

# **Managerial Pay Disparity, Firm Risk and Productivity: New Insights from the Bond Market**

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## **Abstract**

Prior literature suggests three alternative explanations for CEO pay gap: tournament incentive, CEO entrenchment, and CEO productivity. In this study, we examine the relation between CEO pay gap and a firm's default risk and its implication for debt contracting. We find negative relations between CEO pay gap and default risk, cost of debt, and the number of restrictive debt covenants but a positive relation between CEO pay gap and debt maturity. Additional analysis indicates that these results concentrate in firms with highly productive CEOs. Our findings are consistent with the CEO productivity explanation for CEO pay gap.

# Managerial Pay Disparity, Firm Risk and Productivity: New Insights from the Bond Market

## Abstract

Prior literature suggests three alternative explanations for CEO pay gap: tournament incentives, CEO productivity, and managerial agency problems. In this study, we examine the relation between CEO pay gap and a firm's default risk and its implications for debt contracting. We find negative relations between CEO pay gap and default risk, cost of debt, and the number of restrictive debt covenants, but a positive relation between CEO pay gap and debt maturity. Additional analysis indicates that these results are concentrated in firms with highly productive CEOs. Collectively, our findings are consistent with the CEO productivity explanation for CEO pay gap.

*JEL classification:* G30, G32, G34

## I. Introduction

Managerial compensation is an important mechanism for aligning the interests of managers with those of shareholders (Jensen and Meckling (1976)). One notable aspect of executive compensation that has received increasing attention as well as criticism from a growing stream of academic research and popular media is the disparity in pay between a CEO and the next group of senior managers of a firm and this disparity's impact on corporate performance and risk-taking.<sup>1</sup> A common measure of this disparity is CEO pay gap, measured as the difference between a CEO's compensation and the median compensation of the next group of a firm's executives. Extant literature offers three effects and explanations for CEO pay gap. Kale, Reis, and Venkateswaran (2009) argue that CEO pay gap fosters tournament incentives that induce senior managers to exert increased effort and take greater risk, which potentially lead to superior corporate performance, to improve their odds of winning the intra-firm rank order tournament. Consistent with this prediction, Kale et al. (2009) find a positive relation between CEO pay gap and performance. Extending the argument to corporate decision making, Kini and Williams (2012) report that CEO pay gap

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<sup>1</sup> Pay disparity has also attracted significant attention from regulators. On August 5, 2015, the Securities and Exchange Commission (SEC) passed the final rule requiring public companies to disclose the ratio of the median of the annual total compensation of all employees to the annual total compensation of their company's CEO.

induces riskier investment and financing policies, which they interpret as consistent with the notion that CEO pay gap acts as a catalyst for tournament incentives among senior managers.<sup>2</sup>

An alternative perspective advanced by Masulis and Zhang (2014) posits that CEO pay gap represents the cumulative effect of the difference in productivity between a CEO and other senior executives. Furthermore, a highly productive CEO can inspire other executives to make greater effort, which enhances overall corporate performance. Hence, the more productive the CEO is, the larger the reward and the resulting pay gap are.

Finally, Bebchuk, Cremers, and Peyer (2011) propose an alternative measure for pay disparity, which they label CEO pay slice, measured as the proportion of CEO compensation out of the total compensation of senior managers, including the CEO. These authors argue that CEO pay slice reflects managerial agency problems, as more entrenched CEOs pressure the board of directors to extract higher pay. Consistent with the notion that higher CEO pay is attributable to managerial agency problems, Chen, Huang, and Wei (2013) find a positive relation between CEO pay slice and cost of equity. Under this scenario, pay disparity between a CEO and senior executives is detrimental to firm value.

In view of the growing concern in the United States about escalating CEO compensation relative to a company's other managers and employees, the inconclusive evidence on the impact of CEO pay gap on firm performance and value calls for further research. Our objective is to shed new insight on this controversy by examining external creditors' perception of CEO pay gap, and its impact on the design of debt contracts. Two recent strands of literature motivate our focus on debt contracts. First, our study complements a stream of research that shows that managerial incentives and preferences significantly influence the design of debt contracts. For instance, Hirshleifer and Thakor (1992) argue that managers' reputational concerns motivate them to pursue conservative investment options, which serve creditors'

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<sup>2</sup> Hass, Muller and Vergauwe (2015) report that fraud firms have significantly higher pay gaps than non-fraud firms, which the authors interpret as consistent with the notion that tournament incentives induce senior managers to greater risk-taking.

interests rather than those of shareholders, allowing firms to raise more debt than equity. Chava, Kumar, and Warga (2010) document that bondholders use various types of covenants to curb managerial entrenchment and fraud, as well as to mitigate the risk of managers' excess consumption of private benefits. Brockman, Martin, and Unlu (2010) report that creditors use short-term debt to mitigate borrowing managers' risk-taking incentives induced by equity-based compensation.

Second, based on the existing literature, we contend that the three alternative perspectives on CEO pay gap imply separable and testable predictions about the terms and structure of debt contracts, and should therefore elicit differential responses from bondholders, which would offer new insights into the unresolved issue of the impact of CEO pay gap. Under the tournament incentives view (Kale, Reis, and Venkateswaran (2009) and Kini and Williams (2012)), a larger CEO pay gap represents a bigger prize, which motivates second-tier executives to undertake risk-increasing activities in order to maximize outcomes and thereby increase their chances of winning the top post. However, greater risk-taking implies a higher likelihood of default on debt payment obligations. Because of their fixed claims on a borrowing firm's assets, bondholders derive no benefit from the upside potential, yet remain vulnerable to the downside risk associated with risky corporate decisions. As a result, bondholders ought to be concerned about managerial agency problems associated with larger CEO pay gap. Prior literature identifies several mechanisms that bondholders employ to address agency issues that arise from shareholder-bondholder conflicts, such as lending short-term debt that subjects borrowing firms to more frequent refinancing, higher risk premiums, and restrictive debt covenants (Chava et al. (2009), and Brockman et al. (2010)). Accordingly, under the tournament incentives hypothesis, we expect borrowing firms with larger CEO pay gap to attract short-term debt, which includes higher risk premiums and stricter covenants.

