Do CEO Inside Debt Holdings Influence the Cost of Equity Capital?

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Abstract: This study examines the relation between CEO inside debt holdings and the cost of equity capital. We conjecture that CEO inside debt holdings could have two opposite effects on the cost of equity. On the one hand, shareholders might perceive CEO inside debt holdings as beneficial because it could constrain aggressive managerial behaviors and, therefore, shareholders could demand lower required rate of returns. On the other hand, a higher level of CEO insider debt may increase shareholders' concerns on potential debtholder-shareholder agency conflicts and lower pay-for-performance sensitivity, leading to a higher cost of equity. Using a sample of 8,182 firm-year observations during 2006-2013, we find an overall negative relation between CEO inside debt holdings and the cost of equity capital. Such a negative relation is robust to a variety of robustness checks, including tests based on CEO turnover events and the instrumental-variable approach. Consistent with the prediction of Edmans and Liu (2011), we also find that the negative relation between CEO inside debt holdings and the cost of equity capital is more pronounced in firms with greater bankruptcy risk. Overall, these findings suggest that shareholders value the beneficial role of CEO inside debt holdings in constraining aggressive managerial behaviors.

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1. Introduction

Defined benefit pensions and deferred compensation are important components in the compensation of U.S. managers (Sundaram and Yermack, 2007). Since these compensation components are unsecured and typically underfunded obligations, the debt-like compensation (i.e., inside debt) exposes managers to the same default risks and insolvency treatment as outside debtholders, and thereby could attenuate the debtholder-shareholder conflicts (Jensen and Meckling, 1976). Although the existing literature focuses predominantly on cash- and equity-based compensation (e.g., salary, bonus, stock and option grants), some recent studies examine the influence of the debt-like compensation on firm risk (Cassell et al., 2012), dividend policy (Srivastav, Armitage, and Hagendorff, 2014), financial reporting quality (He, 2014), accounting conservatism (Wang, Xie, and Xin, 2014), M&A decisions (Phan, 2014), debt contracting (Anantharaman, Fang, and Gong, 2014), etc. However, none of them have examined whether CEO inside debt holdings influence the cost of equity capital.

The cost of equity capital is a key input variable in corporate financing decisions and capital structure decisions. In addition, it represents the discount rate at which expected future cash flows of investment projects are valued, therefore firms with expensive equity capital may have to bypass worthwhile investment projects. Given the critical roles of the cost of equity in financing and investment decisions, it is interesting to understand whether inside debt—a significant component of executive compensation that was largely overlooked by earlier studies—influences the cost of equity capital.

Inside debt could have two opposite effects on the cost of equity. Some previous studies (e.g., Dhaliwal, Heitzman, and Li, 2005; Bhattacharya et al., 2012; Hutchens and Rego, 2013) find that shareholders demand a greater cost of equity capital when firms engage in various aggressive behaviors, such as using high leverage, manipulating earnings, and avoiding taxes. These findings suggest that shareholders are concerned with the risks

engendered by the aggressive corporate policies. Inside debt provides incentives to constrain managers from engaging in aggressive behaviors. For example, Cassell et al. (2012) find that CEO inside debt holdings are negatively related to stock return volatility and firm leverage. In addition, Phan (2014) shows that CEO inside debt holdings prevent managers from conducting value-destroying M&A transactions. He (2014) found that higher CEO inside debt holdings are associated with less aggressive financial reporting, leading to a lower likelihood of earnings misstatement and reduced firm-specific stock price crash risk. Chi, Huang, and Sanchez (2014) as well as Kubic and Robinson (2014) find that CEO inside debt holdings induces managers to adopt less aggressive tax reporting practices. If shareholders perceive CEO inside debt holdings as a factor that induces managers to adopt more conservative firm policies, then CEO inside debt holdings could reduce shareholders' concerns and lower their required rate of returns, suggesting a *negative* relation between CEO inside debt holdings and the cost of equity capital.

On the other hand, it is possible that a high level of CEO insider debt holdings could align the interests of CEOs with those of debtholders so closely that debtholder-shareholder agency conflict becomes a salient risk factor for shareholders. In addition, Bebchuk and Fried (2005) argue that significant inside debt holdings of executives could have been largely unrelated to the executives' performance while in office, leading to lower pay-for-performance sensitivity and greater agency conflicts between shareholders and mangers. Consequently, if shareholders perceive a higher level of CEO inside debt as indicative of these problems identified in past studies, then they would demand a *greater* cost of equity. As such, these two competing hypotheses imply that inside debt could be either positively or negatively related to the cost of equity capital. A large-scale empirical study thus is called for to shed light on this issue.

We test these conjectures by examining the overall effect of CEO inside debt holdings on the *ex ante* cost of equity measures implied in stock prices and analysts' earnings forecasts. These measures have been used in many accounting and finance studies.[1] Some of these studies (e.g., Gebhardt, Lee, and Swaminathan, 2001; Pastor, Sinha, and Swaminathan, 2008; Chava, 2014; Tang, Wu, and Zhang, 2014) underscore the benefits of using the ex ante implied cost of equity as a proxy for expected returns instead of using ex post realized returns. For example, different from the traditional approaches for estimating ex post realized rates of return, the estimation of the ex ante measures does not rely on historical stock return data, and therefore reflects the investor's *expected* rate of return at the point of estimation.[2] Specifically, our key dependent variable—the ex ante cost of equity—is computed as the internal rate of return that makes the current stock price equal to the present value of all future cash flows to common shareholders, or the rate that the market implicitly uses to discount all future cash flows (Gebhardt, Lee, and Swaminathan, 2001).

To measure CEO inside debt holdings, we following prior research (e.g., Sundaram and Yermack, 2007; Edmans and Liu, 2011; Cassell et al., 2012; Phan, 2014) to use the following two variables: (i) CEO relative debt-to-equity ratio (*CEO-firm D/E*) is measured as the ratio of CEO's debt-to-equity ratio (*CEO D/E*) scaled by the firm's debt-to-equity ratio

[1] Please refer to the accounting studies such as Gebhardt, Lee, and Swaminathan (2001), Gode and Mohanram (2003), Easton (2004), Botosan and Plumlee (2005), Ohlson and Juettner-Nauroth (2005), Dhaliwal, Heitzman, and Li (2006), Hail and Leuz (2006), Dhaliwal, Krull, and Li (2007), Ogneva, Subramanyam, and Raghunandan (2007), Azizkhani, Monroe, and Shailer (2013), Dai, Shackelford, Zhang, and Chen (2013), Dhaliwal, Judd, Serfling, and Shaikh (2014), etc. Please also see Friend, Westerfield and Granito (1978), Kaplan and Ruback (1995), Claus and Thomas (2001), Brav, Lehavy and Michaely (2005), Lee, Ng, and Swaminathan (2009), and Pastor, Sinha, and Swaminathan (2008), Chen, Chen, and Wei (2011), Chen, Kacperczyk, and Ortiz-Molina (2011), Attig, Cleary, El Ghoul, and Guedhami (2013), Chen, Huang, and Wei (2013), Mishra (2014), Chava (2014) in finance literature.

[2] In addition, these models of ex ante cost of equity imply discount rates by simultaneously controlling for the effects of cash flows and growth in firm valuation (Leuz and Hail, 2006). On the contrary, there is a debate that ex post stock returns might not be a good measure a firm's cost of equity. Some prior studies (e.g., Hail and Leuz, 2006; Chen, Chen, and Wei, 2011) argue that the ex post realized returns not only capture differences in a firm's cost of equity, but may also reflect the shocks to a firm's growth opportunities, differences in expected growth rates, and changes in investors' risk aversion. Additionally, many studies (e.g., Froot and Frankel, 1989; Elton, 1999; Campello, Chen, and Zhang, 2008; Tang, Wu, and Zhang, 2014) argue that realized returns are a noisy proxy for expected returns for various reasons. For example, Elton (1999) demonstrates that average realized returns can deviate significantly from expected returns over prolonged periods of time.

(*Firm D/E*); (ii) CEO relative incentive (*CEO-firm ΔD/ΔE*) is the ratio of the marginal change in the value of CEO inside debt holdings to the marginal change in CEO equity holdings given the change in firm value, scaled by the firm's respective ratio.

Using a sample of 8,182 firm-year observations during 2006-2013, we conduct tests to examine the effect of CEO inside debt holdings on the cost of equity capital. We find an overall *negative* relation between CEO inside debt holdings and the firm's cost of equity capital. Such a negative relation is robust to controlling for firm attributes, CEO equity-based compensation, and other CEO characteristics. Our main finding also holds in a battery of sensitivity tests, including the instrumental-variable two-stage analysis.

We further use CEO turnover events to pinpoint the causal relation between CEO inside debt holdings and the cost of equity capital. We find that a reduction in CEO inside debt holdings due to CEO turnover leads to a significant increase in the cost of equity capital. In addition, such a negative relation is more pronounced if the CEO turnover of a firm is *unexpected*.[3] Taken together, these findings suggest that shareholders perceive CEO inside debt holdings as beneficial in refrain managers from adopt overly risky firm policies, and, consequently, lower required rate of returns.

