Managerial Duties and Managerial Biases*

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Abstract

Much of the evidence on managerial biases in corporate finance focuses on the CEO, and in particular CEO overconfidence. This singular focus can lead to misattribution as it ignores the roles of other managers who are responsible for a given corporate outcome. We evaluate the influence of the CFO and other C-suite executives, as compared to the CEO. Mirroring the widely used *Longholder CEO* measure of CEO overconfidence, we construct *Longholder CFO* and *Longholder Other* measures. For financing decisions, we find that CEO overconfidence becomes an insignificant predictor of most decisions when included jointly with the CFO proxy, while CFO overconfidence has strong predictive power. The reverse holds for non-financing decisions: CEO beliefs predict the risk and return of investment projects and, thus, their cost of financing, as well as acquisitions. Other C-suite managers' overconfidence is not significant in either of these two realms. CEO overconfidence does remain significant even for financing decisions in the subsample of firms with "powerful" (entrenched) CEOs. We also show that overconfident CEOs tend to hire overconfident CFOs, which generates a multiplier effect and explains the misattribution to the CEO in analyses when not accounting for the roles of other managers. Our results imply that analyses of managerial biases need to identify the dominant decision-makers and account for their respective influence.

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1 Introduction

Managerial overconfidence and other managerial biases have been shown to strongly affect corporate decisions. Prior research has established a significant role of managerial traits and biases in shaping investment, mergers, and financing (cf. Baker and Wurgler, 2013),[1] and a first-order impact on corporate performance (Kaplan, Klebanov, and Sorensen, 2012). Behavioral corporate finance, and in particular research on managerial biases, has become the fastest-growing strand of behavioral-finance research.[2] Much of this research focuses on the traits and biases of the "top manager," typically the chief executive officer (CEO). The focus on CEOs reflects both their central role and, more mundanely, data availability. Few papers touch on the roles of other top managers, such as the chief financial officer (CFO), and even fewer consider two or more managers jointly.[3]

In this paper, we demonstrate the importance of accounting for managers *other* than the CEO when assessing the influence of managerial biases on corporate outcomes. Otherwise, both theoretical and empirical analyses run the risk of misattribution and of drawing the wrong conclusions about optimal corporate policies and incentives. Such misattribution is particularly likely under assortative matching of managers who share similar beliefs. We show this in the context of managerial overconfidence, where we evaluate the influence of the CFO and other C-suite executives, such as CIOs or CTOs, compared to the CEO.

We find that, in the realm of financial decision making, the CFO's beliefs and biases, rather than those of the CEO, determine the choice of external financing and firm leverage. The seeming influence of CEO overconfidence on these outcomes becomes insignificant when the estimation also accounts for the role of the CFO. The reverse holds for non-financing decisions such as investments and acquisitions. Here, the CEO's beliefs determine the decisions, their risk-return implications, and the resulting cost of financing. Other C-suite managers' overconfidence is not significant in either of these two realms. We also document that CEO

[1] The spectrum of managerial traits and biases in the corporate-finance literature ranges from risk aversion, education, childhood experiences, and gender, to behavioral biases such as overconfidence, loss aversion, and escalation of commitment, cf. Graham, Harvey, and Puri (2013), Bertrand and Schoar (2003), Malmendier and Tate (2005 and 2011), Malmendier et al. (2011), Huang and Kisgen (2013), Camerer and Malmendier (2012), Bazerman and Neale (1992), and Ross and Staw (1993), among others.

[2] Malmendier (2018) documents publication growth rates of 31-70% in research on managerial biases and social ties over the last years, compared to 9-12% in other fields of behavioral finance research.

[3] Notable examples of CFO studies include Ben-David, Graham, and Harvey (2013), Jiang, Petroni, and Wang (2010), and Chava and Purnanandam (2010). Studies that analyze several members of the C-suite managers include Aggarwal and Samwick (1999), Datta, Iskandar-Datta, and Raman (2001), and Selody (2010).

overconfidence does remain significant even for financing decisions in the subsample of firms with CEOs who are "powerful" (entrenched) and less likely to delegate decisions. Finally, we show that overconfident CEOs tend to hire overconfident CFOs, which generates a multiplier effect and explains the misattribution to the CEO in analyses that do not account for the roles of other managers. Our results imply that the narrow emphasis on CEOs in prior research misses out on the opportunity to better understand corporate outcomes by accounting for the attitudes and beliefs of other key managers, such as the CFO. Analyses of managerial biases need to identify the dominant decision-makers and account for their respective influence.[4]

This study focuses specifically on the role of overconfidence as it is the most extensively researched and most robustly documented behavioral trait in corporate decision-making, or, as Bazerman and Moore (2013) put it, "the mother of all biases."[5] We define managerial overconfidence as managers' overestimation of future expected returns, or cash flows, accruing to their firms,[6] and employ the widely used *Longholder* measure as our empirical proxy. It captures managers' personal overinvestment in their firms in the form of delayed option exercise (see, e. g., the overview in Malmendier and Tate, 2015). The basic idea is simple: Managers who overestimate future returns believe that the value of their firm will significantly increase in the future. One way to benefit from these future stock-price increases is not to exercise in-the-money stock options. That is, while rational managers typically exercise executive stock options some years before expiration, depending on how much the options are in the money, overconfident managers tend to delay exercise in order to reap the future increases in value. As Malmendier and Tate, 2005 have shown before, and as we replicate here, the proxy is unrelated to insider trading, signaling, and other alternative interpretations.

We replicate the Longholder measure from Malmendier et al. (2011)[7] and, in addition, generate parallel measures for CFOs and other C-suite executives, focusing on the highest paid executive other than the CEO and the CFO. To the best of our knowledge we are the first to apply the Longholder measure to top managers

[4] Our approach can be applied to other the C-suite managers and their responsibilities, e. g., the COO and operating decisions. The intersection of ExecuComp and Thompson data is currently too small to perform such an analysis in our data; see Section 2.

[5] 53% of all papers on managerial biases in top finance and economics journals analyze overconfidence (Malmendier, 2018). Meikle, Tenney, and Moore (2016) survey the large research on the organizational consequences of overconfidence in firms.

[6] While most of the literature on managerial overconfidence since Roll (1986) has focused on on right shift in the distribution, or increase in mean, some studies analyze the effects of "overprecision" on managerial decisions and entrepreneurship (e. g., Goel and Thakor (2008), Ben-David et al. (2013), Bernardo and Welch (2001)), where individuals underestimate the uncertainty surrounding their forecasts. Herz, Schunk, and Zehnder (2014) contrast these two different forms of overconfidence in an experimental setting.

[7] This measure corresponds to the "Longholder_Thomson" proxy in Malmendier et al. (2011).

beyond the CEO.[8] For robustness, we also construct continuous Longholder proxies following Otto (2014).

We develop and test three sets of predictions that account for the possible presence of overconfidence among CEOs, CFOs, and other top managers. First, overconfident managers exhibit a preference for debt over equity when accessing external finance (pecking order). Intuitively, overconfident managers believe that the broader market underestimates the stream of future cash flows generated by their firm. Since equity prices are more sensitive to differences in opinions about future cash flows, overconfident managers find equity financing too costly – "even more so" than debt, which they also perceive as too costly given the underlying risk. This argument is developed in Malmendier et al. (2011) and Heaton (2002), with the important difference that, here, we question whether the manager in charge is the CEO or rather the CFO.

Empirically, we test for the CEO's, the CFO's, and other top executives' influence on the choice of external financing, using measures of net debt issuance as well as traditional financing-deficit models. We find that overconfident beliefs of both the CEO and the CFO predict external financing decisions that are tilted towards higher debt and leverage, but that the CFO's beliefs strictly outweigh those of the CEO. That is, when accounting only for the influence of the CEO, we recoup estimates similar to those found in prior research. When accounting only for the role of the CFO, we estimate larger and more significant Longholder effects. Most importantly, when including both Longholder proxies jointly, CEO overconfidence almost always becomes insignificant while the estimated effect of CFO overconfidence remains similar or becomes stronger. Other executives, instead, appear to play a limited role in financing decions.

Why, then, did prior research find that the CEO's beliefs and overconfidence shape corporate financing? The answer to this question is twofold. Partly, it is simply because prior research had not accounted for the CFO. When we fill this gap the results change. Partly, our results point to firm heterogeneity that prior research had not yet explored. While a large academic and practitioner literature discusses the (growing) influence of CFOs,[9] it is also true that CEOs are likely to reserve the ultimate decision-making power in some firms. For example, the survey data in Graham, Harvey, and Puri (2015) indicates that, on the one hand, CEOs are more

[8] Other work has employed different CFO measures. Ben-David et al. (2013) use survey measures of miscalibration, and Ham, Lang, Seybert, and Wang (2017) follow the approach of Hirshleifer, Low, and Teoh (2012), which does not rely on actual transaction data.

[9] There is broad consensus that the responsibilities of CFOs have expanded significantly over our sample period (Fabozzi, Drake, and Polimeni, 2008), driven partly by regulatory changes such as the Sarbanes-Oxley Act (Narayanan and Seyhun, 2005).

likely to delegate capital-structure decisions than other corporate decisions; but on the other hand, nearly 40% of CEOs claim to dominate even capital-structure decisions.

We investigate the role of heterogeneity empirically and show that differences in the balance of power between the CEO and other mangers predict when the CEO takes a more active role in financing decisions. When we restrict the analysis to the subsample of firms where the CEO is more likely to be dominant, or entrenched, as measured by higher compensation (Frydman and Jenter, 2010) or longer tenure (Hermalin and Weisbach, 1998), her beliefs have stronger explanatory power for leverage and debt-to-financing-deficit sensitivity than the CFO's. Conversely, in firms where the CEO likely has less power, we observe the pattern from the full sample, with the CFO's overconfidence being the main determinant of financing choices.

Finally, we note that the non-results for other C-level executives are important from two perspectives. First, they help ensure that the Longholder estimates do not reflect unobserved firm-level variables that might correlate with option holding. Second, they speak to the importance of accounting for managers' domains of decision making: For financing decisions, it is the CFO whose beliefs matter and, in fact, dominate those of the CEO and other C-suite executives. This finding is consistent with the CFO's core responsibility in designing the financing model and with prior evidence on the CFO being in charge of financing decisions, e. g., the dominance of CFO over CEO fixed effects in determining financial policies (Bertrand and Schoar, 2003), or of CFOs' over CEOs' equity incentives in determining firms' debt structure (Chava and Purnanandam, 2007). Our analysis brings this characterization of managerial roles to the realm of behavioral biases.

Given this evidence, it is natural to ask whether CEO traits dominate those of the CFO (and other executives) in other domains, outside the financial decision-making realm. Harris and Raviv (2005) argue that CEOs are less likely to delegate decisions for which a global perspective is needed, such as *external* projects, and Graham et al. (2015) show that, indeed, CEOs appear to use little input from other executives in the context of mergers and acquisitions. Precisely because the CEO has a final say on the main strategic decisions of the company, her traits should be those that investors regard as the most important when assessing the solvency of a firm, in turn determining the cost of financing. Thus, a second set of predictions concerns corporate investment. For both (the cost of) internal investment, namely capital expenditures, and external

investment (mergers and acquisitions), CEOs are likely the dominant decision-maker and we would thus expect CEO biases, rather than those of the CFO or other executives, to play a significant role.

In the context of internal investment, CEOs who overestimate the returns to their investment choices are less discouraged by negative profitability shocks than rational CEOs (who might prefer to default rather than exert effort merely to repay lenders), and keep working hard towards successful project completion, akin to the mechanisms in Pikulina, Renneboog, and Tobler (2014), Gervais, Heaton, and Odean (2011), and Hackbarth (2009). In other words, overconfidence helps solve the incentive problem. Anticipating such behavior, lenders require a lower premium on debt financing from an overconfident than from a rational CEO.[10]

To test this prediction, we merge DealScan data on syndicated loans with our dataset. We find that firms, for a given risky project, with overconfident CEOs obtain better financing conditions, as measured by the interest rates on their corporate loans: Overconfident CEOs are charged significantly lower rates, controlling for the known determinants of the cost of debt, including loan characteristics that have been associated with CEO overconfidence, such as the presence of covenants (Sunder, Sunder, and Tan, 2010) or performance-pricing provisions (Adam, Burg, Scheinert, and Streitz, 2020), or loan maturity (Huang, Tan, and Faff, 2016).

We sharpen these empirical tests building on the insight that the association between managerial overconfidence and the cost of debt should vary non-monotonically with profit variability: Very mild shocks to profits do not matter much for effort choices of both rational and overconfident CEOs, and severe negative shocks diminish the incentives to work for both rational and overconfident CEOs. For some intermediate range, however, a rational CEO anticipates the project to be out of the money following a negative shock and does not push its implementation or continuation, whereas an overconfident CEO overestimates the return to effort enough to work hard. This non-monotonicity is testable and helps rule out alternative explanations based on omitted firm characteristic. Empirically, we find that the effect of overconfidence on the cost of debt is indeed significant only for firms characterized by a medium degree of earnings variability. Note that this finding also implies that the favorable financing conditions offered to overconfident managers do not merely reflect investors assessing overconfident CEOs' abilities too positively (cf. Schwardmann and Van der Weele, 2019).

[10] Designing different contracts based on the CEO's degree of bias requires stakeholders to recognize managerial overconfidence. Otto (2014) argues that this assumption is supported by the empirical evidence.

Another domain in which CEOs are likely to exert a dominant influence is mergers and acquisitions. Consistent with Malmendier and Tate (2008), we show that overconfident CEOs have a higher propensity to engage in M&A activity, as measured by the dollar value spent in acquisitions scaled by firm's market capitalization, if their firm is financially unconstrained. Neither in the external investment (M&A) context nor in the internal investment context we find that biases of other executives play a significant role, suggesting that the role of the CEO is by far the most dominant in the context of these corporate decisions.

A third prediction is that CEO overconfidence affects corporate outcomes, including financing decisions, indirectly through hiring. When selecting a new CFO, an overconfident CEO is more likely to choose one who shares her views regarding the firm's profitability. While CEOs do not have complete discretion in hiring a new CFO, they do have a significant say in the selection of board members, who in turn appoint the CFO (Shivdasani and Yermack, 1999; Cai, Garner, and Walkling, 2009; Fischer, Gramlich, Miller, and White, 2009). This prediction implies a potential multiplier effect of overconfident managers.

Empirically, we show that the commonality of beliefs plays an important role in the selection of new CFOs. Companies with overconfident CEOs are more likely to appoint like-minded CFOs during their tenure. The statistical and economic magnitudes of the effect are large, indicating strong assortative matching. The hiring of overconfident CFOs is, instead, uncorrelated with the presence of other overconfident managers, which helps distinguish the estimate from unobserved firm-specific correlates, such as a common compensation structure or attractiveness of a firm for overconfident managers. The results are also robust to focusing on CFOs that can be classified as overconfident (or not) based on their trading behavior *before* their appointment as CFO.

Overall, our findings confirm the thrust of the existing literature in that they provide evidence on the significant role of managerial biases for corporate outcomes. We go beyond the sole focus on CEO overconfidence, and consider the biases of the CEO, the CFO, and other executives jointly. The domain specificity of the bias, e. g., the relevance of CFO overconfidence for financing and of CEO overconfidence for the investment portfolio and its cost, corroborates the empirical importance of managerial overconfidence and the interpretation of the widely used Longholder proxy. The results also help address identification concerns about unobserved firm characteristics that had affected prior literature, e. g., that board preferences for high leverage might be

correlated with the appointment of overconfident managers. While the inclusion of firm fixed effects rules out time-invariant confounds, the inclusion of both the Longholder CEO and Longholder CFO proxies, as well as a Longholder Other proxy in some analyses, addresses time-varying firm characteristics since it seems implausible that they predict the hiring of overconfident CFOs, but not CEOs and other C-level managers.

Our analysis cautions against the focus on one single manager in the analysis of corporate decisions, including behavioral analyses. Our results suggest that previously identified effects of CEO overconfidence could reflect biases of the CFO. Empirical analyses of managerial traits and biases would benefit from more complete firm datasets that include all top managers responsible for specific firm outcomes. As a practical implication, the joint consideration of managerial biases is important for boards when composing the C-suite and when devising corporate-governance responses to biased managerial behavior.

Literature Review. The paper relates to several strands of literature in corporate finance and organizational economics. First, we contribute to the literature that links overconfidence to capital-structure decisions. The survey evidence in Graham and Harvey (2001) suggests that CFOs' reluctance to issue equity may reflect overconfidence. From a theoretical perspective, Hackbarth (2009) predicts higher debt ratios for managers who overestimate earnings growth. Landier and Thesmar (2009) and Graham et al. (2013) confirm empirically that overconfidence is associated with higher leverage and a preference for short-term debt. We show that overconfidence at the CFO level, rather than at the CEO level, matters most in this context.

Previous work on the role of CFOs and their biases includes Ben-David et al. (2013), Jiang et al. (2010), and Chava and Purnanandam (2010). Using the methodology of Bertrand and Schoar (2003), Ge, Matsumoto, and Zhang (2011) find that CFO "style" is related to accounting choices. Huang and Kisgen (2013) link the gender of CEOs and CFOs to the returns of acquisitions (where male executives are more likely to be overconfident).

More broadly, our paper extends the literature that shows that differences in beliefs between investors and managers affect capital structure choices (Dittmar and Thakor, 2007, Boot and Thakor, 2011). Outside the behavioral realm, Jiang et al. (2010) and Kim, Li, and Zhang (2011) show that CFOs' equity incentives have stronger explanatory power for earnings management and stock crashes than those of CEOs. We are the first to bring the comparison of CFO and CEO traits for financing decisions to the realm of overconfidence, to jointly

consider overconfidence among different managers, and to analyze direct and indirect channels of influence.

Our findings also contribute to the literature emphasizing the "bright side" of overconfidence. Ever since the influential paper by Roll (1986) on the link between managerial "hubris" and poor returns to acquirers, it has been a puzzle why boards continue to appoint overconfident managers, who make poor decisions in a host of contexts (see the overview in Malmendier and Tate, 2015). More recent papers address this puzzle arguing that overconfident managers may increase firm value (Goel and Thakor, 2008), innovate more (Hirshleifer et al., 2012), and require lower levels of incentive compensation for a given amount of effort (Otto, 2014). Others argue that mild overconfidence can prevent underinvestment (Campbell, Gallmeyer, Johnson, Rutherford, and Stanley, 2011), improve information aggregation (Bernardo and Welch, 2001), reduce conflicts between bondholders and shareholders such as the debt overhang problem (Hackbarth, 2009). We provide a new angle on the "bright side" of overconfidence by showing that overconfident CEOs obtain lower interest rates on corporate loans. The proposed mechanism is that overconfident CEOs exert more effort, in line with Gervais and Goldstein (2007) and Hilary, Hsu, Segal, and Wang (2016). We also identify the firms that benefit most from hiring an overconfident manager – those experiencing medium profit variability. Our results on better financing conditions for overconfident CEOs are also consistent with the experimental evidence that people rate an overconfident person as significantly more likely to be successful (Schwardmann and Van der Weele, 2019). However, the non-monotonicity in return variability points to the effort angle, rather than the mere ability of overconfident CEOs to persuade others of their chances of success.

Finally, our model relates to studies of dissent between managers in organizations (Landier and Thesmar, 2009; Landier, Sauvagnat, Sraer, and Thesmar, 2013), which suggest that CEOs are more likely to hire like-minded executives. Relatedly, Graham et al. (2015); Acemoglu, Aghion, Lelarge, Reenen, and Zilibotti (2007); and Bloom, Sadun, and Van Reenen (2012) analyze empirically when and where managers are likely to delegate. In the Graham et al. (2015) survey, "gut feel" is an important element for 48.2% of the CEOs in the decision to delegate corporate investment tasks to lower-level executives. Our empirical results support the inclination to lean on "like-minded" people in the context of managerial overconfidence. They are also consistent with the finding in Goel and Thakor (2008) that overconfident managers are more likely to be appointed as CEOs. Here, we ask who is chosen as CFO conditional on the overconfidence of the CEO, and show that the commonality

of personal traits plays an important role.

2 Overview and Data

2.1 Overview of the Empirical Analyses

We briefly summarize the empirical analyses we will conduct, and then turn to discussing the construction of the datasets used for these analyses and the sample characteristics.

Table 1 presents a schematic summary of the analyses outlined in the introduction, sorted by type of executive (CEO, CFO, Other) and type of corporate outcome (debt issues, financing deficit, leverage, cost of debt, acquisitions, CFO hiring), as well as a preview of the results. In the first three analyses, which will be presented in Tables 3, 4, and 5, we investigate which executives matter the most for financing decisions (debt issues, financing deficit, leverage). As indicated, our estimates will reveal that that CFOs consistently dominate CEOs. We also uncover significant cross-sectional heterogeneity, namely, that powerful CEOs (long tenure, high compensation) dominate the CFO's influence even in financing decisions, shown in Table 6.

In Table 7 we re-examine this evidence by considering other members of the C-suite. We replicate the results on financing by introducing "Longholder Other," a measure of overconfidence for the highest paid executive other than CEO and CFO. We find that other executives' traits do not appear to influence financing decision; conversely, the effect of CFO overconfidence remains robust.

In Tables 8, 9, and 10, we test whether managerial biases are associated with internal investments and, in particular, the interest rate charged on corporate loans for those investments, as well as with external investments (acquisitions). Here, CEO biases dominate those of CFOs and other executives. Finally, in Table 11 we find evidence of assortative matching, with overconfident CEOs being substantially more likely to hire like-minded CFOs. In all these tests, we also include a proxy for the overconfidence of other members of the C-suite, but fail to find any effects. Thus, although their biases are likely to matter in other contexts, their influence in the domains we focus on appears negligible.

2.2 Overconfidence Measure

Measuring managerial overconfidence is a challenge to empirical researchers. The existing methodologies fall into four categories: option based, earnings-forecast based, survey based, and press based. Option-based measures, first proposed by Malmendier and Tate (2005), are by far the most widely-used. This approach infers managers' expectations about their companies from their personal investment choices. Managers who overestimate future cash flows tend to overinvest their personal wealth in their companies, expecting to personally benefit from future stock-price increases. In particular, they do not diversify their stock-based compensation and delay the exercise of executive stock options.[11] This measure captures when a manager is likely to overestimate returns. Galasso and Simcoe (2011), Malmendier et al. (2011), Otto (2014), and Hirshleifer et al. (2012) also adopt this measurement strategy.[12] The earnings-forecast-based approach, proposed by Otto (2014), infers overconfidence from overstated earnings forecasts. The survey-based approach, developed by Ben-David et al. (2013), constructs CFO overconfidence proxies based on miscalibrated stock-market forecasts of CFOs in the Duke/CFO Business Outlook survey.[13] The media-based approach, employed by Malmendier and Tate (2008) and Hirshleifer et al. (2012), constructs CEO overconfidence measures from the characterization of CEOs in the press. In this paper, we follow the option-based approach, which is both the most commonly employed in prior literature and is generally most robust to alternative interpretations (see Malmendier and Tate, 2015). We replicate and expand the Longholder proxy of Malmendier et al. (2011). In addition, we also replicate our results using a continuous variant of the option-based measure proposed by Otto (2014).