According to the productivity-based argument of Masulis and Zhang (2014), CEO pay gap reflects a CEO's higher productivity relative to that of other senior executives. These authors further suggest that a CEO's higher compensation is attributable not only to the CEO's individual performance, but also to the multiplicative productivity gains associated with the resources and subordinates under the CEO's

supervision. All else equal, a more productive CEO is thus expected to make a greater contribution to the firm's operating performance and value, which benefits both shareholders and creditors. Accordingly, the productivity hypothesis predicts that CEO pay gap is associated with lower default risk, which induces creditors to offer debt with longer maturity, a lower cost, and fewer restrictive covenants.

Finally, the managerial agency hypothesis asserts that large CEO pay gap is the outcome of an entrenched CEO's power over a board of directors with respect to setting compensation (Bertrand and Mullainathan (2001), Bebchuk and Fried (2003)). Prior literature is ambiguous about the impact of CEO entrenchment on a firm's risk-taking. Some studies suggest that entrenched CEOs are inherently risk-averse and prefer conservative policies that align with bondholders' interests (Hirshleifer and Thakor (1992)) but not necessarily with those of shareholders (Amihud and Levi (1981) and Kim and Lu (2011)). Other studies conclude that entrenched managers tend to increase a firm's systematic risk due to overinvestment to capture higher private benefits (Albuquerque and Wang (2008), Garmaise and Liu (2005), and Chava et al. (2010)). Thus, the relation between CEO pay gap and default risk and bond characteristics is inconclusive with respect to the managerial agency argument and, as such, remains an empirical question.

Our analyses are based on a sample obtained from Execucomp that includes 23,216 firm-year observations of 1,446 unique firms over the period 1992-2010. Following Kale et al. (2009), Kini and Williams (2012), and Masulis and Zhang (2014), we calculate CEO pay gap as the difference between a CEO's total compensation and the median total compensation of the next layer of senior managers. We focus our analysis on the relations between CEO pay gap and distance to default (i.e., default probability) and bond characteristics: maturity, cost, and covenants. Following Merton (1974), we measure distance-to-default as the estimated z-score, which reflects the equity of a firm as a call option on the underlying value of the firm with strike price equal to the face value of outstanding debt. We measure debt maturity as the proportion of debt maturing within three years as reported in the balance sheet. However, since firms do not frequently access the debt market, debt maturity reported in the balance sheet may reflect past decisions, whereas CEO pay gap tends to be more dynamic. Therefore, we use new debt issues obtained from the

Security Data Company (SDC) Platinum database to perform a complementary analysis. We measure cost of debt as the spread between the yield to maturity of newly issued debt and that of the Treasury bond with similar maturity. Finally, we obtain data from Thomson One Banker on debt covenants from 3,697 loan contracts over the period 1994-2011.

One of our major objectives is to identify what better explains the impacts of CEO pay gap on debt characteristics: CEO productivity, tournament incentives, or managerial agency problems. Since CEO productivity is unobservable, we follow Masulis and Zhang (2014) and perform a principal component analysis of Certified Inside Director (CID) dummy, CEO tenure, firm size, and industry-adjusted growth rate in operating income over the previous three years to construct CEO productivity factors. We retain the two orthogonal factors (*productivity1* and *productivity2*), both with eigenvalues greater than one. We then categorize a CEO as highly productive if both *productivity1* and *productivity2* are above their respective sample medians, and lowly productive otherwise. Consistent with the productivity hypothesis, we find that the subgroup of CEOs with high productivity has significantly higher CEO pay gap than the subgroup of CEOs with low productivity. For CEO entrenchment, we use the BCF index developed by Bebchuk, Cohen, and Ferrell (2009) as a proxy. The BCF index is based on these six provisions: staggered boards, limits to shareholder bylaw amendments, supermajority requirements for mergers, supermajority requirements for charter amendments, poison pills, and golden parachutes. The index is constructed by adding one for the incidence of each provision.

We begin our analysis by examining the effect of CEO pay gap on default risk, proxied by distance to default. Our results indicate that CEO pay gap is positively related to distance-to-default, which suggests a negative relation between CEO pay gap and default risk. Moreover, the positive relation between CEO pay gap and distance-to-default is observed only for firms with highly productive CEOs. Next, we investigate the effects of CEO pay gap on debt maturity, debt cost, and covenants. Our analysis reveals a significantly positive relation between CEO pay gap and maturity, particularly for firms with highly productive CEOs. We also find that CEO pay gap is negatively related to the cost of debt, and this finding

is concentrated in firms managed by highly productive CEOs.<sup>3</sup> Finally, we find that CEO pay gap is significantly negatively related to the number of covenants, and this relation is stronger for firms led by productive CEOs. On the other hand, CEO entrenchment and tournament incentives have no bearing on our findings.

Extant literature (e.g., Brockman et al. (2010)) demonstrates that a CEO's propensity to take risk is influenced by the sensitivity of a CEO's compensation with respect to changes in stock price (CEO delta) and volatility of stock returns (CEO vega). To ensure the robustness of our results, we therefore control for CEO delta and CEO vega throughout our analyses. Furthermore, we use the following identification strategies to alleviate concerns about possible endogeneity between CEO compensation and debt contract terms: (i) we conduct ordinary least square (OLS) regressions using lagged independent variables and controlling for firm fixed effects, and (ii) we conduct instrumental variable (IV) regressions in which CEO pay gap, CEO delta, and CEO vega are instrumented. In so doing, our results are essentially similar. Overall, our analyses suggest that creditors view CEO pay gap positively and, in turn, offer firms with larger CEO pay gap more favorable terms. Moreover, this effect is observed only for firms with highly productive CEOs. Collectively, our findings are consistent with the CEO productivity explanation for CEO pay gap, as suggested by Masulis and Zhang. Hence, managerial agency and tournament-based explanations for CEO pay gap have little bearing on our evidence.

Our study makes important contributions to the ongoing debate on the impact of CEO pay gap on cost of capital, firm performance, and value. The studies central to this debate (Kale et al. (2009), Bebchuk et al. (2011), Kini and Williams (2012), Chen et al. (2013), and Masulis and Zhang (2014)) yield mixed evidence on the determinants and consequences of CEO pay gap. That said, our finding that firms with higher CEO pay gap have lower default risk and receive favorable debt terms from creditors conditional on

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<sup>3</sup> We complement this analysis with an investigation of the relation between CEO pay gap and the implied cost of equity; we find a negative relation between the two for firms with highly productive CEOs.

