THE IMPACT OF THE CEO'S VIEW OF RISK ON TURNOVER AND THE VALUE OF EQUITY

A Dissertation

by

TIMOTHY COLIN CAMPBELL

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

August 2010

Major Subject: Finance

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Approved by:

Chair of Committee,	Shane A. Johnson
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ABSTRACT

The Impact of the CEO's View of Risk on Turnover and the Value
of Equity. (August 2010)
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Chair of Advisory Committee: Dr. Shane A. Johnson

Recent theory predicts that two factors influencing the CEO's view of risk, overconfidence and debt-like compensation, have implications for CEO forced turnover and firm equity value, respectively. We test each of these predictions using large samples of CEOs from S&P 1500 firms, with statistical methods such as Cox proportional semi-parametric hazard models and Ordinary Least Squares regressions.

Section 2 tests the theoretical prediction that CEOs with excessively low or excessively high overconfidence face a higher likelihood of forced turnover. We find empirical support for this prediction: excessively overconfident (diffident) CEOs have forced turnover hazard rates approximately 67% (97%) higher than moderately overconfident CEOs. To the extent that boards terminate non-value-maximizing CEOs, the results are broadly consistent with the view that there is an interior optimum level of managerial overconfidence that maximizes firm value.

Section 3 tests the theoretical prediction that debt or debt-like compensation can be used as a part of optimal executive compensation, leading to an increase in the value

of equity. We find weak evidence of positive abnormal returns in response to decreases in the deviation from optimal CEO debt-to-equity when the CEO's debt-to-equity was less than the firm's or when then firm had low institutional ownership. The results suggest that the optimal use of debt compensation can in fact be beneficial to equity holders.

DEDICATION

For my wife, who has supported me through a much longer period in College Station than she expected, and for my family who always supported me throughout my education.

ACKNOWLEDGEMENTS

I would like to thank my committee chair, Dr. Shane A. Johnson, and my committee members, Dr. Ekkehart Boehmer, Dr. Neal Galpin, and Dr. Li Gan, for their advice, insight and support throughout the course of this research.

I would also like to thank Jessica Rutherford and Brooke Stanley for the turnover data that I was able to use for my research. The second section is part of a larger research effort with my committee chair, Dr. Shane A. Johnson, Dr. Michael Gallmeyer, Jessica Rutherford, and Dr. Brooke Stanley. The data has been invaluable to both my dissertation and our journal-focused research.

Finally, thanks to my wife for helping me to solve issues leading up to my defense, and to my parents, for helping me get to a Ph.D. program before I was 22.

TABLE OF CONTENTS

Page

1. INTRODUCTION

Recent theory has made two interesting predictions. First, new theory predicts that CEO overconfidence, a form of bias, can actually benefit the firm. Specifically, moderate overconfidence can offset agency conflicts due to CEO risk aversion, and actually increase firm value. A resulting prediction is that excessively overconfident CEOs and excessively diffident CEOs should have a greater likelihood of forced turnover than moderately overconfident CEOs. We test this prediction in Section 2, and find empirical support for this prediction: excessively overconfident (diffident) CEOs have forced turnover hazard rates approximately 67% (97%) higher than moderately overconfident CEOs. By comparison, a CEO who generates industry-adjusted stock returns two standard deviations below the mean is 65% more likely to face forced termination than the mean CEO. To the extent that boards terminate non-value-maximizing CEOs, the results are broadly consistent with the view that there is an interior optimum level of managerial overconfidence that maximizes firm value.

New theoretical predictions also suggest that debt or debt-like compensation can be used as a part of optimal executive compensation. In fact, debt compensation may lead to a decrease in the agency costs of debt and an *increase* in the value of equity when used optimally. In Section 3, we estimate multiple empirical models for the optimal level of CEO debt-to-equity to determine the impact of a deviation from the optimal level on firm equity value. We find weak evidence of positive abnormal returns in response to

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This dissertation follows the style of the Journal of Financial Economics.

decreases in the deviation from optimal CEO debt-to-equity when the CEO's debt-to-equity was less than the firm's or when then firm had low institutional ownership. Specifically, we find approximately a 1% positive abnormal stock return over the two-day event window for the firm's proxy release date and the following day in response to a large decrease in the distance from optimal CEO relative debt to equity. The results suggest that the optimal use of debt compensation can in fact be beneficial to equity holders.

Taken together, the evidence provides support for theoretical predictions linking factors that influence the CEO's view of risk, such as overconfidence and debt-like compensation, to the value of the firm and its equity and to the CEO's likelihood of being fired. These results suggests that the CEO's view of risk is an important consideration for the firm, as are any factors that would influence the way in which the CEO views the firm's risk or his/her control of that risk.

2. THE IMPACT OF CEO CONFIDENCE ON FORCED TURNOVER

2.1 Introduction to Section 2

Goel and Thakor (2008) study theoretically the effects of three levels of CEO confidence—excessive diffidence (low confidence), moderate overconfidence, and excessive overconfidence—on investment policy and firm value. In their model, moderate levels of overconfidence cause the decision making of risk-averse CEOs to approach that of a risk-neutral CEO, and thereby increase firm value. Excessively overconfident CEOs overestimate the precision of their information and underinvest in information acquisition, leading them to overinvest in projects and reduce firm value. CEOs who are excessively diffident also reduce firm value because they reject profitable projects that would have increased shareholder wealth. Boards of directors learn about their CEOs' confidence levels by observing whether CEOs accept or reject investment projects conditional on signals of the projects' quality levels. A key resulting prediction is that boards of directors will fire CEOs who are excessively overconfident and those who are excessively diffident, retaining instead CEOs with moderate overconfidence because they maximize firm value. We test this prediction using a large sample of CEOs and forced turnover events.

We classify all CEOs in the ExecuComp database as excessively diffident, moderately overconfident, or excessively overconfident. To identify excessively overconfident CEOs, we use a modified version of the stock option-based overconfidence measure from Malmendier and Tate (2005), in which overconfident CEOs are those who hold options very deep in the money. As an additional measure of

excessive overconfidence, we draw upon Malmendier and Tate's measure based on a CEO's net purchases of shares of stock. We modify both of these measures by establishing classification cutoffs closer to the overconfident end of the continuum. As complements to the excessive overconfidence measures, we develop measures of excessive CEO diffidence.[1] Based on the reverse logic of the option-holding-based measure of excessive overconfidence, we define an excessively diffident CEO as one who exercises stock options too early at low levels of moneyness. As a complement to the net stock purchase-based measure of excessive overconfidence, we define CEOs as excessively diffident if they sell relatively large amounts of their stock holdings. Moderately overconfident CEOs are those not classified as excessively overconfident or excessively diffident. As a robustness measure of confidence that is not directly related to components of CEO compensation, we use firms' investment levels to construct indicator variables for CEO confidence.

We then identify all CEO turnover events among our set of classified CEOs, and classify the turnovers as forced or unforced based on Parrino (1997). Given that some of the confidence measures are likely related to stock returns and that extant studies find that boards are more likely to terminate CEOs with poor performance, we control for firms' stock return performance. Goel and Thakor (2008) also predict that boards terminate low-ability CEOs regardless of their confidence level, which is an additional

[1] One can view the group of CEOs that we call excessively diffident as either excessively diffident or just less confident than moderately overconfident CEOs (even rational, correctly confident) with no change in the predictions regarding turnover.

reason to control for stock return performance. We also control for the fraction of firm equity a CEO owns, and CEO age, tenure, salary, and bonus.

The results provide strong support for Goel and Thakor's (2008) hypothesis that both excessively overconfident CEOs and excessively diffident CEOs should face a greater likelihood of forced turnover than CEOs with moderate overconfidence. The effects are statistically and economically significant: Averaged across the different measures, excessively overconfident (diffident) CEOs are 67% (97%) more likely to face forced turnover than moderately overconfident CEOs. Moreover, these two probabilities do not differ significantly from each other, which implies that excessively overconfident CEOs and excessively diffident CEOs do not face significantly different risks of forced turnover. To put the figures in perspective, a CEO who generates industry-adjusted stock returns two standard deviations below the mean is 65% more likely to face termination than a CEO who generates mean returns. Thus, the effects of CEO confidence on turnover are large compared to other important determinants of forced turnover. The results hold in nonparametric, semiparametric, and parametric analyses. As expected from the underlying theory, we find consistent evidence of a relation between forced turnover and the confidence measures only among firms with strong board governance; confidence levels have no reliable effect on forced turnover among firms with weak board governance.

The excessive overconfidence and excessive diffidence measures could capture some effect related to turnovers per se, rather than forced turnovers. To rule out this possibility, we conduct two additional tests. First, we exclude all nonturnover

observations from the regressions, so that we compare only forced turnovers to voluntary turnovers. Among this subset, we find that excessively overconfident CEOs and excessively diffident CEOs are significantly more likely than moderately overconfident CEOs to face forced turnover rather than voluntary turnover. Second, we exclude all forced turnover observations, so that we compare only voluntary turnovers to nonturnovers. We find that the measures of excessive overconfidence and excessive diffidence are not reliably related to the likelihood that a CEO turns over voluntarily. These two tests imply that the measures of excessive overconfidence and excessive diffidence are related specifically to forced turnover, and not to turnover in general. These tests provide indirect support for the view that excessively overconfident CEOs and excessively diffident CEOs do not maximize firm value, so they are subject to forced turnover, and not voluntary turnover. Stated differently, the results are broadly consistent with the view that there is an interior optimum level of managerial overconfidence that maximizes firm value.

Another possible interpretation is that the measures of excessive overconfidence and excessive diffidence are just proxies for risk aversion. In particular, CEOs that we classify as excessively overconfident because they hold options deep in the money, or purchase large amounts of their firm's stock, may just have little or no risk aversion. Goel and Thakor (2008), however, emphasize that firm value should increase as risk aversion falls, which implies that CEOs identified as excessively overconfident by these measures should maximize firm value and therefore, be less subject to forced turnover compared to CEOs with moderate overconfidence. But this is opposite of what we find.

Thus, the excessive overconfidence measure is unlikely to just identify CEOs with little or no risk aversion.

Our results extend the growing literature on the impact of overconfidence on CEO decision-making and firm value. Most directly, our results support key predictions about the relation between CEO turnover and CEO confidence from Goel and Thakor (2008). By showing that moderately overconfident CEOs are less likely to be terminated, our results also provide indirect support for Hackbarth's (2008) model of capital structure with CEO overconfidence and/or optimism. In Hackbarth (2008), there is an interior optimum level of CEO overconfidence that maximizes firm value—it is straightforward to argue that if moderately overconfident CEOs maximize firm value, they should be less subject to forced turnover. Our results also suggest that CEO compensation contracts either cannot, or in practice do not, completely offset suboptimal levels of managerial overconfidence (see Gervais, Heaton, and Odean, 2008).

Our research also extends the work of Malmendier and Tate (2005, 2008) by developing measures that extend the CEO confidence classifications to include excessively diffident CEOs. To our knowledge, we are the first to document empirically the different effects of very low, moderate, and very high levels of CEO confidence. Our results also demonstrate that one can construct useful stock option exercise-based confidence measures similar to those in Malmendier and Tate (2005, 2008) using ExecuComp data rather than the more detailed, proprietary data that they use. This could prove useful to future researchers because ExecuComp data are available for a large number of executives over a long time period. Our results also contribute to the large

literature on CEO turnover.[2] We show that the effects of CEO overconfidence and CEO diffidence are economically large determinants of CEO turnover, after controlling for the determinants that prior literature has found to be important.

2.2 Background and hypotheses

We focus on testing a key prediction from Goel and Thakor (2008). Thus, we first review the relevant results of their model. They first demonstrate that when managerial ability cannot be observed and firms promote managers with the highest realized returns from the projects they selected, ceteris paribus, promoted managers that compose the potential CEO labor pool are likely to be relatively more overconfident than other managers. This result provides a strong theoretical underpinning for the notion that CEOs might be expected to be overconfident and is consistent with empirical evidence exploring managerial confidence levels.

Goel and Thakor (2008) then move on to consider the board's decision whether to retain or fire in-place CEOs with different confidence levels. Excessive diffidence, or low confidence, will lead a risk-averse CEO to forego some positive net present value projects that are risky despite positive quality signals about the projects. This is suboptimal to shareholders who would prefer that a CEO accept all positive NPV projects. At moderate levels of overconfidence, a CEO's actions will approach those of a risk-neutral manager, leading to a greater number of risky positive NPV projects being accepted, and thereby to an increase in firm value. Beyond some level of

[2] See e.g., Weisbach (1988, 1995), Kang and Shivdasani (1995), Mikkelson and Partch (1997), Parrino (1997), Defond and Park (1999), Huson, Parrino, and Starks (2001), Farrell and Whidbee (2003), Engel, Hays, and Wang (2003), Parrino, Sias, and Starks (2003), Defond and Hung (2004), Huson, Malatesta, and Parrino (2004), Clayton, Hartzell, and Rosenberg (2005), Lehn and Zhao (2006), Jenter and Kanaan (2008), and Peters and Wagner (2009).

overconfidence, however, CEOs overestimate the precision of their information and underinvest in information acquisition. Given the information-related problems, they wind up accepting negative NPV projects (i.e., overinvesting), which reduces firm value.

Collecting the results, the authors predict that a board of directors acting in the best interest of shareholders will recognize that moderate CEO overconfidence is beneficial to shareholders, and will fire CEOs with excessive diffidence and those with excessive overconfidence. In short, unobservable information prevents the board of directors from initially hiring CEOs with the optimal level of confidence, so they correct any mistakes later via forced turnover when they learn more about the CEO's confidence level by observing her investment decisions conditional on project quality signals. This is the main hypothesis we test. Specifically, CEOs who display excessive diffidence and CEOs who display excessive overconfidence will face higher rates of forced turnover than CEOs with moderate levels of overconfidence.

We should emphasize that in Goel and Thakor (2008), boards terminate low-ability CEOs, regardless of the CEO's confidence level. Thus, it is important that we control for CEO ability. As we describe in the next subsection, we include controls for CEO age, tenure, cash compensation, and the industry-adjusted stock returns over the CEO's tenure. Hermalin and Weisbach (1998) argue that CEO tenure and past performance capture CEOs' "perceived" ability, so our tests should be able to separate out the effects of low ability from the effects of confidence on forced turnover.

We should also emphasize that in Goel and Thakor (2008), CEO overconfidence is a distinct effect that is separate from low risk aversion. They argue that firm value

should have an inverse U-shaped relation with CEO confidence, but that firm value should increase monotonically as risk aversion falls. Thus, if our empirical measures of excessive overconfidence and excessive diffidence reflect only information about low and high CEO risk aversion, respectively, we should find that CEOs that we classify as excessively diffident are more likely to be terminated, whereas CEOs that we classify as excessively overconfident are *less* likely to be terminated than CEOs that we classify as moderately overconfident. Thus, our tests should also help to sort out confidence-related effects from risk aversion effects.

We focus on the turnover implications of Goel and Thakor's model instead of the firm value implications because turnovers are clean, binary-type events that should allow more powerful tests of the model. Once investors in a firm become aware that its CEO has a suboptimal confidence level, firm value should be a weighted average of the suboptimal valuation that the current CEO would generate and the greater valuation that a new CEO would generate, appropriately weighted by expectations of the turnover probability. It is difficult for a researcher to know when investors realize the suboptimal confidence level and what their expectations of turnover probability are, so testing the firm value implications of the theory presents empirical difficulties that are not straightforward to resolve.

2.3 Empirical approach

2.3.1 Confidence measures

Measuring CEO diffidence and CEO overconfidence empirically presents some difficulty because CEO confidence cannot be observed directly. The extant literature on

CEO overconfidence employs a number of measures based on the actions taken by the CEO and on the portrayal of the CEO by outsiders. Malmendier and Tate (2005) develop measures of a CEO's overconfidence based on the CEO's net stock purchases and on her stock option holding and exercising decisions, and Malmendier and Tate (2008) develop a measure based on the CEO's portrayal in the media. Schrand and Zechman (2007) use the investment decisions of the firm or industry (as riskier firms might attract more overconfident CEOs) and Ben-David, Graham, and Harvey (2007) use the predictions made by the executive with regards to the firm's future prospects. As we discuss later, our sample construction begins with the ExecuComp population and contains over 9,000 CEO-year observations. Given the sample size, it is infeasible to hand collect measures based on the media's portrayal of the CEO or the predictions made by the CEO.[3] Thus, we base our confidence measures on CEO's stock option exercise decisions and net stock purchases, and on firms' investment levels.