The Longholder measure exploits the timing of option exercise relative to a benchmark model (Hall and Murphy, 2002), where the optimal exercise schedule depends on individual wealth, risk aversion, and diversification. Given that executive stock options are not tradable, and short-selling of company stock is prohibited, managers are highly exposed to the idiosyncratic risk of their firms. Rational, risk-averse managers address their under-diversification by exercising in-the-money options some time before expiration. Overconfident man-

[11] Another way to overinvest in the own company is to delay the sale of stock. Overconfident managers also exhibit that behavior, and even buy additional stock of their firms. Empirical research has relied more on option-based measures than on stock purchases and sales as they raise fewer concerns about signaling to the market; cf. Malmendier and Tate (2008).

[12] Relatedly, Sen and Tumarkin (2015) measure overconfidence as the share retention rate after an option exercise.

[13] This behavioral bias reflects an underestimation of variance but is sometimes also called overconfidence. However, it does not imply delayed option exercise. See Malmendier et al. (2011) (fn. 1) for a brief discussion.

agers, who overestimate the future cash flows of their firms, postpone exercising in order to tap expected future gains. Malmendier and Tate (2005) capture this insight with a binary variable called Longholder. It indicates whether a manager, at some point during their tenure, held an option until the last year before expiration even though the option was at least 40% in-the-money.

In order to replicate the Longholder measure for a longer and more recent sample period, and for a broader set of managers and firms, we build on the Longholder variant proposed by Malmendier et al. (2011). Their proxy has the same definition as the original Longholder measure, but uses the Thomson Insider Filing dataset to identify option exercises for managers in public U.S. firms. We reconstruct the measure for our extended sample period, and apply the measure to CFOs and other executives.[14] We identify CFOs in the Thomson Reuters Insiders using their titles and in ExecuComp using the CFO flag. For "other" top executives, there is no flag and no systematic recording in ExecuComp, and we include the following titles: chairman, vice-chairman, chief investment officer, chief operating officer, president, and executive vice-president.[15] We then construct an overconfidence proxy for each of these executives following the procedure used for CEOs and CFOs. If "Longholder Other" can be constructed for more than one executive in a given firm-year, we retain the highest paid one. If it cannot be constructed for a given firm year, typically due to the lack of a sufficient number of transactions, we set an additional indicator variable, "Missing Longholder Other," equal to 1. In these instances, we replace missing values of Longholder Other with zero. The control group consists of managers who are also in the Thomson data but do not meet the overconfidence criteria.

We obtain tenure as well as stock and option holdings of the managers from ExecuComp. This step limits our sample to the intersection of ExecuComp and Thomson data, i. e., a subset of the S&P 1500 small-, medium-, and large-cap firms from 1992-2015. We provide details on the construction of the dataset (extraction and

[14]Note that the interpretation of late option exercise varies to some extent between CEOs and other executives. A Longholder CEO overestimates her abilities to generate returns. Longholder CFOs and other C-suite executives also overestimate future returns; but their overconfident beliefs likely stem from (also) overestimating the potential of the firm and the CEO's ability to generate returns. For the empirical analyses it is not important precisely why a manager is overconfident since the Longholder measure captures return overestimation regardless of the reason.

[15] ExecuComp has specific flags only for CFOs and CEOs; however, it reports for every manager the title description from the company proxy statement (variable *titleann*). This variable does not have a standardized format, thus we manually code the role for each executive by reading the title description. We use the Thomson Reuters variables *rolecode1*, *rolecode2*, *rolecode3*, *rolecode4*, and keep observations where at least one of the four variable is equal to: CB (Chairman), VC (Vice-Chairman), CI (Chief Investment Officer), CO (Chief Operating Officer), CT (Chief Technology Officer), P (President), EVP (Executive Vice-President).

cleaning of the transaction data, and matching between ExecuComp and Thomson) in Appendix B. Our final sample consists of 4,581 firm-years. We only keep managers for which we observe at least ten transactions to ensure that we capture a systematic behavior. (In Appendix Figure C.1 we report the estimates of the main coefficients of interest obtained when relaxing this restriction, i. e., when requiring only 1, 2, ..., 9 transactions recorded in Thomson.) We also use the data to construct a continuous version of the Longholder measure proposed by Otto (2014). Here, we first calculate overconfidence indicators for each option exercise, and then average all executive-specific indicators weighted by the number of shares exercised. Details of the construction and replications of all estimates with the continuous measure are in Appendix C.

The discrete and continuous measures are strongly correlated, with correlation coefficients of, for example, 41.9% for CEOs and 46.5% for CFOs. The estimation results are also similar for our main specifications. They differ only when we work with relatively small and selected samples.

2.3 Alternative Interpretations

Before turning to the remaining data construction, we address possible alternative interpretations of the Longholder measure and their implications for the results of this paper.

Procrastination. The Longholder overconfidence measure captures a persistent tendency of managers to delay option exercise, a behavior that may indicate inertia or procrastination. We find, however, that 74% of overconfident CEOs and 69% of overconfident CFOs conduct other portfolio transactions one year prior to the year when their options expire, which is inconsistent with this interpretation.

Insider information. Managers may choose to hold exercisable options because they have positive inside information about future returns. One issue with this alternative explanation is that inside information should, by definition, be transitory rather than persistent, but Longholders persistently hold exercisable options for several years. A second issue with the inside-information interpretation is that insiders should earn positive abnormal returns from holding options until expiration. While we cannot calculate expected returns from an ex-ante perspective, we can calculate the actual returns of Longholder CEOs and CFOs from holding options that were at least 40% in-the-money until their expiration. We compare these actual returns to hypothetical

returns from exercising these options 1, 2, 3, or 4 years earlier and investing the proceeds in the S&P 500 Index until the options were actually exercised. We find that, depending on the horizon chosen, approximately 45-48% of the these transactions do not earn positive abnormal returns.

Signaling. One might argue that Longholders intend to signal to the capital market that their firms have better prospects than other, similar firms. However, private positive information revealed by a manager through option exercise should be quickly incorporated into prices (as long as the manager is credible) and thus give rise to occasional, rather than persistent, behavior. Moreover, all estimations control for the number of vested options held by the manager to account for the possibility of signaling via option holdings.

Risk tolerance. The Longholder overconfidence measure captures a habitual tendency of managers to hold company risk. One might be concerned that risk-tolerant or risk-seeking managers prefer to hold exercisable options longer, and therefore appear to be overconfident under the Longholder measure. However, the executive's willingness to hold risk should be reflected in the riskiness of the overall portfolio of options or shares she is willing to hold at any given point in time, not the timing of exercise per se. Hence, we control for vested options and shares held in our estimations.

Agency problems. Another alternative interpretation is that, being more incentivized, option-holding managers are more willing to act in the interest of (existing) shareholders. However, in all of our regressions, we control for both the shares and the vested options owned by managers. Moreover, the observed differences in the behavior of Longholders, compared to managers who diversify their holdings, are not easily interpreted as shareholder-value maximizing. By increasing leverage, Longholders likely reduce the cash flow available to shareholders. This behavior might be costly to shareholders if there are non-negligible bankruptcy costs.

Firm performance. Another concern is a potential mechanical correlation of the Longholder measure with past performance. Given the construction of the proxy, an executive cannot be identified as overconfident unless her firm's stock has appreciated by at least 40%. Therefore, one may worry that, in our empirical analysis, overconfident managers are simply those running particularly successful firms. To address this confound, we compute, for each firm, the buy-and-hold return over the previous 1, 2, 3, 4, and 10 years and test whether they are systematically correlated with the overconfidence measures. We find that the correlations of the Longholder dummies with lagged buy-and-hold returns are small and often negative. For example, at the ten-year horizon,

which is the most relevant horizon for our analysis, the two correlation coefficients are very small in absolute value and of opposite signs, positive for Longholder CEOs (0.024) and negative for the Longholder CFOs (-0.009). This is at odds with the idea that our measures capture a common pattern of past performance.

Mismeasurement. The Longholder proxy draws a simple dichotomous distinction between overconfident and rational managers. It may thus be susceptible to mismeasurement in at least two ways. First, it is sensitive to errors in the Thomson Reuters data (e. g., in the grant or expiration dates of the options). Second, it does not distinguish between managers who display a stronger or weaker tendency to exercise options late.

The continuous version of the Longholder measure developed by Otto (2014) is unlikely to be affected by occasional errors in the Thomson database, and allows us to distinguish more finely different degrees of overconfidence. As reported in Appendix C, we obtain largely similar results when following this approach.[16]

Tax advantages. Tax reasons are another possible concern. The informal argument, also discussed in McDonald (2005), goes as follows: When exercising a stock option, executives pay ordinary income tax. Upon sale of the underlying stock, they pay only capital gains tax, which is typically lower. Early exercise may thus be optimal if the stock price is expected to rise, and late exercisers may be those who predict poor performance. If option owners are on average correct, late exercise would be correlated with poor future performance.

The discussion of signaling and insider information has already emphasized that the Longholder proxy captures persistent behavior. While a manager may be more or less pessimistic about the firm's prospects at a given time, a standard model cannot explain a *systematic* pattern of optimistic (or pessimistic) expectations and resulting option exercise behavior. Moreover, stocks owned by Longholders do not appear to under- or outperform the market in the long run. Finally, and perhaps most importantly, the intuitive argument sketched above may be appealing but, as McDonald (2005) shows, its logic is not correct. In a rigorous framework where a manager does not borrow money to pay income taxes, accelerating the option exercise is not optimal in general.

Other concerns. A large literature has discussed many other potential interpretations of the Longholder

[16] Results using the alternative measures are reported in Appendix-Table C.2 To summarize briefly, they are similar for the analyses of Debt Issuance, Leverage, Acquisitions, and CFO Hiring (Panels A, C, I, and J); qualitatively similar but slightly weaker statistically in some specifications for the Interest Rates regressions (Panels F and G); and inconsistent only for the regressions that adopt the "Financing Deficit" approach (Panel B). Moreover, the estimated effect sizes are of the same order of magnitude under the dummy and the continuous measure. For example, a one-standard-deviation increase in CFO overconfidence using the continuous measure increases the odds ratio of issuing debt by 14–15% (Panel A of Table C.2), in line with the results of Table 3.

measure. Malmendier and Tate (2005) address concerns about industry selection, proxying for observable firm or manager characteristics, in addition to an in-depth analysis of inside information, signaling, risk tolerance, taxes, and procrastination. Malmendier and Tate (2008) also discuss concerns about CEO preference, past performance, market inefficiency, board pressure, corporate governance, taxes, and dividends. Malmendier et al. (2011) address concerns about dilution and more aspects of inside information, signaling, and risk tolerance.

Hence, while any empirical estimates using option-based overconfidence measures must be subjected to scrutiny as they are not the result of exogeneous variation, the leading alternative interpretations appear to be addressed either in the details of the construction of the measure, or in the empirical results.

2.4 Other variables

The analysis requires a broad array of financial and other firm-level variables and industry characteristics. We retrieve these variables from Compustat, excluding financial firms and regulated utilities (SIC codes 6000-6999 and 4900-4999). We describe briefly the main variables of interest; details are in Appendix B.

The key variables for our analysis of financial policies are Net Debt Issues and Net Financing Deficit. Following Malmendier et al. (2011) and other prior literature (cf., among many others, Shroff, 2015), we construct Net Debt Issues as long-term debt issues minus long-term debt reductions. Net Financing Deficit is cash dividends plus investment plus the change in working capital minus cash flow after interest and taxes. Both variables are normalized by assets at the beginning of the year. Standard firm-level control variables include Q, profitability, tangibility, size, book leverage, and annual changes in these variables. We combine manager-level with firm-level variables to form a panel of 679 S&P 1500 firms from 1992 to 2015, corresponding to 4,581 firm-years. The construction of the data is detailed in Appendix-Table B.1.

Table 2 reports summary statistics for firm-level variables in Panel A and for manager-specific variables in Panel B, using the largest sample (employed in financing-deficit, leverage, and sorting analyses). Not surprisingly, the typical company in our dataset is large relative to the Compustat universe. The average revenues amount to \$5.7 billion, relative to a mean of \$2.5 billion for the full Compustat data over the same time period. Panel B reveals that, on average, CEOs tend to own significantly more stock of their companies

than CFOs and other C-suite executives (1.81% versus 0.12% and 0.69%, respectively). The difference is somewhat less pronounced for vested options (1.04% versus 0.26% and 0.40%). These figures are comparable to those we obtain in the full ExecuComp dataset.[17] We have also analyzed managerial controls separately for the full sample and for overconfident managers and find that they tend to have fairly similar equity incentives.[18]

Compared to the samples used in Malmendier and Tate (2005, 2008) and Galasso and Simcoe (2011), the Thomson and ExecuComp-based datasets in Malmendier et al. (2011) and Hirshleifer et al. (2012), and also compared to the survey sample of Ben-David et al. (2013), our sample differs in three ways: First, it extends to a more recent time period. Second, it considers small and medium firms in addition to large firms. And third, it includes overconfidence measures for the CFO and other C-level executives.

These differences in sample composition explain the differences in the observed frequency of overconfident managers. In our sample, 66.5-69.8% of CEOs, 52.8-57.5% of CFOs, and and 64.3-64.5% of other C-suite executives are Longholders. These frequencies are two to three times as high as in the first wave of overconfidence research, which used option exercise data from the 1980s to mid-1990s, but in line with the more recent wave of research, which also uses the more recent option-exercise data, e. g., Malmendier and Tate (2015).

Finally, we merge the ExecuComp-Compustat with the Dealscan data on syndicated loans to test our predictions on the cost of debt. Dealscan provides detailed information on the pricing, type, maturity, and size of loans. We merge this data with the quarterly Compustat file, using the mapping provided by Chava and Roberts (2008).[19] We discuss the sample and main variables in more detail in Section 4.

[17] The average stock ownership in ExecuComp is 2.43% for CEOs, 0.15% for CFOs, and 0.77% for other C-suite executives; the number of vested options scaled by number of shares is 0.73% for CEOs, 0.15% for CFOs, and 0.29% for other C-suite executives. Thus, executives in our sample have similarly powered equity incentives, with a slight tilt toward options rather than stock, possibly reflecting the merge with option exercise data from *Thomson*.

[18] In unreported tests, we have further included gender and age as additional controls. Gender is available for all managers but exhibits very little variation, with only 2% of CEOs, 8% of CFOs, and 4% of other C-suite executives being women. It has no effects on our estimates. When including age as control variable, we also find very similar results; given that age is missing for about 10% of the CFOs and 29% of other C-suite executives, we chose to omit it and work with a more comprehensive sample.

[19] The crosswalk is available up to 2012 at `https://finance.wharton.upenn.edu/~mrrobert/styled-9/styled-12/index.html`.

3 Overconfidence and Financing Choices

In this section, we test whether managerial overconfidence induces a preference for debt over equity, conditional on accessing the market for external financing. Differently from prior work, we test for both the influence of the CFO, as predicted by the theoretical model in Appendix A, and the influence of the CEO, whose overconfidence was the focus in prior literature. We will also consider other C-level executives.

We use three different empirical approaches. First, we focus on firms that access external financing in a given year, and ask whether they are more likely to issue debt than equity when led by overconfident managers (Section 3.1). We estimate the corresponding logit models both on Compustat and on SDC data, with the latter relegated to Appendix C. The second approach (Section 3.2) employs the standard 'financing-deficit framework' of Shyam-Sunder and Myers (1999), also used in Malmendier et al. (2011). The third approach (Section 3.3) asks whether the influence of managerial characteristics on the flow of financing is strong enough to affect the resulting capital structure. If so, firms run by overconfident executives should be more leveraged.

3.1 Debt Issues

We first test whether overconfident managers are more likely to issue debt than equity, using Compustat data. This analysis conditions on firms accessing external capital, thus controlling for potential differences in the baseline frequencies of debt and equity issues by overconfident managers and their rational peers. The regression sample only includes observations with either positive net debt issues or positive net equity issues. In total, we have 2,939 firm-years with external financing (635 firms). We estimate the following logit model:

$$\Pr(\text{NDI}_{i,t}|\text{LTCEO}_{i,t}, \text{LTCFO}_{I,t}, X_{i,t}, \delta_t) = G(\beta_1 \text{LTCEO}_{i,t} + \beta_2 \text{LTCFO}_{i,t} + X'_{i,t}B + \delta_t + \varepsilon_{i,t}), \tag{1}$$

where G is the cumulative logistic distribution function, and the subindices i,t indicate year t in which company i accessed external financing. The dependent variable $\text{NDI}_{i,t}$ is an indicator of Net Debt Issuance, i. e., of firm i issuing positive net debt in year t. As defined in Section 2.4, net debt issues are long-term debt issues minus long-term debt reductions.[20] $\text{LTCEO}_{i,t}$ and $\text{LTCFO}_{i,t}$ represent the Longholder measures for the CEO and

[20] Alternatively, we construct debt issues as change in total assets minus net equity issues and retained earnings, following Baker and Wurgler (2002). We generally find very similar results, in particular when including the full set of control variables.

the CFO. $X_{i,t}$ is the vector of firm- and manager-level control variables for firm i in year t. Firm-level control variables are the traditional determinants of capital structure—book leverage, log(Sales), profitability, Q, and tangibility—, and also include two-digit SIC industry fixed effects, following the specification of Ben-David et al. (2013). Manager-level control variables are stock ownership and vested options, which control for the incentive effect of stock-based executive compensation. In addition, we include a vector of year fixed effects. Following standard practice in the literature on managerial traits (i.e., Malmendier and Tate, 2005), standard errors are adjusted for firm-level clustering, here and in all the estimations that follow. This is the most natural choice, given that the "treatment," i. e., managerial overconfidence, varies at the firm level. Nevertheless, we replicate all regressions with clustering at the industry-level (using the 2-digit SIC code classification), recognizing possible dependences in financing practices within industries (Leary and Roberts, 2014). Appendix-Table C.6 shows that our key inferences remain unaffected.[21] Coefficient estimates are transformed to indicate, for a unit increase in each independent variable, the expected change in the log odds of issuing debt.

Table 3 reports the results. In the baseline estimations with only the CEO overconfidence proxy, we estimate a small and insignificant log odds ratio when we only control for industry effects (column 1); the coefficient becomes negative, and even smaller in magnitude, when we include the firm- and manager-level controls as well as year dummies, which remove cyclical effects of debt issues (column 2). The coefficients of the firm-level control variables are generally similar to those in prior capital-structure literature. For example, firm size is positively related to the likelihood of debt issues, possibly reflecting easier access to bank loans or bond markets for larger firms with sufficient collateral. This result is consistent with Malmendier et al. (2011), who estimate an insignificant effect of CEO overconfidence on debt choice and a significantly negative effect on equity issues.

In columns 3 and 4, we replace the CEO with the CFO overconfidence measure. In the regression with only industry controls, the CFO overconfidence effect is large and significant at the 1% level, and it remains unaffected when we control for CFO-level variables, firm-level variables, industry dummies, and year dummies.

[21] Industry-level clustering does not appear to systematically increase or reduce standard errors, relative to those obtained with firm-level clustering. For example, the t-statistics for our key coefficient becomes slightly lower in the Financing Deficit regressions of Table 4, and slightly higher in the Leverage regressions of Table 5 (see Panels B and C of Table C.6). The only case in which the statistical significance falls below the conventional 5% level occurs in the Acquisition regressions of Table, where the t-statistic of the Longholder CEO coefficient is significant at the 10% level (see Panel I of Table C.6).

It indicates that the odds of debt issues are 48% higher for overconfident than for rational CFOs.[22]

In columns 5 to 7, we include both CEO and CFO overconfidence, first in the baseline regression, then adding managerial controls, and finally including the full set of controls.[23] We find that, while CEO overconfidence remains insignificant, the CFO overconfidence effect retains its economic and statistical magnitude. Further, the coefficients on CEO and CFO overconfidence are statistically different at the 10%, 5%, and 1% level in columns 5, 6, and 7 respectively. The Longholder CFO coefficient of 0.437 in the estimation with the full set of controls (column 7) implies that an overconfident CFO is 55% more likely than a rational CFO to issue debt, conditional on accessing external markets.

As a robustness check, we have re-estimated model (1) using the SDC data on equity and bond issues by US corporations, following Malmendier et al. (2011). As Appendix-Table C.3 shows, we obtain similar results.

3.2 Financing Deficit and Managerial Overconfidence

We now turn to our second approach of testing the first prediction on financing choices, using the standard financing-deficit framework of Shyam-Sunder and Myers (1999). This framework allows us to analyze whether, for a given need of external funding, managers display a preference for debt over equity. We examine the impact of managerial overconfidence on the association between the net financing deficit and the choice of external financing, as done in Malmendier et al. (2011) for the CEO. The estimation framework allows for overconfident managers and their rational peers to have different baseline needs for external financing. Another advantage of this approach is that it utilizes all firm-years, resulting in a larger sample.

We estimate OLS regressions using the following equation:

$$\begin{aligned} D_{i,t} = \beta_1 \mathrm{FD}_{i,t} + \beta_2 \mathrm{LTCEO}_{i,t} + \beta_3 \mathrm{LTCFO}_{i,t} + \beta_4 \mathrm{FD}_{i,t} \mathrm{LTCEO}_{i,t} \\ \beta_5 \mathrm{FD}_{i,t} \mathrm{LTCFO}_{i,t} + X'_{i,t} B_1 + \mathrm{FD}_{i,t} X'_{i,t} B_2 + \theta_i + \delta_t + \varepsilon_{i,t}, \end{aligned} \tag{2}$$

where $D_{i,t}$ is Net Debt Issues and $\mathrm{FD}_{i,t}$ is the Net Financing Deficit, which measures the amount of external

[22] This is given by $\exp(0.392) - 1 \approx 0.48$.