CEO productivity is consistent with the productivity-based argument. The finding that larger CEO pay gap is associated with greater CEO productivity has significant implications for the controversy over disproportionately high CEO compensation when compared to that of senior officers. If greater productivity is indeed the main driver of higher CEO pay, as our data suggest, then the prevalent notion and concern that CEO compensation is disproportionately high may be unwarranted. This implication of our findings should be of interest to both policymakers and investors.

## **II. Sample and Data**

### *A. Sample Selection and Variable Construction*

We use the Execucomp database to obtain CEO and senior executive compensation data for 1,446 unique firms for the period 1992 to 2010 (23,216 firm-years). Executives' total compensation package is measured in Execucomp by the variable TDC1, which includes salary, bonus, total value of restricted stock grants, total value of stock option grants, long-term incentive payouts, and other forms of compensation. We calculate CEO pay gap as the difference between a CEO's total compensation and the median total compensation of the next layer of senior managers, (i.e., VPs) (Kale et al. (2009), and Kini and Williams (2012)). We exclude from the pay gap estimation those former CEOs who remain with the firm in an executive position.

Of note, Execucomp reports option values using the Black-Scholes option pricing model for the pre-2006 period and, following the passage of FAS 123R on December 12, 2004, it provides firms' self-reported fair values of options for the post-2005 period. To ensure consistency in option valuation, we follow Kini and Williams (2012) to estimate the inputs for the dividend-adjusted Black-Scholes option pricing model, and we then use this model to estimate option values (option delta and vega) for the post-2005 period. We then substitute the estimated option values for firms' self-reported figures in ExecuComp and re-estimate TDC1 for the post-2005 period. In addition, we use the Consumer Price Index (CPI) to adjust CEO pay gap, CEO delta, and CEO vega for inflation. We also use the BCF index developed by Bebhuk, Cohen, and Ferrell (2009) as a proxy for managerial agency. The BCF index is based on these



six provisions: staggered boards, limits to shareholder bylaw amendments, supermajority requirements for mergers, supermajority requirements for charter amendments, poison pills, and golden parachutes. The index is constructed by adding one for the incidence of each provision. We obtain information on these six provisions from Institutional Shareholder Services (ISS). According to this construction, a higher index value indicates a higher degree of CEO entrenchment. In our analysis, we classify a CEO as entrenched if the BCF index value of the CEO's firm is above the sample median BCF index value, and non-entrenched otherwise. Finally, we follow Bharath and Shumway (2008) to estimate a firm's distance-to-default (i.e., z-score). The higher the z-score is, the greater the distance-to-default and the lower the default risk is. The distance-to-default (DD) is calculated by the following formula:

$$DD = \frac{\ln\left(\frac{V}{P}\right) + (\mu - 0.5\sigma^2)T}{\sigma\sqrt{T}} \quad (1)$$

for which asset value ( $V$ ) is assumed to follow a geometric Brownian motion with drift  $\mu$  and volatility  $\sigma$ ,  $T$  denotes the maturity, and  $P$  is the face value of outstanding debt. Because a firm's asset value  $V$  and its associated volatility  $\sigma$  are not directly observable, we use equity data and an iterative procedure to estimate these values.<sup>4</sup>

We obtain the debt-related data from a number of sources. Short-term debt is measured as the proportion of total debt maturing within three years (ST3), as reported in the balance sheet gathered from Compustat.<sup>5</sup> The maturity of newly-issued debt and the cost of debt, defined as the difference in the yield to maturity of newly-issued debt and that of the corresponding Treasury bond with similar maturity, are obtained from SDC Platinum. Finally, we manually collect debt covenants data from the Thomson One Banker database.

Following Masulis and Zhang (2014), we use the following variables to perform a principal component analysis, so we may construct the CEO productivity factors: Certified Inside Director (CID)

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<sup>4</sup> See Bharath and Shumway (2008) for details of the estimation procedure.

<sup>5</sup> Our results are robust to other measures of short-term debt, such as ST2, ST4, and ST5.

dummy, CEO tenure, firm size, and industry-adjusted growth rate in operating income over the previous three years.<sup>6</sup> CID and industry-adjusted operating income growth reflect both a CEO's performance as well as the firm's past performance. CEO tenure is used as an indicator of a CEO's experience. Firm size reflects the scale of the CEO's responsibility. These variables are positively related to a CEO's productivity. We retain the two orthogonal factors (*productivity1* and *productivity2*), both with eigenvalues greater than one. Our analysis indicates that these two factors explain over 61 percent of the total variance of the original variables. For *productivity1*, the variables with absolute values of factor loadings above the threshold of 0.40 are CEO tenure (factor loading -0.61), CID dummy (factor loading 0.57), and firm size (factor loading 0.48). Important variables that are associated with *productivity2* include growth rate of industry-adjusted operating income over the prior three years (factor loading 0.91) and CID dummy (factor loading 0.40). We categorize a CEO as highly productive if both *productivity1* and *productivity2* are above their respective sample medians, and lowly productive otherwise. We provide the descriptions of other variables in the Appendix.

### *B. Summary Statistics*

Table 1 presents the summary statistics of the variables. CEO pay gap has a mean value of \$2.46 million and a median value of \$0.94 million over the study period. These values are qualitatively similar to those reported by Kale et al. (2009) and Kini and Williams (2012). The CEO delta indicates that, on average, a CEO's wealth increases by approximately \$518 thousand for every \$1 increase in stock price. In addition, an increase of 0.01 in volatility of annual stock returns results in an increase of \$73 thousand in a CEO's wealth. Since all three variables are right-skewed, we use their natural logarithm transformation in our regression analysis.

With respect to firm characteristics, distance-to-default (z-score) has a mean of 7.36 and a median of 6.57, indicating that, on average, firms have low default risk. ST3, the proportion of total debt maturing

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<sup>6</sup> Certified inside director is defined as inside directors with outside directorship (Masulis and Mobbs (2011)).

within three years, has a mean (median) of 0.40 (0.32), which is comparable to the corresponding finding in Brockman et al. (2010). Sample firms are large, as indicated by the average market capitalization of \$11.4 billion. Following prior literature, we use the market value of equity plus the book value of total assets minus the book value of equity as a proxy for firm size throughout our analyses. The mean (median) market-to-book ratio is 1.84 (1.48). The leverage ratio has a mean (median) value of 0.16 (0.13), and CEO stock ownership has a mean (median) value of 0.02 (0.01). Finally, the average size of new debt issue is \$401 million, with an average maturity of 12.37 years, 1.72 covenants, and a yield spread of 1.88%. Because the number of years to maturity is skewed to the right, we use their natural logarithmic transformations in our analysis.