2.3.1.1 Confidence measures based on stock option holding / exercise decisions

For our first set of confidence measures, we draw upon on the stock option-based overconfidence measure from Malmendier and Tate (2005). They define CEOs as overconfident if they hold stock options that are more than 67% in the money (i.e., the stock price exceeds the exercise price by more than 67%). Their choice of 67% comes from calibrating Hall and Murphy's (2002) model using a detailed dataset on executive stock option holdings and exercises. Hall and Murphy's model recognizes that risk-

[3] We do, however, conduct a validation exercise of our measures following the media-based approach by Malmendier and Tate (2008) at the end of this section.

averse executives typically hold undiversified portfolios and should exercise options early if they are rational expected utility maximizers. We do not have the same level of detailed data that Malmendier and Tate use, so we cannot perform a similar calibration. Thus, we take their 67% moneyness cutoff for the full sample of CEOs as a given to indicate overconfident CEOs. We need to identify *excessively* overconfident CEOs, however, so we require that CEOs hold stock options that are more than 100% in the money. To the extent that the 67% cutoff identifies overconfident managers, the 100% cutoff should identify the set of CEOs who are even more overconfident.[4]

Following Malmendier and Tate (2005), we apply the chosen cutoff across the full sample of CEOs. Also following Malmendier and Tate, we require that a CEO exhibit the option holding behavior at least twice during the sample period. The excessive overconfidence classification is assigned, however, beginning with the first time the CEO exhibits the behavior. Results are similar to those reported if we instead classify CEOs as excessively overconfident beginning with the second time they exhibit the option exercise behavior.

We compute option moneyness to determine the classifications as follows. The data that we use do not have option-grant-specific exercise prices, so we estimate the average exercise price of the aggregated options by using Core and Guay's (2002)

[4] Even if one had detailed data to calibrate a model, distinguishing between overconfident and excessively overconfident would still represent a judgment call. To explore the sensitivity of our results to the 100% cutoff, we alternatively define three groups of CEOs holding options between: 100% and 150% moneyness, 151% and 250% moneyness; and above 250% moneyness. Unreported results show that the forced turnover hazards do not differ significantly from each other across these groups, but all three groups do have significantly greater forced turnover hazards than moderately overconfident CEOs do at the 0.10 level or better. Given that the three categories beyond 100% moneyness cutoff appear to have similar forced turnover hazards, we combine them into one measure capturing all CEOs holding options at 100% or greater moneyness.

approximation method. Specifically, we compute the average realizable value per option as the total realizable value of the options (i.e., the net value from exercising) divided by the number of options. We then estimate the average exercise price of the options as the stock price at the fiscal year end minus the per-option realizable value. The average percentage moneyness of the options is then the stock price at the fiscal year end divided by the average estimated exercise price, minus one. Because we want to identify which CEOs hold options that could have been exercised, we include only exercisable options in these calculations.

As a complement to the excessive overconfidence measure, we need a measure of excessive managerial diffidence, or low confidence. Based on the logic that excessively overconfident CEOs *hold* options too long (i.e., they let options go too deep in the money before exercise), we define an excessively diffident CEO as one who *exercises* stock options that are less than 30% in the money and does not hold other exercisable options that are greater than 30% in the money.[5,6] To compute the percentage moneyness of the exercised options, we first divide the value realized from exercising stock options by the number of options exercised to compute a per option value realized from exercising. The percent moneyness of the exercised option holdings is computed as

[5] The data do not permit us to know when options are at expiration. Almost all executive stock options in the United States, however, have original expiration periods of exactly ten years (Murphy, 1999). When we include only those CEOs with company tenures less than ten years, who are very unlikely to have options expiring, our main results still hold.

[6] In footnote 4, we discuss a sensitivity analysis of the 100% moneyness cutoff for the excessive overconfidence measure. We are severely limited in doing a comparable analysis for the 30% moneyness cutoff for excessive diffidence because there are so few observations in which a CEO exercises options with very low moneyness. For example, using a 15% moneyness cutoff, there are only 51 CEO-firm years classified as excessively diffident. Thus, our 30% cutoff identifies CEOs at the lower end of the confidence spectrum, while producing a group sufficiently large to be useful in our statistical analyses.

per option value realized from exercising divided by the average estimated exercise price (which is estimated as discussed above for the excessive overconfidence measure). The percent moneyness of the unexercised (but exercisable) option holdings is computed as the stock price at the end of the fiscal year divided by the estimated average option exercise price of the exercisable options, minus one. As with the excessive overconfidence measure, we require that CEOs exhibit the relevant exercise behavior at last twice in the sample period and classify them as excessively diffident beginning with the first time they do. Results are similar to those reported if we instead classify CEOs as excessively diffident beginning only with the second time they exhibit the option exercise behavior.

Given the definitions of excessively overconfident CEOs and excessively diffident CEOs, we classify CEOs as moderately overconfident if they hold and/or exercise options with moneyness between 30% and 100%. With the three option-based definitions, we are unable to classify some CEOs as excessively overconfident, excessively diffident, or moderately overconfident. For example, we cannot classify CEOs who have all of their options out of the money or have no options at all. On the one hand, these CEOs clearly have not held options too long which would allow us to classify them as excessively overconfident, but on the other hand they really have not had an opportunity to exercise early so that we could classify them as excessively diffident. Moreover, it is difficult to argue that they have moderate overconfidence because they do not clearly lie between excessive diffidence and excessive overconfidence on the measure. Similarly, we cannot classify CEOs who have no

options for every year they are in the sample. If a CEO has no options held in a given year because she exercised all of them in previous years, however, she retains her classification going forward from the year in which she was classifiable. In the analyses using the option-based measures of confidence, we omit the unclassified CEOs.

Before discussing our other confidence measures, we need to address a potential issue arising from our use of an adapted version of Malmendier and Tate's (2005) stock option exercise-based overconfidence measure to test Goel and Thakor's (2008) turnover prediction. In Malmendier and Tate, an overconfident CEO overestimates the expected payoff (mean) from an investment, whereas in Goel and Thakor an overconfident CEO underestimates the variance of the payoff. Malmendier and Tate motivate their stock option-based overconfidence measure by noting that a CEO who overestimates the mean payoff should hold the option beyond the moneyness level that a rational, risk-averse CEO would. Under risk-neutral option valuation, the critical stock price for early exercise of an American call option increases in stock return volatility (see e.g., Kim, 1990). Thus, from a risk-neutral standpoint, an option holder who underestimates variance would exercise stock options at lower stock prices rather than hold them too deep in the money. This risk neutral view would imply that our measure and Malmendier and Tate's measure based on stock options held too deep in the money identify CEOs who *overestimate* variance rather than those who underestimate variance, and thus are underconfident in the variance sense. Conversely, our measure based on stock option exercises at below 30% moneyness would identify CEOs who underestimate variance and thus would be overconfident (in the variance sense) rather than diffident as we use

the measure. In short, from a risk-neutral standpoint, our stock-option based measures would capture the opposite of what we want.

The effect of variance on the critical stock price for early exercise differs, however, when considering a risk-averse manager who is undiversified and is prohibited from hedging a stock option's payoff risk. Carpenter, Stanton, and Wallace (2009a) show theoretically that volatility has a non-monotonic effect on the critical stock price for early exercise for such managers, in contrast to what risk-neutral valuation implies. The critical stock price rises or falls with volatility depending on a number of manager characteristics that we cannot observe. Fortunately, Bettis, Bizjak, and Lemmon (2005) and Carpenter, Stanton, and Wallace (2009b) provide empirical evidence on the question, finding that managers of firms with higher observed stock return volatility exercise stock options earlier, which is opposite of what risk neutral valuation predicts. If observed stock return volatility is a reasonable proxy in the cross section for a CEO's own estimate of volatility, the results imply that CEOs with lower estimates of volatility exercise stock options later. To the extent that later exercise corresponds to exercise at higher stock prices, we can infer that CEOs who hold stock options to high levels of moneyness are those who underestimate variance and thus, are overconfident in the variance sense. The opposite inference should be true for CEOs who exercise stock options at low levels of moneyness. Thus, the stock option-based measures should identify CEO confidence levels whether one views overconfidence as overestimating the mean or underestimating the variance. Further, Campbell, Gallmeyer, Johnson, Rutherford, and Stanley (2010) show theoretically that both over confidence in a mean

and in a variance sense have similar implications for a risk-averse CEO's investment decisions. CEOs who are diffident will underinvest, but the level of investment will increase with the CEO's overconfidence, leading moderately overconfident CEOs to invest optimally while excessively overconfident CEOs overinvest. To the extent that our measure proxies for both overconfidence in means and variance, each of these is consistent with theoretical predictions. It is also worth emphasizing that the other measures of confidence that we use are not subject to the same criticism.[7] In particular, the investment-based measure that we discuss later is motivated by Ben-David, Graham, and Harvey (2007), who classify executives as overconfident when they underestimate variance.

We address one additional issue before moving to our alternative measures. The ExecuComp data that we use are not as detailed as the proprietary stock option holding and exercise data that Malmendier and Tate (2005) use. Thus, an interesting question is whether one can use data aggregated across grants within a given year (as provided by ExecuComp for our sample period) to achieve similar classifications. We conduct two validation analyses to shed light on this question.[8] First, we examine whether Malmendier and Tate's (2005) main results hold using our algorithm and ExecuComp data to identify overconfident managers. With minor substitutions for the governance

[7] It is also worth emphasizing that Goel and Thakor (2008, footnote 10) note that although they model overconfidence based on variance, the overconfident manager will also be too optimistic (i.e., overestimate the mean). Thus, even if the stock option exercise-based measures only capture a CEO's propensity to misestimate the mean, they should still be useful in testing the turnover prediction from Goel and Thakor because their model embeds both optimism and overconfidence.

[8] We thank Geoff Tate for suggesting these validation exercises.

control variables due to data availability, untabulated results confirm Malmendier and Tate's finding that firms with overconfident managers have significantly greater investment-cash flow sensitivity. The coefficient on cash flow has *p*-values of 0.07 and 0.03 when replicating their regressions (6) and (7), respectively, of their Table V.

For the second validation analysis, we draw upon Malmendier and Tate's (2008) media-based measure. We randomly choose 30 CEOs that we classify as excessively diffident and 30 that we classify as excessively overconfident using ExecuComp data and our algorithm. For these random samples, we search Lexis-Nexis for a three-year window centered on the first year that we classify the CEO as excessively diffident or excessively overconfident. In any given year, a single major event such as a merger, asset sale, or change of management structure may significantly impact search results. Thus, we use a three-year period to provide a more balanced count of keywords that indicate overconfidence or diffidence. For each CEO, we count (1) the total number of articles that mention the CEO; (2) the number of articles containing the words "confident," "confidence," "optimism," or "optimistic"; and (3) the number of articles that contain the words "reliable", "cautious", "conservative", "practical", "frugal", or "steady." We verify that the keywords either describe the CEO or are used in direct quotes by the CEO, and reclassify cases in which the keywords are negated by the context. We then estimate logistic regressions to test the relation between our classifications and the media-based classifications. In untabulated logistic regression results, the probability that we classify a CEO as excessively diffident (versus excessively overconfident) using our algorithm and ExecuComp data is significantly

positively related to the total number of times diffident-type keywords are used by or about a CEO, controlling for the total number of media mentions. Furthermore, a dummy variable equal to one for CEOs for whom the total number of diffident-type keywords exceeds the total number of confident-type keywords yields similar results; the coefficient on this dummy variable implies an odds ratio of 3.7. Thus, a CEO characterized more often as diffident than overconfident in the media is 3.7 times likely to be classified as excessively diffident than excessively overconfident using our option-exercise / holding measure and ExecuComp data. In sum, the two validation analyses suggest that one can produce empirically useful measures of CEO confidence using ExecuComp data along with our algorithm.

2.3.1.2 Confidence measures based on net stock purchases

For additional confidence measures, we draw upon Malmendier and Tate's (2005) overconfidence measure based on a CEO's net purchases of shares of stock. Net stock purchases equal purchases minus sales, both in units of shares. Malmendier and Tate define a CEO as overconfident if the net purchases measure is positive over the first five years of their sample period.[9] Given that we need to identify *excessively* overconfident CEOs, we modify their measure. We classify CEOs as excessively overconfident if in a given year their net purchases are in the top quintile of the distribution of net purchases by all CEOs and those purchases increase their ownership by at least 10% of their stock ownership in the firm. By requiring the two conditions,

[9] We study CEO turnover, which may be related to CEO power obtained over years, so we do not impose a minimum years–in–sample requirement that would classify CEOs based on their first five sample years of net stock purchases. Using logic similar to Malmendier and Tate, however, we exclude the year of the high net stock purchase that causes the classification of a CEO as excessively overconfident and repeat our analysis. The results are qualitatively similar to those reported.

CEOs are classified as being excessively overconfident only if the amount of the net purchase is large in absolute terms, and if the CEO has substantially increased her ownership of the firm. All net purchase values in the top quintile are positive, which indicates that the CEO has purchased relatively large amounts of stock.

Likewise, we define CEOs as excessively diffident if their net stock purchases place them in the bottom quintile of the distribution of net stock purchases by all CEOs and they reduce their stock ownership in the firm by 10% or more in a given year. All net stock purchase values in the bottom quintile are negative, which indicates that the CEOs' stock sales exceed their purchases. Thus, a CEO is classified as excessively diffident only if the amount of the net sales is large in absolute terms, and if the CEO has substantially reduced her ownership of the firm. This should help avoid classifying CEOs who have other reasons for selling stock, such as personal liquidity needs, as excessively diffident. To the extent that liquidity-motivated sales introduce measurement error, this should create a bias against finding a positive effect of diffidence on forced turnover.

CEOs who are not classified as excessively diffident or excessively overconfident based on the net stock purchase measure are classified as moderately overconfident. In contrast to the stock option-based confidence measures, the net stock purchase-based measures allow us to classify all CEOs who have the requisite stock transactions data in Thomson Financial Insider Transactions database.

Some stock purchases and stock sales are related to stock option exercises. In constructing an indicator of CEO confidence, there are potential advantages and

disadvantages to including such transactions. Rather than trying to resolve whether inclusion or exclusion of such purchases and sales is best, we construct separate measures including and excluding the option related transactions, and use both in the analyses. The Thomson Financial Insider Transactions database includes a field indicating whether a stock purchase or sale transaction is related to stock options.

One potential criticism of an overconfidence measure based on net stock purchases is that the stock sale decisions may be driven by the CEO's personal tax considerations. Indeed, Jin and Kothari (2008) find that the tax burden associated with a CEO's stock holdings is an important determinant of her stock sales. The danger is that a poorly performing CEO should, ceteris paribus, have a low tax burden and be more likely to sell stock as a consequence. If the sales are sufficiently large in relative and absolute magnitudes, the net stock purchase-based measures of confidence could classify such a CEO as excessively diffident. If the poor performance increases the likelihood of forced turnover, then our indicator of excessive diffidence could just reflect the effects of poor performance. As we discuss later, we include as a control variable the stock returns over the CEO's tenure, which should absorb any variation in stock performance effects that might cause forced turnover.

Another potential criticism of classifying CEOs based on their decisions about stock option exercises and net stock purchases is that these decisions may reflect inside information that the CEO has about future firm performance. Later in the section, we lay out this criticism more specifically and examine its importance in explaining our results. As a preview, we note here that the main results are robust to controlling for stock

returns following the stock sales or purchases that result in classification, which are the returns that should reflect any inside information a CEO might have had.