[23] The significant negative sign on CFO Vested Options may seem surprising but is consistent with the coefficient on CEO Vested Options in Table 2 Panel B of Malmendier et al. (2011) which finds CEO Vested Options to be significantly positively related to the likelihood of choosing equity. They suggest this result is primarily driven by outliers. It may also reflect unobserved determinants. Importantly, column 5 demonstrates that our results are not driven by the inclusion of this variable.

financing needed in a given year. $\text{LTCEO}_{i,t}$ and $\text{LTCFO}_{i,t}$ are our measures of managerial overconfidence, and $X_{i,t}$ is a set of manager- and firm-level control variables including executive stock and vested options holdings, changes in Q, profitability, tangibility, and size. In the most conservative specifications, we also interact our vector of controls with the Financing Deficit. We note that the coefficients on the control variables generally show the expected signs (not shown for brevity).[24] We also include firm and year fixed-effects. The coefficients of interest β_4 and β_5 measure the effects of CEO and CFO overconfidence, respectively, on debt financing, conditional on the financing deficit.

We start again from the relationship between CEO overconfidence and financing, which has been the focus of prior research, before turning to CFO biases. The baseline regression in column 1 of Table 4 includes only the CEO overconfidence measure, its interaction with the net financing deficit, and firm fixed effects. Column 2 adds the full set of control variables. In column 3, we further add the interactions between the net financing deficit and the control variables.[25] In these regressions, the coefficients of CEO overconfidence interacted with net financing deficit are positive, though varying in significance and size. When the full set of controls and interaction effects is included (column 3), the coefficient is 0.164, significant at the 5% level, which is smaller but more precisely estimated than the estimate in Malmendier et al. (2011).

In columns 4 to 6, we replace the CEO- with the CFO-overconfidence measure. The sensitivity of net debt issues to the net financing deficit among overconfident managers increases significantly. The coefficient estimates of the interaction effect lie between 0.179 and 0.243. These results corroborate our finding that CFO biases exert a significant influence on firms' financing decisions and tilt them towards debt financing.

Finally, we include both CEO- and CFO-overconfidence measures jointly. The results remain similar. The effect of CEO overconfidence is insignificant in columns 7 to 8, and remains only marginally statistically significant in the full-model estimation in column 9, with the estimated size dropping somewhat from 0.164 in column 3 to 0.104. Conversely, the effect of CFO overconfidence remains large and precisely estimated. The estimated effect on the sensitivity of net debt issues to the net financing deficit ranges from 0.166 to 0.247, and is significant at the 1% or 5% level. For example, compared to the stand-alone FD coefficient of 0.094 in column

[24] For example, Q is negatively related to debt issuance, tangibility and size positively. (All variables are in first differences.)
[25] In columns 3, 6, and 9, FD is interacted with year dummies, so the (redundant) stand-alone variable is omitted.

8, this sensitivity more than triples for overconfident CFOs, to 0.302 (0.094 + 0.208). In the specifications of columns 7 and 8, the CEO and CFO coefficients are also statistically different at the 10% level (p-values of 0.057 and 0.078, respectively). We cannot reject the null hypothesis that the two coefficients are not different in the most demanding specification of column 9; however, we will see in Section 3.4 that the difference becomes larger and significant once we restrict attention to firms where the CEO is less likely to be entrenched.

Taking the results from both the debt-issuance and financing-deficit estimations together, CFO overconfidence emerges as statistically and economically significant while CEO overconfidence exerts at most marginal influence once we account for the role of the CFO.

3.3 Leverage and Managerial Overconfidence

Given the magnitude of our estimates so far, it is conceivable that the effect might translate into a measurable impact on firms' capital structure. As overconfident CFOs tend to prefer debt over equity issuances, their companies might display, on average, higher leverage. To investigate this question, we estimate the following specification:

$$\text{Leverage}_{i,t} = \beta_1 \text{LTCEO}_{i,t} + \beta_2 \text{LTCFO}_{i,t} + X'_{i,t} B + \theta_i + \delta_t + \varepsilon_{i,t}. \tag{3}$$

$\text{LTCFO}_{i,t}$ and $\text{LTCEO}_{i,t}$ are the usual Longholder proxies, $X_{i,t}$ is a vector of control variables, θ_i are firm fixed effects, and δ_t are year dummies. After controlling for firm fixed-effects, the identifying variation comes from firms that switch from an unbiased to an overconfident manager, and vice versa. Our dependent variable is market leverage, expressed as the ratio of long-term debt plus debt in current liabilities over market capitalization (price times common shares outstanding) plus the value of debt from the numerator, all multiplied by 100. This estimation uses again the full sample.[26]

Table 5 reports the results. In column 1, we include only Longholder CEO plus firm and year dummies. The coefficient estimate for CEO overconfidence is positive, and equal to 1.485, although insignificant. The coefficient estimate is reduced to 0.89, and remains insignificant, when control variables are included (column 2). All the firm-level control variables, on the other hand, have the expected sign. Larger firms with higher tangibility are more leveraged, whereas profitability and Q are negatively related to leverage. Hence, we

[26] We lose 24 observations relative to the specification in Table 4 because either long-term debt or short-term debt is missing.

estimate a qualitatively similar but weaker role of CEO overconfidence than prior literature (cf. Malmendier et al., 2011). As we will discuss in Section 3.4, though, this result masks substantial heterogeneity, with biases of more dominant CEOs exerting a large influence of capital structure.

Turning to the CFO effect, in columns 3 and 4, we estimate a strong and sizeable positive association with market leverage. It makes little difference whether or not we include control variables. In column 4, the coefficient is 3.678 (with a t-statistic of 2.815). When we consider both managerial biases jointly, in columns 5 and 6, the coefficient estimate on Longholder CFO becomes slightly larger and more precisely estimated, e.g., 3.800 with a t-statistic of 2.904 in the specification with the full slate of controls (column 6). To further probe the robustness of this result, we also add controls for financing deficit (in column 7) and lagged one-year returns (in column 8). The coefficient on Net Financing Deficit is positive, giving support to traditional pecking-order models of corporate financing (Shyam-Sunder and Myers, 1999). The coefficient on past returns is negative, likely capturing both market timing reasons (see, e.g., Welch, 2004) and a mechanical effect: past high returns lower market leverage simply because they increase the denominator. In all cases, our coefficient of interest is unaffected. The coefficients on CEO and CFO overconfidence are statistically different from each other at the 10% level in columns 6, 7, and 8, respectively. We will see in Section 3.4 that, once we restrict the attention to CEOs who are less entrenched, the difference becomes larger and more precisely estimated.

In summary, our analysis of leverage confirms and strengthens the main message of Sections 3.1 and 3.2: The influence of CFO overconfidence on financing decisions appears to be strong and persistent enough to translate into a measurable influence even on the overall leverage ratio.

3.4 CEO Power Analysis

Our findings imply that, in the realm of financing decisions, the influence of CEO biases and beliefs might be weaker than previously thought. The seeming influence of CEO biases on financing decisions appears to reflect, at least partially, the influence of CFO biases. Moreover, the stand-alone influence of CEO overconfidence appears to be comparable, albeit somewhat smaller in the debt issues and financial-leverage context than in prior evidence on older samples (Malmendier et al., 2011).

Our estimates are consistent with the evolution of the CFO role in recent years. There is broad consensus that the importance and responsibilities of CFOs have expanded significantly over our sample period (Fabozzi et al., 2008), driven partly by regulatory changes such as the Sarbanes-Oxley Act (Narayanan and Seyhun, 2005). Still, even across modern corporations there is considerable heterogeneity in the balance of power between the CEO and the other top executives. In this subsection, we test whether such heterogeneity affects the relative influence of CEO versus CFO overconfidence.

We build on two strands of the prior literature to construct proxies for firms where the CEO is rather dominant and likely to have an outsized influence on all decisions, including capital structure. A first proxy is CEO tenure. Dynamic principal-agent models like Hermalin and Weisbach (1998) predict that CEO dominance increases over her tenure, and tenure has been used as a proxy for managerial entrenchment in numerous analyses (Berger, Ofek, and Yermack, 1997; Chava, Kumar, and Warga, 2009; Korkeamäki, Liljeblom, and Pasternack, 2017). Most closely related, Graham et al. (2015) find that CEOs are more likely to delegate capital structure decisions to CFOs when they have short tenure. Second, there is ample evidence that CEO compensation is at least partially determined by managerial power (see, e. g., Frydman and Jenter, 2010). An example is the negative relationship between measures of stringency of governance and CEO pay (Bertrand and Mullainathan, 1999; Chhaochharia and Grinstein, 2009).

We use above- versus below-median tenure (averaged over the sample period) and CEO pay (scaled by market capitalization to allow comparisons across firms of different sizes) as our proxies. We replicate our prior financing-deficit and leverage analyses from Sections 3.2 and 3.3, separately for each of the four subsamples.

In columns 1 and 2 of Panel A, Table 6, we display the coefficients on the interaction between CEO overconfidence and financial deficit, separately for firms with below-median and above-median CEO tenure. The magnitude of the coefficient doubles when we move from the low to the high CEO-tenure subsample (0.122 versus 0.226), and the significance increases from the 10% to the 5% level. When we include proxies for CFO overconfidence, the magnitude and statistical significance of the effect of CEO overconfidence drops sharply; however, the coefficient remains (marginally) statistically significant in the high CEO-tenure group. Remarkably, the coefficients on the interaction between CFO overconfidence and financing deficit follows the *opposite* pattern: CFO overconfidence strongly predicts the choice of external financing only in the subsample

where CEO tenure, and so entrenchment, is low. In other words, our finding of a significant role of CFO overconfidence in firms' financing decisions is driven by those firms where the CEO is more likely to delegate decisions to other managers, while CEO overconfidence remains a (marginally) significant determinant in firms where the CEO is likely to be the dominant decision-maker.

The same picture emerges when we restrict the attention to firms with above-median pay, on the right in Panel A: Without the CFO proxy, the coefficient on FD $\times$ Longholder CEO is positive and similar in magnitude in both the low- and high-pay subsamples, although more precisely estimated in the latter group of firms. With the CFO proxy included, however, the CEO effect remains positive, large, and significant only in the high-pay subsample. The coefficients are 0.191 in the high- versus -0.029 in the low-pay subsample. When we look at the role of CFO overconfidence, we find again the opposite pattern, with a significant estimate of 0.313 in the low- and an insignificant estimate of 0.028 in the high-pay sample. In the low-pay sample, the CEO and CFO overconfidence coefficients are statistically different at the 1% level.

The results of Panel B, where we analyze the relationship between leverage and managerial overconfidence, tell a similar story. CEO overconfidence is positive and, mostly, marginally statistically significant in the high CEO tenure and high CEO pay subsamples. The magnitudes and statistical significance are also in line with previous research.[27] The coefficient is small and insignificant, and, if anything, negative, in the subsamples where CEOs are likely to be less powerful. In these sets of firms, characterized by low CEO tenure or pay, however, CFO overconfidence displays a much stronger association with capital structure choice. In both the low-tenure and low-pay subsamples the CEO and CFO overconfidence coefficients are statistically different at the 5% level, with $p-$values equal to 0.015 and 0.024, respectively.

All estimation results confirm the significant role of CFO biases as well as the (partial) confound regarding the role of CEO biases in prior literature. Most importantly, they offer a more nuanced picture of the respective roles of CEO and CFO biases in corporate financing: In firms where the CEO tends to dominate all decision making, CEO overconfidence does have a significant influence on external financing decisions, even after accounting for the influence of the CFO. In firms where instead the CEO is more likely to delegate, external

[27] Table VII of Malmendier et al. (2011) finds coefficients between 3.61% and 5.18%, with t-statistics ranging from 1.95 to 2.44.

financing is strongly influenced by the CFO's rather than CEO's overconfident beliefs.[28]

3.5 The Roles of Other Executives

The estimation results so far indicate that CFO biases significantly affect corporate financing. This finding has two important implications: First, biases of top managers other than CEOs have a measurable impact on corporate decisions, and failure to account for them will lead to misattribution. Second, the domains of managers matter. We have found CFO beliefs to influence decisions precisely in those domains where they exert a more dominant role – financing outcomes – and to dominate the influence of CEO beliefs in those areas.

To probe the latter claim on the importance of domain specificity, we re-estimate our empirical models including the Longholder Other proxy. Since, for most companies, ExecuComp provides information on the highest-paid executives regardless of their title, and since many of the "other" executives do not have large option packages that allow building an overconfidence proxy, the data does not allow us to systematically test the influence of each type of C-suite executive on their domain-specific realms beyond the CEO and CFO. We can test, though, for a lack of influence on financing decisions that are in the CFO's realm (and later, in the next section, for a lack of influence on internal and external investment decisions, which are the CEO's realm). If the Longholder Other proxy were to significantly predict financing decisions, and the estimated effects of CEO and CFO overconfidence changed, then the test would challenge the proposed interpretation. If instead the alternative Longholder proxy does not have significant predictive power for financing decisions, while the CFO remains significant, the additional analyses will corroborate the domain-specific role of CFO bias.

We re-estimate models (1) for debt issuance, (2) for the financing-deficit analysis, and (3) for leverage with Longholder Other, the indicator for missing values, and controls for stock and vested options (unreported for brevity). In addition, we include the interaction with the financing deficit in the replicated financing-deficit analysis. We also replicate the analysis that splits firms depending on our proxies for CEO "power."

In Table 7, columns 1 to 3, we show the estimation results for the most conservative specifications from

[28] We have also performed a similar exercise with respect to the analysis of debt issues from Section 3.1. Here, the coefficient on Longholder CEO does not display any distinctive heterogeneity with respect to CEO tenure or pay. One possible explanation is that the *frequency* of debt issues is a less precise measure of pecking-order preferences than their *amount* (as measured by the financing-deficit framework) or debt *holdings* (as measured by the leverage regressions).

Tables 3 (debt issues), Table 4 (financing deficit), and Table 5 (leverage). The effect of CFO overconfidence remains highly significant and quantitatively very similar to the previous estimations. The effect of CEO overconfidence is also similar to the prior estimations: It remains insignificant in the debt-issues and leverage regressions in columns 1 and 3, and it becomes slightly more significant in the financial-deficit estimation in column 2. The coefficient of Longholder Other (or its interaction with the financing deficit) is insignificant, except in the leverage regression (column 3), where, however, it has a negative sign.

In columns 4 to 11, we move to "CEO power" splits as in Table 6, now with all three overconfidence proxies included. Again, our conclusions remain unchanged. CEOs appear to dominate CFOs in firms where they are more likely to exert influence, with the results being particularly strong in the financing deficit regressions (columns 4 through 7). The inclusion of Longholder Other has little effect on the results.

All estimation results corroborate our prior findings and explanation. In each of the empirical models concerning financing decisions, it is primarily the CFO's bias that affects financing choices, unless the firm is run by a "powerful" (entrenched) CEO. The additional analysis also helps further address identification concerns about omitted firm characteristics that might be correlated with our Longholder proxy, which had affected prior literature, e. g., the concern that board preferences for high leverage might be correlated with the appointment of overconfident managers. While the inclusion of firm fixed-effects rules out such confounds to the extent that they are time-invariant, the inclusion of both the Longholder CEO and Longholder CFO proxy, and here even the Longholder Other proxy, help address time-varying firm characteristics, as it seems implausible that the board would lean towards overconfident managers for the CFO role but not the CEO and other C-level roles. More generally, it would seem unlikely that a spurious correlation arose only for CFO's overconfidence but not for the CEO and not for other C-level executives.

4 Overconfidence, Cost of Debt, and Acquisitions

We complement the analysis of financing decision by considering decision-making domains of the CEO rather than the CFO. For this second set of predictions, we first focus on corporate investment, and specifically the relationship between overconfidence and the cost of debt. We also consider the role of earnings volatility since,

as we discuss, overconfidence counteracts potential debt overhang problems only when volatility is not too high (or too low). Second, we consider the propensity to engage in M&A. This second set of estimations also addresses the concern that our proxy, due to some measurement error, may systematically fail to detect a meaningful CEO influence. As we show here, once we move from the financing domain to the investment domain, CEO overconfidence does significantly impact corporate outcomes.

4.1 Corporate Investment and the Cost of Debt

The CEO is the ultimate responsible for the implementation and continuation of investment projects, and determines the risk and return of the firm's investment projects. As a result, investors will base the appropriate required interest rate when funding an investment on the CEO's attitudes, skills, and beliefs, including overconfident beliefs. While there is evidence that overconfident CEOs may engage in value-destroying projects (Malmendier et al., 2011), the theoretical literature also suggests that overconfidence can lead to a *lower* cost of debt conditional on the choice of investment project. Intuitively, as Hackbarth (2009) shows theoretically, overconfident managers can credibly commit to exert effort in the implementation and continuation of a risky project even after receiving negative signals regarding their success. Rather than abandoning the project and defaulting, they will tend to keep striving for the good outcome. Knowing the attitude of the CEO, lenders require a lower rate of return ex ante. Moreover, as we derive in the theoretical model in Appendix A, the lower cost of financing is driven by firms that display an intermediate range of earnings volatility. In firms where volatility (difference between the good and bad earnings realizations) is very large or very low, overconfident and rational CEOs display the same response to receiving a bad signal, and financing costs are unaffected. For an intermediate range, however, overconfidence helps address potential debt overhang problems.

We test this second set of predictions using DealScan data merged with our overconfidence measures. To match the finer time periods in DealScan, we re-construct our firm-level control variables using the Compustat quarterly database, following Valta (2012), among others. We measure the cost of debt financing as the spread between the interest rate paid by the firm and the LIBOR (in basis points). This variable is slightly right-skewed, and we employ the natural logarithm in our specifications. (Results are unaffected if we use the actual

spread.) We relate this outcome variable to managerial overconfidence as follows:

$$\log(\text{Net Interest}_{i,t}) = \beta_1 \text{LTCEO}_{i,t} + \beta_2 \text{LTCFO}_{i,t} + \beta_3 \text{LT Other}_{i,t} + X'_{i,t}B + \delta_t + \varepsilon_{i,t}, \tag{4}$$

where $\text{LTCEO}_{i,t}$, $\text{LTCFO}_{i,t}$, and $\text{LT Other}_{i,t}$ are our usual proxies for overconfidence. $X_{i,t}$ is a vector of control variables at the manager, firm, and loan level, and also includes industry fixed-effects. At the firm level, we include log(Assets) as larger firms might be perceived as less risky by lenders;[29] book leverage, given that highly indebted firms presumably face a higher cost of debt; cash holding scaled by total assets as an additional proxy for a firm's liquidity; and the z-score, which captures the firm's default risk. Following Valta (2012), we also include earnings volatility, defined as the ratio of the standard deviation of the past eight earnings changes to the average book assets over the past eight quarters. At the loan level, we include log(Maturity) (in months) and log(Loan Amount) (in millions of dollars). The control for loan maturity is also motivated by Huang et al. (2016), who find that CEO overconfidence is associated with a preference for a shorter debt maturity. We include further loan-level controls motivated by recent work on the relationship between managerial biases and the cost of debt financing. Adam et al. (2020) show that managerial optimism is related to the inclusion of performance-pricing provisions (PPP) in loan contracts. Sunder et al. (2010) find, instead, that loan contracts are more likely to include debt covenants when the borrower CEO is overconfident. Therefore, we also include indicator variables equal to 1 if the loan contract includes PPPs or covenants, respectively.[30] We include the usual managerial level controls for the total number of shares and the number of vested options owned by each executive, standardized by the number of shares outstanding. Finally, δ_t captures year-quarter fixed-effects and, in some specifications, we also add loan-type fixed effects.

Before moving to the empirical analysis, we notice that we are not the first to analyze the relationship between overconfidence and the cost of debt. For example, Sunder et al. (2010) study the use of covenants and also mention that they tested for an association between CEO overconfidence and public bond yields. They state that they do not find conclusive evidence, possibly because of the small sample size. Lin, Chen, Ho, and Yen (2020) analyze covenants and other loan characteristics, and find a negative relationship between CEO overconfidence and interest rates on corporate loans. While their estimates are smaller than those

[29] We use log(Assets) as the proxy for size following Valta (2012); using log(Sales) produces the same results.
[30] Covenants are identified using the procedure of Bradley and Roberts (2015).

presented here, it is important to acknowledge that their measure of overconfidence does not use the detailed transaction-level data from Thomson Reuters but only ExecuComp data, following Hirshleifer et al. (2012). Hence, as discussed extensively in prior literature (see, e. g., Malmendier and Tate, 2015), due to the lack of actual exercise data the measure requires strong assumptions about the true exercise price of options, and attenuation bias resulting from misclassification likely explains the weaker results. In addition, they do not construct overconfidence proxies for the CFO or other executives; hence, they do not examine which of the two executives are more important in predicting loan rates, which is the main goal of our analysis here.

Baseline Results. Table 8 shows the main results from estimating equation (4). Column 1 shows the baseline estimation that includes only Longholder CEO, industry fixed effects, and year-quarter fixed effects as independent variables. We find that CEO overconfidence is associated with a lower cost of debt. The coefficient of -0.199 is highly significant (p-value < 0.01). The estimated effect is economically sizeable, amounting to about one fifth of a standard deviation of the outcome variable.

In column 2 we include the control variables mentioned above. Our coefficient of interest is slightly reduced (-0.168), but the statistical significance increases, with a t-statistic over 3. Among the other regressors, leverage and maturity enter with a positive sign, and size and loan amount are associated with lower interest rates. The presence of PPPs is associated with a reduction in interest rates, whereas loans with covenants tend to be more costly. Earnings volatility, cash holdings, and the managerial control variables are insignificant.

In columns 3 and 4 we turn to CFO overconfidence. The association between Longholder CFO and lower interest rates is insignificant in the baseline estimation, and becomes marginally significant in the specification with control variables. All control variables are very similary. However, when we include our measures of CEO and CFO overconfidence jointly (in columns 5 and 6), the association with CFO overconfidence becomes insignificant whereas the coefficient of Longholder CEO remains large in magnitude and significant (-0.159, with a t-statistic of -3.046). Hence, it appears that the effect of managerial overconfidence on banks' willingness to finance a loan more cheaply does not extend to the CFO. The results persist even when we add loan-type fixed effects (column 7). The latter specification is rather conservative as the controls for the type of loan may absorb some of the relation between overconfidence and the cost of debt. Nevertheless, the coefficient on

Longholder CEO remains similar (−0.118) and significant at the 5% level.

We conclude that the beliefs of the CFO and, specifically, CFO overconfidence do not significantly influence the cost of financing, while those of the CEO do. The interpretation offered by the model in Appendix A is that the CFO, while involved in the choice of external and internal financing modes, is less relevant to the operational decisions and effort choices pertaining to the identification, implementation, and continuation of corporate investment projects.