We conduct a univariate analysis of the difference in pay gap between CEOs in the high productivity subgroup and CEOs in the low productivity subgroup. Our unreported results indicate that, on average, CEOs with high productivity experience a significantly higher (\$1,035,000) pay gap than CEOs with low productivity. Also, the difference in median pay gap between the two CEO subgroups is similar in magnitude. This finding is consistent with Masulis and Zhang (2014) and highlights a positive relation between CEO pay gap and CEO productivity.

### **III. Empirical Predictions, Analyses, and Discussion of Results**

#### *A. CEO Pay Gap and Distance-to-Default*

Previous research is inconclusive regarding the implications of CEO pay gap. The tournament hypothesis posits that CEO pay gap, in conjunction with the power and prestige associated with the CEO position, provides the incentive for a tournament among the second-tier executives for the top position (Kale et al. (2009)). Because the true ability of managers is unobservable, a firm that runs the intra-firm tournament will rank managers based on their performance in order to select the next CEO. Kini and Williams (2012) suggest that tournament incentives are analogous to a call option, and managers have the incentive to undertake risk-increasing activities to maximize the likelihood of the outcome that is used to rank them. In line with this notion, Kini and Williams find a positive relation between CEO pay gap and

risky investment and financing choices, as made manifest in larger research and development (R&D) investment, higher financial leverage, and higher volatility of cash flow and stock returns. The propensity for greater risk-taking induced by the tournament incentive implies a negative relation between CEO pay gap and distance-to-default.

Following a performance-based view of CEO compensation, CEO pay gap reflects a CEO's superior productivity relative to that of second-tier executives (Masulis and Zhang (2014)). To the extent that a productive CEO enhances the firm's overall performance and value, we expect a positive association between CEO pay gap and distance-to-default. We further examine the effect of CEO pay gap on distance-to-default conditional on CEO productivity by separately analyzing subsamples of high-productivity CEOs versus low-productivity CEOs. If CEO pay gap reflects high CEO productivity, then we expect the favorable effect of CEO pay gap on debt contracting to be more pronounced for high-productivity CEOs.

Alternatively, the managerial agency hypothesis asserts that large CEO pay gap is attributable to an entrenched CEO's power and influence on the board of directors in setting the CEO's pay (Bertrand and Mullainathan (2001), and Bebchuk and Fried (2003)). Extant literature does not provide an unambiguous prediction about the impact of CEO entrenchment on a firm's risk-taking behavior. For example, some authors argue that entrenched CEOs tend to be inherently risk-averse and prefer conservative investment and financing policies, those which serve bondholders' interests (Hirshleifer and Thakor (1992)) but not necessarily those of shareholders (Amihud and Levi (1981) and Kim and Lu (2011)). Other authors assert that entrenched managers seek private benefits of control and tend to overinvest, which increases a firm's systematic risk (Albuquerque and Wang (2008), Garmaise and Liu (2005), Chava et al. (2010)). We divide the sample into high CEO entrenchment versus low CEO entrenchment subgroups to examine the relation between CEO pay gap and distance-to-default conditional on the level of CEO entrenchment.

Table 2 reports the results of the regressions of distance-to-default on CEO pay gap when we control for firm and year fixed effects. In Panel A, we use ordinary least squares (OLS) regressions (columns 1 and 2) to examine the relation between CEO pay gap and distance-to-default for the full sample.

Column 1 reports the results of the model that includes only CEO pay gap as the main explanatory variable, while column 2 controls for CEO delta, CEO vega, and CEO tenure. The coefficients of CEO pay gap in columns 1 and 2 are positive (0.1116 and 0.0959, respectively) and highly significant. This result indicates that a firm's default risk decreases in relation to CEO pay gap. Because we use the logarithm form of CEO pay gap in the regressions, measuring the economic impact of CEO pay gap is not straightforward. Hence, to estimate the impact of a one standard deviation change in CEO pay gap centered on its mean, we calculate CEO pay gap for a one-half standard deviation above and one-half standard deviation below its mean value; thereafter, we compute the difference in the logarithm of these two values (Kini and Williams (2012)). Based on the coefficient estimate of CEO pay gap in column 2 and holding the other variables unchanged at their sample means, we find that a one standard deviation increase in CEO pay gap centered on its mean results in a 0.058 standard deviation increase in distance-to-default, which is economically significant. In terms of control variables, we find that a firm's distance-to-default is positively associated with its Tobin's Q, operating performance as measured by ROA, and Altman Z-score, but is negatively associated with sales growth and financial leverage. These results are consistent with the evidence documented in the existing literature.

CEO compensation and distance-to-default could be jointly correlated with firms' unobserved characteristics, such as their financial condition. In addition, firms may consider their default likelihood as they set CEO compensation, implying reverse causality. We use the IV approach to address the possible endogeneity between CEO pay gap, CEO delta, CEO vega, and distance-to-default that may bias the coefficient estimates. Following prior research (Kale et al. (2006), and Kini and Williams (2011)), we use industry median CEO pay gap and an indicator variable for succession plan as instruments for CEO pay gap. Also, we use industry median CEO delta as an instrument for CEO delta, and use industry median

CEO vega as an instrument for CEO vega.<sup>7</sup> We report the first-stage results of the IV regression in Panel B of Table 2. In columns 1, 2, and 3, we use CEO pay gap, CEO delta, and CEO vega as the dependent variables, and include other control variables in the outcome regression. We find that the coefficients of the instruments have the signs and significance consistent with those documented in the existing literature, and the instruments pass both relevance and validity tests. The second-stage IV regression results reported in column 4 of Panel B indicate that the coefficient of the predicted CEO pay gap is positive and significant, which corroborates our previous finding and confirms that our results are robust when correcting for possible endogeneity. Moreover, these findings are consistent with the productivity hypothesis, but inconsistent with the tournament incentive hypothesis.