A third potential criticism of the measures relates to the (non)optimality of CEO incentives. The two sets of confidence measures described above rely on CEO stock and stock options, which are components of CEO compensation. Relying on measures related to CEO compensation introduces the risk that the measures actually identify CEOs with suboptimal incentive levels and structure instead of CEOs with different levels of confidence. For example, suppose that a rational CEO sells large amounts of her stockholdings, and that some friction prevents the board from restoring the incentive levels to the optimum. The weakened incentive levels may lead the CEO to make suboptimal investment decisions that ultimately result in termination. Our net stock purchase-based measure would identify that CEO as excessively diffident and attribute the forced turnover to diffidence, when in fact it stemmed from suboptimal incentives. We next discuss an additional set of confidence measures that are not based on components of CEO compensation.

2.3.1.3 Confidence measures based on firm investment levels

Ben-David, Graham, and Harvey (2007) use detailed survey-response data to classify chief financial officers (CFO) as overconfident or not. They find that overconfident CFOs invest more, which is consistent with theoretical predictions in Hackbarth (2008) and Gervais, et al. (2008). To the extent that these overconfident CFOs likely have overconfident CEOs who agree to go along with the investment

decisions, we can use investment as an instrument for CEO confidence.[10] We classify CEOs as excessively diffident (overconfident) if their firm is in the bottom (top) quintile of firms sorted on industry-adjusted investment rates for two consecutive years. We impose the two-year requirement because investment is lumpy through time, and we do not want to identify firms that just happen to bunch investment in one year. However, results are robust to relaxing the two consecutive year requirement and defining this measure based on a single year of industry-adjusted investment. Following Malmendier and Tate (2005), we define the investment rate as capital expenditures divided by beginning of year property, plant, and equipment. We note that the investment-based confidence measure is also consistent with Goel and Thakor's (2008) model in which excessively diffident (overconfident) CEOs underinvest (overinvest), assuming that the industry median is a reasonable proxy for the optimal level of investment.

2.3.1.4 Semi-permanence of the confidence measures

We apply the CEO confidence classifications to each CEO each year they are in the sample. If a CEO is classified as excessively overconfident (diffident) in a particular year, the CEO retains this classification going forward unless she exhibits excessive diffidence (overconfidence) according to the measures. For example, a CEO who holds stock options with greater than 100% moneyness in a given year remains classified as excessively overconfident going forward unless she exercises stock options in the future at less than 30% moneyness, i.e., unless she meets our definition of excessively diffident

[10] Ben-David, Graham, and Harvey (2007) also find that overconfident CFOs use lower discount rates, choose higher leverage levels and longer debt maturity, and are less likely to pay dividends and more likely to repurchase shares. In contrast to investment levels, all of these other decisions are more purely financial in nature, so while it is straightforward to argue that they indicate CFO overconfidence, it is more difficult to argue that they might also indicate CEO overconfidence.

at some future date. Thus, the measures constitute semi-permanent measures of excessive overconfidence or excessive diffidence, in which the CEO is reclassified only if she exhibits characteristics of a CEO with the opposite behavioral trait.

One can argue that the CEO decisions or actions underlying our confidence measures are endogenously related to the likelihood of their termination or to some other factor that also affects termination. Malmendier and Tate (2005) address this potential problem by basing the overconfidence classification on CEO decisions or actions made before the investment decisions that they study. The analog in our study is to omit years in which a CEO is first classified in a particular way. When we do so, the results are qualitatively similar to those reported. Thus, the results are not driven by an endogeneity problem stemming from simultaneous classification and turnover or nonturnover.

2.3.2 Sample

To generate the sample, we first collect all CEOs from 1992 through 2003 in Standard & Poor's ExecuComp database. We then use news reports collected from searching Lexis-Nexis to ascertain whether each CEO: (1) has maintained office (no turnover event); (2) has left office voluntarily; or (3) has been forced from office. Following Parrino (1997), we classify a turnover as forced if it is explicitly stated as forced; or if the CEO was under 60 years old at the time of turnover and (1) the turnover was not announced at least six months in advance, or (2) the CEO did not leave for health reasons or to take a position at another firm.[11]

[11] It is possible that some CEOs who are forced out are able to secure positions quickly at other firms. This could occur when the hiring firms are unaware that the CEO was forced out of her prior position. This could also occur when the hiring firms are aware of the forced turnover, but choose to hire the CEO anyway because she fits their firm better or because of social or other connections between the CEO and

To compute the excessive overconfidence and excessive diffidence indicators, we require option grant data from ExecuComp, stock purchases and sales data from Thomson Financial's Insider Transactions database, and capital expenditures and net property, plant, and equipment from Compustat. As control variables, we include CEO age, tenure, and cash compensation (salary and bonus separately), all collected from ExecuComp. We also include the annualized industry-adjusted stock return over the lesser of the CEO's tenure or five years, defined as the firm's stock return minus the corresponding median return computed from firms in the same three-digit Standard Industrial Classification (SIC) code. Untabulated results are similar to those reported when we use separate covariates for each year of stock returns in the five-year window. Untabulated results using raw stock returns are also similar to those reported, as are results using firm returns that are decomposed into firm-specific and industry components as in Jenter and Kanaan (2008). All stock return data are from the Center for Research in Security Prices (CRSP) database. Excluding CEO-year combinations with missing data for any of the above measures yields a sample of 9,063 total CEO-year observations across 2,619 CEO-firm combinations. Of the 2,619 CEOs, 238 are subject to a forced turnover at some point.

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agents at the hiring firm. In any of these cases, the Parrino (1997) classification scheme misclassifies these forced turnovers as voluntary because the CEOs have secured other positions. There are 38 turnovers in our sample in which the CEO subsequently finds another position, so at most 38 forced turnovers are misclassified as voluntary. If the problem is significant, it should blur distinctions between forced and voluntary turnovers in our analysis and make it more difficult to find any differences. In results reported later in Table B5, we find that the confidence variables and various control variables reliably distinguish between forced and voluntary turnovers (while excluding nonturnovers from the analysis). These results suggest that any misclassification problems are likely to be relatively minor.

2.3.3 Proportional hazard model

Given the nature of the data and our analysis, we employ the Cox semiparametric proportional hazard model to estimate the relation between the likelihood of forced turnover and CEO confidence, while controlling for other known determinants of turnover. This model has advantages over logistic and multinomial logistic models that are commonly used in studies of CEO turnover. First, a hazard model like the Cox model explicitly incorporates the fact that a CEO can be at risk of forced turnover in a given year and yet not be turned over in that year. The hazard function provides the probability of forced turnover in a particular year conditional on the fact that the CEO has survived up to that point, which is precisely what we want to know in a study of forced turnover. Second, the Cox model uses the time series of information of a CEO in estimating the hazard of forced turnover that she faces. Third, the Cox proportional hazard model is semiparametric and makes no assumption about the particular shape or nature of the survival distribution, which contrasts with parametric models. Shumway (2001) provides an excellent discussion of the advantages of hazard models over static models like logistic models, including a demonstration that estimates from static models can be inconsistent.

The Cox proportional hazard model assumes proportionality, which simply means that the ratio of the hazard functions for two different observations with different values of the covariates does not depend on time—instead, the ratio is proportional based on the covariates. When this assumption does not hold, one can allow the effects of the covariates to be time dependent. We test the proportionality assumption, and in

cases where it is violated, we change the specification to allow the effects of the covariates to be time dependent.

While hazard models have become common in the recent literature on financial distress (Shumway, 2001; Chava and Purnanandam, 2007), these models have not been used widely in the literature on CEO turnover. Given the estimator consistency issue we discuss above, we present results for the Cox proportional hazard model. In an untabulated analysis, however, instead of using the semiparametric Cox proportional hazard model, we estimate (parametric) logistic regressions. We first use only one observation per CEO to address the statistical dependence issue that arises in the panel data we use. We also estimate logistic regressions with multiple years per CEO and include year fixed effects and cluster errors at the CEO level. The main results for either estimation of the logistic models are qualitatively similar to those reported for the Cox proportional hazard model. As shown in the next subsection, the main results also hold in nonparametric univariate analyses.

2.4 Results

2.4.1 CEO confidence and forced turnover

Table B1 presents summary statistics for the confidence measures and for the control variables we use. Panel A of Table B1 contains results where the unit of observation is a CEO (a CEO's values are averaged across her years in the sample), and Panel B contains results where the unit of observation is a CEO-year. Because each confidence level indicator is a zero-one dummy variable, its mean represents the proportion of the CEOs that are classified in the respective way. As shown in Panel A,

using the stock option-based measures, we classify approximately 11% of the CEOs as excessively diffident and 39% CEOs as excessively overconfident. By implication, our measures classify approximately 50% of CEOs as moderately overconfident. Although the unevenness of these proportions stems directly from our chosen 30% and 100% moneyness cutoffs, there is no obvious reason to expect the proportions to be equal across the groups. One of Goel and Thakor's (2008) main theoretical results is that the tournament process in firms that produces the potential CEO labor pool yields hired CEOs who are on average overconfident. Our scheme that classifies substantially more CEOs as excessively or moderately overconfident than excessively diffident is consistent with this prediction of Goel and Thakor's model.

As shown in Panel A of Table B1, the net stock purchase-based measures (excluding option-related transactions) classify 36% of CEOs as excessively diffident and 22% of CEOs as excessively overconfident; the respective figures are 37% and 26% for the net stock purchase based measures including option-related transactions. Despite the fact that we use upper and lower quintile cutoffs to define excessive overconfidence and excessive diffidence, respectively, the resulting sample proportions should not necessarily equal 20% each. This is because the quintile breakpoints are computed using CEO-year observations each year and once a CEO meets the quintile threshold to classify them in one group, they remain in that group going forward unless they display the opposite behavioral trait.

If the asymmetries in the proportions of CEOs classified as excessively diffident and excessively overconfident using the above measures are problematic for any reason,

we note that the classifications based on investment rates are quite symmetric. As shown in Panel A of Table B1, with this measure approximately 17% of CEOs are classified as excessively diffident and approximately 18% are classified as excessively overconfident.

As shown in Panel B of Table B1, the mean and median annualized industry-adjusted stock return are both positive. We use the CRSP population to compute the respective median industry monthly return that is subtracted from each firm's monthly return before computing the annualized industry-adjusted stock return. Our ExecuComp-based sample is a subset of CRSP. Thus, the industry-adjusted mean and median should not necessarily be expected to be zero. The age, tenure, and cash compensation figures are in line with other studies of CEO turnover or CEO characteristics.

Before examining the effect of confidence on forced turnover in a regression framework that controls for other determinants of turnover, we perform two univariate analyses. First, in Table B2 we show results for simple one-way sorts on the confidence measures. Consistent with Goel and Thakor's (2008) predictions, we find that CEOs who are excessively diffident and CEOs who are excessively overconfident face greater forced turnover rates than CEOs who are moderately overconfident. For example, using figures for the stock option-based confidence measures, 3.15% of excessively diffident CEOs, 0.90% of moderately overconfident CEOs, and 2.12% of excessively overconfident CEOs are subject to forced turnover. The pattern of results is similar based on the other three sets of confidence indicators. In all cases, the moderately overconfident CEOs have the lowest forced turnover rates. Thus, the effects of CEO confidence on forced turnover are evident even in a univariate analysis.

Next, we examine the Nelson-Aalen estimator of the cumulative hazard for CEOs in the three groups of confidence levels. This nonparametric analysis complements the analysis in Table B2 by illustrating the hazard rates cumulated over time for each group of CEOs. As shown in Figure A1, as time passes, excessively diffident CEOs face the greatest cumulative hazard of forced turnover of the three groups, followed by excessively overconfident CEOs, and then by moderately overconfident CEOs, who face the lowest cumulative hazard. Both the log-rank test and the Tarone-Ware (1977) test imply rejection of the null hypothesis of equal hazard functions across the CEO confidence groups at the 0.01 level. Thus, as time passes CEOs in the three confidence groups face significantly different hazards of forced turnover.

We next move to the Cox proportional hazard regressions that examine the relation between CEO forced turnover and CEO confidence while controlling for other determinants of forced turnover. Table B3 presents the results. The dependent variable equals one for forced turnovers, and zero otherwise. We employ a dummy variable for excessively diffident CEOs and a dummy variable for excessively overconfident CEOs. Moderately overconfident CEOs are the omitted group and thus serve as the baseline. The coefficients on the excessive diffidence and excessive overconfidence dummy variables (appropriately adjusted) indicate the probability of a forced turnover relative to the probability faced by a moderately overconfident CEO.[12] The control variables include the annualized industry-adjusted return over the lesser of the CEO's tenure or

[12] Similar to a logistic regression, one must compute the exponential of the coefficient times the variable value, which is 0 or 1 here.

five years[13], the percentage of firm equity the CEO owns, and the CEO's age, tenure, and cash salary and bonus figures. Each column presents results based on a different classification scheme for CEO confidence level.

As shown in Table B3, regardless of the measure underlying the confidence classifications, we find that excessively diffident CEOs and excessively overconfident CEOs face significantly greater turnover hazards than moderately overconfident CEOs. All confidence coefficients are significant with *p*-values of 0.02 or smaller. Depending on the measure, the coefficients imply that an excessively diffident CEO faces a 64% to 139% greater probability of forced turnover than a moderately overconfident CEO does, with an average of 97% greater. The range of probabilities for excessively overconfident CEOs is 57% to 103% greater than moderately overconfident CEOs, with an average of 67% greater. These effects are large economically.

To put the magnitude of the effects of confidence on forced turnover in perspective, we compare them to the effect of a CEO generating a poor industry-adjusted stock return. Specifically, we compute the relative probability (compared to the baseline probability) of a CEO generating an industry-adjusted stock return that is two standard deviations below the mean. Depending on the regression in Table B3, such a CEO faces a 44% to 74% greater probability of forced turnover than a mean-performing CEO, with an average of 65%. Thus, on average the effect on the likelihood of forced turnover of

[13] Our main results also hold when we include the five years of returns individually as separate covariates in the regression. Additionally, we discuss an alternate measure of returns, which is calculated over the lesser of the time since the CEO was classified as excessively diffident (overconfident) or five years, in Section 4.2 below.

excessive diffidence or excessive overconfidence is comparable to the effect of stock return performance two standard deviations below the mean.

Although Goel and Thakor (2008) make no specific predictions about the relative magnitudes of turnover hazard across excessively diffident and excessively overconfident CEOs, another interesting result emerges from the results: the coefficients on the excessive overconfidence indicator and the excessive diffidence indicator do not differ significantly from each other in any regression. Thus, CEOs who are classified at opposite ends of the confidence spectrum do not face statistically different likelihoods of being subject to forced turnover, and both face significantly higher risk than a moderately overconfident CEO faces. These results provide indirect support for the view that there is an interior optimum level of overconfidence that maximizes firm value.

Among the control variables, industry-adjusted stock return, percent ownership, salary, bonus, age, and tenure are significant in most regressions and have the expected signs.

In subsection 2.2, we note that the predictions in Goel and Thakor (2008) that link forced turnover of CEOs to their confidence levels presume strong board governance, i.e., that the board acts in the best interests of shareholders. More specifically, the board of directors must have sufficient motivation and ability to terminate a CEO who exhibits excessive diffidence or excessive overconfidence. A board with weak governance may lack the incentive or ability to terminate CEOs with suboptimal levels of confidence even when that confidence reduces shareholder wealth. Thus, we next examine the relation between forced turnover and confidence levels for

firms with weak and strong board governance separately. We define firms with weak board governance as those that jointly have a majority of insiders, have the CEO as Chairman of the board, and are classified; other firms are defined as having strong board governance. The data for these variables come from the Investor Responsibility Research Center, Inc. database.

The results of the analysis split by board governance are in Table B4. The first four columns of figures in Table B4 show that among firms with strong board governance, excessively diffident and excessively overconfident CEOs are significantly more likely to face forced termination than moderately overconfident CEOs. In contrast, the last four columns of Table B4 show that among firms with weak boards there is no reliable relation between forced turnover and CEO confidence levels. Results for the confidence measures based on firms' investment levels imply that excessively diffident CEOs face a greater turnover hazard even at firms with weak boards, but this relation is not significant at conventional levels for the other sets of confidence measures. Thus, our overall results are driven by firms with strong board governance, which is expected given that we study CEO forced turnovers.