Finally, we test whether other executives' biases matter for interest rates charged on loans. In column 8 we include Longholder Other, namely the overconfidence proxy of the highest paid executive other than CEO and CFO, along the lines of the estimations in Section 3.5. For brevity we show only the most conservative estimation. We do not find evidence that other executives' beliefs matter for financing terms. Importantly, the coefficient on Longholder CEO remains statistically significant and similar in magnitude (−0.125).

We acknowledge that, even though the difference between the overconfidence coefficient for the CEO and the CFO or, respectively, the CEO and other C-suite executives is economically large, we do not have enough statistical power to reject the null hypothesis that the respective two coefficients are different given the small sample size. (In columns 5, 6, 7, and 8 the p-values are 0.245, 0.153, 0.266, and 0.229, respectively.)

To summarize, overconfident CEOs appear to generate more favorable financing conditions. Longholder CFOs affect the type of financing but not the cost of financing; the overconfidence of other C-suite executives does not signficantly influence outcomes in either domain.

Effect of Overconfidence in Different Subsamples. As outlined above, and formalized in the model in Appendix A, we hypothesize that the negative relationship between overconfidence and the cost of debt arises because overconfidence can reduce the extent of the moral hazard problem associated with the risk of debt overhang. Based on this insight, first formulated by Hackbarth (2009), we develop the additional and distinctive prediction that the firms that are able to obtain more favorable debt financing under an overconfident CEO are those that experience intermediate ranges of return variability. In these firms, the uncertainty about future cash flows is large enough to reduce the incentives to 'work hard' on the implementation or continuation of investment projects in bad states of the world for rational CEOs, but not for overconfident CEOs. Overconfidence drives

a wedge into managerial choices, as overconfident CEOs continue to believe that they can generate a positive outcome when the intermediate signal is negative, and rational CEOs do not. If, instead, uncertainty is very small or very large, there are no such differences in CEO behavior. Rational and overconfident CEOs will either both continue or both abandon their investment efforts upon negative news.

To test the predicted non-monotonicity of the CEO overconfidence effect, a natural proxy for firm return variability is earnings volatility, estimated from actual earnings realizations. As discussed above, we use the ratio of the standard deviation of the past eight earnings changes to average book assets over the past eight quarters, which is a popular proxy for profit variability (at least) since Brealey, Hodges, and Capron (1976). (Recent uses include Valta (2012) and Matsa (2010).) The autocorrelation of this measure at annual frequencies is about 78% in our data. Hence, lagged values of volatility are strong predictors of future firm-level risk, making our measure of return variability a good proxy for a firm's risk from the lenders' perspective.

Based on the earnings variability proxy, we sort firms every year into a region of low, medium, or high variability, and estimate equation (4) on each of the three subsamples. As the model does not pin down the exact thresholds between low, medium, and high, we use terciles as a natural starting point. Terciles allow us to test for the predicted non-monotonicity while ensuring sufficient statistical power and estimates of comparable reliability across subgroups.[31] We check the robustness of our results to a wide range of different cutoffs, by using quantile splits of 35-30-35, 30-40-30, and 25-50-25. We also replicate the results using the continuous overconfidence proxy of Otto (2014). Results are reported in Appendix C (see Appendix-Table C.2).

The results are reported in Table 9. For brevity, we display the estimation with the full set of controls, mirroring column 8 of Table 8, and report only the coefficients of Longholder CEO, Longholder CFO, and Longholder Other. We continue to control for loan riskiness in multiple ways, as discussed above.

Starting from the top panel, we see that the coefficient on Longholder CEO is large and significant in the intermediate tercile, with a coefficient of -0.209 and a t-statistic of -2.798. Since our dependent variable is log-transformed, the coefficient indicates a change of 20.9%, or 26.75 bp relative to a sample mean of 127.97

[31] We divide the data into percentiles of each proxy year-by-year to account for non-stationarity. We then adjust the cutoffs to ensure that the size of each subsample is roughly one third. The adjustment ensures that our results are not driven by variation in sample size as well as cutoff points, though the results are similar without the adjustment. We also find similar results when we define quantiles using loans rather than companies, impose a minimum number of companies in a given year, or group together adjacent years with small sample sizes.

bp. In terciles 1 and 3, instead, the coefficients on CEO overconfidence are small (-0.026 and -0.090) and insignificant. In addition, neither Longholder CFO nor Longholder Other are significant in any tercile. The difference between the CEO and CFO Longholder coefficients in the medium tercile is statistically different from zero at the 10% level (p-value = 0.090).

When using alternative sample splits, shown below the tercile split, we obtain qualitatively very similar results, with the Longholder CEO coefficient being statistically significant only in the medium variability subsample (except in the 35-30-35 split, where it is significant at the 10% level). We also replicate the result that the economic magnitude is always largest in the medium region.

In addition to employing earnings volatility, we use two additional measures of return variability that capture uncertainty as perceived by outside observers: (1) analyst coverage (similarly to Hong, Lim, and Stein, 2000, and Schutte and Unlu, 2009); and (2) the coefficient of variation of analysts' annual earnings forecasts (Cheng and Warfield, 2005). As Appendix-Table C.1 shows, we obtain similar results when we use these two alternative proxies.

Overall, these results, together with the robustness checks in the Appendix,[32] reveal that CEO overconfidence predicts lower financing costs, but only for firms displaying medium volatility. The Longholder proxies for overconfident CFOs and other C-suite executives do not predict variation in financing costs.

The robustness of the estimates in this medium range, and the lack thereof in the other subsamples, corroborate the proposed interpretation and address concerns about unobserved covariates more sharply. If an unobserved variable were to explain our findings, it would have to vary non-monotonically with earnings volatility and analyst uncertainty to rationalize our findings. It is hard to find such an explanatory variable. For example, if our concern is that the lower cost of debt reflects private information about the superior quality (lower risk) of Longholder CEOs' investment projects (despite the evidence to the contrary in Section 2.3), then we would expect the effect to be strongest for firms that are subject to high asymmetric information, such as those that have low analyst coverage or high disagreements, rather than co-vary non-monotonically.

In addition, any alternative interpretation of the Longholder coefficients would need to offer an explanation

[32] We replicate the analysis using the continuous overconfidence proxy of Otto (2014). As shown in Panels F and G of Appendix-Table C.2, the baseline Longholder CEO effect as well as the non-monotonicity and estimates in the "medium" sample under various sample splits are very similar.

for why the CEO proxy and not the CFO proxy is significant here, while the CFO proxy and not the CEO proxy is significant for the financing choices analyzed above. This variation is hard to attribute to an unobserved variable being correlated with the Longholder proxy. Taken together, the non-monotonicity and the variation in which Longholder proxy matters seem unlikely to be explained by a hypothetical unobserved variable.

4.2 Acquisitions

Another corporate decision in the CEO's domain are mergers and acquisitions. CEOs are likely to retain the role as central decision-makers in the context of strategic decision that can have long-term consequences for firm value. A natural outcome to consider is the propensity to engage in acquisitions, following Malmendier and Tate (2008). Intuitively, overconfident CEOs tend to overestimate the additional value they create when merging with a target. At the same time, they are reluctant to use external financing to fund acquisitions, as they believe that investors underestimate the value of their company and hence that external financing is too expensive. These two implications of managerial overconfidence result in opposing predictions regarding the propensity to engage in acquisitions: positive according to the first channel, and negative according to the second. However, in financially *unconstrained* firms, which do not need to rely on external financing or in which external financing does not come at (perceived) excess costs, the first channel dominates the second.

We test whether overconfident CEOs have a higher propensity to engage in acquisitions (when financially unconstrained) while the biases of CFOs and other executives do not play a significant role. We estimate

$$\frac{\text{Acquisitions}_{i,t}}{\text{Market Cap}_{i,t}} = \beta_1 \text{LTCEO}_{i,t} + \beta_2 \text{LTCFO}_{i,t} + \beta_3 \text{LT Other}_{i,t} + X'_{i,t} B + \theta_i + \delta_t + \varepsilon_{i,t}. \tag{5}$$

where LTCEO, LTCFO, and LT Other are our usual overconfidence proxies. X is a vector of firm- and manager-level controls, and θ and δ are firm and year fixed effects, respectively. Our key outcome of interest is given by the total dollar amount spent in acquisitions (Compustat item *aqc*) scaled by the firm's market capitalization.[33]

The results are shown in Table 10. We estimate equation (5) with only Longholder CEO and Longholder

[33] Results are similar when scaling by total enterprise value, net or gross of cash.

CFO included and without control variables in column (1). Here, the coefficients on both Longholder CEO and Longholder CFO are insignificant and small in magnitude, consistent with the ambiguous prediction for the *unconditional* relationship between managerial overconfidence and the propensity to engage in acquisitions.

Turning to the distinction between financially more or less constrained firms, we follow Farre-Mensa and Ljungqvist (2015), who argue that, among various commonly used measures of financial constraints, Merton (1974)'s distance to default most consistently captures the behavior of truly constrained firms.[34] Accordingly, we sort firms in terciles, going from the most to the least constrained firms (i.e., from lowest to highest distance to default) and re-estimate the model from (5) in columns 2 through 4. As predicted, we estimate a positive and significant coefficient (0.016) on the Longholder CEO proxy only in column 4, where we restrict the analysis to unconstrained firms. In columns 5 through 7 we perform the same analysis, this time adding firm- and manager-level controls. Results are similar: If anything, the coefficient on Longholder CEO is slightly larger, equal to 0.019 and significant at the 5% level. Interestingly, not only the coefficient on Longholder CFO is always small and insignificant, but exhibits no variation related to the degree of the firm's financial constraints.

Finally, in column 8 we also include the Longholder Other dummy. For brevity, we perform this test only in the subsample of unconstrained firms. The coefficient on this variable is small and insignificant;[35] conversely, the coefficient on CEO overconfidence remains positive and significant. The point estimate, 0.019, is also economically large, as compared to the sample mean and standard deviation (0.025 and 0.061, respectively). Moreover, the difference between the coefficients on Longholder CEO and Longholder CFO is statistically significant at the 10% level (the $p-$values are 0.084, 0.084, and 0.086 in the analyses of the unconstrained sample in columns 4, 7, and 8, respectively).

These results confirm the thrust of previous empirical research on the relationship between CEO overconfidence and M&A actitivity (Malmendier and Tate, 2008), and enrich it by showing that CEOs dominate other executives in this setting. The overconfident beliefs of CFOs and other C-suite executives do not exert

[34] We construct the distance-to-default measure following Farre-Mensa and Ljungqvist (2015) and Bharath and Shumway (2008).

[35] In unreported tests, we estimate a positive (0.046) and significant coefficient for Longholder Other in the sample of constrained firms, the only case in which we detect a significant effect of other executives' overconfidence on corporate decisions. This result may suggest that other executives' biases could play a role in strategic decisions involving acquisitions. However, we also note that overconfidence would predict a higher propensity to engage in acquisitions in *unconstrained*, not *constrained* firms, which makes this result hard to interpret.

significant influence on merger decisions. In addition, this evidence, coupled with the results on the cost of debt, helps mitigate concerns that our measure of CFO overconfidence always trumps CEO overconfidence regardless of the outcome.

5 CFO Hiring Decisions

As the final step in our empirical analysis, we provide evidence that overconfident CEOs are more likely to hire other top managers with similar beliefs. We perform the analysis with the understanding that the CEO does not necessarily select other top executives single-handedly, but is able to influence the board in the selection of a CFO who will not systematically oppose her own vision (Landier et al., 2013), and can strongly affect the overall composition of the board (Shivdasani and Yermack, 1999).

Our analysis focuses on CFOs because of the incomplete and uneven coverage of other C-suite executives, especially as we cannot utilize the the auxiliary indicator for missing information here when the overconfidence indicator is the outcome variable. (We are, however, able to control for Longholder Other as before.) We consider all CFOs appointed after a given CEO, and test whether they are more or less likely to be overconfident depending on the CEO's bias. We identify CFO changes in our sample using ExecuComp's *execid* identifier. We then relate, for any new CFO appointed in year t, the time t Longholder CFO proxy to the time $t-1$ Longholder CEO proxy and all relevant control variables at time $t-1$. We estimate the following regression model:

$$\text{LTCFO}_{i,t} = \beta\, \text{LTCEO}_{i,t-1} + X'_{i,t-1}B + \delta_t + \varepsilon_{i,t}, \tag{6}$$

where $X_{i,t-1}$ is a vector of controls, and δ_t a vector of year dummies. These filters leave us with 213 observations.

Results are reported in Table 11. The baseline analyses in columns 1 to 3 show the coefficient estimates with a stepwise increasing set of control variables: In column 1, we include only year fixed-effects. In column 2, we add industry fixed-effects, which take into account the fact that overconfident executives may sort into specific industries.[36] Column 3 further adds our usual set of managerial and firm-level controls.

All three empirical models consistently show that overconfident CEOs are more likely to appoint overconfi-

[36] We use the Fama and French (1997) 12 industries classification because of the small number of observations. However, using the more detailed two-digit SIC Code industry dummies (as in the other tables) has no effect on our results.

dent CFOs. Despite the small number of observations, the coefficient on Longholder CEO is always significant at the 1% level. In our most demanding model (column 3), the estimates imply that in a firm run by an overconfident CEO the likelihood of hiring an overconfident CFO rises by 29%. Not surprisingly, given the magnitude of this estimate, the incremental explanatory power of Longholder CEO is also large, with an R^2 of 25.4%, relative to 20.5% when the overconfidence proxy is dropped.

We perform several robustness checks to address possible alternative explanations. First, we ask whether there might be spurious similarities in the two executives' option-exercise behavior. Since the CEO and CFO are employed at the same firm, they might receive similar compensation packages, for example heavily tilted towards option grants, which might result in similar stock-exercise behavior. Another possibility is that, once being hired, a CFO might start mimicking the CEO's trading behavior, either to signal loyalty or because they receive common signals regarding the firm prospects.

One way to address both concerns is to classify CFOs as overconfident solely based on their option exercises *prior* to their CFO appointment. That is, we restrict the analysis to CFOs who have executed at least one trade in the years before being hired and construct the overconfidence proxy based on their pre-appointment trading behavior. If, before being hired, a CFO has not executed any transactions that would lead us to classify him as overconfident, we set Longholder CFO to zero, even if his later behavior would reveal him to be overconfident. This sample restriction and re-classification addresses both concerns as CFOs' trading behavior before being appointed cannot be driven by similarity in the compensation schemes nor by mimicking behavior.

As shown in column 4, the restriction reduces the sample, denoted as "Pre" at the bottom of the table, to only 61 observations. Even in this small sample, however, the coefficient β remains statistically significant and is, if anything, slightly larger (0.337) than the coefficient estimated on the full sample (0.29 in column 3).

As a second way to tackle this concern, we return to the full sample, but include characteristics of the CFO's compensation package to control for package-related determinants of the CFO's trading behavior. Specifically, we control for the CFO's vested options and shares owned, scaled as usual by the total number of shares outstanding, measured in his first year as CFO (time t). We also include their lagged values (time t-1), to control for characteristics of the CFO's compensation packages before being hired.[37] As shown in column 5,

[37] The lagged values of vested options and shares owned are missing for 89 out of 213 CFOs, either because they were not

our estimation results are robust to the inclusion of these controls. The coefficient on CEO overconfidence remains very close to its baseline estimate, and all CFO compensation package controls are insignificant.

Finally, we include Longholder Other in the estimation. As before, the purpose is twofold: First, it is a check on domain specificity. The CEO and not other executives would be expected to play the key role in selecting the next CFO. Second, it addresses unobserved correlates. If our hiring results were driven by similarities in the compensation structure granted to top executives working at the same firm, we would expect to also estimate a positive correlation between Longholder Other and the hiring of a Longholder CFO. As shown in the last column of Table 11 (column 6), we estimate a small and insignificant coefficient of Longholder Other, while the magnitude and significance of the Longholder CEO coefficient remains unaffected.

In summary, our hiring analysis reveals that, above and beyond the direct influence of CEOs' biased beliefs on corporate outcomes, CEO biases exert an indirect influence via assortative matching. These results also help bridge the gap between the existing literature and our findings. As discussed before, we estimate a similar relationship between CEO overconfidence and debt financing as in prior research (Malmendier et al., 2011) when not controlling for CFO overconfidence; but the estimate becomes insignificant when we do include CFO overconfidence into the estimation. The assortative-matching result implies that some of the effects of CEO overconfidence on debt choice are a second-order effect of hiring an overconfident CFO. Although sample size plays a role, this also helps to explain the lower significance of the CEO overconfidence findings in Malmendier et al. (2011) in comparison to our findings on CFO overconfidence.

6 Conclusion

A key question in the analysis of managerial biases and the assessment of their empirical relevance is how to account for the beliefs and choices of other managers with whom a biased manager interacts. Prior research has mostly focused on one type of manager, typically the CEO, thereby running the risk of misattribution. For example, the estimated impact of CEO overconfidence on financing choices might reflect, at least partly, the

employed by any firm or because their former employers are not covered in ExecuComp. We include among the controls a dummy equal to one whenever the lagged values are missing, and replace those values with zero.

influence of overconfident CFOs, who might assortatively match with overconfident CEOs.

In this paper, we have taken a first step towards advancing this line of research. We have considered the overconfident beliefs of CEOs, CFOs, and other C-suite executives jointly. We show that CFOs' overoptimistic beliefs have significant predictive power in explaining financing decisions while CEO overconfidence predict investment costs and acquisitions, with positive implications for the cost of debt. That is, CEO overconfidence influences those corporate outcomes that are determined by CEOs, while CFO overconfidence does not. Similarly, CFO overconfidence affects outcomes in the realm of the CFO and, here, CEO overconfidence does not matter. Other top executives' overconfidence does not have significant predictive power in either of these realms. Our findings corroborate previous findings on the significant influence of managerial overconfidence on corporate decisions, address concerns about possible confounds of the Longholder proxy in prior research, and point to the importance of extending the analysis beyond the person of the CEO.

Our analysis also updates previous work on CEO overconfidence in that we estimate a weaker influence of CEO traits on financing decisions in our (more recent) data, even when CEO's overconfidence is considered in isolation. The weaker estimates might reflect that, as noted by practitioners, CFOs' importance has increased sharply over the past decade.[38]

Our findings point to at least two promising avenues for future research. First, it will be interesting to further explore the traits of other (C-suite) managers, such as CTOs or COOs, and their influence on corporate decisions. Are their beliefs, biases, and personal characteristics associated with firm outcomes related to their duties (and not associated with outcomes that do not fall into their decision-making realm)? Such an analysis will require more comprehensive data with more detailed information on managers' characteristics.

Second, our findings suggest richer economic implications of managerial characteristics than demonstrated in previous research, including their influence on effort choices and on hiring decisions. Future research on interactions and peer effects among managers that account for biased belief formation thus appears to be another promising avenue. Relatedly, it might be interesting to explore how managerial traits and biases of

[38] For example, according to a 2014 survey of finance executives run by Accenture PLC, over 70% of the respondents believed that "the CFO's influence over executing business transformation initiatives has grown." (See the report at `https://www.accenture.com/t20150523T035018Z__w__/us-en/_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Dualpub3/Accenture-2014-High-Performance-Finance-Study-CFO-Architect-Business-Value.PDF#zoom=50`.)

candidates affect how managers and boards make hiring decisions.

The last point also suggests important practical implications of our analysis. A longstanding question among practitioners regards the optimal composition of the board and the top management team. It is both important that new members can relate and interact well with the existing team, and that they bring in new and different perspectives. In assessing the composition of boards and the managerial team, practitioners (and academics) tend to rely on easily measurable demographics such as gender, age, education, and prior professional experience. Our results, however, imply that similarity in attitudes and beliefs are an important determinant of decision-making. While executive search firms and appointment committees actively measure and consider such traits (cf. Kaplan et al., 2012; Kaplan and Sorensen, 2021), our findings suggest that they should be evaluated not just in a stand-alone manner (e. g., testing for the "most desirable" traits and attitudes), but jointly with those of the other team members. Moreover, given that top decision-makers tend to surround themselves with similarly-minded individuals, boards of directors should carefully assess whether such homogeneity in beliefs is desirable and, if not, take a more active role in the selection of other members of the C-suite.