Next, we divide the sample into separate subgroups based on either CEO productivity or CEO entrenchment and re-estimate the distance-to-default regressions for high CEO productivity versus low CEO productivity, as well as for high CEO entrenchment versus low CEO entrenchment. The results reported in Panel C of Table 2 indicate that CEO pay gap is positively and significantly related to distance-to-default for firms with high CEO productivity, but the relation is negative for firms with low CEO productivity. Moreover, the coefficients of CEO pay gap for the two subgroups are significantly different. In contrast, the relation between CEO pay gap and distance-to-default is significantly positive for both subgroups of firms categorized by CEO entrenchment, and the coefficients for the two subgroups are statistically similar. Collectively, our evidence suggests that CEO productivity, rather than CEO entrenchment, is more likely the driver of the positive relation between CEO pay gap and distance-to-default.

### *B. CEO Pay Gap and Debt Maturity*

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<sup>7</sup> We also consider other instruments suggested by Kale et al. (2009) and Kini and Williams (2012), such as the number of VPs, CFO as VP, and inside CEO promotion; however, these do not pass the instrument validity test in this analysis.

As fixed claimants of a borrowing firm's assets, bondholders do not benefit from a firm's upside potential, but are vulnerable to the downside risk of a firm's operations. Thus, managers' propensity for greater risk-taking induced by tournament incentives should cause concern for bondholders and motivate them to design debt contracts in ways that protect their interests. Extant literature suggests that bondholders use debt maturity—particularly short-term debt—to mitigate the risks arising from the conflicts of interest between shareholders and bondholders (Leland and Toft (1996), Rajan and Winton (1995), and Brockman et al. (2010)). The advantage of short-term debt stems from its contracting flexibility and monitoring ability. In particular, by engaging in short-term lending and exposing borrowing firms to the risk of failure to roll over short-term debt when it matures, bondholders discourage managers from pursuing risk-increasing activities induced by their compensation contract. Consistent with this notion, Brockman et al. (2010) find a positive (negative) relation between short-term debt and CEO vega (CEO delta), as CEO vega (CEO delta) encourages (discourages) risk-taking. As such, to the extent that intra-firm tournament incentives motivate managers to pursue risk-increasing activities, we expect a negative relation between CEO pay gap and debt maturity.

According to the productivity hypothesis, large CEO pay gap can be attributed to high CEO productivity. All else equal, creditors should have a favorable view of a firm with a highly productive CEO who helps increase firm value while lowering bankruptcy risk. Following this scenario, we predict a positive relation between CEO pay gap and debt maturity, and we expect this relation to be more pronounced for firms with more productive CEOs. Alternatively, if CEO pay gap reflects CEO entrenchment, then the prediction is not straightforward, given the ambiguous relation between CEO entrenchment and risk-taking as previously discussed. We therefore test the relation between CEO pay gap and debt maturity conditional on the level of CEO entrenchment. To examine the effect of CEO pay gap on debt maturity, we estimate the following multivariate regression model:

$$ST3_{i,t} = \alpha_i + \alpha_1 \text{Log}(CEO \text{ pay gap})_{i,t-1} + \alpha_2 \text{Log}(CEO \text{ delta})_{i,t-1} + \\ \alpha_3 \text{Log}(CEO \text{ vega})_{i,t-1} + \alpha_4 \text{Log}(Size)_{i,t-1} + \alpha_5 \text{Log}(Size)_{i,t-1}^2 + \alpha_6 \text{Leverage}_{i,t-1} +$$

$$\begin{aligned}
& \alpha_7 \text{Asset maturity}_{i,t-1} + \alpha_8 \text{Ownership}_{i,t-1} + \alpha_9 \text{Market/Book}_{i,t-1} + \\
& \alpha_{10} \text{Term structure}_{i,t} + \alpha_{11} \text{Abnormal earnings}_{i,t-1} + \alpha_{12} \text{Return volatility}_{i,t-1} + \\
& \alpha_{13} \text{Rate dummy}_{i,t-1} + \alpha_{14} \text{Altman Z\_score}_{i,t-1} + \theta \text{Year dummies} + \varepsilon_{i,t} \quad (2)
\end{aligned}$$

We report the estimation results in Table 3. Column 1 of Panel A includes CEO pay gap as the test variable and other standard control variables known to explain debt maturity, whereas column 2 includes CEO delta and CEO vega as additional control variables. In both models, the coefficients of CEO pay gap are negative (-0.0079 and -0.005, respectively) and statistically significant, indicating that larger CEO pay gap is associated with longer-term debt. Using the coefficient of CEO pay gap in column 2 to estimate the economic effect and holding the other variables at their sample means, we find that a one standard deviation increase in CEO pay gap centered on its mean leads to a 0.044 standard deviation decrease in the proportion of short-term debt. This finding is consistent with the prediction of both the CEO productivity hypothesis and the managerial agency hypothesis, but inconsistent with that of the tournament hypothesis. The signs and significance of the coefficients on control variables are consistent with those documented in the existing literature. Specifically, the coefficients of *size squared*, *return volatility*, and *ownership* are significantly positive. Also, the coefficients of *CEO delta*, *size*, *financial leverage*, *Altman z-score indicator*, and *S&P credit rating indicator*, which takes a value of one if a firm has an S&P credit rating in a given year and zero otherwise, are all significantly negative.

We note that the relations between CEO compensation variables (CEO pay gap, CEO delta, and CEO vega) and debt maturity could be endogenous due to a joint determination of debt maturity structure and executive compensation. Alternatively, firms' capital structure may affect managerial compensation contracts, implying reverse causality (Ortiz-Molina (2007)). To address potential endogeneity, we endogenize CEO pay gap, CEO delta, and CEO vega, and then use IV regressions for estimation. We use industry median CEO pay gap and inside promotion dummy as instruments for firm CEO pay gap. We also use industry median CEO delta and industry median CEO vega as instruments for firm CEO delta and CEO vega, respectively. Our unreported first-stage estimation results indicate that the coefficients of these



instruments have expected signs and are statistically significant.<sup>8</sup> We report the IV regression results in column 3 of Panel A, Table 4. Corroborating our previous findings, the coefficient of *predicted CEO pay gap* is negative and significant, which implies that creditors associate larger CEO pay gap with lower default risk and, as a result, induces them to lend longer-term debt. This evidence further suggests that our results are robust to corrections for endogeneity bias.

Having established that debt maturity increases in relation to CEO pay gap, a finding consistent with both the CEO productivity and managerial agency paradigms, we next examine which of these paradigms provides a more robust explanation of our findings. We divide the sample into subgroups based on either CEO productivity or CEO entrenchment, and then analyze each subgroup. In Panel B of Table 3, we report the regression results for high versus low CEO productivity subsamples, as well as high versus low CEO entrenchment subsamples. We find a significantly negative relation between CEO pay gap and the proportion of short-term debt only for the subgroup of firms with high CEO productivity. In contrast, the coefficients of CEO pay gap are not statistically significant for both high and low CEO entrenchment subsamples, suggesting that the positive relation between CEO pay gap and debt maturity is not attributable to CEO entrenchment.