2.4.2 Alternative explanations

Our results thus far show that CEOs that we classify as excessively overconfident and CEOs that we classify as excessively diffident face significantly greater forced turnover hazards than do CEOs that we classify as moderately overconfident. It is possible that our measures capture some other feature of CEOs or CEO performance that relate to turnovers in general rather than forced turnovers. For example, given that most

executive stock options are granted at the money, CEOs with options deep in the money (greater than 100%) are likely those whose firms have experienced raw stock returns of at least 100%. If this is considered exceptional performance, then the external labor market may attract these CEOs away to better opportunities. Such turnovers are voluntary, but if a significant fraction of them are misclassified as forced, then our results for excessively overconfident CEOs could be wrong.

Another possibility relates to the CEOs who are excessively diffident. CEOs with very low confidence may reach a point at which they believe they cannot add value to their firm and consequently choose to leave their firms voluntarily. As with excessively overconfident CEOs, such turnovers are voluntary, but if a significant fraction of them are misclassified as forced, then our results for excessively diffident CEOs could also be wrong.

In both of the alternative explanations we discuss above, the dummy variables for excessive CEO overconfidence and excessive CEO diffidence pick up in part the effects of voluntary turnovers and thus do not directly support Goel and Thakor's (2008) predictions about forced turnover and CEO confidence. To rule out this possibility, we conduct two additional tests. First, we exclude all nonturnover observations from the regressions, so that we compare only forced turnovers to voluntary turnovers. If turnovers of CEOs with excessive overconfidence are mostly voluntary, with some misclassifications as forced turnovers, the CEO excessive overconfidence indicator should have no ability to distinguish between voluntary and forced turnovers. A similar argument applies for the turnovers of CEOs with excessive diffidence.

Table B5 contains results for Cox proportional hazard regressions estimated over the subsample of forced and voluntary turnovers. In these regressions, the dependent variable equals one for forced turnovers, and zero for voluntary turnovers. This analysis excludes all nonturnover CEO-years. There are 672 observations for the confidence measures based on stock option holdings, and 1,242 observations for confidence measures based on the other schemes. With only two exceptions, the indicator variables for excessively overconfident CEOs and for excessively diffident CEOs are significantly positive with *p*-values less than 0.05. The two exceptions are the excessive overconfidence dummy variable based on net stock purchases including option-related transactions (*p*-value = 0.14) and the excessive overconfidence dummy variable based on investment rates (*p*-value = 0.08). Overall, the confidence measures appear to distinguish statistically between forced and voluntary turnovers. Moreover, the magnitudes of the coefficients imply that the relative probabilities of forced turnover (versus voluntary turnover) for excessively diffident CEOs and excessively overconfident CEOs are large economically. The results imply that the measures do not simply capture a turnover effect per se.

Our second approach to distinguish between general turnover versus forced turnover effects is to exclude all forced turnover observations, so that we compare only voluntary turnovers to nonturnovers. In these regressions, the dependent variable equals one for voluntary turnover, and zero otherwise. The results of these regressions are in Table B6. In no case do we find that excessively overconfident CEOs are more likely to turn over voluntarily than CEOs with moderate overconfidence. The coefficients on the

excessively diffident CEO indicator variable based on stock options or based on net stock purchases including option-related transactions are positive, but the effects are weak statistically (*p*-values of 0.10 and 0.07 respectively) and small economically. The coefficient on the excessively diffident CEO indicator based on net stock purchases excluding option related transactions is close to zero in magnitude with a *p*-value of 0.69, and the corresponding coefficient based on investment rates is actually negative in sign (*p*-value of 0.20). In short, there is no consistent evidence that the confidence indicator variables predict voluntary turnover.

Collectively, these two tests imply that the measures of excessive CEO overconfidence and excessive CEO diffidence are related specifically to forced turnovers, and not to turnovers in general. The results support Goel and Thakor's (2008) prediction that turnovers of such CEOs are forced, and indirectly are consistent with predictions from other theoretical models that such CEOs create less value than CEOs with moderate overconfidence.

Another potential explanation is that the indicators of excessive CEO overconfidence and excessive CEO diffidence do not capture CEO confidence, but rather CEO risk aversion levels. CEOs that we classify as excessively overconfident because they hold options deep in the money or purchase large amounts of their firm's stock may actually be *rational* agents with little or no risk aversion. CEOs that we classify as excessively diffident because they exercise options too early or liquidate their undiversified holdings of company stock may actually be rational agents with high levels of risk aversion. CEOs that we classify as moderately overconfident may just be rational

agents with moderate levels of risk aversion. Goel and Thakor (2008), however, emphasize that firm value increases monotonically as risk aversion falls because less risk-averse CEOs would accept profitable but risky projects that more risk-averse CEOs would reject. If forced turnover rates are lower for CEOs who maximize firm value and if our confidence measures just capture risk aversion effects, then we should find that the likelihood of forced turnover falls monotonically with the measured CEO overconfidence. Although our finding that excessively diffident CEOs face a greater turnover hazard than moderately overconfident CEOs is consistent with this alternative, the finding that CEOs classified as excessively overconfident face greater turnover hazards than CEOs that we classify as moderately overconfident is the opposite of what the alternative explanation predicts. Thus, the overconfidence measures likely do not just capture CEO risk aversion effects. This conclusion is too strong if one believes that the CEOs that we classify as excessively overconfident are actually risk seeking rather than risk neutral. We do not see a convincing way to examine this possibility empirically.

Another possible explanation is that the confidence indicators just reflect the effects of CEO inside information. Specifically, CEOs that we classify as excessively diffident because they exercise options at low moneyness or because they sell large amounts of their stock holdings may just possess inside information about future negative outcomes that would reduce firm value and increase the likelihood of forced turnover. Conversely, CEOs that we classify as excessively overconfident because they hold options deep in the money or increase their stockholding significantly may just possess inside information about future positive outcomes that would increase firm

value. As with the risk aversion explanation, if our measures just capture the effects of CEO inside information, we should find that the likelihood of termination falls monotonically in presumed confidence, which is not what we find. Thus, it is unlikely that our confidence measures just capture the effects of inside information.

An alternate version of this explanation is that CEOs that we classify as excessively diffident and excessively overconfident *both* have negative inside information about the firm and due to the expectation of poor firm performance are more likely to be fired. This could be the case if the CEOs that we classify as excessively overconfident have negative information but are restricted from exercising options, thus causing them to hold their options too deep in the money. Before discussing the analysis of this potential problem, we emphasize that all of our results hold when we use the investment-based measure of confidence, which is not subject to this criticism. We also note that any restrictions on exercising options would have to be those beyond formal vesting restrictions on options because (as we discuss in subsection 2.3) we use only exercisable options in classifying a CEO as excessively overconfident.

If either of the above explanations based on inside information explain our results, we should find that the importance of the confidence classifications falls or vanishes once we control for stock returns following the point at which a CEO is classified because those are the stock returns that would reflect the inside information. Thus, we adjust our return control variable in the regressions to account for the possibility of inside information. For CEOs that are classified as excessively diffident or excessively overconfident, we calculate annualized industry-adjusted returns for the

lesser of three years or *the time since the CEO was classified*. Three years is the mean time between classification and forced turnover for CEOs in our sample. For all other CEOs, the return variable is calculated over the lesser of three years or the CEO's tenure. For the CEOs that we classify as excessively diffident or excessively overconfident, this return measure focuses on the period following their classification if it was relatively recent (within the past three years) and should capture any effect of CEOs being terminated due to poor performance consistent with an inside information story. The untabulated regression results from this analysis, however, are quantitatively and qualitatively similar to those reported. Similar results hold when we use raw returns in place of the industry-adjusted returns. These results are inconsistent with an inside information-based explanation of the relation between forced turnover and our confidence classifications.

2.5 Discussion

We find that excessively diffident CEOs and excessively overconfident CEOs face significantly greater hazards of forced turnover than moderately overconfident CEOs face. We control for firm stock return performance, and CEO age, tenure, salary, bonus, and stock ownership, so the effects of confidence that we document suggest an important new determinant of CEO turnover that is distinct from these CEO characteristics, compensation, and performance. The results are consistent with direct theoretical predictions by Goel and Thakor (2008). The results point to the importance of considering the whole range of CEO confidence levels in theoretical and empirical

analyses, and are broadly consistent with the view that CEOs with moderate levels of overconfidence maximize firm value (Goel and Thakor, 2008; Hackbarth, 2008).

In addition to providing evidence about recent theoretical models, we contribute to the empirical literature on CEO overconfidence by adapting and refining previously employed measures of overconfidence to also indicate excessive diffidence, or low confidence. Now that theoretical models have begun examining whether there are interior optimum levels of overconfidence, our measures of excessive diffidence should prove useful in future empirical research on CEO confidence. We also contribute to the empirical literature by validating the construction of the Malmendier-Tate option-holder confidence measure using stock option data in ExecuComp instead of the proprietary data they use. This validation should prove useful to researchers who want to study confidence effects among executives in the ExecuComp database, which contains a greater number of executives over a longer time period than do most proprietary datasets.

3. OPTIMAL DEBT COMPENSATION AND THE VALUE OF EQUITY

3.1 Introduction to Section 3

Jensen and Meckling (1976) theorize that debt-like compensation will impact the incentives for the CEO to reduce firm risk and maximize the value of the CEO's debt claim. In particular, when the CEO's debt-to-equity ratio exceeds the firm's, the CEO will have the incentive to risk shift, and lower the firm's risk in order to maximize the value of debt. This will negatively impact equity holders if the CEO foregoes positive NPV projects in order to reduce risk, in effect shifting value away from equity holders who would prefer the CEO invest in projects with the highest expected payoffs, regardless of project risk. If this is the case, higher debt compensation should lead to a decreased value of firm equity. Recent empirical work has found evidence consistent with this prediction: Sundaram and Yermack (2007) and Wei and Yermack (2010) find that CEO debt-like compensation is negatively associated with firm risk and equity value, but positively related to firm debt value, primarily when the CEO's debt-to-equity is higher than the firm's debt-to-equity.

On the other hand, recent theory considers the potential gains from debt-like compensation through a reduction in total agency costs, and suggests that debt compensation may not always negatively affect shareholders. Specifically, Edmans (2008) theoretically predicts that debt-like compensation could be used as part of an optimal compensation package, and it may be optimal for the CEO's debt-to-equity to exceed the firm's debt-to-equity in some instances. A consequence is that deviations

from optimal debt compensation could lead to increased agency costs of debt. And if equity holders bear the debt agency costs, this would lead to decreased equity value as well. By limiting the deviation from optimal incentives, the firm can potentially decrease total agency costs, and increase the value of equity.

Adding to this stream of research, Gerakos (2007) studies the use of debt-like executive compensation in an attempt to determine whether its use is justified by optimal contracting or driven by CEO power. The results provide little support for the view that powerful CEOs receive higher pension benefits, but do suggest that pensions can be used to extract rents. However, results also suggest that economic variables explain a substantial portion of CEO pension benefits. The author concludes that results support portions of each possible underlying cause, but that debt-like compensation does appear to be driven in part by optimal contracting concerns.

Taken together, extant literature has only been able to support a rather weak conclusion: granting debt-like compensation to managers *may* be optimal *in some instances*, and harm equity holders in others. Thus, no consensus has been reached in the literature, and the empirical question remains: can a non-zero level of CEO debt compensation, even a large level, be optimal (based on firm characteristics) for equity holders? In other words, are deviations from the optimal level *costly* to equity holders? We address this question using a relatively large sample of CEOs with available data on debt-like compensation.

We follow Wei and Yermack (2010) in focusing our research on the CEO's relative debt-to-equity, defined as the CEO's debt-to-equity ratio divided by the firm's

debt-to-equity ratio. We begin with a simple empirical model for the optimal level of CEO debt-to-equity, where the optimum is the point at which the CEO's debt-to-equity exactly matches the firm's debt-to-equity ratio. This corresponds to the level that Jensen and Meckling (1976) suggest would not give the CEO any incentives to risk shift. We then extend the analysis to incorporate possible determinants of CEO debt-to-equity that could be associated with optimal contracting. Drawing on the empirical results of Sundaram and Yermack (2007) and Gerakos (2007), we estimate four models of the optimal level of CEO relative debt-to-equity holdings. Our empirical models focus on the determinants of CEO debt-to-equity previously found to be relevant in the literature that likely represent considerations for optimal contracting.

For three specifications, we estimate the model for the full set of available firms and apply the estimated model to all firms with non-missing data. For our fourth model, we consider an alternate specification where the empirical model is estimated using only firms with relatively high institutional ownership (as a measure of governance), and apply the estimated model to all firms in the full sample. We consider multiple empirical models in an effort to insure that our results do not depend on any one particular specification. We estimate the optimal level of CEO relative debt-to-equity each year, and compare the deviation of the CEO's actual debt-to-equity ratio from the estimated optimal level. We then construct a measure of the adjustment in the CEO's holdings relative to the optimal level, using the change (from t=0 to t=1) in the absolute value of the deviation from optimal holdings. If debt compensation is driven by optimal contracting, deviations from the optimal level should be costly, and reductions in the

deviation should result in *positive* stock price reactions. We test this prediction using abnormal stock returns around the firm's proxy date, when new CEO compensation data is released.

We conduct our investigation in an event study framework following the recommendations of Brown and Warner (1985) and Campbell, Lo, and MacKinlay (1997). Abnormal returns are calculated using a simple market model for the expected return, where the value-weighted return from CRSP is employed as the market return. We follow Wei and Yermack (2010) and analyze returns over the two-day window at the proxy release date, covering the date that the proxy is released and the following day (0,+1). If equity holders benefit from the optimal use of debt compensation, abnormal returns should be positive when the firm announces that the CEO's debt compensation has approached the optimal level. We use this event return data to test two hypotheses.

Our first hypothesis is that a decrease (increase) in the deviation from optimal CEO relative debt-to-equity will have a positive (negative) impact on abnormal returns to firm equity at the firm's proxy date. In other words, we expect abnormal returns to be negatively related to the change in the deviation from optimal CEO holdings, *on average*, for our entire sample of firms. We test this prediction using each of the five empirical models for optimal CEO relative debt-to-equity mentioned above. We find that, for the full sample of firms, stock prices typically do not react to changes in the deviation from optimal CEO relative debt-to-equity. In only one case, where the simple model is used to determine the optimal level, do we find a significant positive stock price reaction in response to a large decrease in the deviation from optimal CEO debt-to-

equity. In this case, there is a significant positive abnormal return of 82 basis points (*p*-value = 0.01) in response to a large decrease in the deviation, amounting to a 50 basis point higher return than firms that did not experience a large decrease (*p*-value = 0.04). In other univariate tests and in regression analyses, there does not appear to be a significant reaction to a decrease in the deviation on average for the full sample of firms.

In our second hypothesis, we consider the possibility that the impact of the deviation from optimal CEO holdings will be asymmetric across firms, such that equity holders are only adversely affected at firms where maintaining the optimal level is likely to be less costly or have the highest benefit. Previous research has suggested that this might be the case. For example, Jensen and Meckling (1976) suggest that the negative effects of debt compensation will be most pronounced when the CEO's debt-to-equity exceeds the firm's. Wei and Yermack (2010) find results consistent with this prediction. It is also possible that the costs associated with decreasing the deviation from the optimal level may be asymmetric depending on the direction of the deviation. For example, it may be easier and less costly for a firm to give the CEO higher pension benefits (which only have a cost to the firm if the CEO retires from that firm) or fail to replace expiring or exercised options or stock that the CEO has sold. This may not be the case when the CEO's relative debt-to-equity is excessively high. The firm typically could find reducing CEO debt compensation to be costly or difficult, because the CEO would likely fight to maintain pension benefits, and the firm will likely lack the ability to decrease the CEO's total deferred compensation. Increasing the CEO's equity holdings can also be problematic due to the possible outrage factor associated with large stock

and option grants. Further, the firm's governance in place may impact the agency costs of debt, and thus the benefits for reducing these costs through the optimal use of debt compensation. Bhojraj and Sengupta (2003) find that high institutional ownership helps to reduce the agency costs of debt. Optimal debt compensation may be relatively important when other mechanisms, such as high institutional ownership, are not in place at the firm. Based on this, we hypothesize that abnormal announcement returns to firm equity will be negatively related to the change in the deviation from optimal CEO relative debt-to-equity primarily when the CEO's holdings had been below one, below the empirically modeled optimal level, or when the firm had relatively low institutional holdings.