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Tables

Table 1
Top Executives and Corporate Outcomes

Executive \ Outcome	Debt Issues	Financing Deficit	Leverage	Cost of Debt	Acquisitions	CFO Hiring
CEO	—	—	—	X	X	X
(Tables)	(3, 7)	(4, 6, 7)	(5, 6, 7)	(8, 9)	(10)	(11)
CFO	X	X	X	—	—	—
(Tables)	(3, 7)	(4, 6, 7)	(5, 6, 7)	(8, 9)	(10)	(11)
Other C-suite Officer	—	—	—	—	—	—
(Tables)	(7)	(7)	(7)	(8, 9)	(10)	(11)

Table 2
Summary Statistics
Panel A. Firm Variables

Variable	Obs.	Mean	Median	St. Dev.
Assets ($m)	4,581	5,792	1,643	14,465
Sales ($m)	4,581	5,706	1,536	17,359
Capitalization ($m)	4,581	8,311	2,264	20,864
Net Fin. Def. / Assets	4,581	-0.030	-0.018	0.366
Net Debt Issues / Assets	4,581	0.027	0	0.159
Book Leverage	4,560	0.290	0.254	0.437
Q	4,581	2.416	1.874	1.960
Change in Q	4,581	-0.034	0.030	1.628
Profitability	4,581	0.185	0.174	0.140
Change in Profitability	4,581	-0.002	0.002	0.097
Tangibility	4,581	0.296	0.198	0.286
Change in Tangibility	4,581	-0.007	-0.003	0.144
log(Sales)	4,581	7.278	7.228	1.578
Change in log(Sales)	4,581	0.108	0.097	0.221
Market Leverage (%)	4,560	0.146	0.105	0.154
Acquisitions	4,581	0.027	0.001	0.085

Panel B. Manager Variables

Variable	Obs.	Mean	Median	St. Dev.
Longholder CEO	4,581	0.683	1	0.466
CEO Stock Ownership [%]	4,581	1.805	0.305	4.839
CEO Vested Options [%]	4,581	1.032	0.665	1.835
Longholder CFO	4,581	0.530	1	0.499
CFO Stock Ownership [%]	4,581	0.120	0.041	0.302
CFO Vested Options [%]	4,581	0.249	0.128	0.644
Longholder Other	1,440	0.640	1	0.480
Other Stock Ownership [%]	1,440	0.617	0.071	2.468
Other Vested Options [%]	1,440	0.387	0.187	0.559

Table 3
Debt Issues

Table 3 shows the estimated log odds ratios from logistic regressions. The binary dependent variable is equal to 1 if Net Debt Issues during the year are positive. Net Debt Issues is long-term debt issuance minus long-term debt reduction. Longholder CEO/Longholder CFO 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. We require managers to have at least ten transactions recorded in Thomson Reuters to be included in the sample. 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 lagged assets. Tangibility is property, plants, and equipment divided by lagged assets. 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, log(Sales), and Book Leverage are measured at the beginning of the year. 2-digit SIC level industry fixed-effects are included in all regressions. Standard errors (and corresponding t-statistics, shown in parentheses) are adjusted for autcorrelation at the firm level. ***, **, and * indicate statistically different from zero at the 1%, 5%, and 10% level of significance, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Longholder CEO	0.111	-0.007			0.012	0.020	-0.126
	(0.944)	(-0.058)			(0.096)	(0.170)	(-1.086)
Longholder CFO			0.354***	0.392***	0.352***	0.412***	0.437***
			(3.182)	(3.430)	(3.062)	(3.510)	(3.725)
CEO Shares		-0.008				-0.028*	-0.009
		(-0.568)				(-1.735)	(-0.659)
CEO Vested		-0.005				-0.007	0.037
Options		(-0.144)				(-0.084)	(1.131)
Q		-0.058		-0.059			-0.060
		(-1.486)		(-1.395)			(-1.423)
Profitability		0.731		0.706			0.706
		(1.213)		(1.184)			(1.179)
Tangibility		0.274		0.296			0.324
		(0.949)		(1.021)			(1.103)
log(Sales)		0.478***		0.475***			0.477***
		(9.757)		(9.873)			(9.856)
Book Leverage		0.096		0.100			0.093
		(0.687)		(0.709)			(0.677)
CFO Shares				-0.085		-0.182	-0.078
				(-0.621)		(-1.055)	(-0.582)
CFO Vested				-0.120		-0.577**	-0.193**
Options				(-1.451)		(-2.486)	(-2.237)
Manager Ctrl.	NO	YES	NO	YES	NO	YES	YES
Firm Controls	NO	YES	NO	YES	NO	NO	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES
Year FE	NO	YES	NO	YES	NO	YES	YES
Observations	2,939	2,939	2,939	2,939	2,939	2,939	2,939
Pseudo R^2	0.042	0.163	0.047	0.169	0.047	0.107	0.170

Table 4
Financing Deficit

Table 4 presents estimates of 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 issuance minus long-term debt reduction. Longholder CEO (LTCEO) and Longholder CFO (LTCFO) are binary variables where 1 signifies that the CEO or CFO, 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. FD is the Net Financing Deficit, which is defined as 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 et al. (2011). Manager-level control variables include Stock Ownership and Vested Options. Stock Ownership is option-excluded shares held by the CEO or CFO as a percentage of common shares outstanding. Vested Options is the number of exercisable options held by the CEO or CFO as a percentage of common shares outstanding. Firm-level control variables include changes in Q, Profitability, Tangibility and log(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. Columns (3), (6), and (9) also include the interaction of Net Financing Deficit with the control variables including year dummies, so the standalone variable is redundant and its coefficient omitted from the table. Standard errors are clustered by firm, and corresponding t-statistics are shown in parentheses. ***, **, and * indicate statistically different from zero at the 1%, 5%, and 10% level of significance, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FD × LTCEO	0.024	0.054	0.164**				-0.024	0.011	0.104*
	(0.207)	(0.545)	(2.112)				(-0.244)	(0.129)	(1.781)
FD × LTCFO				0.243**	0.210*	0.179***	0.247**	0.208**	0.166***
				(2.151)	(2.026)	(2.981)	(2.269)	(2.110)	(2.958)
FD	0.203**	0.158**		0.106***	0.099***		0.118*	0.094*	
	(2.317)	(2.498)		(2.828)	(2.803)		(1.837)	(1.716)	
LTCEO	-0.003	-0.001	0.003				-0.005	-0.001	0.003
	(-0.295)	(-0.083)	(0.274)				(-0.488)	(-0.141)	(0.313)
LTCFO				0.012	0.010	-0.003	0.013	0.008	-0.008
				(0.850)	(0.704)	(-0.259)	(0.908)	(-0.568)	(-0.616)
Manager Contr.	NO	YES	YES	NO	YES	YES	NO	YES	YES
Firm Controls	NO	YES	YES	NO	YES	YES	NO	YES	YES
FD x Controls	NO	NO	YES	NO	NO	YES	NO	NO	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	NO	YES	YES	NO	YES	YES	NO	YES	YES
Observations	4,581	4,581	4,581	4,581	4,581	4,581	4,581	4,581	4,581
R-squared	0.208	0.294	0.447	0.272	0.337	0.482	0.273	0.338	0.490

Table 5
Leverage

Table 5 presents estimates of OLS regressions with market leverage (multiplied by 100) as the dependent variable. Market leverage is long-term debt plus debt in current liabilities item, all divided by price times common shares outstanding plus the numerator. Longholder CEO (LTCEO) and Longholder CFO (LTCFO) are binary variables where 1 signifies that the CEO or CFO, 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 option-excluded shares held by the CEO or CFO as a percentage of common shares outstanding. Vested Options is the number of exercisable options held by the CEO or CFO as a percentage of common shares outstanding. Firm-level control variables include Q, Profitability, Tangibility, log(Sales), Net Financing Deficit, and Returns$_{t-1}$. 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 lagged assets. Tangibility is property, plants, and equipment divided by lagged assets. Manager-level and firm-level control variables are all measured at the beginning of the year. Net Financing Deficit (FD) which is cash dividends plus investment plus change in working capital minus cash flow after interest and taxes, normalized by lagged assets. Returns$_{t-1}$ are lagged one year returns. All the regressions include year and firm fixed-effects. Standard errors (and corresponding t-statistics, shown in parentheses) are adjusted for autcorrelation at the firm level. ***, ** and * indicate statistically different from zero at the 1%, 5%, and 10% level of significance, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LTCEO	1.485	0.890			1.063	0.483	0.444	0.382
	(1.127)	(0.690)			(0.794)	(0.371)	(0.344)	(0.298)
LTCFO			4.151***	3.678**	4.044***	3.800***	3.681***	3.730***
			(3.045)	(2.815)	(2.972)	(2.904)	(2.831)	(2.874)
CEO Shares		0.062				0.107*	0.102*	0.107*
		(0.908)				(1.798)	(1.686)	(1.776)
CEO Vested		0.140				0.125	0.115	0.114
Options		(1.376)				(1.150)	(1.055)	(1.020)
CFO Shares				-0.482		-0.795	-0.758	-0.697
				(-1.132)		(-1.438)	(-1.396)	(-1.318)
CFO Vested				-0.330*		0.208	0.213	0.208
Options				(1.800)		(1.096)	(1.132)	(1.127)
Q		-0.676***		-0.658***		-0.654***	-0.758***	-0.633***
		(-4.260)		(-4.209)		(-4.205)	(-4.422)	(-3.859)
Profitability		-15.100***		-15.245***		-145.206***	-14.660***	-14.111***
		(-5.542)		(-5.627)		(-5.601)	(-5.361)	(-5.053)
Tangibility		6.825***		6.894***		6.901***	6.759***	6.737***
		(4.688)		(4.757)		(4.769)	(4.531)	(4.446)
log(Sales)		3.049***		3.009***		3.066***	3.282***	3.096***
		(4.117)		(4.085)		(4.143)	(4.333)	(4.087)
FD							2.906***	2.967***
							(4.253)	(4.343)
Returns$_{t-1}$								-0.918***
								(-4.446)
Manager Controls	NO	YES	NO	YES	NO	YES	YES	YES
Firm Controls	NO	YES	NO	YES	NO	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	4,557	4,557	4,557	4,557	4,557	4,557	4,557	4,557
R^2	0.089	0.142	0.094	0.147	0.095	0.148	0.161	0.169

Table 6
Financing Deficit and Leverage (Sorting by CEO Power)

Panels A and B of Table 6 replicate the tests of Table 4 and 5 in different subsamples. In columns 1 through 4 we sort firms according to the average CEO tenure over the sample period, depending on whether tenure is below (subsample "Low") or above (subsample "High") the sample median. In columns 5 through 8 we sort firms according to the average CEO compensation, scaled by market capitalization. Control variables (omitted for brevity) are as in column 9 of Table 4 and as in column 8 of Table 5, respectively (that is, the most conservative specifications). Standard errors (and corresponding t-statistics, shown in parentheses) are adjusted for autcorrelation at the firm level. ***, ** and * indicate statistically different from zero at the 1%, 5%, and 10% level of significance, respectively.

Panel A

Sorting by:	CEO Tenure				CEO Pay			
	Low	High	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FD × Longholder CEO	0.122*	0.226**	0.054	0.164*	0.253*	0.213***	-0.029	0.191***
	(1.903)	(2.071)	(0.951)	(1.927)	(1.871)	(2.830)	(-0.342)	(2.720)
FD × Longholder CFO			0.180***	0.115			0.313***	0.028
			(2.684)	(1.330)			(3.963)	(0.408)
Observations	2,411	2,096	2,411	2,096	2,309	2,272	2,309	2,272
R-Squared	0.531	0.559	0.526	0.601	0.623	0.490	0.679	0.491

Panel B

Sorting by:	CEO Tenure				CEO Pay			
	Low	High	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Longholder CEO	-0.111	5.137*	-0.747	4.933*	-0.511	3.776*	-0.965	3.414
	(-0.089)	(1.766)	(-0.612)	(1.686)	(-0.387)	(1.721)	(-0.695)	(1.531)
Longholder CFO			4.703**	2.462*			3.777**	2.944*
			(2.387)	(1.676)			(2.149)	(1.788)
Observations	2,402	2,081	2,402	2,081	2,293	2,264	2,293	2,264
R-Squared	0.769	0.798	0.772	0.799	0.791	0.785	0.793	0.785

Table 7
Other C-suite Executives

Table 7 replicates the analyses of Tables 3, 4, 5, and 6 adding, beyond the Longholder CEO and Longholder CFO dummies, the additional regressor Longholder Other. Longholder Other is a binary variable where 1 signifies that an executive other than the CEO or the 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. We require managers to have at least ten transactions recorded in Thomson Reuters to be included in the sample. For each firm, we keep the executive with the highest compensation. We also include a dummy equal to 1 if Longholder Other cannot be defined (not shown); in those cases, we code it is as zero. For the replication of Tables 3, 4, 5, we only keep the most conservative specification (that is, the one presented in the rightmost column). For the replication of Table 6, we keep the specifications presented in columns 3, 4, 7, and 8 of each panel. Standard errors are adjusted for clustering at the firm level, and corresponding t-statistics are shown in parentheses. ***, **, and * indicate statistically different from zero at the 1%, 5%, and 10% level of significance, respectively.

Outcome Variable:	Debt Issues	Fin. Deficit	Leverage	Financing Deficit				Leverage			
Sorting by:				CEO Tenure		CEO Pay		CEO Tenure		CEO Pay	
				Low	High	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Longholder CEO	-0.105		0.542					-0.627	4.695**	-0.391	3.081
	(-0.866)		(0.466)					(-0.515)	(2.064)	(-0.322)	(1.519)
Longholder CFO	0.417***		3.876***					5.060***	2.290	3.931**	2.938*
	(3.516)		(3.085)					(2.608)	(1.628)	(2.352)	(1.743)
Longholder Other	0.147		-3.144**					-2.315	-4.115*	-4.592***	0.510
	(0.776)		(-2.293)					(-1.512)	(-1.907)	(-3.101)	(0.203)
FD × Longholder CEO		0.115**		0.119**	0.149*	0.056	0.169**				
		(2.189)		(1.970)	(1.822)	(0.719)	(2.343)				
FD × CFO Longholder		0.158***		0.137**	0.111	0.233***	0.036				
		(3.124)		(2.166)	(1.338)	(3.188)	(0.530)				
FD × Longholder Other		0.139		0.112	0.018	0.016	0.169				
		(1.605)		(1.009)	(0.195)	(0.194)	(1.523)				
Observations	2,939	4,537	4,513	2,383	2,081	2,282	2,255	2,374	2,066	2,267	2,246
Pseudo R-Squared	0.171										
R-Squared		0.588	0.787	0.545	0.608	0.693	0.499	0.773	0.802	0.799	0.786

Table 8
Cost of Debt Financing

Table 8 presents regressions of log(Interest Spread) on our overconfidence measures and several control variables, including year-quarter, industry, and loan type fixed effects. Log(Interest Spread) is the difference between the interest rate of the loan in basis points and the London Interbank Offered Rate. The key regressors are Longholder CEO, Longholder CFO, and Longholder Other. Control variables are: Log(amount), Log(maturity), a performance-pricing dummy, a covenant dummy, Log(size), book leverage, Z-Score, cash holding, earnings volatility, CEO and CFO stock ownership and vested options. See Appendix B for detailed variables definitions. Control variables are all measured at the beginning of the year. Standard errors (and corresponding t-statistics, shown in parentheses) are adjusted for autcorrelation at the firm level. ***, **, and * indicate statistically different from zero at the 1%, 5%, and 10% level of significance, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Longholder CEO	-0.199***	-0.168***			-0.185**	-0.159***	-0.118**	-0.125**
	(-2.820)	(-3.543)			(-2.480)	(-3.046)	(-2.443)	(-2.561)
Longholder CFO			-0.096	-0.081*	-0.040	-0.033	-0.030	-0.028
			(-1.290)	(-1.657)	(-0.520)	(-0.630)	(-0.639)	(-0.610)
Longholder Other								0.062
								(0.814)
Log(Amount)		-0.105***		-0.103***		-0.105***	-0.096***	-0.097***
		(-3.961)		(-3.959)		(-4.001)	(-3.732)	(-3.814)
Log(Maturity)		0.152***		0.158***		0.152***	0.070	0.069
		(5.000)		(5.097)		(4.997)	(1.415)	(1.418)
PPP		-0.098**		-0.101**		-0.098**	-0.056	-0.058
		(-2.216)		(-2.264)		(-2.215)	(-1.298)	(-1.339)
Covenants		0.201***		0.201***		0.202***	0.154***	0.151***
		(4.943)		(4.834)		(4.956)	(4.095)	(4.007)
Log(Size)		-0.191***		-0.193***		-0.190***	-0.191***	-0.192***
		(-7.042)		(-7.006)		(-6.998)	(-7.552)	(-7.669)
Leverage		0.590***		0.581***		0.586***	0.532***	0.540***
		(5.911)		(5.862)		(5.896)	(5.875)	(5.936)
Z-Score		-0.010		-0.011		-0.010	-0.009	-0.009
		(-1.322)		(-1.459)		(-1.359)	(-1.323)	(-1.280)
Earnings Volatility		0.206		0.238		0.206	0.327	0.332
		(0.741)		(0.803)		(0.744)	(1.262)	(1.278)
Cash Holding		0.134		0.104		0.137	0.097	0.090
		(1.112)		(0.905)		(1.124)	(0.897)	(0.861)
CEO Shares		0.003				0.003	0.004	0.004
		(0.570)				(0.524)	(0.713)	(0.686)
CEO Vested Options		0.012				-0.005	-0.003	-0.003
		(0.716)				(-0.237)	(-0.140)	(-0.176)
CFO Shares				0.042		0.043	0.050	0.064
				(0.690)		(0.689)	(0.881)	(1.090)
CFO Vested Options				0.052		0.058	0.051	0.051
				(1.342)		(1.345)	(1.345)	(1.407)
Manag. Controls	NO	YES	NO	YES	NO	YES	YES	YES
Firm Controls	NO	YES	NO	YES	NO	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year-Quarter FE	YES	YES	YES	YES	YES	YES	YES	YES
Loan Type FE	NO	NO	NO	NO	NO	NO	YES	YES
Observations	1,651	1,651	1,651	1,651	1,651	1,651	1,651	1,651
R-Squared	0.415	0.642	0.408	0.638	0.416	0.643	0.685	0.686

Table 9
Net Interest Rates Across Subsamples

Table 9 tests the relation between CEO overconfidence and the cost of debt across different subsamples, using different cutoffs for low, medium, and high earnings volatility. All panels show regressions of log(Interest Rate Spread) on our measures of overconfidence and the same control variables and fixed effects as in Column 8 of Table 8. We estimate the empirical model specified in equation 4 in the main text in each subsample. ***, ** and * indicate statistically different from zero at the 1%, 5%, and 10% level of significance, respectively.

	Sorting by Earnings Volatility		
	Low Tercile	Medium Tercile	High Tercile
	(1)	(2)	(3)
Longholder CEO	-0.026	-0.209***	-0.090
	(-0.342)	(-2.798)	(-0.929)
Longholder CFO	-0.108	-0.008	0.054
	(-1.562)	(-0.110)	(0.656)
Longholder Other	-0.074	-0.148	0.167
	(-0.666)	(-0.993)	(1.288)
Observations	533	530	538
R-Squared	0.780	0.734	0.773
	Bottom 35%	Medium 30%	Top 35%
Longholder CEO	-0.041	-0.140*	-0.080
	(-0.570)	(-1.662)	(-0.852)
Longholder CFO	-0.077	-0.059	0.039
	(-1.185)	(-0.731)	(0.485)
Longholder Other	-0.093	-0.186	0.176
	(-0.852)	(-1.191)	(1.341)
Observations	574	500	577
R-Squared	0.787	0.761	0.777
	Bottom 30%	Medium 40%	Top 30%
Longholder CEO	-0.005	-0.213***	-0.171*
	(-0.055)	(-3.113)	(-1.797)
Longholder CFO	-0.116	-0.001	0.096
	(-1.511)	(-0.009)	(1.106)
Longholder Other	-0.086	-0.098	0.192
	(-0.743)	(-0.779)	(1.510)
Observations	492	662	497
R-Squared	0.791	0.741	0.795
	Bottom 25%	Medium 50%	Top 25%
Longholder CEO	0.005	-0.223***	-0.145
	(0.059)	(-3.394)	(-1.493)
Longholder CFO	-0.100	-0.004	0.110
	(-1.169)	(-0.065)	(1.326)
Longholder Other	-0.018	0.010	0.017
	(-0.147)	(0.100)	(0.129)
Observations	417	822	412
R-Squared	0.802	0.728	0.837

Table 10
Acquisitions

Table 10 presents estimates of OLS regressions with acquisitions as dependent variable, defined as dollar value of firm acquisitions scaled by market value of equity. Longholder CEO and Longholder CFO are binary variables where 1 signifies that the CEO or CFO, 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. Longholder Other is a binary variable where 1 signifies that an executive other than the CEO or the 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. For each firm, we keep the executive with the highest compensation. We also include a dummy equal to 1 if Longholder Other cannot be defined (not shown); in those cases, we code it is as zero. Columns 5 through 8 include both manager-level and firm-level controls. Stock Ownership is option-excluded shares held by the CEO or CFO as a percentage of common shares outstanding. Vested Options is the number of exercisable options held by the CEO or CFO as a percentage of common shares outstanding. Firm-level control variables include Q, Profitability, Tangibility, log(Sales) and Net Financing Deficit. 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 lagged assets. Tangibility is property, plants, and equipment divided by lagged assets. Manager-level and firm-level control variables are all measured at the beginning of the year. Column 1 includes the full sample. In columns 2 through 4, and 5 through 7, firms are sorted according to Merton (1974)'s distance to default. All the regressions include year and firm fixed-effects. Standard errors (and corresponding t-statistics, shown in parentheses) are adjusted for autcorrelation at the firm level. ***, ** and * indicate statistically different from zero at the 1%, 5%, and 10% level of significance, respectively.

		Sorting by Distance to Default						
	Full Sample	Low	Medium	High	Low	Medium	High	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Longholder CEO	-0.007	-0.040	-0.018*	0.016**	-0.033	-0.016	0.018**	0.019**
	(-0.962)	(-1.210)	(-1.759)	(2.081)	(-0.981)	(-1.607)	(2.213)	(2.264)
Longholder CFO	0.002	0.008	0.004	-0.002	0.011	0.006	-0.001	-0.001
	(0.342)	(0.508)	(0.335)	(-0.278)	(0.681)	(0.532)	(-0.145)	(-0.134)
Longholder Other								-0.002
								(-0.201)
Manag. Controls	NO	NO	NO	NO	YES	YES	YES	YES
Firm Controls	NO	NO	NO	NO	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	4,581	1,283	1,283	1,283	1,283	1,283	1,283	1,283
R-Squared	0.217	0.285	0.346	0.416	0.298	0.353	0.423	0.423

Table 11
CFO Hiring

Table 11 shows coefficients from regressions with Longholder CFO as the dependent variable. The sample includes all instances in which a new CFO is appointed between year t and year $t-1$ and the following variables are not missing: (i) the overconfidence proxy for the new CFO at time t; (ii) the overconfidence proxy for the incumbent CEO at time $t-1$; (iii) manager and firm control variables at time $t-1$. Longholder CEO, CFO, and Other are binary variables where 1 signifies that the CEO, CFO, or other C-suite executive, respectively, 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 option-excluded shares held by the respective manager as a percentage of common shares outstanding. Vested Options is the number of exercisable options held as a percentage of common shares outstanding. Firm-level control variables include Q (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 (operating income before depreciation divided by assets at the beginning of the year), tangibility (property, plants, and equipment divided by assets at the beginning of the year), and book leverage (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, Log(Sales), and Book Leverage are measured at the beginning of the year. Year fixed effects are included in all the regressions and Fama and French (1997) 12 industry dummies effects are included in columns 2-6. The Sample denoted "Pre" (column 5) only includes CFOs for which at least one transaction is executed before the appointment, and Longholder CFO is redefined based on pre-appointment transactions. The suffixes t and $t-1$ indicate the year of the CFO appointment and the year prior to the appointment, respectively. All standard errors are adjusted for clustering at the firm level. ***, **, and * indicate statistically different from zero at the 1%, 5%, and 10% level of significance, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Longholder CEO	0.218***	0.258***	0.290***	0.337**	0.277***	0.298***
	(2.984)	(3.471)	(3.739)	(2.491)	(3.452)	(3.569)
CEO Vested Options			-0.044**	0.001	-0.042**	-0.048**
			(-2.316)	(0.044)	(-1.990)	(-2.423)
CEO Shares			-0.000	0.016	0.002	0.001
			(-0.061)	(0.986)	(0.213)	(0.161)
CFO Vested Options$_t$					0.030	
					(1.471)	
CFO Shares$_t$					0.078	
					(1.398)	
CFO Vested Options$_{t-1}$					0.039	
					(1.136)	
CFO Shares$_{t-1}$					-0.078	
					(-1.408)	
Longholder Other						-0.004
						(-0.042)
Year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	YES	YES	YES	YES	YES
Firm Controls	NO	NO	YES	YES	YES	YES
CEO Controls	NO	NO	YES	YES	YES	YES
CFO Controls	NO	NO	NO	NO	YES	YES
Sample	All	All	All	Pre	All	All
Observations	213	213	213	61	213	213
R-Squared	0.144	0.205	0.254	0.548	0.295	0.279

Appendix

This Appendix consists of three parts. Appendix A presents a simple theoretical framework that helps rationalize the empirical findings discussed in the main text. Appendix B presents additional details regarding the construction of the dataset and lists definitions of the variables in our empirical analysis. Appendix C provides summary statistics for specific subsamples of the data, as well as numerous robustness checks.