For these tests, we use the maturity structure of outstanding debt reported in the balance sheet to measure debt maturity. This approach allows us to track the impact of CEO pay gap on debt maturity structure in both cross-section and time series. However, since firms do not issue debt regularly, this approach is prone to bias, as maturity is likely to decrease naturally over time whereas CEO pay gap changes dynamically; consequently, any documented relation between CEO pay gap and debt maturity could be spurious. To mitigate this problem, we examine the effect of CEO pay gap on the maturity of newly issued

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<sup>8</sup> The Anderson-Rubin *F-test* for joint significance rejects the null hypothesis, which implies that the endogenous variables are jointly significant. The Hansen *J-statistic* of the over-identification test is insignificant, indicating that the instruments meet the exclusion restriction requirements. Finally, the Difference-in-Sargan *C-statistic* is statistically significant, which allows us to reject the null hypothesis that CEO pay gap, CEO delta, and CEO vega are jointly exogenous. These tests substantiate the need to correct for endogeneity bias.

debt, which we obtained from SDC Platinum. This analysis allows us to capture bondholders' perception of CEO pay gap precisely at the time when a firm accesses the external debt market. To examine the relation between CEO pay gap and the maturity of newly issued debt, we use the following model motivated by prior research on debt maturity (e.g., Brockman et al. (2010)):

$$\begin{aligned}
\text{Log}(\text{Maturity})_{i,t} = & \alpha_i + \alpha_1 \text{Log}(\text{CEO pay gap})_{i,t-1} + \alpha_2 \text{Log}(\text{CEO delta})_{i,t-1} + \\
& \alpha_3 \text{Log}(\text{CEO vega})_{i,t-1} + \alpha_4 \text{Log}(\text{Size})_{i,t-1} + \alpha_5 \text{Log}(\text{Size})_{i,t-1}^2 + \alpha_6 \text{Leverage}_{i,t-1} + \\
& \alpha_7 \text{Asset maturity}_{i,t-1} + \alpha_8 \text{Ownership}_{i,t-1} + \alpha_9 \text{Market/Book}_{i,t-1} + \\
& \alpha_{10} \text{Abnormal earnings}_{i,t} + \alpha_{11} \text{Return volatility}_{i,t-1} + \alpha_{12} \text{Average return}_{i,t-1} + \\
& \alpha_{13} \text{Interest coverage} + \alpha_{14} \text{Term structure}_{i,t-1} + \alpha_{15} \text{Altman Z - Score}(\text{dummy})_{i,t-1} + \\
& \theta \text{Year dummies} + \varepsilon_{i,t}
\end{aligned} \tag{3}$$

We present the results of this analysis for the full sample in Panel A, Table 4. Column 1 reports the results for the model that includes CEO pay gap as the only compensation variable and other control variables, while column 2 additionally includes CEO delta and CEO vega. In both columns, the coefficients of CEO pay gap are positive (0.0337 and 0.0316, respectively) and significant, indicating creditors' willingness to provide longer-term debt to firms with larger CEO pay gap. In terms of economic impact, we find that a one standard deviation increase in CEO pay gap centered on its sample mean results in a 8.95% increase in the debt maturity of new debt issues. This evidence is consistent with our earlier finding based on maturity data obtained from the balance sheet. To address possible endogeneity between CEO pay gap and maturity of new debt issues, we estimate an IV regression model of the maturity of new debt issues. The instruments that pass the relevance and validity tests include industry-median CEO pay gap, industry-median CEO delta, industry-median CEO vega, and succession plan dummy. In column 3, we report that the instrumented CEO pay gap is significantly positive, confirming that our earlier findings are robust to the correction for potential bias due to endogeneity. In terms of other control variables, our results indicate that financial leverage, growth opportunity proxied by market-to-book ratio, and return volatility are negatively related to debt maturity, whereas pre-issue average stock returns and the Altman Z-score

indicator are positively related to debt maturity, which is consistent with the findings of Brockman et al. (2010).

In Panel B of Table 4, we present the analysis results for subsamples of firms sorted by either CEO productivity or CEO entrenchment. Consistent with our earlier findings, the positive relation between CEO pay gap and debt maturity is significant (insignificant) for firms with highly (lowly) productive CEOs; however, the level of CEO entrenchment has no bearing on the relation between CEO pay gap and maturity. In sum, based on maturity data from both balance sheet and new debt issues, we find consistent evidence of a positive relation between CEO pay gap and debt maturity for firms with productive CEOs. This finding is qualitatively unchanged when we control for other managerial compensation-based incentives, such as CEO delta and CEO vega.

### *C. CEO Pay Gap and Cost of Debt*

Previous literature documents that bondholders use cost of debt as a mechanism to restrain managerial risk-taking and to compensate for the incremental risk they are willing to bear (Brockman et al. (2010)). With respect to the tournament hypothesis (i.e., larger CEO pay gap provides managers with incentives to take risk), we expect a positive relation between CEO pay gap and the cost of debt. Alternatively, if bondholders view CEO pay gap as a reward for a CEO's higher productivity, then the cost of debt should decrease in relation to CEO pay gap, particularly for firms led by highly productive CEOs. Finally, the CEO entrenchment hypothesis yields no definitive prediction of the relation between cost of debt and CEO pay gap. To test these competing hypotheses, we estimate the following multivariate regression model that includes cost of debt as the dependent variable:

$$\begin{aligned}
 \text{Yield Spread}_{i,t} = & \alpha_i + \alpha_1 \text{Log}(\text{CEO pay gap})_{i,t-1} + \alpha_2 \text{Log}(\text{CEO delta})_{i,t-1} + \\
 & \alpha_3 \text{Log}(\text{CEO vega})_{i,t-1} + \alpha_4 \text{Return volatility}_{i,t-1} + \alpha_5 \text{Average return}_{i,t-1} + \\
 & \alpha_6 \text{Log}(\text{Total proceeds})_{i,t} \text{Return on sales}_{i,t-1} + \alpha_7 \text{Leverage}_{i,t-1} + \\
 & \alpha_8 \text{Interest coverage}_{i,t-1} + \alpha_9 \text{Return on sales}_{i,t-1} + \alpha_{10} \text{Treasury Benchmark Yield}_{i,t} + \\
 & \alpha_{11} \text{Yield curve slope}_{i,t} + \theta \text{Year dummies} + \varepsilon_{i,t} \quad (4)
 \end{aligned}$$