We also find that the relation between CEO inside debt holdings and the cost of equity capital is non-linear. Specifically, the negative relation becomes less negative when the level of CEO inside debt increases. We interpret this finding as evidence that a higher level of inside debt holdings could closely align the incentives of managers with those of debtholders and thus increase shareholders' concerns on agency risk engendered by potential debtholder-shareholder conflicts and lower pay-for-performance sensitivity.

[3] We classify the a CEO turnover event as "expected" if (i) the stepping-down CEO is of age higher than 60 or (ii) the firm reported a negative income in last fiscal year; and define the rest of CEO turnover events as "unexpected".

In our subsample analyses, we find the negative relation between CEO inside debt holdings and the cost of equity capital is stronger for firms with greater bankruptcy risk. This finding is consistent with the argument of Edmans and Liu (2011) that CEO inside debt holdings could be more desired to induce managerial effort and alleviate the agency costs of debt, when bankruptcy is likely. Additionally, we also find an overall positive and non-linear relation between CEO inside debt holdings and forward-looking performance measures.

This study contributes to multiple research streams. First, it contributes to an emerging literature on debt-like compensation (e.g., Choy, Lin, and Officer, 2014). Although some of these studies (e.g., Anantharaman, Fang, and Gong, 2014) examine whether CEO inside debt is a priced factor in bank loan market, none of these studies examine whether inside debt is perceived by *shareholders* as a priced factor. To the best of our knowledge, this study is the first one showing a robust and negative relation between the use of debt-like compensation and the cost of equity capital. This finding highlights the importance of inside debt in the design of an optimal executive compensation contract, which could be of particular interests to board of directors.

Second, our study also contributes to the literature on corporate governance in general. Prior studies debate on whether various corporate governance mechanisms, including the design of executive compensation, can reduce risks for shareholders. Theoretical studies (e.g., Albuquerque and Wang, 2008) predict that agency conflicts increase the cost of equity capital, and certain governance mechanisms that mitigate agency risks should lower the cost of equity capital. Empirical studies (e.g., Chen, Chen, and Wei, 2011; Attig, Cleary, El Ghoul, and Guedhami, 2013) provide evidence consistent with this argument. We contribute to this stream of literature by showing that CEO inside debt—a significant component of executive compensation—could be perceived as a risk-reduction factor and lower the cost of equity capital.

Lastly, our study adds to the literature examining the determinants of the cost of equity capital. These studies find that the cost of equity capital is positively associated with dividend taxes (Dhaliwal, Krull, Li, and Moser, 2005), analysts' optimism (Easton and Sommers, 2007), internal control deficiencies (Ashbaugh-Skaife, Collins, and Lafond, 2009), greater financial reporting frequencies (Fu, Kraft, and Zhang, 2012), executive pay disparity (Chen, Huang, and Wei, 2013), and environmental externalities (Chava, 2014), but negatively associated with political connections (Boubakri, Guedhami, Mishra, and Saffar, 2012), long-term institutional ownership (Attig, Cleary, El Ghoul, and Guedhami, 2013), and CEO ability (Mishra, 2014). Our study adds to this long stream of literature by identifying CEO inside debt holdings as a significant determinant of the cost of equity capital.

The next section will review the prior literature, and explain how CEO inside holdings could influence the cost of equity capital. Section 3 introduces data sources and present descriptive statistics. Sections 4 to 6 present empirical results. Section 7 provides a brief summary and concluding remark.

2. Literature and Hypotheses

This section discusses related literature, and formulates the hypothesis on the relation between CEO inside debt holdings and the cost of equity capital.

2.1. What are CEO Inside Debt Holdings?

While executive compensation in the US is assumed to consist primarily of cash- and equity-based compensation, an emerging literature (see, e.g., Sundaram and Yermack, 2007) suggests that executives of U.S. firms have received significant amounts of pay in the form of defined benefit pension plans for decades and often participated in compensation schemes that allow them to delay the receipt of current-year salary and bonus income until retirement.

Both CEO pensions and deferred compensation plans are often *unfunded* and *unsecured* to preserve their tax-deferral benefits and to be exempt from the rules applicable to ordinary tax-qualified plans under Employee Retirement Income Security Act (ERISA). Here, "unfunded" means that firms often do not allocate money to the pension or deferred compensation plans, but only make payments after executives or employees retire although the pension and deferred compensation accounts are stated to accumulate and grow over time. "Unsecured" refers to the fact that when a firm files bankruptcy, bankruptcy courts typically classify the beneficiaries of the pension and deferred compensation plans as unsecured creditors of the firm. In a word, CEO pensions and deferred compensation offers debt-like payoffs: if the firm remains solvent, the beneficiaries receive fixed payoffs under these plans based on a scheduled payment scheme; if the firm goes bankrupt, the beneficiaries are treated as unsecured creditors and could only receive partial payoffs that are proportional to the firm's liquidation value. Therefore, CEO pensions and deferred compensation are generally referred to as CEO inside debt holdings.

2.2. How Can CEO Inside Debt Holdings Influence the Cost of Equity Capital?

Debtholders (fixed claimants to firm assets) and stockholders (residual claimants) have significantly different payoffs and risk appetites, creating a variety of agency problems such as claim dilution, underinvestment, and risk shifting. Prior studies (e.g., Jensen and Meckling, 1976; DeFusco, Johnson, and Zorn, 1990; Edmans and Liu 2011; Anantharaman, Fang, and Gong, 2014) argue that paying debt-like compensation to executives could mitigate debtholder-shareholder conflicts in leveraged firms and reduce cost of debt.[4] However, none

[4] For example, Jensen and Meckling (1976) suggest that agency cost of debt can be reduced, if a firm grants managers not only equity but also debt compensation in a ratio similar to the firm's debt-to-equity ratio. Edmans and Liu (2011) show that inside debt is a superior remedy for shareholder-debtholder conflicts than cash-based compensation (e.g., bonuses and salaries), and inside debt can improve managerial effort as well as alleviate agency costs of debt if bankruptcy is likely.

of these studies explicitly examine whether inside debt holdings of managers exert a significant influence on the cost of equity capital, which is the focus of our study.

Because the value of inside debt holdings is sensitive to both bankruptcy risks and the liquidation value of the firm in the bankruptcy event, some recent studies argue that inside debt holdings can counterbalance risk-taking incentives of equity-based compensation and induce managers to adopt conservative firm policies. These studies find that greater inside debt holdings are found to be associated with lower firm risk (Cassell et al., 2012; Choy, Lin, and Officer, 2014), less aggressive financial reporting practices (He, 2014; Wang, Xie, and Xin, 2014), value-increasing M&As (Phan, 2014), lower propensity to avoid taxes (Chi, Huang, and Sanchez, 2014; Kubick, Lockhart, and Robinson, 2014), etc. The managerial conservatism induced by inside debt holdings should be valued by shareholders, because prior studies (e.g., Bhattacharya et al., 2012) find that shareholders are usually averse to aggressive managerial behaviors and demand greater returns from firms engaging in these behaviors (e.g., value-destroying M&A, aggressive financial and tax reporting, etc.). If greater CEO inside debt holdings can induce managers to adopt more conservative firm policies, shareholders may perceive CEO inside debt holdings as a risk-reduction factor and lower their required rate of stock returns, leading to a *negative* relation between CEO inside debt holdings and the cost of equity capital.

However, there are also arguments predicting a *positive* relation between CEO inside debt holdings and the cost of equity capital. First, a substantial amount of debt-like compensation may result in a relative low ratio of equity-based compensation to total compensation and, consequently, lead to a potential misalignment between the CEO's incentives and those of outside shareholders. It suggests that greater CEO inside debt holdings could increase shareholders' concerns on agency risks engendered by debtholder-

shareholder conflicts, leading to a *positive* relation between CEO inside debt holdings and the cost of equity.

Second, Bebchuk and Fried (2005) argue that the value of executives' retirement packages and deferred compensation could be largely unrelated to their performance while in office. It suggests that CEO inside debt holdings could reduce pay-performance sensitivity and manifests itself as the agency conflicts between shareholders and managers. Some studies (e.g., Albuquerque and Wang, 2008; Chen, Chen, and Wei, 2011) show that agency conflicts increase the cost of equity capital. Therefore, if significant inside debt holdings could lead to less pay-performance sensitivity and greater agency conflicts, then we expect CEO inside debt holdings should be *positively* related to the cost of equity capital.

Taken together, the preceding discussions suggest that CEO inside debt holdings could be perceived by shareholders as a priced factor that constrains managers from adopting aggressive firm policies, leading to a *lower* cost of equity. Or, it could aggravate shareholders' concerns on debtholder-shareholder conflicts and lower pay-for-performance sensitivity, which would lead to a *greater* cost of equity. All told, the overall effect of CEO inside debt holdings on the cost of equity capital will depend on the relative strengths of these two competing effects. It is therefore an empirical issue to examine whether the relationship is negative or positive.

3. Variable Definitions, Research Design and Summary Statistics

This section presents our empirical measures for CEO inside debt holdings and the cost of equity capital, describes the main empirical model and the sample selection procedure, and presents the summary statistics.

