimate column (5) and (6) of Appendix-Table A-II respectively; column (15) and (16) reestimate column (5) and (6) of Panel A of Appendix-Table A-III respectively; column (17) and (18) reestimate column (5) and (6) of Panel B of Appendix-Table A-III respectively. All standard errors are adjusted for clustering at the firm level.

Panel B. Non-Financial Decisions

	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Dependent Variables	Capital Expenditure / lagged Assets		Acquisitions / lagged Assets		Net Investment Intensity		R&D Intensity		R&D Shares	
LTCEO	-0.004	-0.009	0.018**	0.015	1.201	0.233	0.001	0.000	0.010	0.018*
	(0.006)	(0.006)	(0.009)	(0.009)	(1.088)	(1.348)	(0.002)	(0.003)	(0.011)	(0.010)
LTCEO*CF	0.047	0.040								
	(0.040)	(0.038)								
LTCFO	0.003	0.002	-0.011	-0.013	-4.017***	-3.996**	-0.005*	-0.006*	0.023*	0.020*
	(0.006)	(0.005)	(0.011)	(0.011)	(1.530)	(1.640)	(0.003)	(0.003)	(0.013)	(0.011)
LTCFO*CF	-0.107**	-0.098**								
	(0.046)	(0.045)								
LTCEO*LTCFO	-0.002	0.000	0.009	0.010	3.207**	3.795**	0.006*	0.006*	-0.009	-0.009
	(0.008)	(0.007)	(0.012)	(0.012)	(1.588)	(1.756)	(0.003)	(0.003)	(0.014)	(0.013)
LTCEO*LTCFO*CF	0.093	0.089								
	(0.067)	(0.062)								
Manager Variables		Yes		Yes		Yes		Yes		Yes
Manager Variables*CF		Yes								
Firm Variables		Yes		Yes		Yes		Yes		Yes
Firm Variables*CF		Yes								
Year Fixed Effects		Yes		Yes		Yes		Yes		Yes
Year Fixed Effects*CF		Yes								
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,229	6,229	6,157	6,157	6,178	6,178	6,229	6,229	6,229	6,229

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%