A A Simple Model

We consider a simple model of investment and financing, following closely the standard textbook treatment of Tirole (2006). The key modifications relative to previous work on managerial overconfidence are that we consider more than just one manager—a CEO *and* a CFO—and that we assign capital-structure decisions to the CFO, while investment and its implementation remain with the CEO. While we will highlight how our conclusions generalize to a less simplistic set-up, our main emphasis lies on providing a consistent framework for all of our empirical tests.

We note that some of the insights of the models are not unique to our setting. First, it has been observed that managerial overconfidence can lead to a preference for debt (Malmendier et al., 2011, Hackbarth, 2009, Heaton, 2002). Second, a number of models share the insight that overconfident managers can be more motivated to work hard, such as Bénabou and Tirole (2002), Puri and Robinson (2007), and, in the managerial context, Otto (2014). Specifically, Hackbarth (2009) formalizes the result that overconfidence can ameliorate moral hazard. Our setting allows us to establish a link between managerial overconfidence, cost of debt, and volatility.

Model Setting. The role of the CEO ("she") is to make an investment decision, whereas the CFO ("he") chooses the financing of the investment. The project costs I and generates an uncertain return $\tilde{R}$, which equals either $I + \sigma$ or $I - \sigma$, each with probability $1/2$, where $\sigma \in (0, I]$ measures the return variability. If the CEO exerts effort, she increases the expected return to $\tilde{R} + \Delta$. Effort is costly, which is modeled as giving up a private benefit B, as in the standard Tirole (2006) model. For simplicity, we assume no discounting, and no other assets. The CEO maximizes the sum of expected net profit and private benefits.

The CFO's job is to raise external financing to maximize firm value. He can either issue debt with a face value of D or issue shares for a fraction of the firm. In both cases, he faces the constraint that external investors, who are risk neutral, must break even in equilibrium. We assume that the CFO maximizes expected net returns.[39]

Both managers form expectations using their personal beliefs. Managers might be rational or exhibit overconfidence. We define overconfidence as the overestimation of future cash flows accruing to the firm. Specifically, an overconfident CEO believes that by exerting effort she increases cash flows by an amount $\Delta + \omega$, where $\omega > 0$ measures her degree of overconfidence. Similarly, an overconfident CFO believes that the cash flows increase by $\Delta + \omega$ whenever the CEO exerts effort. Both managers are aware of each other's beliefs. When one manager is biased and the other is not, they agree to disagree. We refer to both belief distortions as

[39] A way to formalize the CEO's and the CFO's incentives would be to assume that the CEO "hires" the CFO and pays him a fraction ϵ of the final cash flow, with the CEO obtaining a fraction $1 - \epsilon$. Given that the CFO's problem is linear in the firm cash flow, the fraction ϵ could be made arbitrarily small, and, for simplicity, we ignore it in our exposition. Yet another possibility is that the CFO gives some weight to the CEO's well-being, which includes the private benefit B. In unreported results, we have modeled the CFO as "fully committed to the CEO," i.e., as maximizing the CEO's expected utility including B, and the model delivers the exact same insights.

"overconfidence." The common label is appropriate in our context, despite the subtle conceptual differences between CEO and CFO overconfidence, as it is identified by exactly the same behavior – late option exercise. However, for a CFO, late option exercise indicates an overestimation of the future returns to the company at which he is employed, not necessarily an overestimation of his ability.

We focus the analysis on the parameter range $\Delta > B \geq \omega$, where moral hazard can affect both rational and overconfident CEOs. Investors anticipate correctly the true expected payoffs of the investment project.

The timing is as follows. At $t = 0$, the CEO announces the planned investment, and the CFO chooses between debt and equity financing. If funding is obtained, the profitability of the investment ($I + \sigma$ or $I - \sigma$) is revealed at $t = 1$, and the CEO decides at $t = 2$ whether to exert effort. At $t = 3$, the cash flow is realized and investors are repaid.

In what follows, to simplify the exposition, we denote an executive's degree of overconfidence as $\hat{\omega}$, where $\hat{\omega} = \omega$ for overconfident executives and $\hat{\omega} = 0$ for rational executives. When necessary, to distinguish between the two top executives, we will use the notation $\hat{\omega}_{CEO}$ and $\hat{\omega}_{CFO}$ to denote CEO and CFO overconfidence, respectively.

A.1 Optimal Debt Contract

Solving backward, we first analyze the effort decision of the CEO at $t = 2$, given the capital-structure choice of the CFO at $t = 0$ and the state of the world drawn at $t = 1$. We now prove the following result:

> **Proposition 1.** *The equilibrium cost of debt financing is lower for firms with overconfident CEOs. Specifically, the cost is strictly lower for intermediate ranges of return variability, and is identical for sufficiently low variability or high return variability.*

Proof. We show that the face value of debt offered to overconfident and rational CEOs is identical for the case of low variability, with $D^*_{\hat{\omega}} = I$; that it is lower for overconfident CEOs than rational CEOs for the case of intermediate variability, with $D^*_{\omega} = I$ and $D^*_0 = I + \sigma$, respectively; and that it is again identical for the case of high variability, with $D^*_{\hat{\omega}} = I + \sigma$. The ranges of return variability σ are $\sigma \leq \Delta - B$ for low return variability; $\Delta - B + \omega \geq \sigma > \Delta - B$ for intermediate return variability; and $\sigma > \Delta - B + \omega$ for high return variability.

We have four incentive compatibility (IC) constraints regarding the CEO's effort choice, one for each financing choice and state of the world. For debt financing and in the good state, the CEO exerts effort if

$$\max\{0, I + \sigma + \Delta + \hat{\omega}_{CEO} - D\} \geq \max\{0, I + \sigma - D\} + B, \tag{A.1}$$

where D is the face value of the debt. In the bad state, the IC for exerting effort under debt financing is

$$\max\{0, I - \sigma + \Delta + \hat{\omega}_{CEO} - D\} \geq \max\{0, I - \sigma - D\} + B. \tag{A.2}$$

We denote the return to the project in state $S \in \{Good, Bad\}$ and with effort $e \in \{0, 1\}$ as $\pi(S, e)$. For example, $\pi(Good, 1)$ equals $I + \sigma + \Delta$. Similarly, we denote the return expected by the CEO and the CFO, given their beliefs, as $\hat{\pi}_{CEO}(S, e)$ and $\hat{\pi}_{CFO}(S, e)$. We express e as a function of S using the notation e_S.

Conditional on debt financing, the CFO solves the following maximization program:

$$\max_D E[\max\{0, \hat{\pi}_{CFO}(S, e_S) - D\}] \tag{A.3a}$$

$$u_{CEO}(S, D, e_S) \geq u_{CEO}(S, D, e'_S)\ \forall\, S \text{ and } e_S \neq e'_S \tag{A.3b}$$

$$E[\min\{D, \pi(S, e_S)\}] \geq I \tag{A.3c}$$

where $u_{CEO}(S, D, e_S)$ denotes the CEO's utility in state S under a debt contract with face value D if she exerts effort e_S. The participation constraint in (A.3c) accounts for the possibilities that returns are larger than D, in which case incumbent shareholders obtain the residual revenues, or lower than D, in which case debtholders obtain all returns. We denote the face value of debt that solves the maximization problem given the CEO's belief $\hat{\omega}_{CEO}$ as $D^*_{\hat{\omega}}$. We will see below that the optimal contract does not depend on the CFO's beliefs.

First, we show jointly that $D^*_{\hat{\omega}} = I$ for the case of low variability ($\sigma \leq \Delta - B$) and also, when the CEO is overconfident, for the case of intermediate variability ($\Delta - B + \omega \geq \sigma > \Delta - B$). We can summarize the full range of both cases as $\sigma \leq \Delta - B + \hat{\omega}_{CEO}$.

We start by showing that the CEO's IC constraint (A.3b) is satisfied in both states of the world. In the good state, the CEO exerts effort iff

$$\begin{aligned} &\max\{0, I + \sigma + \Delta + \hat{\omega}_{CEO} - I\} \geq \max\{0, I + \sigma - I\} + B \\ \iff &\max\{0, \sigma + \Delta + \hat{\omega}_{CEO}\} \geq \max\{0, \sigma\} + B \\ \iff &\sigma + \Delta + \hat{\omega}_{CEO} \geq \sigma + B \\ \iff &\Delta + \hat{\omega}_{CEO} \geq B, \end{aligned} \tag{A.4}$$

which holds given our model assumption $\Delta > B$. In the bad state, the CEO exerts effort iff

$$\begin{aligned} &\max\{0, I - \sigma + \Delta + \hat{\omega}_{CEO} - I\} \geq \max\{0, I - \sigma - I\} + B \\ \iff &\max\{0, -\sigma + \Delta + \hat{\omega}_{CEO}\} \geq \max\{0, -\sigma\} + B \\ \iff &-\sigma + \Delta + \hat{\omega}_{CEO} \geq B \\ \iff &\Delta - B + \hat{\omega}_{CEO} \geq \sigma, \end{aligned} \tag{A.5}$$

which is exactly the parameter range we are considering. Thus, the CEO exerts effort in both states.

We can now plug these effort choices into the participation constraint (A.3c), and obtain

$$\frac{1}{2}(\min\{I, I + \sigma + \Delta\} + \min\{I, I - \sigma + \Delta\}) = I, \tag{A.6}$$

i.e., the participation constraint holds with equality since $\sigma \leq \Delta - B + \hat{\omega}_{CEO}$ and, per model assumption, $B \geq \omega$, and thus $\sigma < \Delta$. Hence, under $D^*_{\hat{\omega}} = I$, all surplus goes to existing shareholders, which in turn implies that the (perceived) firm value is maximized under this contract. The expected utility of a rational CFO is Δ, whereas the overconfident CFO expects to get $(\Delta + \omega)$.

To prove uniqueness, consider any other contract with face value $\tilde{D} \gtrless I$. We can rule out $\tilde{D} < I$, as it does not satisfy the participation constraint. For $\tilde{D} > I$, there are two cases to consider: either the CEO exerts effort in both states of the world, or she does not. If she does, the surplus is the same as under $D^*_{\hat{\omega}} = I$ and debtholders extract positive rents. Hence this type of contract cannot be optimal for the CFO. If she does not, the resulting welfare loss implies that the rents that the CFO can extract (under debtholders' break-even constraint) will not be maximized. Hence, $D^*_{\hat{\omega}} = I$ is optimal when $\sigma \leq \Delta - B + \hat{\omega}_{CEO}$.

Second, we show that $D^*_{\hat{\omega}} = I + \sigma$ for the case of high variability ($\sigma > \Delta - B + \omega$) and, when the CEO is rational, also for the case of intermediate variability ($\Delta - B + \omega \geq \sigma > \Delta - B$). We can summarize these two cases as $\sigma > \Delta - B + \hat{\omega}_{CEO}$.

We start again from the IC constraint (A.3b) and show that, under $D^*_{\hat{\omega}} = I + \sigma$, the CEO exerts effort in

the good state and shirks in the bad state. In the good state, the CEO exerts effort iff

$$\begin{aligned} &\max\{0, I+\sigma+\Delta+\hat{\omega}_{CEO}-I-\sigma\} \geq \max\{0, I+\sigma-I-\sigma\}+B \\ \iff &\max\{0, \Delta+\hat{\omega}_{CEO}\} \geq \max\{0,0\}+B \\ \iff &\Delta+\hat{\omega}_{CEO} \geq B, \end{aligned} \tag{A.7}$$

which is implied by our initial assumption $\Delta > B$. In the bad state, the CEO shirks iff

$$\begin{aligned} &\max\{0, I-\sigma+\Delta+\hat{\omega}_{CEO}-I-\sigma\} < \max\{0, I-\sigma-I-\sigma\}+B \\ \iff &\max\{0, -2\sigma+\Delta+\hat{\omega}_{CEO}\} < \max\{0,-2\sigma\}+B \\ \iff &\max\{0, -2\sigma+\Delta+\hat{\omega}_{CEO}\} < B. \end{aligned} \tag{A.8}$$

This is satisfied both if $-2\sigma+\Delta+\hat{\omega}_{CEO} \leq 0$ since $0 < B$; and if $-2\sigma+\Delta+\hat{\omega}_{CEO} > 0$ since, over the parameter range $\sigma > \Delta - B + \hat{\omega}_{CEO}$, it must also hold that $2\sigma > \Delta - B + \hat{\omega}_{CEO}$, and hence $-2\sigma + \Delta + \hat{\omega}_{CEO} < B$. Therefore, under $D^*_{\hat{\omega}} = I + \sigma$, the CEO exerts effort in the good state of the world and shirks in the bad state of the world.

Turning to the participation constraint (4c) and plugging in these effort choices, we can now show that the participation constraint holds with equality:

$$\frac{1}{2}(\min\{I+\sigma, I+\sigma+\Delta\} + \min\{I+\sigma, I-\sigma\}) = I. \tag{A.9}$$

Again, debtholders receive I in expectation, and all surplus goes to existing shareholders. In this case, a rational CFO's expected utility is $\Delta/2$, and an overconfident CFO expects to get $(\Delta+\omega)/2$.

To see that this is an optimal contract, and that it is the unique optimal contract, consider an alternative contract $\tilde{D} \neq D^*_{\hat{\omega}}$. We can again rule out $\tilde{D} < I$ since debtholders would not break even. For $\tilde{D} \geq I$, we first ask in which state of the world the CEO would exert effort under such a contract. In the bad state of the world, the CEO exerts effort under contract $\tilde{D}$ iff

$$\max\left\{0, I-\sigma+\Delta+\hat{\omega}_{CEO}-\tilde{D}\right\} \geq \max\left\{0, I-\sigma-\tilde{D}\right\}+B. \tag{A.10}$$

With $\tilde{D} \geq I$, the IC becomes

$$\max\left\{0, I-\sigma+\Delta+\hat{\omega}_{CEO}-\tilde{D}\right\} \geq B, \tag{A.11}$$

which holds only if $I - \tilde{D} \geq \sigma - (\Delta + \hat{\omega}_{CEO} - B)$. However, as we are analyzing the parameter space of $\sigma - (\Delta + \hat{\omega}_{CEO} - B) > 0$, this implies $I - \tilde{D} > 0$, contradicting that $\tilde{D} \geq I$. Hence, the CEO shirks in the bad state of the world, and we are left with two cases: Either the CEO exerts effort only in the good state of the world, or in neither state. Because debtholders cannot obtain more than $I - \sigma$ in the bad state of the world, the participation constraint requires $\tilde{D} \geq D^*_{\hat{\omega}} = I + \sigma$ in order for debtholders to break even. As $\tilde{D} \neq D^*_{\hat{\omega}}$, we must have $\tilde{D} > D^*_{\hat{\omega}}$. Thus, if the CEO exerts effort only in the good state of the world, debtholders extract a strictly positive rent (given the higher face value $\tilde{D} > D^*_{\hat{\omega}}$), contradicting optimality. And if the CEO exerts effort in neither state, the contract with face value $D^*_{\hat{\omega}}$ generates higher total surplus for the CFO because of the CEO's higher effort choice (in the good state of the world), in combination with the lower face value. This contradicts optimality. ■

A.2 Optimal Equity Contract and Cost of Equity

As an intermediate step in the analysis of the CFO's choice between debt and equity, we first define in Lemma 1 the optimal equity contract, conditional on equity financing, and discuss the resulting cost of equity. As in the case of debt, we will see that the optimal equity contract is independent of the CFO's type.

We adopt the same notation as for the debt contract. Let $\hat{\pi}_{CFO}(S,e)$ be the return to the project under the CFO's beliefs. We denote the fraction of the firm owned by new shareholders as γ. In this case, the ICs for the good and the bad state of the world, $(1-\gamma)(I+\sigma+\Delta+\hat{\omega}_{CEO}) \geq (1-\gamma)(I+\sigma)+B$ and $(1-\gamma)(I-\sigma+\Delta+\hat{\omega}_{CEO}) \geq (1-\gamma)(I-\sigma)+B$, can both be simplified to

$$(1-\gamma)(\Delta+\hat{\omega}_{CEO}) \geq B. \tag{A.12}$$

The CFO solves the following program to determine the (second-best) optimal equity contract:

$$\max_{\gamma}(1-\gamma)E[\hat{\pi}_{CFO}(S,e_S)] \tag{A.13a}$$

$$u_{CEO}(S,\gamma,e_S) \geq u_{CEO}(S,\gamma,e'_S)\,\forall S \text{ and } e_S \neq e'_S \tag{A.13b}$$

$$\gamma E[\pi(S,e_S)] \geq I \tag{A.13c}$$

Lemma 1 (Optimal Equity Contract). *The optimal equity contract depends on the CEO's but not on the CFO's bias. In particular, we have*

$$\begin{aligned} \gamma^*_{\hat{\omega}} = \tfrac{I}{I+\Delta} \;\; \textit{and} \;\; e_S = 1\,\forall S \quad & \textit{if} \;\; \tfrac{\Delta+\hat{\omega}_{CEO}}{I+\Delta}\Delta \geq B \;\; \textit{and} \\ \gamma^*_{\hat{\omega}} = 1 \;\; \textit{and} \;\; e_S = 0\,\forall S \quad & \textit{if} \;\; \tfrac{\Delta+\hat{\omega}_{CEO}}{I+\Delta}\Delta < B. \end{aligned}$$

Proof. We start from the IC constraint under equity financing, shown in inequality (A.12) in the paper. We know from (A.12) that the CEO's choice of effort is independent of the state of the world. She exerts effort in both states iff

$$(1-\gamma)(\Delta+\hat{\omega}_{CEO}) \geq B \iff \gamma \leq 1 - \frac{B}{\Delta+\hat{\omega}_{CEO}} \tag{A.14}$$

In this case, the participation constraint of new shareholders becomes

$$\gamma(I+\Delta) \geq I \tag{A.15}$$

Conversely, she does not exert effort in either state of the world if and only if $\gamma > 1 - \frac{B}{\Delta+\hat{\omega}_{CEO}}$. In the latter case the participation constraint becomes $\gamma \geq 1$, and the only feasible equity financing contract assigns full ownership to new shareholders, while the CFO obtains zero payoff. In the former case, instead, the participation constraint is satisfied with equality, $\gamma^*_{\hat{\omega}} = \frac{I}{I+\Delta}$, and the resulting (perceived) payoff of the CFO is $(1-\gamma^*_{\hat{\omega}})E[\hat{\pi}_{CFO}(S,1)] = \frac{\Delta}{I+\Delta}(I+\Delta+\hat{\omega}_{CFO}) = (\Delta+\frac{\Delta}{I+\Delta}\hat{\omega}_{CFO}) > 0$.

Hence, inducing effort is optimal if $\gamma^*_{\hat{\omega}} = \frac{I}{I+\Delta}$ satisfies the IC constraint, i.e., if $\frac{I}{I+\Delta} \leq 1 - \frac{B}{\Delta+\hat{\omega}}$ or, solving for B, if $B \leq \frac{\Delta+\hat{\omega}_{CEO}}{I+\Delta}\Delta$. If, instead, $\frac{\Delta+\hat{\omega}_{CEO}}{I+\Delta}\Delta < B$, the CEO cannot be induced to exert effort under any equity contract that allows new shareholders to break even. Therefore, the project is going to deliver I in expectation and the only contract satisfying equity holders' participation constraint requires $\gamma^*_{\hat{\omega}} = 1$. ■

A.3 Choice between Debt and Equity

We show that an overconfident CFO is weakly more likely to issue debt than a rational CFO, whether the CEO is overconfident or rational. Specifically, there are parameter ranges for which an overconfident CFO strictly

prefers debt while a rational CFO does not (and is instead indifferent between the two financing choices).[40] Whenever the overconfident CFO strictly prefers equity, instead, so does the rational CFO.

The proof of Proposition 2 involves comparing the CFO's perceived utility under debt and equity financing. We use again the notation $\hat{\omega}_{CEO}$ to capture both the case of a rational CEO ($\hat{\omega}_{CEO} = 0$) and of an overconfident CEO ($\hat{\omega}_{CEO} = \omega$). As before, "perceived firm value" is short-hand for "expected payoff to incumbent shareholders under the CFO's beliefs."

Proposition 2. *An overconfident CFO uses (weakly) more debt financing and less equity financing than a rational CFO, both under an overconfident and under a rational CEO.*

Proof. Recall from the proof in Appendix A.2 that the optimal equity contract depends on whether $\frac{\Delta+\hat{\omega}_{CEO}}{I+\Delta} < B$ or not. This holds whether the CEO is rational or overconfident.

If $\frac{\Delta+\hat{\omega}_{CEO}}{I+\Delta}\Delta < B$, the optimal equity contract assigns all surplus to new shareholders ($\gamma^* = 1$), and the CEO shirks in both states of the world. We have also shown that the optimal debt contract induces the CEO to exert effort in at least in one state of the world, achieving a strictly higher firm value, and that not all surplus goes to the lenders. Since investors must break even (under any type of financing), the gain in firm value translates into rents to incumbent shareholders, and thus to the CFO. Therefore, both types of CFOs prefer debt financing over the parameter range $\frac{\Delta+\hat{\omega}_{CEO}}{I+\Delta}\Delta < B$.

If instead $\frac{\Delta+\hat{\omega}_{CEO}}{I+\Delta}\Delta \geq B$, the optimal equity contract does not assign all surplus to new shareholders, and the CEO exerts effort in both states of the world. As a result, a rational and an overconfident CFO have different perceptions of the value created by the CEO:

i. Rational CFO. Under the optimal equity contract, incumbent shareholders obtain $(1 - I/[I + \Delta])(I + \Delta) = \Delta$. Under the optimal debt contract, we have to consider two cases: If $\sigma \leq \Delta - B + \hat{\omega}_{CEO}$, the CEO exerts effort in both states of the world, and the expected firm value is $(I + \sigma + \Delta + I - \sigma + \Delta)/2 - I = \Delta$. If $\sigma > \Delta - B + \hat{\omega}_{CEO}$, the CEO exerts effort only in the good state of the world, and the expected firm value is $(I + \sigma + \Delta + \Delta - I - \sigma)/2 = \Delta/2$. Comparison of these firm values gives us the CFO's choice, shown in the first table ("*Rational CFO*") below.