3.1. Measures of CEO Inside Debt Holdings

We define CEO inside debt as the sum of present values of accumulated pension benefits and deferred compensation of a CEO as reported in Execucomp Database. Specifically, the pension of the CEO is the present value of the accumulated pension benefits under the company's pension plans for a CEO in a year, while the deferred compensation is the aggregate balance in non-tax-qualified deferred compensation plans for a CEO in a year. We define CEO equity holdings as the total value of stocks and stock options held by the CEO in a year. We then define the CEO's debt-to-equity ratio as the ratio of CEO inside debt to CEO equity holdings.

Jensen and Meckling (1976), Sundaram and Yermack (2007), and Edmans and Liu (2011) demonstrate that the incentive alignment varies with the relative weight of debt- versus equity-based compensation in the executive pay structure. For example, they argue that if a CEO's debt-to-equity ratio is lower than the firm's debt-to-equity ratio, then the CEO could be tempted to engage in debtholder expropriation on behalf of shareholders. On the contrary, a high level of CEO debt-to-equity ratio could align the CEO's interest closely with those of debtholders, and potentially incentivize the CEO to take actions to transfer wealth from shareholders to debtholders. These discussions suggest that the comparison between the CEO's debt-to-equity ratio and the firm's debt-to-equity ratio would better capture the dynamics in CEO incentives from their debt and equity holdings.

We follow prior studies (e.g., Wei and Yermack, 2011) to construct the CEO relative debt-equity ratio (*CEO-firm D/E*), which is equal to a CEO's debt-to-equity ratio divided by the firm's debt-to-equity ratio. In addition, we also follow Wei and Yermack (2011) to construct a similar statistic based upon the CEO's and firm's changes in debt and equity value for a unit change in the value of the firm. Specifically, the CEO relative incentive ratio (*CEO-firm ΔD/ΔE*) is defined as (*CEO ΔD/CEO ΔE*)/(*Firm ΔD/Firm ΔE*), where the variables in changes are computed based on the assumption that the value of the firm

increases by one unit. In other words, this CEO relative incentive ratio, which is in the same spirit of the *k* ratio derived in Edmans and Liu (2011), captures how one unit change in the value of the firm influences the relative value of the CEO's inside debt versus inside equity claims, scaled by a similar measure of how a same unit increase in firm value would cause changes in the company's external debt versus external equity claims.

3.2. Measures of the Cost of Equity Capital

We use four methods to empirically estimate the cost of equity that is implied in current stock prices and analysts' earnings forecasts. The first method is based on Ohlson's (1995) residual income valuation model and derived by Gebhardt, Lee, and Swaminathan (2001). The latter three models, introduced by Easton (2004) and Ohlson and Juettner-Nauroth (2005), are constructed based on Ohlson and Juettner-Nauroth's abnormal earnings growth valuation model.

Appendix A provides a detailed introduction to these models.[5] Prior literature does not have consensus on which models perform best (Botosan and Plumlee, 2005; Gode and Mohanram, 2003). We follow prior studies (e.g., Hail and Leuz, 2006) and use the median value of the risk premiums ($Prem^{MED}$) estimated from the four models as our measure of the cost of equity to mitigate the potential measurement errors associated with each individual model.

3.3. Baseline Regression Model

We use the following regression model, hereafter baseline model, to test our hypothesis:

[5] To isolate the influence of time-variation in risk-free rate of returns, we compute risk premium as the difference between the implied cost of equity capital and risk-free rate of return and use risk premium as the dependent variables of our regressions. [6] The summary statistics indicate that the mean values of the inside debt measures are significantly greater than the median values, indicating the existence of extreme observations.

$$Prem^{MED} = f\ (CEO\ inside\ debt\ holdings,\ CEO\ attributes,\ firm\ characteristics,\ year\ dummies,\ industry\ dummies), \quad (1)$$

where $Prem^{MED}$ is the median value of the four equity premium measures computed based on the implied cost of equity. To mitigate the influences of outliers, we use the logarithm of the CEO inside debt holdings measures.[6] Specifically, the key independent variables include the logarithm of CEO relative debt-equity ratio (*CEO-firm D/E*) and the logarithm of the CEO relative incentive ratio (*CEO-firm ΔD/ΔE*). Following prior studies (e.g. Anantharaman, Fang, and Gong, 2014), we include several variables to control for the effect of CEO characteristics. *CEO Delta* is the dollar increase (in million dollars) in the value of a CEO's compensation portfolio if the stock price increases by 1%. *CEO Vega* is the dollar increase (in million dollars) in the value of a CEO's compensation portfolio if the stock return volatility increases by 1%. *CEO Age* is the age of the CEO in a specific year. *CEO Tenure* is the number of years that the current CEO has worked as a CEO in the firm. We also include some firm-level variables to isolate the effects of firm size, profitability, growth potential (*MVE*), growth opportunity (*B/M*), leverage, and firm risk (*Volatility*). In addition, Ogneva, Subramanyam, and Raghunandan (2007) find that analyst forecast optimism is positively related to cost of equity, while Fu, Kraft, and Zhang (2012) provide evidence that firms with greater information asymmetry have a greater cost of equity. We include analyst forecast properties (*FBias* and *FError*) to control the effects of analyst optimism and information asymmetry. Please refer to Appendix B for detailed definitions of these variables. Lastly, we include dummy variables to control for year effects and two-digit SIC industry effects in the regression models.

3.4. Sample Selection and Summary Statistics

[6] The summary statistics indicate that the mean values of the inside debt measures are significantly greater than the median values, indicating the existence of extreme observations.

We construct the sample using data from various sources. We obtain information of CEO inside debt holdings and other CEO characteristics from the Compustat Execucomp database. We obtain analyst forecast data from IBES database and financial data from the Standard & Poor's Compustat database. Data is then merged from the various sources and observations containing missing values are removed. The final sample consists of 8,182 firm-year observations from 2006 to 2013. The sample period starts in year 2006 because Execucomp database report inside debt holdings data from 2006.

Table 1 reports descriptive statistics for all variables used in the baseline model. The cost of equity measures have mean values ranging from 3% to 8%. The mean and median values of $Prem^{MED}$ are 5.47% and 4.73%, respectively. These statistics are in line with those reported in prior studies (e.g., Chen, Chen, and Wei, 2011; Attig, Cleary, El Ghoul, and Guedhami, 2013). Table 1 also indicates that the average CEO debt-to-equity ratio (*CEO D/E*) is approximately 0.278. By comparison, Wei and Yermack (2011) and Phan (2014) report that the mean values of CEO debt-to-equity ratio are 0.22 and 0.322, respectively. The mean value of CEO relative debt-equity ratio (*CEO-firm D/E*) and CEO relative incentive ratio (*CEO-firm ΔD/ΔE*) are 1.76 and 2.53, respectively. The statistics are comparable to those reported in some prior studies. For example, Anantharaman, Fang, and Gong (2014) report that the mean value of CEO relative debt-equity ratio is 1.29, and Cassell, Huang, Sanchez, and Stuart (2012) show that the mean CEO relative incentive ratio is 2.47. We also find that CEO relative debt-equity ratios are greater than one (i.e., *I{CEO-firm D/E>1}*) in around 23.2% of sample firms.

Table 1 shows that the mean values of *CEO Delta* and *CEO Vega* are \$0.44 million and \$0.12 million, respectively. On average, the CEOs in the sample are 56 years old. The mean market value of equity is roughly \$10 billion, and the average firm leverage is around 0.175. The mean values of *Firm Age* and *Volatility* are around 25 and 0.10, respectively.

Lastly, the average analyst forecast bias (*FBias*) is 0.028. The statistics of these CEO and firm characteristics are in the range of those reported in prior studies (e.g., Chen, Huang, and Wei, 2013).

[Insert Table 1 here]

4. The Relation between CEO Inside Debt Holdings and the Cost of Equity

This section presents the results of univariate tests and regression analyses on the relation between CEO inside debt holdings and the cost of equity capital.

4.1. Univariate Analyses

In Table 2, Panel A displays Pearson correlation coefficients for the individual cost of equity measures (i.e., $Prem^{GLS}$, $Prem^{OJ}$, $Prem^{PEG1}$, and $Prem^{PEG2}$). The results indicate that all of these measures are positively and significantly correlated. Therefore, prior studies (e.g., Hail and Leuz, 2006) use the median value ($Prem^{MED}$) of the four variables as the key measure for the cost of equity.

[Insert Table 2 here]

We also conduct a simple univariate test to compare the cost of equity capital across firms with zero CEO inside holdings and firms with positive CEO inside debt holdings. In Panel B of Table 2, the upper (lower) panel presents the mean (median) values of the cost of equity measures across these two subsamples. We find that the cost of equity of firms with positive CEO inside debt holdings is generally smaller than that of firms with zero inside debt. We perform the *t*-test (Wilcoxon sign-rank test) to determine whether the mean (median) values of the cost of equity measures for firms with positive inside debt holdings are greater those for firms with zero inside debt. The last column indicates that the differences are statistically significant at 1% level. The univariate test results in Panel B confirm the negative

correlation between CEO inside debt holdings and the cost of equity capital that is presented in Panel A. Overall, Table 2 provides preliminary evidence that CEO inside debt holdings are negatively related to the cost of equity capital.