The variables are similar to those discussed previously. We obtain data on new debt issues from the Global New Issues database of SDC Platinum. In Table 5, we report the regression results. Column 1 of Panel A includes CEO pay gap as the test variable and other control variables suggested by extant literature, but excludes CEO delta and CEO vega. The coefficient on CEO pay gap is negative (-0.0006) and highly significant, indicating that bondholders are willing to accept lower interest rates when borrowing firms' CEO pay gap is large. In column 2, which includes CEO delta and CEO vega as additional control variables, the coefficient of CEO pay gap remains negative (-0.001) and significant, indicating that our results are robust when we control for CEO equity-based compensation. Our estimation indicates that a one standard deviation increase in CEO pay gap centered on its sample mean while holding other variables unchanged at their sample means results in a 28 basis points (0.28%) decrease in the yield spread of new debt issues.

To address potential endogeneity between executive compensation and the cost of debt, we run the IV regressions. We use industry-median CEO delta, industry-median CEO vega, CEO tenure, and the number of VPs as instruments. As we report in column 3, the coefficient of instrumented CEO pay gap remains negative and significant, suggesting that our results are robust to endogeneity correction. In addition, we find that *CEO vega*, *issue size*, and *financial leverage* are positively related to the cost of debt, whereas *CEO delta*, *average stock returns prior to debt issues*, *interest coverage*, *slope of yield curve*, and *profit margin* measured by the return on sales are negatively correlated with the cost of debt. These results are consistent with the findings of Brockman et al. (2010). In sum, our evidence does not appear to be consistent with the tournament incentives hypothesis.

We also perform cost of debt analyses separately for subgroups of firms sorted by either CEO productivity or CEO entrenchment. In Panel B of Table 5, we report the effect of CEO pay gap on the cost of debt for each subgroup of firms. In so doing, we find that the negative relation between CEO pay gap and the cost of debt is statistically significant only for the high CEO productivity subgroup, indicating that bondholders offer lower interest rates to firms with larger CEO pay gap conditional on high CEO

productivity. On the other hand, we find no evidence that the effect of CEO pay gap on the cost of debt varies with the level of CEO entrenchment.

#### *D. CEO Pay Gap and Debt Covenants*

Previous studies document that, in addition to maturity and cost of debt, bondholders use restrictive covenants as another mechanism to protect themselves from potential managerial risk taking. For instance, Begley and Feltham (1999) report that bondholders are likely to use covenants restricting dividends and additional borrowings when they perceive a threat of CEO opportunism motivated by CEO stock ownership, which serves shareholders' interests at the expense of creditors' interests. Similarly, Billett, King, and Mauer (2007) find that short-term debt and covenants are substitutes that mitigate bondholders' concerns with respect to opportunistic managerial behavior. Chava et al. (2010) also document that bondholders use covenants to mitigate the risk of managerial self-dealing. Thus, in the next analysis, we use the following model to examine the impact of CEO pay gap on the number of debt covenants:

$$\begin{aligned}
 \text{Log}(\text{Sum of Debt Covenants})_{i,t} = & \alpha_i + \alpha_1 \text{Log}(\text{CEO pay gap})_{i,t-1} + \\
 & \alpha_2 \text{Log}(\text{CEO delta})_{i,t-1} + \alpha_3 \text{Log}(\text{CEO vega})_{i,t-1} + \alpha_4 \text{Log}(\text{Maturity})_{i,t-1} + \\
 & \alpha_5 \text{Leverage}_{i,t-1} + \alpha_6 \text{Asset Maturity}_{i,t-1} + \alpha_7 \text{Market/Book}_{i,t-1} + \\
 & \alpha_8 \text{Return Volatility}_{i,t-1} + \alpha_9 \text{Ownership}_{i,t-1} + \alpha_{10} \text{Abnormal Earnings}_{i,t-1} + \\
 & \alpha_{11} \text{Altman Z\_Score(dummy)}_{i,t-1} + \theta \text{Year dummies} + \varepsilon_{i,t}
 \end{aligned} \tag{5}$$

We report the covenant regression results in Table 6. Column 1 of Panel A includes CEO pay gap as the test variable when controlling for other variables, suggested by the previous literature. The coefficient of CEO pay gap is negative (-0.0206) and significant, indicating that bondholders impose fewer debt covenants when lending to firms with larger CEO pay gap. This result is not only consistent with our finding a negative relation between CEO pay gap and cost of debt in the previous sections, but also further corroborates bondholders' favorable response to CEO pay gap. Our results are qualitatively similar when we control for CEO delta and CEO vega in column 2. Using the coefficient estimate of CEO pay gap in column 2 to illustrate its economic effect on the number of covenants, our calculation indicates that a one

standard deviation increase in CEO pay gap centered on its sample mean leads to a 10.51% decrease in the number of debt covenants.

To account for the possible endogeneity between CEO pay gap, CEO delta, and CEO vega, and the number of debt covenants, we run an IV regression and report the results in column 3. The instruments we use for CEO pay gap (CEO delta and CEO vega) that pass the relevance and validity requirements include industry median CEO pay gap and inside promotion dummy (industry median CEO delta and industry median CEO vega). The coefficient of instrumented CEO pay gap remains negative and significant, indicating that our finding is robust to correction for potential endogeneity. Overall, our evidence of a negative relation between CEO pay gap and the number of debt covenants is consistent with both CEO productivity and CEO entrenchment hypotheses, but inconsistent with the tournament hypothesis. With respect to control variables, we find that the number of debt covenants increases in leverage, which is similar to the finding of Billet et al. (2007).

Finally, we estimate the covenant model for subsamples of firms sorted by either CEO productivity or CEO entrenchment. The results in Panel B of Table 6 indicate that CEO pay gap is related significantly to the number of debt covenants for the subsample of firms with highly productive CEOs, but not so for lowly productive CEOs. In contrast, the relation between CEO pay gap and the number of debt covenants is significantly negative in both high and low CEO entrenchment subsamples, suggesting that the effect of CEO pay gap on the number of debt covenants does not vary with the level of CEO entrenchment. This finding corroborates our earlier conclusion that bondholders view CEO pay gap as a signal of CEO productivity.