Rational CFO	**Debt**	**Equity**	***Preferred Choice***
$\frac{\Delta+\hat{\omega}_{CEO}}{I+\Delta}\Delta \geq B$ and $\sigma \leq \Delta - B + \hat{\omega}_{CEO}$	Δ	Δ	Indifferent
$\frac{\Delta+\hat{\omega}_{CEO}}{I+\Delta}\Delta \geq B$ and $\sigma > \Delta - B + \hat{\omega}_{CEO}$	$\Delta/2$	Δ	Equity

ii. Overconfident CFO. The overconfident CFO believes incorrectly that the CEO's effort is worth $\Delta + \omega$ instead of Δ. Thus, as the CEO exerts effort in both states of the world under equity financing, the CFO perceives firm value to incumbent shareholders under equity financing to be $(1 - \frac{I}{I+\Delta})(I + \Delta + \omega) = \Delta + \frac{\Delta}{I+\Delta}\omega$. The same misperception applies under debt financing when $\sigma \leq \Delta - B + \hat{\omega}_{CEO}$: As the CEO

[40] If the rational CFO randomizes his financing choice when indifferent, with positive probabilities for both debt and equity, an overconfident CEO uses strictly more debt, on average, than a rational CFO over this parameter range.

exerts effort in both states of the world, and the face value of debt is I, the CFO perceives firm value to equal $(I+\sigma+\Delta+\omega+I-\sigma+\Delta+\omega)/2-I=\Delta+\omega$. If instead $\sigma>\Delta-B+\hat{\omega}_{CEO}$, the CEO shirks in the bad state of the world, and the CFO's perceived firm value is therefore $(I+\sigma+\Delta+\omega-I-\sigma)/2=(\Delta+\omega)/2$. The next table below ("*Overconfident CFO*") summarizes these computations and the CFO's choices.

Overconfident CFO	**Debt**	**Equity**	***Preferred Choice***
$\frac{\Delta+\hat{\omega}_{CEO}}{I+\Delta}\Delta \geq B$ and $\sigma \leq \Delta-B+\hat{\omega}_{CEO}$	$\Delta+\omega$	$\Delta+\frac{\Delta}{I+\Delta}\omega$	Debt
$\frac{\Delta+\hat{\omega}_{CEO}}{I+\Delta}\Delta \geq B$ and $\sigma > \Delta-B+\hat{\omega}_{CEO}$	$(\Delta+\omega)/2$	$\Delta+\frac{\Delta}{I+\Delta}\omega$	Equity

In summary, for either rational or overconfident CEOs, we find that both types of CFOs choose debt financing for some parameter ranges ($\frac{\Delta+\hat{\omega}_{CEO}}{I+\Delta}\Delta < B$), and both types choose equity financing for other ranges ($\frac{\Delta+\hat{\omega}_{CEO}}{I+\Delta}\Delta \geq B$ and $\sigma > \Delta-B+\hat{\omega}_{CEO}$). However, we also find that in some instances only the overconfident CFO strictly prefers debt ($\frac{\Delta+\hat{\omega}_{CEO}}{I+\Delta}\ \Delta \geq B$ and $\sigma \leq \Delta-B+\hat{\omega}_{CEO}$). In other words:
- If the rational CFO strictly prefers debt, so does the overconfident CFO.
- If the rational CFO is indifferent between debt and equity, the overconfident CFO strictly prefers debt.
- If the rational CFO strictly prefers equity, so does the overconfident CFO.

Taken together, these results imply that, conditioning on the CEO's type, an overconfident CFO weakly prefers debt relative to a rational CFO. ■

A.4 Hiring Decision

The CEO's beliefs might also affect the selection of new a CFO. The recruiting of the CFO is a prerogative of the board of directors. However, a large empirical literature documents the strong influence of the CEO on the appointment of board members (Shivdasani and Yermack, 1999, Cai et al., 2009, Fischer et al., 2009), and CEOs also control the selection of all other C-suite managers. In our simplified setting, we assign the CEO sole discretion in replacing a CFO. In this section we propose a simple extension of our model where we analyze the possibility of endogenous pairing between CEO and CFO.

Proposition 3. *An overconfident CEO (weakly) prefers to hire an overconfident CFO.*

Proof. The CEO is indifferent between the two types of CFOs if she expects either type to make the same financing choice. Therefore, we only need to analyze cases in which the two types of CFOs may behave differently, given the CEO's bias.

We start by considering the rational CEO's choice ($\hat{\omega}_{CEO}=0$). From Section A.3 above we know that if $\frac{\Delta^2}{I+\Delta}\Delta \geq B$ and $\sigma \leq \Delta-B$, the overconfident CFO strictly prefers debt (see A.3.ii) but the rational CFO does not (see A.3.i); he is indifferent. The rational CEO, instead, is always indifferent between a debt and an equity contract, as she expects to obtain Δ under either contract. Therefore, she will not exhibit any preference regarding the CFO to be appointed.

Moving to an overconfident CEO's choice ($\hat{\omega}_{CEO} = \omega$), from Section A.3 above, we know that if $\frac{\Delta+\omega}{I+\Delta}\Delta \geq B$ and $\sigma \leq \Delta - B + \omega$, the rational CFO is indifferent between debt and equity, whereas the overconfident CFO strictly prefers debt. With debt financing, the overconfident CEO expects to obtain $(\Delta + \omega)$; with equity her perceived future payoff is only $(\Delta + \frac{\Delta}{I+\Delta}\omega)$. Therefore, under the CEO's beliefs, debt strictly dominates equity, and she prefers an overconfident CFO, who chooses debt financing for sure, to a rational CFO, who instead, being indifferent, may choose equity.

In sum, a rational CEO is indifferent between appointing an overconfident or a rational CFO; an overconfident CEO weakly prefers an overconfident CFO. ■

Empirical Predictions. We summarize our findings formulated as three testable predictions:

Prediction 1. Overconfident CFOs are more likely to issue debt rather than equity when accessing external financing, conditional on the CEO's type.

Prediction 2. CEO overconfidence is associated with a lower average cost of debt. This effect is driven by firms experiencing medium variability in their profits.

Prediction 3. A firm run by an overconfident CEO is more likely to hire an overconfident CFO.

B Construction of the Dataset and Variables Definitions

B.1 Additional Details on the Construction of the Dataset

We use the Thomson Insider Filing data to construct Longholder measures for CEOs, CFOs, and other executives. Thomson collects data from Forms 3, 4, and 5, which insiders report to the SEC. The data consists of two datasets called "Table 1" (Stock Transactions) and "Table 2" (Derivative Transactions). We extract the option exercise data from the "Table 2" data, which contains information from Form 4 (changes in ownership, reported to the SEC within two business days). These transactions data are available since 1996. However, as Longholder is constructed as a permanent characteristic, we can include the years 1992-1995 for companies that had managers for which we can obtain transactions data from Form 4. We only keep records with Thomson cleanse indicators R, H, and C (very high degree of confidence in data accuracy and reasonableness) or L and I (reasonably high degree of confidence). Following prior literature (e.g., Lakonishok and Lee, 2001), we drop records that are amendments to previous records or have obvious errors, such as an indicated maturity date before the exercise date, or a missing exercise date. We also remove outliers with exercise prices below \$0.1 or above \$1000. We calculate the percentage-in-the-money for each option using stock price data from CRSP.

Information on tenure and stock and option holdings are from ExecuComp. We use CUSIPs to merge the firm-level information in Thomson and Compustat/ExecuComp, and a conservative fuzzy algorithm to link the names of the executives in the two datasets. We verify manually the accuracy of each match. If a firm has more than one CEO or CFO listed in ExecuComp, we manually check the 10-K forms on the SEC website[41] and identify the executive who held the relevant position at the end of the fiscal year.

Table B.1 summarizes the data construction. Of the 8,054 CEOs and 7,402 CFOs in ExecuComp, about 20% (1,623 CEOs and 1,246 CFOs) are also recorded in Thomson and report at least ten transactions, corresponding to 5,810 firm-years. After dropping financial and utilities companies and firms with missing manager or firm controls, the final sample consists of 4,581 firm-years. From this sample we identify the highest paid executive among the individuals holding one of the titles listed in Section 2.2 and construct a "Longholder Other" dummy. The 10-transaction requirement limits the number of other executives that we can classify and, in our final sample, we have a non-missing Longholder Other dummy for 1,440 firm-years.

Table B.1
Data Construction

	CEOs	**CFOs**
Executives in ExecuComp	8,054 executives	7,402 executives
...matched with Thomson	3,372 executives	2,908 executives
Executives with at least 10 transactions	1,623 executives	1,246 executives
...corresponding to...	13,898 firm-years	9,374 firm-years
Compustat sample with non-missing Longholder CEO/CFO	5,810 firm-years	
Sample after excluding financial, utilities and firms with missing controls	4,581 firm-years	
Final sample merged with information on other executives	1,440 firm-years with non-missing Longholder Other +3,141 firm-years with missing Longholder Other	

[41] See http://www.sec.gov/edgar.shtml. The Edgar database contains 10-K forms starting in 1994. For some earlier cases we cannot recover the information and exclude those observations.

B.2 Variables Definition

Below, we provide detailed definitions of the variables used in the empirical analyses. For the variables extracted from Compustat, ExecuComp and, Dealscan we also indicate the data item (in italic).

Table B.2
Variables Definitions and Sources

Variable	**Definition**
Manager Variables	*(constructed from Thomson Insider Filing Dataset, CRSP and ExecuComp)*
Longholder CEO / Longholder CFO	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
Longholder Other	Overconfidence proxy constructed as Longholder CEO and Longholder CFO for executives other than CEO and CFO. If more than one executives satisfy the requirements to be included in the sample, the manager with the highest compensation is retained.
Stock Ownership	option-excluded shares (*shrown_excl_opts*) held by the CEO/CFO/other executive as a percentage of common shares outstanding (*csho*)
Vested Options	number of exercisable options (*opt_unex_exer_num*) held by the CEO/CFO/other executive as a percentage of common shares outstanding (*csho*)
Firm Variables	*(constructed from Compustat (Annual or Quarterly), SDC, Dealscan)*
Net Debt Issues ($m)	long term debt issuance (*dltis*) - long term debt reduction (*dltr*)
Net Debt Issues Indicator (Compustat)	binary variable where 1 signifies that Net Debt Issues during the year is positive
Net Debt Issues Indicator (SDC)	binary variable where 1 signifies that the company issued bonds during the year
Book Leverage	(long-term debt (*dltt*) + debt in current liabilities (*dlc*)) / (long-term debt (*dltt*) + debt in current liabilities (*dlc*) + common equity (*ceq*))
Net Financing Deficit($m)	cash dividends (*dv*) + investment + change in working capital - cash flow after interest and taxes, where ...
...investment	*capx + ivch + aqc + fuseo - sppe - siv* for firms with cash flow format code (*scf*) 1 to 3; *capx + ivch + acq - sppe - siv - ivstch - ivaco* for firms with cash flow format code 7; 0 for other firms
...change in working capital	*wcapc + chech + dlcch* for firms with cash flow format code 1; *-wcapc + chech - dlcch* for firms with cash flow format code 2 and 3; *-recch - invch - apalch - txach - aoloch + chech - fiao - dlcch* for firms with cash flow format code 7; 0 for other firms
...cash flow after interest and taxes	*ibc + xidoc + dpc + txdc + esubc + sppiv + fopo + fsrco* for firms with cash flow format code 1 to 3;

Continued on next page

Table B.2 – *Continued*

Variable	**Definition**
	items *ibc + xidoc + dpc + txdc + esubc + sppiv + fopo + exre* for firms with cash flow format code 7; 0 for other firms
Book Leverage	(long-term debt (*dltt*) + debt in current liabilities (*dlc*)) / (long-term debt (*dltt*) + debt in current liabilities (*dlc*) + common equity (*ceq*))
Market Leverage	(long-term debt (*dltt*) + debt in current liabilities (*dlc*)) / (price (*prcc*) × common shares outstanding (*csho*) + debt in current liabilities (*dlc*) + long-term debt (*dltt*))
Q	(assets (*at*) + price (*prcc*) × common shares outstanding (*csho*) - common equity (*ceq*) - balance sheet deferred taxes and investment tax credit (*txditc*)) / assets (*at*)
Profitability	operating profit (*oibdp*) / lagged assets (*at*)
Changes in Profitability	profitability - lagged profitability
Tangibility	property, plants, and equipment (*ppent*) / lagged assets (*at*)
Changes in Tangibility	tangibility - lagged tangibility
log(Sales)	log(sales (*sale*))
Changes in log(Sales)	log(sales) - lagged log(sales)
log(Interest Spread)	difference between the interest rate the borrower pays in basis points and the London Interbank Offered Rate (variable *allindrawn* in Dealscan)
Z-Score	1.2 × (current assets (*actq*) - current liabilities (*dlcq*)) / total assets (*atq*) + 1.4 × (retained earnings (*req*) / total assets (*atq*)) + 3.3 × (pretax income (*piq*) / total assets (*atq*)) + 0.6 × (market capitalization (*cshoq* × *prccq*) / total liabilities (*ltq*)) + 0.9 × (sales (*saleq*) / total assets (*atq*))
Covenants	Dummy equal to 1 if the loan contract includes covenants
PPP	Dummy equal to 1 if the loan contract includes performance-pricing provisions
Earnings Volatility	(standard deviation of the past eight earnings (*ibq*) changes) / (average book asset size over the past eight quarters).
log(Amount)	log (natural logarithm) of the amount of the loan (in million dollars) (*amt*)
Analysts' Coverage	number of analysts making at least one annual earnings forecast in a given year
Coefficient of Variation of Earnings Estimates	standard deviation of annual earnings forecasts normalized by the absolute value of the mean forecast (We require at least ten forecasts made.)
Acquisitions	Total spending amount in acquisitions (*aqc*) divided by market capitalization (price (*prcc*) × common shares outstanding (*csho*))
Distance to Default	Follows Farre-Mensa and Ljungqvist (2015) (see Appendix A.3)

C Robustness Checks

Appendix C presents additional details about the data and a series of robustness checks for all estimations presented the paper.

Appendix-Table C.1 replicates the results of Table 9 using alternative proxies for return variability, namely analyst coverage (Panel A) and the coefficient of variation of earnings estimates (Panel B). Analyst coverage (in Panel A) is measured as the number of analysts who made at least one annual earnings forecast and are included in IBES (similarly to Hong et al., 2000). Schutte and Unlu (2009) show that analysts coverage reduces noise, and Zhang (2006) finds that it is negatively related to price continuation anomalies, suggesting that analysts reduce information uncertainty. The coefficient of variation of analysts' annual earnings forecasts (in Panel B) is defined as the standard deviation of forecasts normalized by the absolute value of the mean forecast. Here, we include only firms with at least 10 analysts to compute the coefficient of variation. A large literature in accounting (cf. Cheng and Warfield, 2005) shows that the coefficient of variation is associated with larger earnings surprises (in absolute value). Results using the alternative cutoffs employed in Table 9 are omitted for brevity and are available upon request.

Appendix-Table C.2 shows the estimation results if we use Otto (2014)'s continuous empirical measure of CEO overconfidence. Under this approach, overconfidence is measured as the weighted average of transaction-specific overconfidence dummmies. We first classify each option exercise of an executive. The transaction-specific dummy takes the value 1 if the options were exercised within one year of their expiration date and were at least 40% in the money at the end of the preceding year. Otherwise, the dummy takes the value 0. We then average the value of the dummies for each executive across his or her transactions, weighting each observation by the number of options that were exercised. Therefore, the final overconfidence measure takes values between 0 and 1. We repeat all of our empirical analyses using this measure and show the results below, omitting the coefficients on the control variables for brevity. The specifications and the control variables are exactly the same. The continuous Longholder proxies are normalized by their respective sample standard deviations for ease of interpretation.

Appendix-Table C.3 reports our estimations of the relation between managerial overconfidence and propensity to issue debt using SDC data rather than Compustat. The advantage of the SDC data is that it identifies the timing of issuances more precisely, relative to the (noisier) accounting data from Compustat. Its disadvantage is that it misses increases or decreases in firms' external financing that are not recorded as new issues in SDC, and that the sample size is much smaller. To generate the data for this analysis, we match all issues of debt, equity, and hybrid securities (convertible debt and convertible preferred stock) with the ExecuComp-Compustat merged sample described in the main text. We have 694 observations when no control variables are required, and 647 observations in the subsample where all control variables are available. Moreover, as the industry dummies perfectly predict some of the debt issues, the actual sample usable for identification varies further, between 694 and 585 observations (when the full set of controls is included). The estimations mirror those using the Compustat data in the main text (in Table 3): We estimate again a logit model with a dummy equal to one if a firm issued debt in a given year, and 0 otherwise, i. e., if the firm issued equity or hybrid securities, and using the same control variables. Given the small sample, we choose to display the estimations using all available observations for the respective specifications. Results of this exercise confirm those in the main text.

As mentioned in the main text, we have also re-run all our tests by restricting the analysis to firms that have appreciated by more than 40% in the previous ten years. This robustness check has the limitation that it mechanically excludes from the sample all firms that, in any given year, have been listed for less than 10

years. We show the replications of Tables 3 and 8 in the main text (Tables C.4 and C.5 of this Appendix).

Table C.6 replicates the tests presented in the main text, clustering standard errors at the industry level (using the 2-digit SIC definition), rather than at the firm level.

Finally, we check the robustness of our results to varying the minimum number of transactions. In our main tests, we require CEOs and CFOs to have at least 10 transactions recorded. Figure C.1 plots the coefficients of interest in each regression using an array of minimum transaction requirements between 1 and 10. We only plot the coefficients from the most conservative regressions (last column of each table). The only difference with the specifications reported in the main text is that, up to 9 transactions required, we do not include the Longholder Other dummy. The reason is that, to keep the data collection, and in particular the fuzzy matching across datasets, manageable, we have constructed this dummy only for the sample employed in the main analysis.

Table C.1
Net Interest Rates Across Subsamples: Alternative Sorting Variables

Panels A and B of Table C.1 test the relation between CEO overconfidence and the cost of debt across different subsamples, using tercile cutoffs for low, medium, and high variability in each sorting variable (Analysts' Coverage in Panel A and Coefficient of Variation of Earnings Forecasts in Panel B). All panels show regressions of log(Interest Rate Spread) on our measures of overconfidence and the same control variables and fixed effects as in Column 8 of Table 8. We estimate the empirical model specified in equation 4 in the main text in each subsample. For the regressions in Panel B we require the firm to have at least 10 analyst forecasts. ***, ** and * indicate statistically different from zero at the 1%, 5%, and 10% level of significance, respectively.

Panel A. Sorting by Analysts' Coverage

	Low	Medium	High
	(1)	(2)	(3)
Longholder CEO	-0.113	-0.239***	0.052
	(-1.550)	(-3.075)	(0.578)
Longholder CFO	0.048	-0.047	-0.115
	(0.708)	(-0.563)	(-1.632)
Longholder Other	-0.009	-0.037	0.256***
	(-0.068)	(-0.322)	(2.626)
Observations	541	541	525
R-Squared	0.699	0.744	0.792

Panel B. Sorting by Coefficient of Variation of Earnings Estimates

	Low	Medium	High
	(1)	(2)	(3)
Longholder CEO	-0.232**	-0.266**	0.300**
	(-2.056)	(-2.040)	(2.203)
Longholder CFO	-0.158	-0.060	-0.288*
	(-1.539)	(-0.566)	(-1.922)
Longholder Other	0.213	0.174	-0.016
	(1.089)	(1.108)	(-0.088)
Observations	278	280	286
R-Squared	0.864	0.844	0.812

Table C.2
Replication using Otto (2014)'s Overconfidence Measure

Table C.2 replicates the tests presented in the main text, using as overconfidence proxies Otto (2014)'s overconfidence measure.