4.2. Baseline Regressions

The univariate analysis results in Table 2 are rudimentary because the negative relation revealed in the univariate tests may be driven by the influences of some omitted CEO and firm characteristics. Therefore, we estimate the multivariate model using ordinary least squares (OLS) regressions with standard errors adjusted for heteroskedasticity and within firm clustering. We first include firm-level control variables and report the results in models 1 and 2 of Table 3. We then add CEO characteristics to the regressions and present these baseline regression results in the last two columns of Table 3.

We find that the coefficients on the CEO inside debt measures are all negative and statistically significant at the conventional level. These results suggest that firms with large CEO inside debt holdings have significantly lower cost of equity, even after the effects of firm-level and CEO-level characteristics are controlled. It is consistent with the conjecture that shareholders perceive CEO inside debt holdings as a risk-reduction factor that constrains CEOs from adopting aggressive firm policies, and, consequently, shareholders could demand lower required rate of returns.

[Insert Table 3 here]

Consistent with previous studies (e.g., Richardson and Welker, 2001; Dhaliwal, Heitzman, and Li, 2006; Ogneva, Subramanyam, and Raghunandan, 2007; Chen, Huang, and Wei, 2013), we find that firms with higher leverage, greater stock return volatilities, and greater analyst forecast bias have greater cost of equity capital. Similar to Ogneva, Subramanyam, and Raghunandan's (2007) findings, we do not find that market value of

equity is a significant determinant of cost of equity capital. In addition, there is an insignificant relation between CEO characteristics and the cost of equity.

We conduct a variety robustness tests on the negative relation between CEO inside debt holdings and the cost of equity capital. First, to assess the sensitivity of our results with respect to different estimation methods, we estimate the baseline regression model using the Fama-MacBeth (1973) method. Second, prior studies (e.g., Bennett, Guntay, and Unal, 2012) find that less than one percent of the CEOs have a relative debt-to-equity ratio that exceeds one. In addition, finance and utilities industries are regulated industries. In a robustness check, we follow some previous studies (e.g., Eisdorfer, Giaccotto, and White, 2013) to exclude utilities (SIC codes 4900–4949) and finance companies (SIC codes 6000–6999) from the sample. We re-run the baseline regression based on this reduced sample consisting only of non-finance and non-utilities firms. The results show that the coefficients on the inside debt measures are negative and statistically significant across all the models. It suggests that the main finding from baseline regressions is robust to different regression methods and alternative samples.

4.3. Explore the Non-linearity

We also conduct tests to explore the non-linearity in the relation between CEO inside debt holdings and the cost of equity. As discussed, CEO inside debt holdings could have two opposite effects on the cost of equity. First, CEO inside debt holdings could be perceived by shareholders as a risk-reduction factor and therefore lead to lower cost of equity capital. Second, greater CEO inside debt holdings could increase shareholders' concerns on agency risks engendered by debtholder-shareholder conflicts and lower pay-for-performance sensitivity, leading to greater cost of equity. The overall negative relation between these two variables as reported in baseline regressions suggests that the first effect is the dominant force.

However, with the increase of CEO inside debt holdings, the specter of risk exposure associated with debtholder-shareholder conflicts and lower pay-for-performance sensitivity becomes more salient for shareholders. It dampens the overall negative relation between CEO inside debt holdings and the cost of equity, suggesting a potential non-linear relation.

We estimate the following regressions to explore the non-linear relation. First, we construct two dummy variables, *I{CEO-firm D/E>1}* and *I{CEO-firm ΔD/ΔE>1}*, which are equal to one if the corresponding inside debt variable is greater than one, and zero otherwise. We then add the two dummy variables and their interaction terms with the inside debt measures to the baseline regression, respectively. We report the results in the first two columns of Table 4. We find that the coefficients on the interaction terms are both positive and statistically significant, indicating that the negative relation between CEO inside debt holdings and the cost of equity capital is significantly weaker when the level of inside debt holdings increases. We also add the squared term of inside debt measures to the baseline regressions (i.e., $Log(1+CEO\text{-}firm\ D/E)^2$ and $Log(1+CEO\text{-}firm\ \Delta D/\Delta E)^2$). Columns 3 and 4 of Table 5 show that the coefficients on the squared terms are both positive and statistically significant, confirming that the nonlinear relation between CEO inside debt holdings and the cost of equity. The finding of a non-linear relation is interesting, because it lends support to the argument that a higher level of CEO inside debt holdings could increase shareholders' concerns of agency risk engendered by potential debtholder-shareholder conflicts and lower pay-for-performance sensitivity (Bebchuk and Fried, 2005).

[Insert Table 4 here]

5. Identification strategies

In this section, the use of CEO turnover events identifies the causal effect of CEO inside debt holdings on the cost of equity. An instrumental-variable two-stage regression approach is also employed to mitigate the endogeneity concern.

5.1. Tests on CEO Turnover Events

CEO turnover events could generate shocks to the level of CEO inside debt holdings, especially if the CEO is appointed from outside of the company. Regression analyses using changes in variables are generally less likely to show spurious relations than those using level variables. If the changes in CEO inside debt holdings have a significant effect on the changes in the cost of equity capitals around the CEO turnover events, it can be inferred that CEO inside debt holdings have a causal effect on the cost of equity capital.

Within our sample, we are able to identify 518 CEO turnover events. We define the change in a variable as the difference of this variable after the turnover event versus prior to the event. We use the changes in variables to re-run the baseline regressions. Columns 1 and 2 of Table 5 report the results. The results show that the coefficients on *ΔLog(1+CEO-firm D/E)* and *ΔLog(1+CEO-firm ΔD/ΔE)* are both negative and statistically significant, which is consistent with the main findings from the baseline regressions in Table 3.

[Insert Table 5 here]

If shareholders expect a CEO turnover event and foresee the forthcoming changes in the level of CEO inside debt holdings, then shareholders might adjust their expectation on required returns and stock values. Therefore, the changes in CEO inside debt holdings should have a stronger effect on the cost of equity capital for those CEO turnover events that are less expected by outside shareholders. A CEO turnover event is classified as "expected" if (i) the

stepping-down CEO is of age higher than 65 or (ii) the average ROA reported by the firm in last three fiscal years is negative; and any other CEO turnover events are classified as "less expected" ones. The aforementioned regressions re-estimate using changes in variables for these two types of CEO turnover events. The results are reported in the last four columns of Table 5. Consistent with our conjecture, the coefficients on *ΔLog(1+CEO-firm D/E)* and *ΔLog(1+CEO-firm ΔD/ΔE)* are all negative but only significant when the CEO turnover events are "less expected" ones.

5.2. Instrumental-Variable Regressions

CEO inside debt holdings could be endogeneously influenced by some other variables. To mitigate the endogeneity concern, we use an instrumental-variable two-stage regression as the second identification strategy.

In their study of CEO pensions, Sundaram and Yermack (2007) find that liquidity constraints are important determinants of inside debt compensation. We follow Cassell et al. (2012) and Phan (2014) to use two instruments for liquidity constraint. The first instrument is a dummy variable (*NegCF Dummy*), that takes a value of one if the firm is experiencing liquidity constraint proxied by negative operating cash flow and zero otherwise. The second instrument is also a dummy variable (*Dividend Dummy*) that equals one if a firm pays cash dividend and zero otherwise. Sundaram and Yermack (2007) also show that the value of the CEO's pension is positively related to CEO age.[7] We also use *CEO Age* as an instrument. A new CEO tends to have lower inside debt holdings, especially the CEO is appointed from outside of the company. Following Phan (2014), we select the new CEO dummy (*New CEO*

[7] We did not find CEO Age as a significant determinant of the cost of equity capital in our previous tests. Thus, CEO Age can be excluded from the second-stage regression and service as a valid instrument in the first-stage regression. For brevity, we also drop a few insignificant variables (e.g., CEO Delta and Vega) from the baseline regressions.

Dummy), a dummy variable takes a value of one if the firm has a new CEO, and the maximal state tax rate (*Max Tax Rate*) as the other two instruments.

In Table 6, columns 1 and 3 present results from the first-stage regression. The dependent variable is one of the inside debt variables, i.e., *Log(1+CEOfirm D/E)* and *Log(1+CEOfirm ΔD/ΔE)*. The independent variables include the four instrumental variables, and all control variables in the second-stage regression. We find that the coefficients on three of these instruments are statistically significant. In particular, consistent with the expectations, the coefficient on *New CEO Dummy* is negative and the estimate on *CEO Age* is positive. A valid instrumental variable in this setting should also have no direct effect on CEO inside debt holdings. We examine this condition and find that it is met. We include the instruments as additional control variables in the second-stage model, and find that they are uncorrelated with the inside debt measures. Results from this additional analysis are not tabulated.

[Insert Table 6 here]

We compute the predicted value of the inside debt variable (i.e., *Instrumented Inside Debt*) based on the estimates obtained from the first-stage regressions in column 1 (column 3) and use as the dependent variable in column 2 (column 4), respectively. That is, columns 2 and 4 report the results from the second-stage regressions, in which the key independent variables are the *Instrumented Inside Debt*. We find that the coefficients on *Instrumented Inside Debt* are both negative and statistically significant, indicating that endogeneity of inside debt is unlikely to be a serious issue affecting the estimation of the baseline model.