In subsets where the CEO's relative debt-to-equity was below one or the firm had relatively weak governance (relatively low institutional ownership), we find evidence that stock prices do react positively to large decreases in the distance from optimal CEO compensation. Within subsamples where the CEO relative debt-to-equity had been lower than the optimum, the evidence is mixed. When the simple model is used, the average abnormal return to a firm with a large decrease is approximately zero, and not significantly different from the mean abnormal return for firms without a large decrease. We only find a positive abnormal when the firm had a large decrease in the deviation from the more sophisticated model optimum and the CEO's relative debt-to-equity had been below one *or* the firm had relatively low institutional ownership. In the latter case, firms with relatively weak governance earn a 118 basis point abnormal return (*p*-value = 0.00) when there is a large decrease in the deviation, which is 66 basis points higher than

the return earned by firms without a large decrease (p-value = 0.03). For other groups however, no significant positive reaction occurs. The results testing our second hypothesis in block-diagonal regressions are similarly mixed: abnormal returns to the firm's equity are negatively related to the change in the deviation from the optimal level, but only when the CEO's relative debt-to-equity had been below one. Our results do suggest that the optimal use of debt compensation can benefit equity holders, but more research is needed to determine why the results are inconsistent across models, and do not hold for the full sample of firms.

One concern with our analysis stems from the joint hypothesis nature of our tests. In essence, we are jointly testing the hypothesis that optimal CEO relative debt-to-equity has a positive impact of equity value, and the hypothesis that our empirical model for the optimal level is accurate. A related concern is that our results are driven by large variation in the estimates for the underlying optimal level of CEO holdings rather than changes in the holdings themselves. This would suggest that our results are due primarily to our empirical model rather than the CEO's actual holdings, which is problematic because we do not have an independent test for our underlying models being correct.

We take two steps to address the concern that our results are driven by large variation in the underlying empirical models for optimal holdings. First, we drop all firms where the predicted optimal level has a large time-series standard deviation. Our results are robust to this, even if we drop firms that have higher than median standard deviation. To more directly address this, we also perform our analysis using the fitted

value at t=0 as the optimal level for both t=0 and t=1, keeping the optimal level fixed, so that any variation in our measure of the change in deviation is driven by changes in CEO's actual relative debt-to-equity. Our results are robust to this as well. Thus, it is unlikely that our results are driven by changes in the estimated optimal level, but rather appear to be driven by changes in the CEO's actual holdings as they relate to the optimal level.

We contribute to the growing literature on the use of debt-like compensation in executive pay packages. Primarily, we provide new evidence consistent with an optimal level of debt-like compensation relative to the CEO's equity holdings, and that positive or negative deviations from the optimal level can have a negative impact on the value of the firm's equity. Our results (weakly) support the theoretical predictions of Edmans (2008) that debt-like compensation can be a part of an optimal compensation contract. Our research also complements and extends the work of Gerakos (2007) by demonstrating that firms correct deviations in the CEO's debt-to-equity holdings from the optimal level, potentially to the benefit of shareholders. However, the lack of a consistent positive reaction to CEO holdings moving nearer the optimal level suggests that further research is needed to determine the cause. Future work should investigate whether the relation between CEO holdings and equity value has a non-linear form, or if the predictive models for optimal CEO relative debt-to-equity are inadequate (and how the models can be improved). If the models are found to be adequate, future research would be needed to understand why investors fail to view the CEO's compensation approaching the optimal level as value increasing.

3.2 Background and motivation

Since Jensen and Meckling (1976) theoretically developed the agency problem for the firm given the separation of ownership and control, a large number of papers have focused on executive compensation as a method to reduce agency costs and conflicts. For example, Haugen and Senbet (1981) show that stock options granted to executives may help to mitigate the agency conflict between equity holders and management. However, call options typically issued to management may create the incentive to increase the variance of cash flows, and maximize the value of the options. This represents an incentive to risk shift, in this case leading the manager to increase firm risk. While equity and option compensation can be effective at decreasing the agency problem between equity-holders and managers, an important implication is that in the absence of an optimal put option contract, an increase in call option compensation may also increase the manager's incentive to increase risk. Many studies have added to this stream of literature analyzing the impact of equity compensation on various firm outcomes. Agrawal and Mandelker (1987) show that increased executive equity ownership acts to mitigate agency problems between management and equity-holders, consistent with the predictions of Jensen and Meckling (1976). In addition, the authors note that the use of convertible debt, which may have similar effects to put options, is not significantly different between firms that take actions to increase and decrease the variance of stock returns. Tehranian, Travlos, and Waegelein (1987) document that long-term performance plans as a part of executive compensation increase the incentives of management to undertake divestitures when these are beneficial to shareholders.

Brickley, Bhagat, and Lease (1985) find that investors react positively to the introduction of long-term managerial compensation plans, but cannot attribute this solely to the effects of agency problems. DeFusco, Johnson, and Zorn (1990) provide results that suggest that the introductions of stock option plans lead to increases in the wealth of shareholders, likely at the cost of debt-holders. The authors analyze a relatively small sample of bond price reactions, but the results do suggest that bond holders react negatively to the announcement. These results imply that increased option compensation for executives does impact the agency struggle between debt- and equity-holders. Many other papers have documented the impact of various forms of compensation on firm value and risk[14], while a number of studies have examined the relation between executive compensation and agency conflicts in a number of alternate settings.[15]

Although until recently debt-like compensation has not been widely considered in the literature as an important component of executive compensation[16], it may have significant implications. Jensen and Meckling (1976) note that the use of this "inside debt" could align managers with bondholders, in some cases to the detriment of shareholders. In this seminal work, the authors extensively consider the theoretical

[14] For example, Agrawal and Mandelker (1987), Bizjak, Brickley, and Coles (1993), Coles, Daniel, and Naveen (2006), DeFusco, Johnson, and Zorn (1990), Haugen and Senbet (1981), Mehran (1992), Yermack (1995), and many others. For a more comprehensive review of this literature, please see Coles, Daniel, and Naveen (2006).

[15] Many studies have analyzed the impact of compensation incentives on agency conflicts in different settings, such as Bitler, Moskowitz, and Vissing-Jorgensen (2005), Chava and Purnanandam (2009), and Dittman and Yu (2008) for example, and generally find that compensation can impact risk-taking, and thus agency conflicts.

[16] Other work has considered debt-like compensation in other contexts, such as Shivdasani and Stefanescu (2008), who consider the impact of defined benefit pension plans on capital structure decisions, but focus on the manner in which managers view pension plans as part of the firm's capital structure, rather than analyzing the incentives generated by such compensation arrangements.

effects of various levels of managerial equity ownership on the extent of agency costs and implications for the value of the firm.

Although the authors do not fully incorporate debt or debt-like compensation into their model, possible implications are developed intuitively. According to Jensen and Meckling (1976), an increase in the ownership of debt claims should lead to an increase in the manager's incentives to maximize the value of these claims, resulting in a shift in the alignment of management from the interests of equity holders to the interests of debt holders. The authors expect that if, for instance, the debt-to-equity ratio of claims on the firm held by a manager exactly equals the debt-to-equity ratio of the firm, the manager would have no incentive to shift risk from shareholders to bondholders under their model. Analysis of the specific effects of changes in the debt claims held by a manager is left for future research. It is straightforward to predict that such changes in debt and equity compensation are likely to have an impact on the value the firm, and the claims against it. Although this intuitive analysis gives a foundation for testable hypotheses, this topic has yet to be thoroughly researched empirically. The focus of many empirical studies has been primarily on attempting to determine the impact of types of equity compensation on executive decision-making and the agency costs of the firm, while leaving the implications of debt-like compensation largely for future research. However, important steps have been taken towards understanding the effects of debt-like executive compensation by recent work, including Sundaram and Yermack (2007) and Wei and Yermack (2010).

Sundaram and Yermack (2007) provide empirical evidence of the determinants of debt-like compensation and its impact on firm risk. Their work takes a number of steps to establish a base for future research into the implications of "inside debt." First, the authors develop a measure of debt compensation based on the present value of the CEO's pension benefits, which represents a lower bound approximation. Pensions are essentially debt contracts whereby management provides labor (at a cost) in order to receive payments in the future. Although the bond and other debt holdings of managers would also be of interest in this analysis, this data is not widely available for U.S. firms at this time. The authors show that many CEOs of large firms possess debt-like claims against the firm, the value of which may be large ($84 million in one case). Futhermore, Sundaram and Yermack (2007) document a significant relation between this measure of debt compensation and firm-level outcomes. The authors hypothesize that, if debt-like compensation aligns the CEO with debt holders who prefer lower risk, the CEO will take actions to decrease the risk of the firm. The analysis considers a proxy for the riskiness of the firm based on the "distance-to-default", defined as the number of standard deviations' decrease in firm value that would make the firm likely to default on its debt. Using a sample of 237 firms, the authors find that higher CEO pension value is correlated with higher "distance-to-default" for the corresponding firm. The authors interpret this as evidence that CEOs with relatively higher pension benefits manage the firm more conservatively. Additionally, the authors document that the structure of compensation shifts systematically from equity grants to debt-like compensation as the CEO grows older. CEO's are also found to be more likely to leave the firm via planned

turnover when the CEO's age is near or exceeds the minimum age needed to collect full pension benefits.

Wei and Yermack (2010) extend this stream of literature further by considering the implications of debt-like compensation for the value of the firm's debt and equity, and provide additional evidence of a negative relation between debt-like compensation and firm risk. The authors perform their tests using the "relative" CEO debt-to-equity, or the CEO debt-to-equity ratio divided by the firm's debt-to-equity ratio. Results suggest that shareholders react negatively and bondholders positively to the initial required announcement of CEO debt-like compensation[17] when the CEO's debt-to-equity ratio exceeds that of the firm. These results are generally consistent with the predictions of Jensen and Meckling (1976).

A different theoretical perspective and extension of the literature comes from Edmans (2008), who develops a model of managerial compensation that includes the use of pensions and other debt-like compensation. The author concludes that the use of "inside debt" is justified as a part of managerial compensation in a number of situations as it may act to reduce agency costs. The model demonstrates that debt-like compensation can be used in optimal contracting, and may optimally exceed equity holdings in particular cases as it can lead to a reduction in total agency costs. If equity holders bear these agency costs, they should benefit from reductions in these costs, and the value of equity should increase. A number of the implications of this paper are supported by empirical findings. For instance, Chava, Kumar, and Warga (2010) find

[17] Release of CEO pension value and benefits was required by the SEC beginning in early 2007 (Wei and Yermack, 2010).

that CEO pension value has a negative impact on the likelihood of having certain bond covenants, which could be viewed as consistent with a decrease in the agency costs of debt. Sundaram and Yermack (2007) document cases for which CEO pension values exceed the value of equity holdings. Gerakos (2007) finds that many of the determinants of debt-like compensation are consistent with optimal contracting, as predicted by Edmans (2008).

Gerakos (2007) analyzes the relation between CEO power and pension values in an attempt to distinguish between "Optimal Contracting" and "Managerial Power" theories of compensation. The results from this work generally do not suggest that powerful CEOs demand higher pension benefits, even though pensions can be used to extract rents. The author is unable to fully distinguish between these two competing theories, as results also suggest that variables consistent with optimal contracting are significant drivers of CEO pension benefits. An additional result is that the bias between reported and actual pension benefits is not large. While results support portions of each theory, the author concludes that debt-like compensation is driven in part by optimal contracting.

To summarize, theoretical and empirical results suggest that the use of equity as a form of compensation for top executives can help to align these agents with shareholders, and encourage managers to act in shareholders' best interest. The issuing of debt to managers might shift this alignment toward debt holders' interests, and the results of Sundaram and Yermack (2007) and Wei and Yermack (2010) generally support this assertion. As mentioned above, CEOs with high inside debt appear to manage the firm

more conservatively, a practice that is in the interest of debt-holders, not shareholders. If this is indeed the case, debt-like compensation should be negatively related to the value of the firm's equity. However, the theoretical and empirical results of Edmans (2008) and Gerakos (2007), respectively, suggest that optimal contracting may involve the use of debt-like compensation, even in excess of the manager's equity holdings, meaning that debt-like compensation would not negatively affect the firm's stock price when used at the optimal level. Edmans (2008) predicts that debt-like compensation could be a part of an optimal executive compensation contract. Empirical evidence is somewhat mixed. Both Sundaram and Yermack (2007) and Gerakos (2007) find evidence of factors contributing to the use of debt-like compensation that are consistent with optimal contracting.

Based on extant theoretical predictions and empirical evidence, we expect that the value of a firm's equity should be negatively related to deviations from the optimal CEO relative debt-to-equity. Thus, we hypothesize that a decrease in the deviation from optimal CEO holdings will have a positive impact of firm equity value, on average, for our full sample of firms. However, previous research suggests that the impact of debt-like compensation may be asymmetric across firms, possibly depending on the marginal benefits and costs of approaching the optimal level for a particular firm.

For example, Jensen and Meckling (1976) predict that the negative consequences of debt compensation will be most significant when the CEO's relative debt-to-equity is greater than one. Wei and Yermack (2010) find that stock prices react negatively to the CEO's relative debt-to-equity ratio, but only when this ratio was greater than one.

According to their results, stock prices do not react significantly for firms where the CEO's relative debt-to-equity was less than one. A second possibility is that the costs associated with reducing the distance from the optimal level may be asymmetric depending on whether the CEO's holdings were greater or less than the optimal level. For example, the firm may encounter fewer obstacles and lower cost when increasing the CEO's pension benefits or choosing not to replace expiring or exercised options or stock that the CEO has sold. In neither case is the firm required to make large grants of additional compensation with associated up-front direct costs. This may not be the case when the CEO's relative debt-to-equity exceeds the optimal level. Reducing CEO debt compensation will likely be costly or difficult; the CEO would likely fight to preserve retirement benefits, and it may be impossible for the firm to reduce the CEO's deferred compensation. Increasing the CEO's equity holdings can also be difficult; the outrage factor for large stock and option grants may be prohibitive. Thus, the costs of adjusting CEO relative debt-to-equity to the optimal level may be higher when the CEO's actual relative debt-to-equity is above one or above the estimate optimal level, and would need to be reduced.

Further, the firm's monitoring mechanisms could affect the agency costs of debt, altering the benefits from reducing these costs through executive compensation. Bhojraj and Sengupta (2003) find that high institutional ownership can act to reduce the agency costs of debt. When high institutional ownership is not in place, the optimal use of debt compensation may become relatively more important. Our second hypothesis stems from the expectation that the negative relation between abnormal returns and changes in the

deviation from optimal CEO holdings will be concentrated in firms where the CEO's holdings were relatively low or where the firm did not have other mechanisms in place to reduce the agency costs of debt. Formally, we hypothesize that abnormal announcement returns to firm equity will be negatively related to the change in the deviation from optimal CEO relative debt-to-equity primarily when the CEO's holdings had been below one, below the empirically modeled optimal level, or when the firm had relatively low institutional holdings.

3.3 The data

3.3.1 Sample description

The dataset was collected from a number of sources. The initial sample is from Execucomp, encompassing all firm/executive combinations from 2006 through 2008, the period that corresponds to the recently imposed requirement for disclosure of executive pension benefits. This set was reduced to include only CEOs that have a non-missing value for their debt and equity holdings. We follow Wei and Yermack (2010) by measuring CEO debt holdings as the sum of the CEO's pension value and the total value of deferred compensation. We rely on this lower-bound measure of debt-like compensation because disclosure of other CEO debt holdings is not generally required. We measure CEO equity as the total value of stock and options held by the CEO. Observations with missing values for CEO stock and option compensation were also excluded. Because our tests are based on changes in the CEO's debt and equity holdings, we require each firm to have non-missing values in consecutive years to be considered in the final analysis. However, we include all firms with non-missing data in a particular

year when estimating optimal CEO relative debt-to-equity ratios. This helps to avoid survival bias issues in estimating the optimal levels of CEO relative debt-to-equity ratios.