Panel A. Debt Issues

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Longholder CEO	0.088	0.095			0.071	0.050	0.050
	(1.569)	(1.405)			(1.231)	(0.812)	(0.714)
Longholder CFO			0.076	0.140***	0.052	0.081	0.133**
			(1.352)	(2.604)	(0.883)	(1.400)	(2.253)
Manager Ctrl.	NO	YES	NO	YES	NO	YES	YES
Firm Controls	NO	YES	NO	YES	NO	NO	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES
Year FE	NO	YES	NO	YES	NO	YES	YES
Observations	2,936	2,936	2,936	2,936	2,936	2,936	2,936
Pseudo-R Squared	0.043	0.164	0.043	0.166	0.044	0.102	0.167

Panel B. Financing Deficit

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FD × Longholder CEO	0.001	0.007	0.006				-0.024	-0.007	-0.015
	(0.014)	(0.146)	(0.222)				(-0.374)	(-0.114)	(-0.511)
FD × Longholder CFO				0.067	0.041	0.027	0.086	0.047	0.038
				(0.720)	(0.501)	(0.777)	(0.839)	(0.497)	(0.966)
Manager Ctrl.	NO	YES	YES	NO	YES	YES	NO	YES	YES
Firm Controls	NO	YES	YES	NO	YES	YES	NO	YES	YES
FD × Controls	NO	NO	YES	NO	NO	YES	NO	NO	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	NO	YES	YES	NO	YES	YES	NO	YES	YES
Observations	4,576	4,576	4,576	4,576	4,576	4,576	4,576	4,576	4,576
R-Squared	0.352	0.420	0.574	0.362	0.423	0.582	0.365	0.423	0.585

Panel C. Leverage

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Longholder CEO	1.266*	0.598			0.839	0.185	0.192	0.179
	(1.862)	(0.929)			(1.244)	(0.293)	(0.290)	(0.266)
Longholder CFO			2.499***	2.223***	2.305***	2.203***	2.175***	2.185***
			(5.428)	(4.718)	(4.448)	(4.256)	(4.182)	(4.165)
Manager Ctrl.	NO	YES	NO	YES	NO	YES	YES	YES
Firm Controls	NO	YES	NO	YES	NO	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	4,552	4,552	4,552	4,552	4,552	4,552	4,552	4,552
R-Squared	0.765	0.778	0.766	0.779	0.766	0.779	0.783	0.785

Panel D. Sorting by CEO Power

Financing Deficit

Sorting by:	CEO Tenure				CEO Pay			
	Low	High	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FD × Longholder CEO	-0.009	0.043	-0.006	0.074	0.060*	0.007	0.003	-0.005
	(-0.333)	(1.018)	(-0.211)	(1.607)	(1.897)	(0.192)	(0.080)	(-0.136)
FD × Longholder CFO			0.158***	-0.118			0.196***	0.029
			(3.180)	(-1.615)			(3.170)	(0.678)
Observations	2,406	2,096	2,406	2,096	2,306	2,270	2,306	2,270
R-Squared	0.601	0.654	0.538	0.604	0.733	0.521	0.694	0.467

Leverage

Sorting by:	CEO Tenure				CEO Pay			
	Low	High	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Longholder CEO	1.020	0.533	0.529	0.604	0.764	0.340	0.729	-1.012
	(1.309)	(0.466)	(0.683)	(0.552)	(1.014)	(0.258)	(0.953)	(-0.865)
Longholder CFO			2.103***	3.762**			2.155	2.405***
			(3.776)	(2.060)			(1.612)	(3.276)
Observations	2,397	2,081	2,397	2,081	2,290	2,262	2,290	2,262
R-Squared	0.770	0.797	0.771	0.799	0.791	0.784	0.792	0.785

Panel E. Other C-suite Executives

Outcome Variable:	Debt Issues	Fin. Deficit	Leverage	Financing Deficit				Leverage			
Sorting by:				CEO Tenure		CEO Pay		CEO Tenure		CEO Pay	
				Low	High	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Longholder CEO	0.047		0.186					0.508	0.561	0.728	-1.018
	(0.664)		(0.286)					(0.658)	(0.486)	(0.955)	(-0.871)
Longholder CFO	0.131**		2.252***					2.176***	3.706**	2.159	2.449***
	(2.218)		(4.260)					(3.860)	(2.081)	(1.627)	(3.380)
Longholder Other	-0.011		-0.314					-0.599	0.898	-0.090	-0.307
	(-0.122)		(-0.513)					(-0.856)	(0.819)	(-0.138)	(-0.209)
FD × Longholder CEO		-0.017		0.013	0.057	0.022	-0.005				
		(-0.621)		(0.508)	(1.155)	(0.948)	(-0.142)				
FD × Longholder CFO		0.037		0.139***	-0.121	0.164***	0.033				
		(0.989)		(3.175)	(-1.622)	(3.492)	(0.793)				
FD × Longholder Other		0.032		-0.013	0.015	0.030	-0.081				
		(0.898)		(-0.321)	(0.305)	(0.962)	(-1.114)				
Observations	2,936	4,576	4,552	2,406	2,096	2,306	2,270	2,397	2,081	2,290	2,262
Pseudo R-Squared	0.169										
R-Squared		0.593	0.786	0.552	0.610	0.718	0.475	0.772	0.799	0.792	0.785

Panel F. Cost of Debt

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Longholder CEO	-0.050	-0.059***			-0.063*	-0.057**	-0.049**	-0.050**
	(-1.480)	(-2.834)			(-1.793)	(-2.536)	(-2.323)	(-2.268)
Longholder CFO			0.023	-0.017	0.042	-0.001	-0.004	-0.004
			(0.780)	(-0.965)	(1.366)	(-0.056)	(-0.191)	(-0.198)
Longholder Other								0.000
								(0.003)
Manag. Controls	NO	YES	NO	YES	NO	YES	YES	YES
Firm Controls	NO	YES	NO	YES	NO	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year-Quarter FE	YES	YES	YES	YES	YES	YES	YES	YES
Loan Type FE	NO	NO	NO	NO	NO	NO	YES	YES
Observations	1,651	1,651	1,651	1,651	1,651	1,651	1,651	1,651
R-Squared	0.408	0.639	0.406	0.636	0.410	0.639	0.684	0.684

Panel G. Net Interest Rates Across Subsamples

	Sorting by Earnings Volatility		
	Low Tercile	Medium Tercile	High Tercile
	(1)	(2)	(3)
Longholder CEO	-0.027	-0.083**	-0.036
	(-0.701)	(-2.485)	(-0.962)
Longholder CFO	0.011	-0.010	0.005
	(0.344)	(-0.308)	(0.156)
Longholder Other	0.054	-0.127**	0.113
	(0.932)	(-2.149)	(1.174)
Observations	550	547	554
R-Squared	0.778	0.735	0.773
	Bottom 35%	Medium 30%	Top 35%
Longholder CEO	-0.022	-0.064	-0.033
	(-0.577)	(-1.502)	(-0.826)
Longholder CFO	0.006	-0.012	0.000
	(0.161)	(-0.319)	(0.013)
Longholder Other	0.048	-0.133*	0.094
	(0.745)	(-1.907)	(0.876)
Observations	574	500	577
R-Squared	0.785	0.763	0.777
	Bottom 30%	Medium 40%	Top 30%
Longholder CEO	-0.034	-0.084**	-0.027
	(-0.963)	(-2.334)	(-0.589)
Longholder CFO	0.040	-0.007	0.010
	(1.007)	(-0.236)	(0.375)
Longholder Other	0.030	-0.101	0.127
	(0.487)	(-1.357)	(1.287)
Observations	492	662	497
R-Squared	0.790	0.742	0.793
	Bottom 25%	Medium 50%	Top 25%
Longholder CEO	-0.017	-0.093***	-0.013
	(-0.586)	(-3.694)	(-0.353)
Longholder CFO	0.078	-0.017	0.026
	(1.647)	(-0.760)	(0.978)
Longholder Other	0.022	-0.063	0.106
	(0.388)	(-0.846)	(0.933)
Observations	417	822	412
R-Squared	0.804	0.729	0.837

Panel H. Acquisitions

		Sorting by Distance to Default						
	Full Sample	Low	Medium	High	Low	Medium	High	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Longholder CEO	0.002	0.007	-0.017***	0.008**	0.013	-0.015***	0.009**	0.010**
	(0.670)	(0.778)	(-3.682)	(2.000)	(1.462)	(-3.355)	(2.104)	(2.110)
Longholder CFO	0.000	0.001	-0.016***	0.002	0.001	-0.015**	0.002	0.003
	(0.083)	(0.258)	(-2.880)	(0.259)	(0.186)	(-2.590)	(0.371)	(0.408)
Longholder Other								-0.001
								(-0.176)
Manag. Controls	NO	NO	NO	NO	YES	YES	YES	YES
Firm Controls	NO	NO	NO	NO	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	4,576	1,281	1,282	1,283	1,281	1,282	1,283	1,283
R-Squared	0.263	0.330	0.364	0.416	0.348	0.371	0.424	0.424

Panel I. CFO Hiring

	(1)	(2)	(3)	(4)	(5)	(6)
Longholder CEO	0.207**	0.212***	0.204***	0.015	0.208***	0.206***
	(2.322)	(2.630)	(2.772)	(1.232)	(2.602)	(2.602)
Longholder Other						0.318
						(0.559)
Year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	YES	YES	YES	YES	YES
CEO Controls	NO	NO	YES	YES	YES	YES
Firm Controls	NO	NO	YES	YES	YES	YES
Sample	All	All	All	Pre	All	All
CFO Controls	NO	NO	NO	NO	YES	YES
Observations	209	209	209	56	209	209
R-Squared	0.181	0.271	0.310	0.997	0.343	0.346

Table C.3
Debt Issues (SDC)

Table C.3 presents the estimated log odds ratios from logit regressions with a binary variable equal to one if the firm issued debt during the fiscal year as the dependent variable, conditioning on having issued debt, equity, or hybrid securities. Data on public issues are from SDC and include 330 firms. Equity issues are issues of common stock or non-convertible preferred stock. Debt issues are issues of non-convertible debt. Hybrid issues are issues of convertible debt or convertible preferred stock. The overconfidence proxy and the control variables are as in Table 3. Standard errors (and corresponding t-statistics, shown in parentheses) are adjusted for autcorrelation at the firm level. ***, **, and * indicate statistically different from zero at the 1%, 5%, and 10% level of significance, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Longholder CEO	0.716**	0.201			0.528*	0.309	-0.062
	(2.537)	(0.506)			(1.856)	(0.923)	(-0.149)
Longholder CFO			0.819***	0.781**	0.688**	0.922***	0.804**
			(3.019)	(2.162)	(2.476)	(2.801)	(2.158)
Manager Controls	NO	YES	NO	YES	NO	YES	YES
Firm Controls	NO	YES	NO	YES	NO	NO	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES
Year FE	NO	YES	NO	YES	NO	YES	YES
Observations	694	611	694	587	694	598	585
Pseudo R-squared	0.092	0.550	0.098	0.558	0.105	0.253	0.557

Table C.4
Debt Issues, Restricted Sample

Logit regressions with the Net Debt Issues Indicator as the dependent variable, regressed on our measure of overconfidence for CEOs and CFOs and the same control variables as in Table 3. The sample includes only firms in the Restricted Sample, i.e., firms that have appreciated by more than 40% in the previous ten years (therefore excluding from the sample all the firms that, in any given year, have been listed for less than 10 years). ***, **, and * indicate statistically different from zero at the 1%, 5%, and 10% level of significance, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Longholder CEO	0.010	-0.063			-0.102	-0.103	-0.183
	(0.0623)	(-0.398)			(-0.612)	(-0.617)	(-1.132)
Longholder CFO			0.419***	0.457***	0.439***	0.483***	0.501***
			(2.982)	(3.075)	(3.054)	(3.098)	(3.289)
Manager Controls	NO	YES	NO	YES	NO	YES	YES
Firm Controls	NO	YES	NO	YES	NO	NO	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES
Year FE	NO	YES	NO	YES	NO	YES	YES
Observations	1,744	1,744	1,744	1,744	1,744	1,744	1,744
Pseudo R^2	0.041	0.170	0.048	0.176	0.048	0.115	0.176

Table C.5
Cost of Debt Financing, Restricted Sample

Regressions of log(Interest Spread) on our overconfidence measures for CEOs and CFOs and several control variables (defined in Table 8), including year and industry fixed-effects. Log(Interest Spread) is the difference between the interest rate the borrower pays in basis points and the London Interbank Offered Rate. The sample includes only firms in the Restricted Sample, i.e., firms that have appreciated by more than 40% in the previous ten years (therefore excluding from the sample all the firms that, in any given year, have been listed for less than 10 years). ***, **, and * indicate statistically different from zero at the 1%, 5%, and 10% level of significance, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Longholder CEO	-0.254***	-0.207***			-0.268***	-0.191***	-0.137**	-0.140**
	(-2.915)	(-3.630)			(-3.013)	(-3.185)	(-2.403)	(-2.464)
Longholder CFO			-0.027	-0.098*	0.042	-0.039	-0.041	-0.053
			(-0.304)	(-1.718)	(0.481)	(-0.677)	(-0.781)	(-1.000)
Longholder Other								0.116
								(1.301)
Manag. Controls	NO	YES	NO	YES	NO	YES	YES	YES
Firm Controls	NO	YES	NO	YES	NO	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year-Quarter FE	YES	YES	YES	YES	YES	YES	YES	YES
Loan Type FE	NO	NO	NO	NO	NO	NO	YES	YES
Observations	1,154	1,154	1,154	1,154	1,154	1,154	1,152	1,152
R-Squared	0.474	0.679	0.461	0.676	0.474	0.683	0.715	0.717

Table C.6
Industry Clustering

Table C.6 replicates the tests presented in the main text, clustering standard errors at the industry level (using the 2-digit SIC definition), rather than at the firm level.

Panel A. Debt Issues

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Longholder CEO	0.111	-0.007			0.012	0.020	-0.126
	(0.908)	(-0.066)			(0.095)	(0.159)	(-1.235)
Longholder CFO			0.354***	0.392***	0.352***	0.412***	0.437***
			(2.854)	(3.033)	(2.912)	(3.135)	(3.346)
Manager Ctrl.	NO	YES	NO	YES	NO	YES	YES
Firm Controls	NO	YES	NO	YES	NO	NO	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES
Year FE	NO	YES	NO	YES	NO	YES	YES
Observations	2,939	2,939	2,939	2,939	2,939	2,939	2,939
Pseudo-R Squared	0.042	0.163	0.047	0.169	0.047	0.107	0.170

Panel B. Financing Deficit

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FD × Longholder CEO	0.024	0.054	0.164***				-0.024	0.011	0.104***
	(0.231)	(0.628)	(3.801)				(-0.263)	(0.150)	(2.692)
FD × Longholder CFO				0.243	0.210	0.179**	0.247*	0.208	0.166**
				(1.600)	(1.478)	(2.349)	(1.688)	(1.528)	(2.208)
Manager Ctrl.	NO	YES	YES	NO	YES	YES	NO	YES	YES
Firm Controls	NO	YES	YES	NO	YES	YES	NO	YES	YES
FD × Controls	NO	NO	YES	NO	NO	YES	NO	NO	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	NO	YES	YES	NO	YES	YES	NO	YES	YES
Observations	4,581	4,581	4,581	4,581	4,581	4,581	4,581	4,581	4,581
R-Squared	0.344	0.415	0.542	0.398	0.451	0.571	0.398	0.452	0.578

Panel C. Leverage

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Longholder CEO	1.485	0.890			1.063	0.483	0.444	0.382
	(0.909)	(0.621)			(0.648)	(0.335)	(0.314)	(0.267)
Longholder CFO			4.151***	3.678***	4.044***	3.800***	3.681***	3.730***
			(3.011)	(3.021)	(3.029)	(3.226)	(3.143)	(3.215)
Manager Ctrl.	NO	YES	NO	YES	NO	YES	YES	YES
Firm Controls	NO	YES	NO	YES	NO	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	4,557	4,557	4,557	4,557	4,557	4,557	4,557	4,557
R-Squared	0.764	0.778	0.766	0.779	0.766	0.780	0.783	0.785

Panel D. Sorting by CEO Power

Financing Deficit

Sorting by:	CEO Tenure				CEO Pay			
	Low	High	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FD × Longholder CEO	0.100*	0.128**	0.054	0.164**	0.265**	0.171***	-0.029	0.191**
	(1.749)	(2.173)	(1.221)	(2.449)	(2.307)	(2.700)	(-0.688)	(2.460)
FD × Longholder CFO			0.180	0.115**			0.313**	0.028
			(1.578)	(2.087)			(2.114)	(0.501)
Observations	2,411	2,096	2,411	2,096	2,309	2,272	2,309	2,272
R-Squared	0.598	0.655	0.526	0.601	0.663	0.535	0.679	0.491

Leverage

Sorting by:	CEO Tenure				CEO Pay			
	Low	High	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Longholder CEO	-0.111	5.137*	-0.747	4.933	-0.511	3.776	-0.965	3.414
	(-0.077)	(1.734)	(-0.552)	(1.647)	(-0.418)	(1.573)	(-0.747)	(1.419)
Longholder CFO			4.703**	2.462*			3.777*	2.944**
			(2.476)	(1.872)			(1.945)	(2.266)
Observations	2,402	2,081	2,402	2,081	2,293	2,264	2,293	2,264
R-Squared	0.769	0.798	0.772	0.799	0.791	0.785	0.793	0.785

Panel E. Other C-suite Executives

Outcome Variable:	Debt Issues	Fin. Deficit	Leverage	Financing Deficit				Leverage			
Sorting by:				CEO Tenure		CEO Pay		CEO Tenure		CEO Pay	
				Low	High	Low	High	Low	High	Low	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Longholder CEO	-0.105		0.542					-0.627	4.695*	-0.391	3.081
	(-0.985)		(0.429)					(-0.465)	(1.821)	(-0.367)	(1.390)
Longholder CFO	0.417***		3.876***					5.060**	2.290*	3.931**	2.938**
	(3.067)		(3.659)					(2.669)	(1.899)	(2.164)	(2.205)
Longholder Other	0.147		-3.144**					-2.315	-4.115*	-4.592***	0.510
	(0.768)		(-2.197)					(-1.629)	(-1.759)	(-3.272)	(0.202)
FD × Longholder CEO		0.115***		0.119***	0.149**	0.056	0.169**				
		(3.337)		(3.205)	(2.554)	(0.861)	(2.172)				
FD × CFO Longholder		0.158**		0.137	0.111**	0.233	0.036				
		(2.309)		(1.294)	(2.085)	(1.416)	(0.679)				
FD × Longholder Other		0.139		0.112	0.018	0.016	0.169				
		(1.557)		(0.826)	(0.242)	(0.225)	(1.119)				
Observations	2,939	4,581	4,557	2,411	2,096	2,309	2,272	2,402	2,081	2,293	2,264
Pseudo R-Squared		0.588	0.787	0.545	0.608	0.693	0.499	0.773	0.802	0.799	0.786

Panel F. Cost of Debt

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Longholder CEO	-0.199***	-0.168***			-0.185**	-0.159***	-0.118***	-0.125***
	(-2.799)	(-4.407)			(-2.616)	(-3.695)	(-3.178)	(-2.926)
Longholder CFO			-0.096	-0.081	-0.040	-0.033	-0.030	-0.028
			(-1.158)	(-1.609)	(-0.480)	(-0.602)	(-0.683)	(-0.651)
Longholder Other								0.062
								(0.949)
Manag. Controls	NO	YES	NO	YES	NO	YES	YES	YES
Firm Controls	NO	YES	NO	YES	NO	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year-Quarter FE	YES	YES	YES	YES	YES	YES	YES	YES
Loan Type FE	NO	NO	NO	NO	NO	NO	YES	YES
Observations	1,651	1,651	1,651	1,651	1,651	1,651	1,651	1,651
R-Squared	0.415	0.642	0.408	0.638	0.416	0.643	0.685	0.686

Panel G. Net Interest Rates Across Subsamples

	Sorting by Earnings Volatility		
	Low Tercile	Medium Tercile	High Tercile
	(1)	(2)	(3)
Longholder CEO	-0.026	-0.209***	-0.090
	(-0.433)	(-3.188)	(-0.791)
Longholder CFO	-0.108*	-0.008	0.054
	(-1.721)	(-0.132)	(0.847)
Longholder Other	-0.074	-0.148	0.167*
	(-0.489)	(-1.136)	(1.749)
Observations	550	547	554
R-Squared	0.780	0.734	0.773
	Bottom 35%	Medium 30%	Top 35%
Longholder CEO	-0.041	-0.140*	-0.080
	(-0.659)	(-1.735)	(-0.696)
Longholder CFO	-0.077	-0.059	0.039
	(-1.193)	(-0.813)	(0.580)
Longholder Other	-0.093	-0.186	0.176*
	(-0.621)	(-1.211)	(1.898)
Observations	574	500	577
R-Squared	0.787	0.761	0.777
	Bottom 30%	Medium 40%	Top 30%
Longholder CEO	-0.005	-0.213***	-0.171
	(-0.064)	(-3.419)	(-1.496)
Longholder CFO	-0.116	-0.001	0.096
	(-1.532)	(-0.011)	(1.265)
Longholder Other	-0.086	-0.098	0.192*
	(-0.549)	(-0.942)	(1.729)
Observations	492	662	497
R-Squared	0.791	0.741	0.795
	Bottom 25%	Medium 50%	Top 25%
Longholder CEO	0.005	-0.223***	-0.145
	(0.053)	(-3.971)	(-1.448)
Longholder CFO	-0.100	-0.004	0.110
	(-1.035)	(-0.074)	(1.334)
Longholder Other	-0.018	0.010	0.017
	(-0.120)	(0.120)	(0.132)
Observations	417	822	412
R-Squared	0.802	0.728	0.837

Panel H. Acquisitions

		Sorting by Distance to Default						
	Full Sample	Low	Medium	High	Low	Medium	High	High
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Longholder CEO	-0.007	-0.040	-0.018	0.016*	-0.033	-0.016	0.018*	0.019*
	(-0.905)	(-1.321)	(-1.497)	(1.729)	(-1.092)	(-1.370)	(1.779)	(1.969)
Longholder CFO	0.002	0.008	0.004	-0.002	0.011	0.006	-0.001	-0.001
	(0.314)	(0.546)	(0.282)	(-0.274)	(0.693)	(0.464)	(-0.142)	(-0.137)
Longholder Other								-0.002
								(-0.209)
Manag. Controls	NO	NO	NO	NO	YES	YES	YES	YES
Firm Controls	NO	NO	NO	NO	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	4,581	1,283	1,283	1,283	1,283	1,283	1,283	1,283
R-Squared	0.217	0.285	0.346	0.416	0.298	0.353	0.423	0.423

Panel I. CFO Hiring

	(1)	(2)	(3)	(4)	(5)	(6)
Longholder CEO	0.218***	0.258***	0.290***	0.337***	0.277***	0.298***
	(3.071)	(3.437)	(3.882)	(3.092)	(3.499)	(3.569)
CEO Vested Options			-0.044**	0.001	-0.042*	-0.048**
			(-2.184)	(0.041)	(-1.848)	(-2.331)
CEO Shares			-0.000	0.016	0.002	0.001
			(-0.060)	(0.830)	(0.214)	(0.165)
CFO Vested Options$_t$					0.030*	
					(1.817)	
CFO Shares$_t$					0.078	
					(1.348)	
CFO Vested Options$_{t-1}$					0.039	
					(1.341)	
CFO Shares$_{t-1}$					-0.078	
					(-1.370)	
Longholder Other						-0.004
						(-0.051)
Year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	YES	YES	YES	YES	YES
Firm Controls	NO	NO	YES	YES	YES	YES
CEO Controls	NO	NO	YES	YES	YES	YES
CFO Controls	NO	NO	NO	NO	YES	YES
Sample	All	All	All	Pre	All	All
Observations	213	213	213	61	213	213
R-Squared	0.144	0.205	0.254	0.548	0.295	0.279

Figure C.1
Coefficient Estimates with Different Transactions Thresholds

These panels report the relevant coefficient estimates from the main empirical analyses of the paper (Tables 3 through 11). For brevity, only the coefficient from the most conservative test (last column of each table) is shown. The x-axis reports the minimum number of transactions required for CEOs and CFOs to be included in the sample. The y-axis has the value of the estimated coefficient of interest. Estimates that use a requirement of 1 up to 9 transactions do not include controls for Longholder Other. Panels a, b, and d report the coefficient on Longholder CFO. Panel c reports the coefficient on Financing Deficit × Longholder CFO. Panels e, f, g, h, and i report coefficients on Longholder CEO. Panels e, f, and g, where we divide the sample using different measures of volatility, have three different coefficients. The coefficients on Longholder estimated in the low, medium and high volatility subsamples are plotted using dotted, solid, and dashed lines, respectively. Panel h, where we divide the sample using different measures of distance to default, have three different coefficients. The coefficients on Longholder estimated in the low, medium and high volatility subsamples are plotted using dotted, dashed, and solid lines, respectively.