6. The Role of Bankruptcy Risk

We have established a robust and negative relation between CEO inside debt holdings and the cost of equity capital. This main finding is consistent with the conjecture that CEO inside debt holdings deter aggressive managerial behaviors, and therefore lead to lower

required returns of shareholders. In this section, we explore whether such a negative relation varies across firms with different levels of bankruptcy risk. Edmans and Liu (2011) argue that when bankruptcy is likely, then CEO inside debt holdings could be desired to induce beneficial outcome (e.g., managerial effort to increase liquidation value).[8] This argument implies that the beneficial effect of CEO inside debt holdings should be more prominent among firms with greater bankruptcy risk. To test this corollary of Edmans and Liu's (2011) theory, we conduct the following subsample analysis.

We use two variables to measure a firm's bankruptcy risk: firm leverage and Altman's Z-score. In particular, we classify high bankruptcy risk firms as those with the levels of firm leverage or Z-score that are greater than the sample medians, respectively. Also, since the theory predicts that the managerial conservatism induced by the "excessive" inside debts should be most prominent for low-bankruptcy risk firms, we further divide the sample based on whether the relative leverage or relative incentive ratios are greater than one. As such, we conduct a two-by-two division of the sample, by bankruptcy risk and by whether the inside debt holding is excessive.

We then estimate the baseline model for each of the subsamples. To save space, Table 7 only reports the coefficients of inside debt variables. Such an investigation yields interesting findings. When the relative leverage ratio or relative incentive ratio is less than one, we find that the magnitude of negative relation between inside debt and cost of equity is indeed larger when the bankruptcy risk is higher (i.e., when the firm leverage is higher or when the Z-score is lower their medians). The difference between the estimated coefficients is significant at 5% level based on the Wald test. These findings are consistent with the

[8] Specifically, inside debt yields a positive payoff in bankruptcy, proportional to the liquidation value. Thus, it renders the manager sensitive to the firm's value in bankruptcy, and induces greater managerial effort to increase the value of the financially distressed firms.

notion that the risk-curbing effect of inside debt is most valuable when the bankruptcy is imminent.

[Insert Table 7 here]

However, when the inside debt holding is relatively high (that is, when the relative leverage or incentive ratios greater than one), the negative relation between inside debt and cost equity disappears. Moreover, such a relation turns to positive for low-bankruptcy risk firms (i.e., low leverage or high Z-score firms), although only two of the four coefficients are statistically significant. In sum, these results are consistent with the argument that CEO inside debt holdings is more desired to induce beneficial effects when bankruptcy is likely. If the likelihood of bankruptcy is remote, then shareholders' concerns of debtholder-shareholder conflicts and lower pay-for-performance sensitivity outweigh the beneficial effects of inside debt, leading to a positive relation between CEO inside debt holdings and the cost of equity capital.

7. The Influence of Inside Debt Holding on Future Firm Value

The cost of equity capital, as a measure of the risk premium applied in the equity valuation model, essentially reflects the shareholders' assessment of the risk associated with the given firm. We interpret our main finding, the overall negative relation between inside debt and the cost of equity, as evidence that shareholders perceive inside debt as a risk-reduction mechanism constraining aggressive managerial behaviors. A related but unanswered question, however, is whether such a reduction in risk is accompanied by a reduction of firm performance as well. That is, do inside debt holdings incentivize managers to become over-conservative and lower the risk at the cost of lower firm performance?

If this is the case, then the "net" value of inside debt to shareholders might not be positive, because firm performance and risk create opposite impacts on the shareholders'

utility function. The utility increased by risk reduction might be eroded by the decreased performance. Yet, it also is possible that the inside debt indeed contributes to trim the "excessive" risk – in the sense it leads the CEO to select investment project carefully and avoid those projects that do not have high enough expected returns to justify the risks. In this case, firms with higher inside debt holdings may eventually have both lower risks and higher future performance.

To empirically investigate this issue, we examine how inside debt holdings affect the forward-looking performance measures, such as the average Tobin's Q (Q^{FWD}) and return on assets (ROA^{FWD}) over the future three years (year *t+1* to *t+3*). If the reduced risk is obtained at the cost of performance, we should find a negative relation between cotemporaneous inside debt and the forward firm performance. In contrast, if inside debt holding leads the manager to screen projects carefully, a positive association between these two variables is expected. To detect the possible detrimental over-conservatism induced by excessive inside debts, we also include the squared term of inside debt variables as in Table 4 to capture the non-linearity relation in our model.

The results in Table 8 indicate the association between inside debt variables and the future firm performance is actually positive. Such finding is consistent with the notion that inside debt holing has the effect of curbing manager's excess risk-taking behavior and improves the firm performance. However, the beneficial effect of inside debt is not monotonic, just as in Table 4. The coefficient of the squared term of inside debt variable is negative. It suggests that excess inside debt holdings could make managers overly conservative and bypass valuable risky project, resulting in lower future performance. Overall, the findings indicate that inside debt holdings have an overall positive but diminishing effect on firm performance.

[Insert Table 8 here]

8. Conclusion

We provide evidence that CEO inside debt holdings have an overall negative effect on the cost of equity capital. We use the tests based on CEO turnover events and the instrumental-variable approach to identify the causal relation between CEO inside debt holdings and the cost of equity capital. The negative relation is consistent with the conjecture that CEO inside debt holdings deter aggressive managerial behaviors, and therefore lead to lower required returns of shareholders.

Furthermore, we find that the relation between CEO inside debt holdings and the cost of equity capital is non-linear. Specifically, the negative relation is dampened when the level of CEO inside debt increases. This finding lends support to the argument that a high level of CEO inside debt holdings could increase shareholders' concerns on agency risk engendered by debtholder-shareholder conflicts and lower pay-for-performance sensitivity. In addition, the subsample analyses indicate that the negative relation between CEO inside debt holdings and the cost of equity capital is stronger in firms with greater bankruptcy risk.

To the best of our knowledge, this study is the first one showing a robust and negative relation between the use of debt-like compensation and the cost of equity capital. This finding highlights the benefit of compensating managers with inside debt, which could be of particular interests to board of directors. Thus, this study contributes to the emerging literature on debt-like compensation (e.g., Cassell et al., 2012; Choy, Lin, and Officer, 2014).

In addition, although some prior studies (e.g., He, 2014; Phan, 2014) find that CEO inside debt holdings induce managers to adopt less aggressive firm policies, these studies fail to answer whether such a role of CEO inside debt holdings is valued by shareholders. This paper complements to this stream of literature, and provides direct evidence that CEO inside debt holdings are valued by shareholders as an incentive mechanism constraining aggressive

managerial behaviors. Likewise, this study also contributes to literature on whether corporate governance influences the cost of capital by showing CEO inside debt—a significant component of executive compensation—is a significant determinant of the cost of equity capital.

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Appendix A. Estimation Methods of the Cost of Equity Capital

We estimate the implied cost of equity based on the four following models. For each of the models, we use a numerical approximation program to solve for the implied cost of equity that equates the right- and left-hand sides of the following four models.

1. Gebhardt, Lee and Swaminathan (2001)

We estimate the cost of equity capital based on the following equations.

$$P_t^* = B_t + \sum_{i=1}^{T-1} \frac{[FROE_{t+i} - R_{GLS}] \times B_{t+i-1}}{(1+R_{GLS})^i} + \frac{[FROE_{t+T} - R_{GLS}] \times B_{t+T-1}}{(1+R_{GLS})^{T-1} R_{GLS}}$$

where P_t = Adjusted market price of a firm's stock at time t. We estimate the cost of equity at month +4, therefore we adjust the stock price at month +4 (i.e., $P_t^* = P_t / (1+R_{GLS})^{4/12}$) to account for the partial year discounting.

B_t = Book value per share at the beginning of the fiscal year.

$FROE_{t+i}$ = mean forecasted earnings per share from I/B/E/S or implied EPS forecasts for year $t+i$ ($FEPS_{t+i}$), *scaled by* book value per share at the beginning of the corresponding fiscal year (B_{t+i-1}).

R_{GLS} = the implied cost of equity derived by Gebhardt, Lee and Swaminathan (2001), which is one of the four different models.

We follow prior studies (e.g., Chen, Chen, and Wei, 2011) to use IBES analysts earnings per share forecasts (*FEPS*) to proxy for the market expectations of a firm's earnings for the next 3 years. We measure *FEPS* by assuming that the future return on equity (*FROE*) decline linearly until it reaches an equilibrium ROE, which carries on from the 4th year to the T-th year. This equilibrium ROE is measured by a historical, 10-year, industry-specific median return on equity. The ROE is defined as the income available to common shareholders (IBCOM) scaled by the lagged total book value of equity (CEQ). We classify all firms into the 48 industries in Fama and French (1997). Following Gebhardt, Lee and Swaminathan (2001), firm-year observations with a negative ROE are excluded from our sample. Future book values are estimated by assuming clean surplus relation ($B_{t+1} = B_t + EPS_{t+1} - DPS_{t+1}$), where the future dividend, DPS_{t+1}, is calculated by multiplying EPS_{t+1} by *POUT*. *POUT* is the forecasted dividend payout ratio, which is measured by the ratio of the

indicated annual dividends from IBES and $FEPS_{t+1}$. If $FEPS_{t+1}$ is negative, we follow prior studies to assume a return on assets of 6% to calculate earnings. We also assume T = 12.