Firm level variables were collected from Compustat. Abnormal stock returns at proxy release were calculated based on a simple market model using EVENTUS. Governance variables are from Risk Metrics and institutional ownership is from Thomson Financial. Firm level variables follow Sundaram and Yermack (2007) and Gerakos (2007). Any observation that did not have data available was excluded from the dataset. This restricts the sample with non-missing data for the abnormal return analysis using "sophisticated" models for optimal CEO holdings to 904 firms.

3.3.2 Variable calculations

The initial dependent variable of interest is the *relative* ratio of the CEO's debt-to-equity holdings. We proxy for the CEO's debt holdings using the present value of the CEO's pension benefits and the CEO's total deferred compensation. We measure CEO equity as the total value of the CEO's stock and option holdings. The CEO's *relative* debt-to-equity is calculated as the CEO's debt-to-equity ratio divided by the firm's debt-to-equity ratio, and winsorized at the 99^{th} percentile. First, we consider a simple measure for optimal CEO holdings, where the CEO's relative debt-to-equity equals one. This corresponds to the point at which the CEO should have no incentive to risk shift, as discussed above. We then consider a number of alternate "sophisticated" empirical models for optimal CEO holdings. In model 1, the optimal level of the CEO's relative

debt-to-equity ratio is estimated as the predicted value from the following Tobit model (including 2-digit SIC industry effects):

CEO relative debt-to-equity = $\gamma_0 + \gamma_1$ * Age + γ_2 * Tenure + γ_3 * Size + γ_4 * Growth Opportunities + γ_5 * Tax Status + γ_6 * Liquidity Constrained + γ_7 * AAA or AA + γ_8 * A + γ_9 * BBB + γ_9 * Market to Book + γ_{10} * PP&E + γ_{11}* Idiosyncratic Risk + ε

The CEO and firm level variables included in the model above (model 1) follow the results of Sundaram and Yermack (2007) and Gerakos (2007). These include CEO age, CEO tenure, firm size (measured by the natural logarithm of total assets), growth opportunities (measured by R&D expenditures to sales), an indicator for if the firm has a tax-loss carry-forward, and indicator for if the firm had negative operating income, indicators for the firm's public debt rating (AAA/AA, A, or BBB), market-to-book assets, net PP&E scaled by assets, and the error from a market model from the prior 24 months as a measure of idiosyncratic risk.[18] In model 2, we incorporate governance variables following Gerakos (2007), including the firm's GIM Index (Gompers, Ishii, and Metrik, 2003), the percentage of outsiders on the board, and the natural logarithm of board size, and we add the firm's book leverage in model 3. In model 4, we remove the governance variables and use only firms that are relatively well-governed (have high institutional ownership) to estimate the model, and then calculate optimal CEO holdings for *all firms* (both firms with relatively weak and relative strong governance) using this model. This allows us to estimate the model for optimal CEO holdings based on firms where the CEO's actual holdings are more likely to depend on optimal contracting,

[18] Idiosyncratic risk is calculated as the error from a market model following Gerakos (2007).

rather than CEO power. In doing so, we do not allow firms with poor governance (and likely high CEO power) to bias our estimated model for optimal CEO relative debt-to-equity.

The errors from the above models are used as measures of the deviation from the optimal level of CEO relative debt-to-equity holdings. We then calculate the change in the absolute deviation from the optimal level from t to t+1 as the absolute value of the error at t+1 minus the absolute value of the error at time t. Additionally, for the purposes of univariate tests, we construct an indicator for a large decrease in absolute deviation, which takes a value of one if the decrease was above the 90th percentile in sample, and zero otherwise.

We conduct our analysis in an event study framework, following the recommendations of Brown and Warner (1985) and Campbell, Lo, and MacKinlay (1997). Brown and Warner (1985) show that event studies on short windows using a market model for expected returns are generally well-specified for sample sizes greater than 50.

The primary dependent variable of interest is the abnormal stock return around the proxy release date, which is calculated using a standard market model with the value-weighted return from CRSP used as the market return. The cumulative abnormal returns are estimated over the two-day period beginning on the proxy statement release date[19], following Wei and Yermack (2010). For univariate analyses, we follow the recommendations of Campbell, Lo, and MacKinlay (1997) and conduct our tests using

[19] Firm proxy statements contain information about the firm's annual meeting as well as CEO and top executive compensation and director information (Brickley, 1986).

standardized cumulative abnormal returns, or abnormal returns adjusted for the estimation error from the market model used to calculate abnormal returns.

3.3.3 Descriptive statistics

Table B7 includes a selection of summary statistics for the sample. The primary variables of interest are the measures of stock abnormal returns and the change in deviation from the optimal CEO relative debt-to-equity holdings. The abnormal stock returns are calculated using a standard market model over the two-day window beginning on the date of the proxy release. The median (mean) abnormal return for our sample is approximately 0.2% (0.4%) over the two-day event window. The change in the deviation from the optimal CEO relative debt-to-equity is calculated as described above. The median (mean) change in the deviation is approximately -0.019 (-0.2), which is relatively small compared to the median CEO relative debt-to-equity of 0.874.

Additionally, summary statistics for variables relating to possible contracting concerns and control variables are included in the table as well. CEOs in our sample are typically older than in the sample used by Wei and Yermack (2010). The average CEO in our sample is 62 years old, compared to their average of 57. Our sample firms appear to be generally similar to Wei and Yermack (2010), with similar values for average total assets ($22 billion), leverage (25%), R&D to sales (0.022), and firm PP&E to assets (0.28).

Table B8 presents correlations between the main variables of interest and many of the possible determinants of CEO relative debt-to-equity. The CEO's relative debt-to-equity is typically positively correlated with the CEO's age, firm growth opportunities,

and firm idiosyncratic risk. The CEO's relative debt-to-equity is negatively correlated with the size of the firm, the size of the firm's board, and the percentage of outsiders on the board. The signs of these correlations are generally consistent with other studies of CEO debt compensation.

3.4 Analysis and results

The first step of our analysis involves the estimation of optimal CEO debt-to-equity holdings. We begin with a simple model, where a value of one is used as the optimal level of CEO *relative* debt-to-equity. Table B9 presents results from four alternate Tobit regressions used to model optimal CEO relative debt-to-equity based on firm and CEO characteristics. The Tobit model was chosen to account for the limited nature of our dependent variable (it cannot take a value below zero). Consistent with Gerakos (2007), CEO age, firm PP&E, and indicators for bond ratings above a "junk" level appear to be significant determinants of CEO debt-to-equity with the predicted (positive) sign. We also find that firm size, growth opportunities, the size of the firm's board, and the firm's book leverage are significant determinants of CEO relative debt-to-equity, depending on the model selected. Using each of the models, we calculate the deviation from the estimated optimal level of CEO relative debt-to-equity. We then analyze the impact of the change in the absolute value of the deviation from the optimal level, and conduct an event study to determine the impact that the deviation has on the value of the firm's equity.

First, we analyze the impact of a large decrease in the deviation on a univariate basis. Second, we examine the implications of the change in the absolute deviation on

the value of equity in a regression framework. In each case, we also allow the effect of the change in error to differ for firms where the deviation could be more likely to have a negative impact of firm equity values.[20] We use a block-diagonal regression framework similar to Wei and Yermack (2010), beginning with our simple model of optimal incentives. We then expand this analysis to incorporate more sophisticated models of optimal CEO debt-to-equity.

We begin by presenting univariate tests of our hypothesis. These results are presented in Table B10, with a separate test corresponding to each of the models for optimal CEO relative debt-to-equity. In Panel A, we sort all firms in the sample based on whether the firm had a large *decrease* in the deviation from optimal CEO debt-to-equity, and calculate t-statistics for the difference in the mean standardized cumulative abnormal returns[21] for two groups: when the *decrease* in the deviation is large, above the 90^{th} percentile within sample, versus firms where the decrease in the deviation is below the 90^{th} percentile. We focus on firms where the decrease is above the 90^{th} percentile because firms with a large decrease in the deviation should be most likely to experience a *positive* stock price reaction under our hypotheses. We concentrate on large decreases rather than large increases in the deviation because the prediction underlying the motivation for our analysis is that CEO debt compensation can have a *positive* impact on

[20] The results of Wei and Yermack (2010) suggest that the market's reaction to the CEO's relative debt-to-equity will be dependent on whether or not it is greater than one, which corresponds to a critical level based on Jensen and Meckling (1976).

[21] The cummulative abnormal returns are standardized following Campbell, Lo, and MacKinlay (1997), placing more emphasis on observations for which the market model provides more precise estimates of abnormal returns.

equity value if it is used optimally. A positive reaction to a decrease in the deviation would be consistent with this.

The abnormal returns presented in Table B10 are average cumulative abnormal returns (not standardized) for each group over the two-day event window beginning on the proxy release date. This period was chosen to be consistent with Wei and Yermack (2010). Only when we use the simple model to determine the optimal level do we find a significant positive stock price reaction in response to CEO debt-to-equity moving closer to the optimum. In this case, we find a significant positive abnormal return of 82 basis points (p-value = 0.01) on average for firms that have a large decrease in the deviation. This is 50 basis point higher than the abnormal return earned by firms that did not experience a large decrease (p-value = 0.04). In tests (2)-(5) in Panel A, where more "sophisticated" empirical models of optimal CEO holdings are used, there does not appear to be a positive reaction to a decrease in the deviation. The mean abnormal returns for firms with a large decrease in the deviation range from 0 to 47 basis points with p-values ranging between 0.12 and 0.64. None of these are significantly different from the abnormal returns to firms that do not experience a large decrease in the deviation.

One possible explanation is that the response to changes in the deviation is asymmetric across firms depending on prior CEO relative debt-to-equity or on the firm's governance, as discussed in our second hypothesis. In Panel B, we take steps to account for this by first sorting firms based on whether the beginning of year CEO relative debt-to-equity ratio is greater than one (tests 1-4), greater than the predicted optimum from

the model (test 5), or the firm had relatively weak governance (test 6). We then sort firms based on having a large decrease in the absolute deviation from optimal CEO relative debt-to-equity, relative to the subsample. Within subsamples where the CEO relative debt-to-equity had been lower than the optimum, we find mixed evidence of firms experiencing a significantly higher abnormal return when the firm has a large decrease in the deviation from optimal CEO debt-to-equity. When the simple model is used, the average abnormal return to a firm with a large decrease is approximately zero, and not significantly different from the mean abnormal return for firms without a large decrease (*p*-value = 0.84). A positive abnormal return to equity is only found when the firm had a large decrease in the deviation from the more sophisticated model optimum and the CEO's relative debt-to-equity had been below one *or* the firm had relatively weak governance. In tests (3) and (4) in Panel B, firms with a large decrease in the error experience an abnormal return of approximately 100 basis points (*p*-values approximately 0.07), significantly larger than the 23 basis point abnormal return earned by firms with no large decrease in the deviation (with p-values around 0.05). In test (6) in Panel B, firms with relatively weak governance earn a 118 basis point abnormal return (*p*-value = 0.00) in response to a large decrease in the deviation. This amounts to a 66 basis point higher abnormal return than firms without a large decrease (*p*-value = 0.03).

We next consider the impact of a continuous measure of the change in the deviation from optimal CEO holdings on the value of the firm's equity, controlling for changes in the CEO's cash compensation. The dependent variable used is the abnormal stock return over the two-day event window beginning on the proxy release date, as

described above. In Table B11, we estimate the impact of a change in the deviation for all firms. For the full set of firms, there does not appear to be a significant reaction on average to a change in the deviation from the optimal level. Coefficients on the change in the deviation from optimal CEO relative debt-to-equity (denoted as the change in absolute error in the table) range between -0.00002 and -0.00005, with p-values between 0.69 and 0.95.

Results from the regression analysis of our second hypothesis are presented in Table B12. We allow the impact of the change in absolute deviation from the optimal CEO relative debt-to-equity to differ depending on whether that ratio was less than one at the beginning of the year (columns 1-4), was less than the predicted optimal level (column 5), or whether the firm had relatively weak governance (column 6). The independent variable of interest is the change in the absolute deviation from optimal CEO relative debt-to-equity when the ratio was less than one, when the ratio was below the predicted optimum, or when the firm had relatively weak governance, as discussed in detail above.

Similar to the univariate tests, the results from the block-diagonal regressions are mixed. Abnormal returns are found to be negatively related to the change in the absolute deviation from optimal CEO relative debt-to-equity, but only when the ratio was less than one. For the simple model, the coefficient on the change in the deviation from the optimal level is -0.00027 (*p*-value = 0.00) when the CEO's relative debt-to-equity was below one at time t=0. The results are similar using the more "sophisticated" models, with coefficients ranging between -0.0033 to -0.0043 (*p*-values approximately 0.00)

when the CEO's relative debt-to-equity was below one at time t=0. Unlike the univariate tests, however, no significant relation between abnormal returns and the change in the deviation when the model based on firms with relatively high institutional ownership is used. A statistically insignificant coefficient of -0.00071 (*p*-value = 0.38) is found when regressing abnormal returns on the change in the deviation from optimal CEO holdings for firms with relatively low institutional ownership. This is seemingly contrary to the positive abnormal reaction to a large decrease in the deviation that is found in univariate testing, suggesting that further analysis of this relation is warranted in future research.

Taken together, the results provide only weak support for the theoretical prediction that debt-like compensation can actually benefit equity holders when used as a part of optimal compensation contracts. Future research should consider further extending models for CEO relative debt-to-equity, and examining alternate (non-linear) specifications for the relation between changes in the deviation and abnormal returns to firm equity. One interesting result is that stock prices react positively to a large decrease in the deviation when the firm had relatively low institutional ownership. Future research might consider why no significant relationship is found when analyzing the continuous measure of the change in the deviation. One possibility is that the relationship is non-linear, which could be investigated in future work.

Another concern is that underlying our analysis is a joint hypothesis problem; in essence our investigation tests both the relation between optimal CEO debt compensation and firm equity value, and that our empirical model for the optimal level of CEO relative debt-to-equity is correct. Our failure to find significant results using

certain models could be due in part to inadequate models for the optimal level of CEO holdings. Further research is needed to determine if the models are inadequate, and if so, how they can be improved. If the models are adequate, future work should investigate why investors do not view the optimal use of CEO relative debt-to-equity as value increasing.

3.5 Robustness checks

In addition to using multiple empirical specifications for the optimal level of CEO relative debt-to-equity, we take a number of steps to determine the robustness of our results. One concern, mentioned above, stems from the joint hypothesis nature of our tests. We are testing both the hypothesis that optimal CEO relative debt-to-equity has a positive impact of equity value and that our empirical model for the optimal level is appropriate. Stemming from this, one possibility is that our results (either significant or insignificant) could be due to large variation in the estimates for the underlying optimal level of CEO holdings rather than changes in the holdings themselves. If that is the case, it could suggest that our results are driven primarily by the specification of our empirical model rather than the CEO's actual holdings. This is problematic because we do not have an independent test for our underlying models being correct.

We use two alternate approaches to address the concern that our results are driven by large variation in the predicted values of optimal holdings rather than actual CEO holdings. First, we exclude firms where the predicted optimal level has a large standard deviation across time. Our results are robust to this, even if we drop firms that have higher than median standard deviation. The sign and significance of all results

described above remain similar in all cases. This suggests that our results are not driven by large variations in the underlying predicted optimal levels.

While this addresses the concern that *large* variation in the fitted values from our empirical models is driving the results, it is also possible that changes in the fitted values are the cause for our findings, even if the fitted values for a particular firm do not fluctuate greatly over time. To directly address each of these possible concerns, we keep the optimal level fixed, using the fitted value at t=0 as the optimal level for both t=0 and t=1. With this alternative, all variation in our measure of the change in deviation is due solely to changes in CEO's actual holdings. Our results are robust to this as well. This suggests that our results are driven by changes in the CEO's actual holdings as they relate to the optimal level, and are not driven by changes in the estimated optimal level itself. While this helps to address some of the concerns related to poor empirical models for optimal CEO relative debt-to-equity driving our results, further analysis is needed to determine whether the models are adequate, and if not, how they can be improved. We leave this for future research.