2. Ohlson and Juettner-Nauroth (2005)

We follow Ohlson and Juettner-Nauroth (2005) to estimate the cost of equity capital based on the following equations.

$$P_t^* = \frac{E_t(EPS_{t+1})}{R_{OJ}} + \frac{E_t(EPS_{t+1})E_t[g_{st} - R_{OJ} \times (1 - POUT)]}{R_{OJ}(R_{OJ} - g_{lt})}$$

where g_{st} is the average of short-term earnings growth rate implied in EPS_{t+1} and EPS_{t+2} and the analysts' forecasted long-term growth rate. The implementation of this model requires that EPS_{t+1}>0 and EPS_{t+2} > 0.

3. Easton (2004) - Modified Price-earnings Growth Ratio Model (PEG1)

We follow Chen, Chen, and Wei (2011) to estimate PEG model of Easton (2004) in the following form.

$$P_t^* = \frac{E_t(EPS_{t+1})}{R_{MPEG}} + \frac{E_t(EPS_{t+1})E_t[g_{st} - R_{MPEG} \times (1 - POUT)]}{R_{MPEG}^2}$$

where the variables are defined as those in other models of cost of equity capital.

4. Easton (2004) – Alternative Estimation of PEG Model (PEG2)

We also estimate the PEG model with the original expression in Easton (2004) as follows.

$$P_t^* = \frac{[E_t(EPS_{t+2}) + E_t(EPS_{t+1})(R_{PEG}POUT - 1)]}{R_{PEG}^2}$$

where the variables are defined as those in other models of cost of equity capital. In essence, it replaces the average earnings growth rate g_{st} in *PEG1* with the short-term growth rate $E_t(EPS_{t+2})/E_t(EPS_{t+1})-1$.

Appendix B. Variable Definitions

Variable	Definition
$Prem^{GLS}$	The difference between the cost of equity capital and risk-free rate, where cost of equity is measured with the method developed in Gebhardt, Lee, and Swaminathan (2001) and risk-free rate is measured as the yield on 10-year Treasury bond.
$Prem^{OJ}$	The difference between the cost of equity capital and risk-free rate, where cost of equity is measured with the method developed in Ohlson and Juettner-Nauroth (2005) and risk-free rate is measured as the yield on 10-year Treasury bond.
$Prem^{PEG1}$	The difference between the cost of equity capital and risk-free rate, where cost of equity is measured with the modified PEG model developed in Easton (2004) and risk-free rate is measured as the yield on 10-year Treasury bond.
$Prem^{PEG2}$	The risk premium estimated by an alternative form of PEG model.
$Prem^{MED}$	The median of four equity premium measures: $Prem^{GLS}$, $Prem^{OJ}$, $Prem^{PEG1}$, $Prem^{PEG2}$.
CEO-firm D/E	The CEO debt-to-equity ratio (*CEO D/E*) divided by the corporate debt-to-equity ratio (*Firm D/E*). *CEO D/E* is defined as the ratio of CEO inside debt holdings to the value of CEO equity holdings, where CEO inside debt is the sum of present values of accumulated pension benefits and deferred compensation as reported in Execucomp, and CEO equity holdings include the stocks and stock options held by CEO. *Firm D/E* is measured as the ratio of total debt to the market value of equity.
CEO-firm ΔD/ΔE	The CEO relative incentive ratio, defined as (*CEO ΔD*/*CEO ΔE*)/(*Firm ΔD*/*Firm ΔE*). CEO delta (*CEO ΔE*) is constructed as $S+\Sigma_i N_i \delta_i$, where S is the number of shares; N_i and δ_i are the number of options and the option delta for tranche i, respectively. Firm delta (*Firm ΔE*) is calculated using the total of number of employee stock options outstanding, the average exercise price of outstanding options, and an assumed remaining life of 4 years. Lastly, following Wei and Yearmack (2011), the change in the value of CEO inside debt holdings (*CEO ΔD*) and the change in the value of debt issued by the firm (*Firm ΔD*) corresponding to one-dollar increase in firm value are approximated by the values of CEO inside debt and firm debt, respectively.
CEO Delta	Dollar increase (in million dollars) in the value of a CEO's compensation portfolio if the stock price increases by 1%.
CEO Vega	Dollar increase (in million dollars) in the value of a CEO's compensation portfolio if the stock return volatility increases by 1%.
CEO Age	Age of the CEO in a specific year.
CEO Tenure	Number of years that the current CEO has worked as a CEO in the firm.
MVE	The market value of equity, calculated as the product of the number of share outstanding and the stock price at the end of year (Compustat items PRCC_F*CSHO).
B/M	The book-to-market ratio, calculated as the ratio of book value of equity (Compustat item CEQ) to the market value of equity.
Leverage	The leverage is the ratio of the sum of long-term debt (Compustat item DLTT) plus debt in current liabilities (DLC) to the market value of assets (AT-CEQ+ PRCC_F*CSHO).
Firm Age	The number of years since a company appears for the first time in CRSP.
Volatility	The annualized standard deviation of monthly stock returns.
FBias	The mean of analyst forecast bias for the annual earnings taken across different analysts. Forecast bias is defined as the actual EPS minus the forecasted EPS, scaled by the stock price at the fiscal year end. A positive forecast bias thus indicates an upward bias in the analyst forecasts.
FError	The mean of analyst forecast error for the annual earnings taken across different analysts. Forecast error is defined as the absolute value of the difference between actual EPS and forecasted EPS, scaled by the stock price at the fiscal year end.

Table 1. Descriptive Statistics

The sample consists of 8,183 firm-year observations from 2006 to 2013. $Prem^{MED}$ is the median value of taken across four equity premium measures rate for each of firm-year observation. The four equity premium measures include $Prem^{GLS}$, $Prem^{OJ}$, $Prem^{PEG1}$, and $Prem^{PEG2}$, which are defined as the differences between annual implied cost of equity and risk-free rate. Please refer to Appendix A for the detailed calculation method for these four measures. The CEO relative debt-to-equity ratio (*CEO-firm D/E*) is obtained by dividing CEO debt-to-equity ratio (*CEO D/E*) by corporate debt-to-equity ratio. The CEO relative incentive ratio (*CEO-firm ΔD/ΔE*) is defined as (*CEO ΔD*/*CEO ΔE*)/(*Firm ΔD*/*Firm ΔE*), where *CEO ΔD* and *CEO ΔE* are the changes in the values of CEO's inside debt and equity holdings for one-dollar change in firm value; and *Firm ΔD* and *Firm ΔE* are the changes in firm's debt and equity values for one-dollar change in firm value. *I{CEO-firm D/E>1}* is an indicator variables that equals to one if *CEO-firm D/E* is greater than one, and zero otherwise; *I{CEO-firm ΔD/ΔE>1}* is defined similarly. *CEO Delta* and *CEO Vega* estimate the change in CEO compensation portfolio value for a 1% change in stock price and 1% change in stock volatility, respectively. *CEO Age* is the age of CEO. *MVE* is the market value of equity. *B/M* is the book-to-market ratio. *Leverage* is the market leverage. *Firm Age* is the number of years since the firm appeared in the CRSP database. *Volatility* is the annualized standard deviation of monthly stock returns. *FBias* is the average analyst forecast bias for annual EPS. *FError* is the average analyst forecast error for annual EPS. Please refer to Appendix B for the detailed variable definitions.

Variable	Mean	Std Dev	Q1	Median	Q3
$Prem^{MED}$ (%)	5.469	4.596	2.406	4.730	7.272
$Prem^{GLS}$ (%)	3.007	4.634	0.285	1.761	4.129
$Prem^{OJ}$ (%)	5.549	4.816	2.411	4.771	7.320
$Prem^{PEG1}$ (%)	5.438	4.850	2.255	4.645	7.245
$Prem^{PEG2}$ (%)	8.035	5.137	4.587	7.014	10.215
CEO D/E	0.278	0.770	0.000	0.050	0.250
CEO-firm D/E	1.760	6.420	0.000	0.178	0.891
I{CEO-firm D/E>1}	0.232	0.422	0.000	0.000	0.000
CEO-firm ΔD/ΔE	2.529	6.310	0.000	0.189	1.507
I{CEO-firm ΔD/ΔE>1}	0.306	0.461	0.000	0.000	1.000
CEO Delta ($mm)	0.440	0.475	0.088	0.237	0.615
CEO Vega ($mm)	0.115	0.130	0.014	0.059	0.177
CEO Age	55.691	7.012	51.000	56.000	60.000
Assets ($mm)	14888.2	36509.4	1124.6	3356.7	10505.9
MVE ($mm)	10110.0	28895.8	907.1	2359.3	7033.6
B/M	0.608	0.415	0.328	0.523	0.779
Q	1.615	0.805	1.081	1.354	1.865
ROA	0.043	0.089	0.013	0.043	0.080
Capex	0.044	0.053	0.011	0.028	0.056
R&D	0.019	0.038	0.000	0.000	0.019
Leverage	0.175	0.144	0.065	0.143	0.254
Z-score	3.232	2.831	1.389	2.755	4.305
Firm Age	24.613	16.272	12.000	20.000	36.000
Volatility	0.101	0.050	0.064	0.090	0.129
FBias	0.028	0.248	-0.007	0.000	0.011
FError	0.105	0.336	0.006	0.014	0.045

Table 2. Correlation Matrix and Univariate Analyses

Panel A presents the Pearson correlation coefficients among the cost of equity measures (i.e., $Prem^{GLS}$, $Prem^{OJ}$, $Prem^{PEG1}$, and $Prem^{PEG2}$) and their median value ($Prem^{MED}$). Panel B presents the results of univariate analyses. This panel displays the mean and median values of the cost of equity measures for two subsamples: firms with positive CEO inside debt holdings and firms with zero inside debt holdings. We compute the differences in mean and median values across the two subsamples and report them in the last column (*Diff*). We also perform the *t*-test (Wilcoxon sign-rank test) to determine whether the mean (median) values of the cost of equity measures for firms with positive inside debt holdings are greater than those for firms with zero inside debt. *, **, *** denote significant at 10%, 5%, 1%, respectively.