Another possible concern is that we do not have controls for other information that is potentially released in firm proxy statements regarding the firm's annual meeting. This might influence our results if the information is new to investors, affects the way investors value the firm or its equity, and is related to the CEO's relative debt-to-equity. The collection of the necessary controls would require reading individual firm proxy statements for each observation in the analysis, and hand-collecting the controls. Wei and Yermack (2010) undertake this task, which is much more feasible for their sample of

approximately 200 firms than our sample of nearly 1000. Instead, we take a random sample of 50 firms in our final dataset, and hand-collect the other proxy control variables.

For this subsample, we follow Wei and Yermack (2010) by collecting indicators that take a value of one if the firm nominated new independent directors (Rosenstein and Wyatt, 1990) or nominated new grey directors (Shivdasani and Yermack, 1999), respectively. We include three indicators for if the firm announced proposed governance changes that could benefit shareholders, such as declassifying the board of directors, instituting majority voting for the election of directors, or removing super-majority voting requirements (Faleye, 2007). We also include the indicators for if shareholders proposed changes relating to governance, executive compensation, or social issues (Karpoff, Malatesta, and Walking, 1996). Finally, we include an indicator that takes a value of one if the firm made its first disclosure personal use of the firm's aircraft by the CEO (Yermack, 2006).

We are able to collect these variables for 49 of the 50 firms randomly chosen for the subsample. In only one case, for the indicator of new grey director nominations, do we find no firms in the subsample for which such an event occurred. Using these indicators as controls, we replicated our regression analysis on this subset of our sample. Our results are generally robust. In two cases (both in Table B12), the change in the deviation from optimal CEO holdings no longer has a significant impact on the firm's abnormal returns. No significant relationship is found using the simple model or the first "sophisticated" model in Table B12. However, the lack of significance appears to be

driven by the sample size rather than the control variables, as coefficients become insignificant within the random subset even when the controls are excluded.

3.6 Discussion

This section empirically examines the implications of deviations from the optimal use of debt-like executive compensation for the market value of firm equity. Debt-like compensation may exist in a number of forms. Our analysis focuses on a portion of debt-like compensation measured by the present value of the CEO's pension benefits payable after retirement and the total balance of the CEO's deferred compensation. Following Wei and Yermack (2010), we specifically consider the implications of the CEO's relative debt-to-equity, or the CEO's debt-to-equity divided by the firm's debt-to-equity. Jensen and Meckling (1976) theorize that a shift in the debt-like compensation of the manager may encourage risk shifting, in this case reducing the risk of the firm in a manner that increases the value of the debt compensation, but negatively impacts the value of the firm's equity. This is primarily the case when the CEO's relative debt-to-equity takes a value greater than one. Sundaram and Yermack (2007) document that an increase in the pension value of the CEO is correlated with a decrease in the riskiness of the firm, as measured by the distance to default. Wei and Yermack (2010) provide additional evidence relating CEO relative debt-to-equity to firm risk, and show that the firm stock prices react negatively to the first announcement of CEO relative debt-to-equity when this ratio is greater than one.

However, an alternate theoretical prediction from Edmans (2008) suggests that high CEO debt-to-equity may not always be suboptimal for shareholders, and may even

increase the value of equity. We empirically test this prediction by considering various models of optimal CEO relative debt-to-equity, but find only weak evidence linking deviations from optimal CEO holdings to firm equity value. However, the lack of consistent positive reaction to a decrease in error, along with weak regression results, suggests that our findings should be interpreted with care.

Our tests depend on the models used to determine the optimal level being good models. One concern is that our results (either significant or insignificant) reflect the inadequacies of our underlying empirical models for optimal CEO holdings. Further research is needed to determine whether current models for optimal CEO debt-to-equity are inadequate, and if so, whether the models can be improved. Or, if the models are adequate, future research should examine why equity holders do not view an improvement in managerial incentives (moving CEO relative debt-to-equity nearer the optimal level) as value increasing.

Our findings also have other implications for future research. First, further research is needed to analyze the relationship between optimal CEO holdings and firm equity value when institutional ownership is low. This represents a scenario when the firm may lack mechanisms in place to reduce the agency costs of debt, and thus benefit greatly from the reductions due to the optimal use of debt-like compensation. Additionally, while Chava, Kumar, and Warga (2010) show that CEO pensions are negatively related to the incidence of certain public debt covenants, only a limited number of other studies have empirically considered the implications of debt-like compensation for factors influencing agency costs. Future studies might more

extensively examine possible effects of debt-like compensation on CEO decision-making as well as other firm outcomes, particularly focusing on changes in the firm or other events that would be consistent with a decrease in agency costs related to the optimal use of debt-like compensation.

4. CONCLUSION

In this research effort, we test recent theoretical predictions linking factors that influence the CEO's view of risk, overconfidence and debt-like compensation, to CEO forced turnover and firm equity value. First, we analyze the impact that excessively low or excessively high CEO overconfidence has on the likelihood of the CEO facing forced turnover. We find that excessively diffident CEOs and excessively overconfident CEOs face significantly greater hazards of forced turnover than moderately overconfident CEOs face. The results point to the importance of considering the whole range of CEO confidence levels in theoretical and empirical analyses, and are broadly consistent with the view that CEOs with moderate levels of overconfidence maximize firm value (Goel and Thakor, 2008; Hackbarth, 2008).

Second, we investigate the impact that deviations from the optimal use of debt-like executive compensation have on the market value of firm equity. This analysis aims to distinguish between two alternate theoretical predictions. One prediction is that the use of debt-like compensation for managers negatively impacts the value of the firm's equity because of increased agency conflicts with equity holders. An alternate prediction is that debt-like compensation may increase the value of equity through a reduction in the agency costs of debt. We test this prediction by analyzing deviations from optimal CEO relative debt-to-equity, and find weak evidence that CEO debt compensation can increase firm equity value. Taken together, the results suggest that the CEO's view of risk is a relevant consideration for the firm, which may impact not only the value of the firm as a whole, but claims against it, and employment outcomes for the CEO.

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APPENDIX A

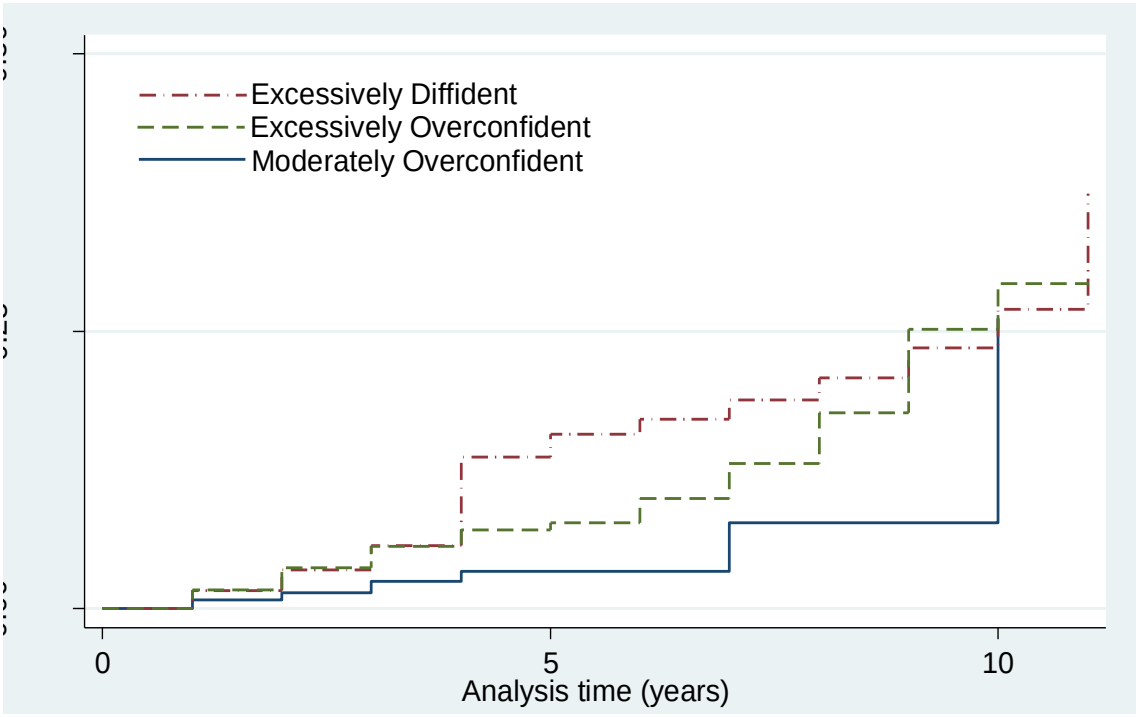

Figure A1: Graph of Nelson-Aalen cumulative hazard estimates across three CEO confidence groups: excessively diffident, excessively overconfident, and moderately overconfident. *P*-values from the log-rank test and the Tarone-Ware (1977) test for the null hypothesis of equality of survivor/failure functions are both less than 0.01.

APPENDIX B

Table B1
Summary statistics for test and control variables.
Details for the confidence measures are in the text. Annualized returns are the annualized return over the tenure of the CEO beginning the month the CEO was hired if the CEO was hired in the last five years, or the returns over the last five years of the CEO's tenure, adjusted by the three-digit SIC industry median return. We winsorize these returns at the 1st and 99th percentiles. The sample size using netbuy-based and investment-based measures is 9,063 CEO-firm-years. The sample size for the option holder based measure is reduced to 5,353 CEO-firm-years because a number of CEOs cannot be classified with this measure.

Panel A: by CEO	Mean	Median
Excessive diffidence (option holder)	0.110	
Excessive overconfidence (option holder)	0.391	
Excessive diffidence (netbuy excl. options)	0.361	
Excessive overconfidence (netbuy excl. options)	0.216	
Excessive diffidence (netbuy incl. options)	0.367	
Excessive overconfidence (netbuy incl. options)	0.260	
Excessive diffidence (investment)	0.174	
Excessive overconfidence (investment)	0.175	
Panel B: by CEO-firm-year		
Excessive diffidence (option Holder)	0.091	
Excessive overconfidence (option Holder)	0.360	
Excessive diffidence (netbuy excl. options)	0.273	
Excessive overconfidence (netbuy excl. options)	0.148	
Excessive diffidence (netbuy incl. options)	0.278	
Excessive overconfidence (netbuy incl. options)	0.186	
Excessive diffidence (investment)	0.115	
Excessive overconfidence (investment)	0.141	
Annualized return over CEO tenure (max 5 years)	0.173	0.102
Percent ownership in firm	0.028	0.004
CEO age (years)	55.658	56.000
CEO tenure (years)	7.626	5.000
CEO salary ($ thousands)	591.982	537.500
CEO bonus ($ thousands)	586.399	320.640

Table B2
Forced turnover rates by CEO confidence level.
This table presents the proportions of CEOs in each confidence group that are subjected to a forced turnover. Confidence classifications are defined in Table B1.

	Confidence measure based on:			
CEO confidence level	Option holdings and exercises	Net stock purchases including options	Net stock purchases excluding options	Industry-adjusted investment
Excessively diffident	3.15%	3.34%	3.27%	5.17%
Moderately overconfident	0.90%	2.14%	2.21%	2.06%
Excessively overconfident	2.12%	2.97%	3.07%	3.40%

Table B3
Cox regressions modeling the probability of forced turnover.
This table presents results from a Cox proportional hazards model of the hazard of forced turnover. The dependent variable equals one for forced turnovers and zero otherwise. Independent variables are defined in Table B1. The impact of the CEO's percent ownership in the firm is allowed to vary with time to satisfy the assumptions of the Cox model. *p*-values are in parentheses.

	Confidence measure based on:			
	Option holdings and exercises	Net stock purchases including options	Net stock purchases excluding options	Investment rate quintile
CEO excessive diffidence dummy	0.8695 (0.01)	0.5665 (0.00)	0.4960 (0.00)	0.7454 (0.00)
CEO excessive overconfidence dummy	0.7100 (0.02)	0.4420 (0.01)	0.4491 (0.02)	0.4235 (0.02)
Industry adjusted stock return over CEO tenure	−0.5894 (0.04)	−0.8983 (0.00)	−0.8837 (0.00)	−0.8798 (0.00)
CEO percent ownership in the firm	−0.3324 (0.50)	−0.8812 (0.03)	−0.8725 (0.03)	−0.7499 (0.05)
CEO salary	−0.0010 (0.05)	0.0003 (0.11)	0.0004 (0.08)	0.0005 (0.02)
CEO bonus	−0.0005 (0.02)	−0.0011 (0.00)	−0.0011 (0.00)	−0.0010 (0.00)
CEO age	−0.0482 (0.00)	−0.0379 (0.00)	−0.0380 (0.00)	−0.0400 (0.00)
CEO tenure	−0.0184 (0.37)	−0.0343 (0.02)	−0.0339 (0.02)	−0.0270 (0.05)
Difference in confidence coefficients test *p*-value	0.52	0.50	0.81	0.12
N	5,353	9,063	9,063	9,063

Table B4
Cox regressions modeling the probability of forced turnover for firms with strong and weak board governance.
This table presents results cut on board governance strength. Weak board governance firms are those that are jointly insider dominated, the CEO is chair, and the board is classified; other firms are strong board governance firms. Variables are defined in Tables 2 and 3. *p*-values are in parentheses.

	Firms with strong board governance				Firms with weak board governance			
	Confidence measure based on:							
	Option holdings and exercises	Net stock purchases including options	Net stock purchases excluding options	Investment rate quintile	Option holdings and exercises	Net stock purchases including options	Net stock purchases excluding options	Investment rate quintile
Excessive diffidence dummy	1.0639 (0.01)	0.6141 (0.00)	0.4864 (0.01)	0.6509 (0.00)	0.8103 (0.24)	0.3953 (0.20)	0.4792 (0.12)	1.1893 (0.00)
Excessive overconfidence dummy	0.9538 (0.01)	0.6445 (0.00)	0.6136 (0.00)	0.5071 (0.01)	0.2913 (0.60)	−0.3748 (0.41)	−0.2933 (0.55)	0.4331 (0.27)
Stock return over tenure	−0.6882 (0.04)	−0.9644 (0.00)	−0.9457 (0.00)	−0.9439 (0.00)	−0.3591 (0.54)	−0.6704 (0.09)	−0.6667 (0.09)	−0.6568 (0.10)
CEO percent ownership	−0.1933 (0.71)	−0.9241 (0.08)	−0.8933 (0.08)	−0.7640 (0.10)	−0.5709 (0.62)	−0.9478 (0.17)	−0.9652 (0.16)	−0.9228 (0.18)
CEO salary	−0.0010 (0.08)	0.0003 (0.13)	0.0004 (0.10)	0.0005 (0.02)	−0.0006 (0.57)	0.0004 (0.37)	0.0004 (0.40)	0.0003 (0.53)
CEO bonus	−0.0006 (0.04)	−0.0012 (0.00)	−0.0012 (0.00)	−0.0012 (0.00)	−0.0004 (0.48)	−0.0005 (0.09)	−0.0005 (0.10)	−0.0006 (0.09)
CEO age	−0.0451 (0.01)	−0.0334 (0.00)	−0.0336 (0.00)	−0.0355 (0.00)	−0.0600 (0.06)	−0.0488 (0.01)	−0.0476 (0.01)	−0.0478 (0.01)
CEO tenure	−0.0116 (0.62)	−0.0349 (0.04)	−0.0337 (0.04)	−0.0290 (0.07)	−0.0043 (0.91)	−0.0254 (0.31)	−0.0273 (0.29)	−0.0204 (0.41)
N	4,093	6,839	6,839	6,839	1,260	2,224	2,224	2,224

Table B5
Cox regressions modeling the probability of forced turnover versus voluntary turnover.
This table presents results from a Cox proportional hazards model of the hazard of forced turnover versus voluntary turnover. The dependent variable equals one for forced turnovers and zero otherwise. Measures of excessive diffidence and overconfidence are as defined in Table B2. Returns are the annual return over the tenure of the CEO, up to 5 years, adjusted by the three-digit SIC industry median. The impact CEO's percent ownership in the firm is allowed to vary with time, in order to satisfy the assumptions of the Cox model. *p*-values in parentheses *p*-values for test of equal coefficients across the excessive diffidence and excessive overconfidence dummy variables are provided at the bottom.

	Confidence measure based on:			
	Option holdings and exercises	Net stock purchases including options	Net stock purchases excluding options	Investment rate quintile
Excessive diffidence dummy	0.8798 (0.01)	0.4010 (0.01)	0.3645 (0.02)	0.4548 (0.01)
Excessive overconfidence dummy	0.7100 (0.02)	0.2627 (0.14)	0.4109 (0.03)	0.3071 (0.08)
Stock return over tenure	−0.3312 (0.20)	−0.3604 (0.05)	−0.3570 (0.05)	−0.3594 (0.05)
CEO percent ownership	0.1376 (0.80)	−0.1498 (0.71)	−0.1744 (0.67)	−0.1167 (0.77)
CEO salary	−0.0004 (0.45)	0.0005 (0.01)	0.0005 (0.01)	0.0005 (0.00)
CEO bonus	−0.0003 (0.14)	−0.0005 (0.00)	−0.0006 (0.00)	−0.0005 (0.00)
CEO age	−0.0877 (0.00)	−0.0659 (0.00)	−0.0651 (0.00)	−0.0654 (0.00)
CEO tenure	0.0004 (0.98)	−0.0247 (0.06)	−0.0257 (0.06)	−0.0212 (0.11)
Difference in coefficient test *p*-value	0.49	0.44	0.81	0.47
N	672	1,242	1,242	1,242

Table B6
Cox regressions modeling the probability of voluntary turnover versus nonturnovers.
This table presents results from a Cox proportional hazards model of the hazard of voluntary turnover versus no turnover. The dependent variable equals one for forced turnovers and zero otherwise. Measures of excessive diffidence and overconfidence are as defined in Table B2. Returns are the annual return over the tenure of the CEO, up to 5 years, adjusted by the three-digit SIC industry median. The impact CEO's percent ownership in the firm is allowed to vary with time, in order to satisfy the assumptions of the Cox model. *P*-values for test of equal coefficients across the excessive diffidence and excessive overconfidence dummy variables are provided at the bottom. *p*-values in parentheses.

	Confidence measure based on:			
	Option holdings and exercises	Net stock purchases including options	Net stock purchases excluding options	Investment rate quintile
Excessive diffidence dummy	0.2642 (0.10)	0.1796 (0.07)	0.0395 (0.69)	−0.1671 (0.20)
Excessive overconfidence dummy	0.0228 (0.87)	0.0367 (0.74)	−0.0654 (0.59)	0.1149 (0.33)
Stock return over tenure	−0.1435 (0.42)	−0.2067 (0.11)	−0.1880 (0.14)	−0.1968 (0.13)
CEO percent ownership	−1.2157 (0.00)	−1.1256 (0.00)	−1.0750 (0.00)	−1.0385 (0.00)
CEO salary	−0.0002 (0.28)	−0.0002 (0.08)	−0.0002 (0.08)	−0.0002 (0.08)
CEO bonus	0.0000 (0.92)	−0.0000 (0.74)	−0.0000 (0.85)	−0.0000 (0.76)
CEO age	0.1201 (0.00)	0.0985 (0.00)	0.0982 (0.00)	0.0990 (0.00)
CEO tenure	−0.0097 (0.19)	−0.0067 (0.22)	−0.0054 (0.32)	−0.0051 (0.34)
Difference in coefficient test *p*-value	0.08	0.22	0.42	0.07
N	5,247	8,820	8,820	8,820

Table B7
Summary statistics.
Below are summary statistics for variables of interest. CEO Relative Debt-to-Equity is the CEO's debt-to-equity ratio divided by the firm's debt-to-equity ratio, and winsorized at the 99th percentile. Growth Opportunities is measured as the ratio of R&D expenditures to sales. Market-to-Book is the market value of assets divided by the book value of assets. Idiosyncratic risk is calculated as the error from a market model of returns, following Gerakos (2007). Abnormal stock returns are calculated using a standard market model and are measured over a two-day event window (0,1).

Variable	Mean	S.D	25th	Median	75th	N
CEO Relative Debt-to-Equity	5.359	22.573	0.257	0.874	2.667	1878
Tenure	6.478	6.518	2.000	5.000	9.000	1878
Age	62.227	7.707	57.000	63.000	68.000	1878
Size	22.363	1.536	21.283	22.181	23.377	1878
Book Leverage	0.250	0.152	0.139	0.237	0.341	1878
Growth Opportunities	0.022	0.069	0.000	0.000	0.015	1878
Market-to-Book	2.695	9.323	1.390	2.007	3.184	1878
PP&E	0.280	0.243	0.088	0.204	0.439	1878
Tax Status	0.394	0.489	0.000	0.000	1.000	1878
Liquidity Constraint	0.028	0.166	0.000	0.000	0.000	1878
AAA of AA	0.036	0.188	0.000	0.000	0.000	1878
A	0.174	0.379	0.000	0.000	0.000	1878
BBB	0.315	0.465	0.000	0.000	0.000	1878
Idiosyncratic Risk	0.001	0.095	-0.046	-0.003	0.038	1878
GIM Index	9.774	2.531	8.000	10.000	11.000	1878
Board Size	10.208	2.255	9.000	10.000	12.000	1878
Outsider Percentage	0.782	0.118	0.714	0.800	0.888	1878
Institutional Ownership	0.796	0.162	0.701	0.818	0.925	1878
Change in Salary (Thousands)	23.202	149.216	0.000	35.000	68.462	904
Change in Bonus (Thousands)	43.338	2621.18	0.000	0.000	0.000	904
Abnormal Stock Return	0.004	0.045	-0.015	0.002	0.022	904
Change in Absolute Error (model 1)	-0.208	19.100	-1.438	-0.019	1.283	904

Table B8
Correlations matrix.
Variables are described in Table B7.

	CEO Relative D-to-E	Age	Size	Book Lev.	Growth Opp.	PP&E	Tax Status	Liq. Cons.	Risk	GIM Index	Board Size	Out. Per.	Abn. Stock Ret.
CEO Relative Debt-to-Equity	1												
Age	0.049	1											
Size	-0.137	0.038	1										
Book Leverage	-0.237	-0.017	0.057	1									
Growth Opportunities	0.152	-0.026	-0.020	-0.051	1								
PP&E	-0.011	0.034	0.470	0.006	-0.040	1							
Tax Status	-0.001	-0.068	-0.151	0.031	0.100	-0.103	1						
Liquidity Constraint	-0.036	0.026	-0.005	0.052	0.038	-0.056	-0.030	1					
Idiosyncratic Risk	0.011	-0.045	-0.078	-0.057	-0.024	-0.005	0.044	0.003	1				
GIM Index	-0.070	0.035	0.012	-0.015	-0.063	-0.115	-0.083	0.006	-0.006	1			
Board Size	-0.144	-0.007	0.518	0.004	-0.085	0.233	-0.105	-0.036	-0.039	0.183	1		
Outsider Percentage	-0.064	0.024	0.153	0.087	0.035	0.104	0.055	0.021	-0.049	0.139	0.077	1	
Abnormal Stock Return	0.003	0.009	0.003	0.019	-0.001	-0.028	-0.046	0.061	0.005	-0.003	0.030	-0.034	1
Change in Absolute Error (model 1)	0.445	0.009	-0.007	-0.030	0.109	0.005	-0.008	0.014	0.016	-0.028	-0.037	-0.053	-0.009

Table B9
Tobit models relating CEO relative debt-to-equity to possible firm and executive level determinants.
Independent variables are described in Table B7 and in detail in the text. *P*-values are in parentheses.

	Model			
	(1)	(2)	(3)	(4)
Age	0.1208*	0.1685**	0.1527**	0.0830
	(0.07)	(0.01)	(0.02)	(0.37)
Tenure	-0.0004	0.0260	0.0603	0.0620
	(1.00)	(0.75)	(0.45)	(0.61)
Firm Size	-3.1192***	-2.2117***	-1.3431**	-1.4855
	(0.00)	(0.00)	(0.02)	(0.11)
Growth Opportunities	20.1505**	25.0214***	20.0350**	7.4792
	(0.01)	(0.00)	(0.01)	(0.41)
Tax Status	-2.1202*	-0.9734	-0.3358	-1.2189
	(0.07)	(0.39)	(0.76)	(0.43)
Liquidity Constraint	2.9309	4.9367	6.8766**	12.8992***
	(0.39)	(0.13)	(0.03)	(0.01)
AAA/AA	16.6220***	12.8321***	11.5403***	13.4029
	(0.00)	(0.00)	(0.00)	(0.20)
A	5.0126***	5.6635***	2.8621	-2.9410
	(0.01)	(0.00)	(0.11)	(0.36)
BBB	1.6624	2.2250	0.4965	-0.5981
	(0.24)	(0.11)	(0.71)	(0.76)
Market to book	0.0034	0.0147	0.0115	-0.0039
	(0.84)	(0.78)	(0.83)	(0.82)
PP&E	0.0001*	0.0001*	0.0001	0.0003
	(0.08)	(0.09)	(0.25)	(0.37)
Idiosyncratic Risk	-0.4935	-2.5611	-1.8019	3.7625
	(0.92)	(0.63)	(0.73)	(0.59)
Outsider Percentage		3.3861	5.7874	
		(0.46)	(0.19)	
ln(Board Size)		-5.9572**	-5.9701**	
		(0.04)	(0.04)	
GIM Index		-0.1232	-0.1076	
		(0.56)	(0.60)	
Book Leverage			-39.3534***	-47.3779***
			(0.00)	(0.00)
Constant	64.9845***	50.1101***	42.2178***	46.3403**
	(0.00)	(0.00)	(0.00)	(0.02)
N	2162	1878	1878	1082

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B10
Abnormal returns to large decreases in the deviation from optimal debt compensation.
Below are univariate tests comparing abnormal returns for firms with large decreases in absolute deviation to firms without large decreases. A large decrease is defined as a decrease in absolute error that is greater than the 90th percentile of decreases with the sample or subsample. In Panel A, all firms with available data are used. In Panel B, the tests are conducted using only firms where a positive reaction is more likely. For tests (1) – (4) in Panel B, the test is conducted on the subset of firms where the CEO's relative debt-to-equity was less than 1. For test (5) in Panel B, the test is conducted on the subset of firms that had a lower than optimal CEO relative debt-to-equity ratio per the model. For test (6), the test is conducted on the subset of firms with relatively weak governance. *P*-values are based on two-sided t-tests for the significance of mean standardized abnormal returns. *P*-values are based on one-sided t-tests for the difference in means using standardized abnormal returns, which are explicitly predicted to be higher for the group with a large decrease.

Panel A

Test	Model		Mean	*P*-value	Difference	*P*-value
(1)	Optimal	Large Decrease	0.0082***	0.0090		
	=1	No Large Decrease	0.0032*	0.0764	0.0050**	0.0381
(2)	(1)	Large Decrease	0.0000	0.4352		
		No Large Decrease	0.0040**	0.0162	-0.0040	0.2861
(3)	(2)	Large Decrease	0.0040	0.1172		
		No Large Decrease	0.0036**	0.0314	0.0004	0.1389
(4)	(3)	Large Decrease	0.0047	0.1918		
		No Large Decrease	0.0035**	0.0490	0.0012	0.2363
(5)	(4)	Large Decrease	0.0012	0.6428		
		No Large Decrease	0.0037**	0.0410	-0.0025	0.5697

Panel B

	Model		Mean	*P*-value	Difference	*P*-value
(1)	Optimal	Large Decrease	-0.0000	0.4626		
	=1	No Large Decrease	0.0034	0.1950	0.0034	0.8367
(2)	(1)	Large Decrease	0.0209	0.1117		
		No Large Decrease	0.0011	0.6931	0.0198**	0.0224
(3)	(2)	Large Decrease	0.0093*	0.0754		
		No Large Decrease	0.0023	0.3199	0.0069**	0.0423
(4)	(3)	Large Decrease	0.0104*	0.0771		
		No Large Decrease	0.0023	0.6017	0.0081*	0.0622
(5)	(3)	Large Decrease	0.0073	0.2811		
		No Large Decrease	0.0021	0.2096	0.0052	0.3116
(6)	(4)	Large Decrease	0.0118***	0.0028		
		No Large Decrease	0.0052**	0.0255	0.0066**	0.0295

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B11

OLS regressions of abnormal returns to firm equity.

Below are OLS regressions of abnormal returns on changes in absolute deviation from optimal CEO relative debt-to-equity and controls for changes in the CEO's cash compensation. The change in absolute error is the change in the absolute value of the deviation from the optimal CEO relative debt-to-equity based on the model listed above each column. Change in salary is the change in the CEO's salary from the previous to the current year. Change in bonus is the change in the CEO's bonus from the previous to the current year. *P*-values are in parentheses.

	Model				
	Optimal = 1	(1)	(2)	(3)	(4)
Δ Abs Error X 10^{-2}	-0.0004	-0.0032	-0.0023	-0.0026	-0.0018
	(0.95)	(0.69)	(0.80)	(0.78)	(0.86)
Δ Salary X 10^{-2}	0.0001	-0.0003	-0.0003	-0.0003	0.0001
	(0.70)	(0.62)	(0.53)	(0.56)	(0.79)
Δ Bonus X 10^{-2}	-0.0000	-0.0001	-0.0001	-0.0001	-0.0000
	(0.40)	(0.14)	(0.28)	(0.28)	(0.47)
Constant X 10^{-2}	0.0021**	0.0022**	0.0024**	0.0025**	0.0022**
	(0.02)	(0.03)	(0.02)	(0.02)	(0.04)
N	1771	904	904	904	904

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B12

Block-diagonal regressions of abnormal returns to firm equity.

Below are block-diagonal regressions of abnormal returns on changes in absolute deviation from optimal CEO relative debt-to-equity and controls for changes in the CEO's cash compensation. The impact of a change in the absolute deviation is allowed to differ for firms predicted to have greater reactions in our second hypothesis. For the first four columns, the impact is allowed to differ depending on whether the CEO's relative debt-to-equity was greater than or less than 1. For column 5, the impact of is allowed to differ depending on whether the firm had a lower than optimal CEO relative debt-to-equity ratio, per the model. For column 6, the impact is allowed to differ depending on the firm's institutional ownership. The change in absolute error is the change in the absolute value of the deviation from optimal CEO relative debt-to-equity. All variables are defined in Table B11. *P*-values are in parentheses.

	Model					
	Optimal = 1	(1)	(2)	(3)	(3)	(4)
Δ Abs Error X 10^{-2}	0.0026	0.0001	-0.0001	0.0005	-0.0085	
Relative was high	(0.74)	(0.99)	(0.99)	(0.96)	(0.35)	
Δ Abs Error X 10^{-2}	-0.0267***	-0.0333***	-0.0371***	-0.0432***	-0.0005	
Relative was low	(0.00)	(0.00)	(0.00)	(0.00)	(0.97)	
Δ Salary X 10^{-2}	0.0002	-0.0004	-0.0004	-0.0004	-0.0004	-0.0004
	(0.62)	(0.51)	(0.50)	(0.48)	(0.53)	(0.48)
Δ Bonus X 10^{-2}	-0.0000	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
	(0.39)	(0.30)	(0.26)	(0.25)	(0.28)	(0.27)
Δ Abs Error X 10^{-2}						0.0138
Good Governance						(0.56)
Δ Abs Error X 10^{-2}						-0.0071
Bad Governance						(0.38)
Constant X 10^{-2}	0.0022**	0.0025**	0.0025**	0.0026**	0.0025**	0.0025**
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
N	1771	904	904	904	904	904

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

VITA

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