Panel A: Correlation Matrix

	$Prem^{GLS}$	$Prem^{OJ}$	$Prem^{PEG1}$	$Prem^{PEG2}$
$Prem^{MED}$	0.575***	0.984***	0.962***	0.626***
$Prem^{GLS}$		0.520***	0.496***	0.390***
$Prem^{OJ}$			0.970***	0.587***
$Prem^{PEG1}$				0.581***

Panel B: Univariate Analyses

	Positive Inside Debt	Zero Inside Debt	
	Mean	Mean	Diff
$Prem^{MED}$	4.343	4.828	-0.485***
$Prem^{GLS}$	2.963	3.535	-0.572***
$Prem^{OJ}$	5.387	6.174	-0.787***
$Prem^{PEG1}$	5.262	6.014	-0.752***
$Prem^{PEG2}$	7.916	8.290	-0.373***
	Median	Median	Diff
$Prem^{MED}$	3.792	4.186	-0.395***
$Prem^{GLS}$	1.703	1.922	-0.219***
$Prem^{OJ}$	4.589	5.166	-0.578***
$Prem^{PEG1}$	4.478	5.037	-0.559***
$Prem^{PEG2}$	6.939	7.168	-0.229*

Table 3. Baseline Regressions

This table presents the baseline regression results. The cost of equity measure ($Prem^{MED}$) is the median value taken across the four equity premium measures for a firm in a given year. The CEO relative debt-to-equity ratio (*CEO-firm D/E*) is obtained by dividing CEO debt-to-equity ratio (*CEO D/E*) by corporate debt-to-equity ratio. The CEO relative incentive ratio (*CEO-firm ΔD/ΔE*) estimates the change in relative equity-debt ratio when firm values increases by 1%. Please refer to Appendix B for detailed variable definitions. Industry dummies and year dummies are included in the regressions. Intercept term is included but not reported to save spaces. The t-statistics reported in parentheses are based on White's robust standard error clustered at firm level. *, **, *** denote significant at 10%, 5%, 1%, respectively.

Variable	Dependent Variable = $Prem^{MED}$			
Log(1+CEO-firm D/E)	-0.224**		-0.265***	
	(-2.48)		(-2.88)	
Log(1+CEO-firm ΔD/ΔE)		-0.180**		-0.214**
		(-2.18)		(-2.55)
Log(1+CEO Delta)			-0.728***	-0.724***
			(-2.70)	(-2.71)
Log(1+CEO Vega)			0.078	0.086
			(0.10)	(0.11)
Log(MVE)	-0.042	-0.076	0.033	-0.008
	(-0.69)	(-1.20)	(0.44)	(-0.10)
B/M	0.306	0.312	0.254	0.262
	(1.20)	(1.22)	(0.98)	(1.01)
Leverage	3.622***	3.704***	3.499***	3.596***
	(5.69)	(5.84)	(5.54)	(5.72)
Firm Age	0.019***	0.020***	0.019***	0.019***
	(3.86)	(3.87)	(3.67)	(3.69)
Volatility	5.195***	5.205***	5.194***	5.206***
	(9.96)	(9.99)	(9.98)	(10.01)
FBias	1.048***	1.049***	1.069***	1.071***
	(2.88)	(2.88)	(2.93)	(2.94)
FError	1.698***	1.691***	1.695***	1.687***
	(6.25)	(6.22)	(6.25)	(6.22)
Industry Effect	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes
N	8183	8183	8183	8183
Adj R^2	0.196	0.196	0.197	0.197

Table 4. Explore the Non-linearity

This table presents a modified version of the baseline regression. The cost of equity measure ($Prem^{MED}$) is the median value taken across the four equity premium measures for a firm in a given year. The CEO relative debt-to-equity ratio (*CEO-firm D/E*) is obtained by dividing CEO debt-to-equity ratio (*CEO D/E*) by corporate debt-to-equity ratio. The CEO relative incentive ratio (*CEO-firm ΔD/ΔE*) estimates the change in relative equity-debt ratio when firm values increases by 1%. *I{CEO-firm D/E>1}* is an indicator variables that equals to one if *CEO-firm D/E* is greater than one, and zero otherwise; *I{CEO-firm ΔD/ΔE>1}* is defined similarly. *Log(1+CEO-firm D/E)*^{2} is the squared term of *Log(1+CEO-firm D/E)*; *Log(1+CEO-firm ΔD/ΔE)*^{2} is defined in the same way. Please refer to Appendix B for detailed variable definitions. Industry dummies and year dummies are included in the regressions. Intercept term is included but not reported to save spaces. The t-statistics reported in parentheses are based on White's robust standard error clustered at firm level. *, **, *** denote significant at 10%, 5%, 1%, respectively.

Variable	Dependent Variable = $Prem^{MED}$			
Log(1+CEO-firm D/E)	-1.322***		-1.113***	
	(-3.48)		(-4.85)	
Log(1+CEO-firm ΔD/ΔE)		-1.921***		-1.141***
		(-4.80)		(-5.18)
Log(1+CEO-firm D/E) ×I{CEO-firm D/E>1}	1.390***			
	(3.37)			
Log(1+CEO-firm ΔD/ΔE) ×I{CEO-firm ΔD/ΔE>1}		2.119***		
		(4.88)		
Log(1+CEO-firm D/E)^2			0.286***	
			(4.25)	
Log(1+CEO-firm ΔD/ΔE)^2				0.324***
				(4.61)
I{CEO-firm D/E>1}	-0.873***			
	(-3.23)			
I{CEO-firm ΔD/ΔE>1}		-1.146***		
		(-4.47)		
Log(1+CEO Delta)	-0.874***	-0.930***	-0.876***	-0.882***
	(-3.19)	(-3.39)	(-3.22)	(-3.25)
Log(1+CEO Vega)	0.320	0.349	0.156	0.210
	(0.41)	(0.45)	(0.20)	(0.27)
Log(MVE)	0.053	0.006	0.063	-0.007
	(0.71)	(0.08)	(0.83)	(-0.09)
B/M	0.261	0.208	0.264	0.219
	(1.01)	(0.81)	(1.03)	(0.85)
Leverage	3.487***	3.885***	3.458***	3.839***
	(5.50)	(6.11)	(5.46)	(6.07)
Firm Age	0.022***	0.022***	0.022***	0.021***
	(4.29)	(4.32)	(4.30)	(4.17)
Volatility	5.099***	5.042***	5.078***	5.071***
	(9.80)	(9.72)	(9.77)	(9.78)
FBias	1.081***	1.064***	1.084***	1.062***

	(2.97)	(2.95)	(2.98)	(2.94)
FError	1.680***	1.632***	1.689***	1.628***
	(6.20)	(6.05)	(6.24)	(6.05)
Industry Effect	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes
N	8183	8183	8183	8183
Adj R^2	0.199	0.202	0.200	0.200

Table 5. Tests on CEO Turnover Events

This table presents a regression using changes in variables around CEO turnover events. The difference operator "Δ" indicates the change of a particular variable around the CEO turnover events (i.e., the variable after the CEO turnover minus the value prior to the CEO turnover). The whole sample consists of 518 CEO turnover events. We also stratify the sample into two subsamples. Specifically, we define a CEO turnover event as "expected" if (i) the stepping-down CEO is of age equal to or greater than 65, or (ii) the average ROA across last three fiscal years is negative; and define the rest of CEO turnovers as "less expected." Intercept term is included but not reported to save space. The t-statistics reported in parentheses are based on White's robust standard error clustered at firm level. The statistical significance of the difference between coefficients estimated for "less expected" and "expected" subsamples are estimated with the Wald test, and the corresponding chi-square statistics are reported in the parentheses in the last row. *, **, *** denote significant at 10%, 5%, 1%, respectively.

	Dependent Variable = $\Delta Prem^{MED}$					
Independent Variable	Whole Sample	Whole Sample	Less Expected	Expected	Less Expected	Expected
ΔLog(1+CEO-firm D/E)	-0.458*		-0.681**	0.410		
	(-1.74)		(-2.37)	(0.82)		
ΔLog(1+CEO-firm ΔD/ΔE)		-0.357			-0.800***	0.314
		(-1.45)			(-3.06)	(0.68)
ΔLog(1+CEO Delta)	-0.791	-0.813	-0.581	-0.346	-0.774	-0.253
	(-1.01)	(-1.04)	(-0.86)	(-0.18)	(-1.14)	(-0.13)
ΔLog(1+CEO Vega)	-4.003*	-4.079*	-3.377*	-0.377	-3.511*	-0.228
	(-1.81)	(-1.85)	(-1.67)	(-0.06)	(-1.76)	(-0.03)
ΔLog(MVE)	-0.803	-0.860	-1.964**	1.439	-2.118***	1.438
	(-1.06)	(-1.14)	(-2.55)	(0.84)	(-2.67)	(0.84)
ΔB/M	-0.302	-0.257	-0.467	0.964	-0.304	0.941
	(-0.31)	(-0.26)	(-0.50)	(0.49)	(-0.32)	(0.48)
ΔLeverage	4.461	4.541	-2.013	12.100*	-2.284	11.924*
	(1.37)	(1.40)	(-0.54)	(1.86)	(-0.62)	(1.83)
ΔVolatility	0.010	-0.043	1.457	-2.489	1.313	-2.503
	(0.01)	(-0.04)	(1.27)	(-1.16)	(1.15)	(-1.16)
ΔFBias	0.469	0.458	0.346	0.311	0.352	0.349
	(0.63)	(0.61)	(0.35)	(0.28)	(0.35)	(0.31)
ΔFError	0.946	0.961	-0.214	1.249	-0.198	1.226
	(1.55)	(1.56)	(-0.31)	(1.36)	(-0.27)	(1.34)
N	516	516	360	156	360	156
Adj R^2	0.061	0.061	0.092	0.035	0.114	0.036
Difference between the coefficients of inside debt variables [Less Expected - Expected]				-1.091*		-1.114**
				(3.77)		(4.82)

Table 6. Instrumental-Variable Regressions

This table presents the results of instrument-variable two-stage regressions. In the first-stage regression, the dependent variable is one of the inside debt variables, *i.e.*, *Log(1+CEOfirm D/E)* and *Log(1+CEOfirm ΔD/ΔE)*. The independent variables include all control variables in the second-stage regression and the following four instrumental variables: *New CEO Dummy* takes a value of one if the firm has a new CEO and zero otherwise; *CEO Age* is the age of CEO; *Dividend Dummy*, as a proxy for liquidity constraint, equals one if a firm pays cash dividend and zero otherwise; *Max Tax Rate* is the maximum state tax rate on individual income. In this table, columns 1 and 3 present the first-stage regression results. In the second-stage regression, the key independent variables are the *Instrumented Inside Debt*. *Instrumented Inside Debt* in column 2 (column 4) represents the predicted value of the inside debt variable based on the estimates obtained from the first-stage regressions in column 1 (column 3). Please refer to Appendix B for detailed variable definitions. Industry and year dummies are included. The t-statistics are reported in parentheses. *, **, *** denote significant at 10%, 5%, 1%, respectively.

	First-stage regression	Second-stage regression	First-stage regression	Second-stage regression
		Dependent Variable =		
Independent Variables	Log(1+CEO-firm D/E)	$Prem^{MED}$	Log(1+CEO-firm ΔD/ΔE)	$Prem^{MED}$
Instrumented Inside debt		-1.543**		-1.144**
		(-2.18)		(-2.34)
New CEO Dummy	-0.083***		-0.134***	
	(-3.44)		(-4.50)	
CEO Age	0.010***		0.012***	
	(4.21)		(4.17)	
Dividend Dummy	0.128***		0.212***	
	(3.72)		(4.89)	
Max Tax Rate	0.169		0.428	
	(0.76)		(1.41)	
Log(MVE)	0.009	-0.029	-0.178***	-0.245**
	(0.74)	(-0.47)	(-13.10)	(-2.37)
B/M	0.042	0.467*	0.144***	0.571**
	(1.29)	(1.88)	(3.06)	(2.17)
Leverage	-1.450***	-0.443	-1.458***	0.138
	(-13.00)	(-0.39)	(-11.20)	(0.16)
Firm Age	0.008***	0.030***	0.010***	0.030***
	(6.96)	(3.42)	(8.29)	(3.55)
Volatility	0.031	5.501***	0.080	5.523***
	(0.48)	(12.90)	(0.95)	(13.01)
FBias	0.058	1.223***	0.064	1.208***
	(1.53)	(3.25)	(1.03)	(3.20)
FError	0.028	1.647***	-0.004	1.594***
	(0.98)	(6.03)	(-0.09)	(5.78)
Industry Effect	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes
N	8004	8004	8004	8004
Adj R^2	0.129	0.079	0.150	0.083
Cragg-Donald Wald F statistic		38.945		55.585
(Stock-Yogo Relative Bias Test 5% Critical Value = 16.85)				
p-value of Hansen J statistic		0.381		0.532

Table 7. Subsample Analyses: The Role of Bankruptcy Risk

This table presents the analyses on high- and low-bankruptcy risk subsamples, where the bankruptcy risk is measured by two variables: financial leverage and Altman's Z score. We conduct a four-way division of our sample, by the levels of bankruptcy risk and inside debt holding. High (low) bankruptcy risk firms are those with a level of firm leverage or Z score that is greater (smaller) than the sample median. Sample is also divided based on whether the inside debt variable (*CEO-firm D/E* or *CEO-firm ΔD/ΔE*) is greater than one. We estimate the baseline regression model separately for each subsample. To save space, the coefficients of inside debt variables are only reported. The t-statistics reported in parentheses are based on White's robust standard error clustered at firm level. The difference between coefficients estimated for high and low bankruptcy risk subsamples is reported in the last column (*Diff*); the chi-square statistics of Wald test are reported in the parentheses. *, **, *** denote significant at 10%, 5%, 1%, respectively.

Panel A. Coefficient of Log(1+CEO-firm D/E)	Low Leverage	High Leverage	Diff
CEO-firm D/E≦1	-0.836**	-2.264***	1.428***
	(-2.02)	(-4.78)	(8.54)
CEO-firm D/E>1	0.293*	-0.414	0.707*
	(1.89)	(-1.01)	(3.60)
Panel B. Coefficient of Log(1+ CEO-firm ΔD/ΔE)	Low Leverage	High Leverage	Diff
CEO-firm ΔD/ΔE≦1	-1.117***	-2.033***	0.916**
	(-2.77)	(-5.19)	(4.78)
CEO-firm ΔD/ΔE >1	0.334	0.029	0.305
	(1.62)	(0.10)	(1.09)
Panel C. Coefficient of Log(1+CEO-firm D/E)	Low Z-score	High Z-score	Diff
CEO-firm D/E≦1	-2.186***	-1.054***	-1.132**
	(-4.31)	(-2.76)	(5.15)
CEO-firm D/E>1	-0.178	0.419***	-0.597**
	(-0.60)	(2.67)	(4.35)
Panel D. Coefficient of Log(1+ CEO-firm ΔD/ΔE)	Low Z-score	High Z-score	Diff
CEO-firm ΔD/ΔE≦1	-2.131***	-1.228***	-0.903**
	(-4.92)	(-3.57)	(4.78)
CEO-firm ΔD/ΔE >1	0.370	0.287	0.083
	(1.26)	(1.43)	(0.09)

Table 8. Forward-looking Performance

This table examines the relation between inside debt holding and the forward-looking performance. We define the forward-looking Tobin's Q (Q^{FWD}) and ROA (ROA^{FWD}) in year *t* as the average Q and ROA taken across the next three years (year *t+1* to *t+3*). Industry dummies and year dummies are included in the regressions. Intercept term is included, but not reported to save space. The t-statistics reported in parentheses are based on White's robust standard error clustered at firm level. *, **, *** denote significant at 10%, 5%, 1%, respectively.

	Dependent Variable =			
Independent Variable	Q^{FWD}	ROA^{FWD}	Q^{FWD}	ROA^{FWD}
Log(1+CEO-firm D/E)	0.091***	0.023***		
	(2.67)	(5.72)		
Log(1+CEO-firm D/E)^2	-0.023**	-0.007***		
	(-2.29)	(-5.21)		
Log(1+CEO-firm ΔD/ΔE)			0.044	0.020***
			(1.42)	(4.63)
Log(1+CEO-firm ΔD/ΔE)^2			-0.021**	-0.007***
			(-1.97)	(-4.53)
Log(1+CEO Delta)	0.403***	0.036***	0.375***	0.034***
	(8.58)	(7.11)	(7.97)	(6.75)
Log(1+CEO Vega)	0.352**	0.012	0.345**	0.011
	(2.20)	(0.92)	(2.15)	(0.86)
Log(Assets)	-0.054***	0.003*	-0.049***	0.004***
	(-4.02)	(1.85)	(-3.98)	(2.65)
Capex	0.573*	-0.007	0.542	-0.009
	(1.69)	(-0.24)	(1.59)	(-0.30)
R&D	3.474***	-0.051	3.391***	-0.051
	(7.00)	(-0.76)	(6.94)	(-0.76)
Leverage	-0.449***	-0.073***	-0.530***	-0.084***
	(-5.56)	(-5.41)	(-6.39)	(-6.14)
Z-score	0.075***	0.007***	0.076***	0.007***
	(7.70)	(6.68)	(7.74)	(6.72)
Industry Effect	Yes	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes	Yes
N	5588	5588	5588	5588
Adj R^2	0.467	0.227	0.466	0.225