#### **IV. Robustness Check**

##### *A. Alternative Measures of Pay Disparity*

In addition to CEO pay gap, CEO pay slice and the Gini coefficient have been used in previous studies as alternative measures of executive pay disparity (Kale et al. (2009), Bebchuk et al. (2011), Kini and Williams (2012), and Chen et al. (2013)). While CEO pay gap measures the dollar gap between a CEO's

pay and the median pay of second-tier executives, CEO pay slice instead measures CEO compensation as a percentage of total compensation of all top executives, including a CEO. Meanwhile, the Gini coefficient measures not only the pay inequity between a CEO and second-tier executives, but also the pay disparity among all the top executives. Although all these measures can capture executive pay inequality, they differ in their economic implications. Bebchuk et al. (2011) suggest that CEO pay slice represents CEO entrenchment, or a CEO's bargaining power. The pairwise correlation between CEO pay gap and CEO pay slice in our sample is 0.34, and the low correlation implies that the two variables may measure different aspects of CEO pay. Indeed, Bebchuk et al. (2011) find that firm value and performance decrease in CEO pay slice, contrary to Kale et al.'s (2009) finding that performance and value increase in CEO pay gap. Nevertheless, in the interest of robustness, we substitute CEO pay slice for CEO pay gap and re-estimate our models. In so doing, we do not find any significant relation between CEO pay slice and debt characteristics.

Based on our sample, the correlation between CEO pay gap and the Gini coefficient is 0.30. Kale et al. (2009) find a positive relation between firm value and the Gini coefficient, but the relation is significantly weaker than that of CEO pay gap. When we rerun our models with the Gini coefficient as a proxy for CEO pay disparity, we find insignificant results.

#### *B. Executive Pay Disparity and Cost of Equity*

Chen et al. (2013) report that the cost of equity increases in executive pay disparity as measured by CEO pay slice. In this section, we examine the relation between the cost of equity and executive pay disparity to complement our findings on CEO pay gap's impact on debt structure. Similar to Chen et al. (2013), we estimate the cost of equity as the internal rate of return that equates the current stock price to the present value of all future cash flows to shareholders; we base this estimate on the method developed by Gebhardt, Lee, and Swaminathan (2001). In column 1 of Table 7, we replicate Chen et al. (2013) and find a significantly positive relation between the cost of equity and CEO pay slice, which is consistent with their evidence. However, when we substitute CEO pay gap for CEO pay slice, we do not find a significant

relation between the cost of equity and CEO pay gap. To examine if CEO productivity is a factor in the relation between the cost of equity and CEO pay disparity, we sort the sample firms into two subgroups based on CEO productivity, and then reexamine the impact of CEO pay slice and CEO pay gap on the cost of equity. Interestingly, we find that the positive relation between CEO pay slice and the cost of equity holds for the subgroup of firms with lowly productive CEOs. However, the relation between CEO pay gap and the cost of equity is significantly negative for the subgroup of firms with highly productive CEOs. This evidence indicates that CEO productivity influences not only the relation between CEO pay gap and debt contracting, but also the relation between CEO pay gap and the cost of equity.

#### *C. CEO Pay Gap and the Joint-Effect of the Cost of Debt and Debt Maturity*

To account for the possibility that debt maturity and cost of debt are jointly determined and that the OLS regression results could therefore be biased, we estimate a system of simultaneous equations with debt maturity and the cost of debt as endogenous variables. In Table 8, we report the results of the system of simultaneous equations using the new debt issues dataset. We find that the relation between CEO pay gap and debt maturity is significant and positive while the relation between CEO pay gap and the cost of debt is significant and negative, which are consistent with our previous findings.

#### *D. Additional Analyses on CEO Pay Gap and Tournament Incentives*

We conduct additional analyses on the effects of CEO pay gap on debt contract terms when firms are more or less likely to run CEO tournaments.<sup>9</sup> As a firm's current CEO nears retirement, the firm is more likely to run a CEO tournament to select a successor. Thus, to the extent that CEO pay gap represents the tournament incentives, we expect the effect of CEO pay gap on debt contract terms to be stronger during this period. Similar to Kale et al. (2009), we consider firms with CEOs aged 63 and above as those that are more likely to run CEO tournaments. When we rerun the analyses that focus on these firms in this period, we do not observe significantly different effects of CEO pay gap on the outcome variables.

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<sup>9</sup> The results are not reported to in the interest of brevity, save space but are available from the authors upon request.



Alternatively, when a new CEO is appointed, a firm is less likely to run a CEO tournament in the near future; therefore, the effect of CEO pay gap, which presumably proxies for tournament incentives, on the outcome variables should be weaker. When we focus our analysis on the first three years after a new CEO is appointed, we find again that the effects of CEO pay gap on the outcome variables during this period are not significantly different from those in other sample periods. This evidence further suggests that tournament incentives are unlikely the driver of relations between CEO pay gap and debt contract terms.

#### *E. CEO Pay Gap, Productivity, and Firm Risk*

Kini and Williams (2012) report that higher CEO pay gap, which implies greater tournament incentive, is associated with greater risk taking by the firm. Their findings appear to contradict our evidence of positive relations between CEO pay gap and distance-to-default and favorable debt terms; in fact, our findings indicate that CEO productivity is the main driver of favorable debt terms. To reconcile our findings with those of Kini and Williams, we revisit the relation between a firm's risk taking and CEO pay gap that was examined by Kini and Williams (2012), but we include the additional test variable of CEO productivity to do so. We report our results in Table 9. In column 1, we find that higher CEO pay gap is associated with greater stock return volatility, which is consistent with Kini and Williams' (2012) evidence. To examine the effect of CEO productivity, we disentangle CEO pay gap into two components: the predicted CEO pay gap based on CEO productivity measures, and the residual CEO pay gap. The predicted CEO pay gap is the predicted value estimated by regressing CEO pay gap on CEO productivity factors 1 and 2, and the residual CEO pay gap is the difference between the actual and the predicted pay gap. Because we assume that CEO pay gap represents both CEO productivity and tournament incentives, the predicted CEO pay gap, by construction, represents the portion of CEO pay gap explained by CEO productivity, and the residual value proxies for the tournament incentives. We substitute CEO pay gap with these two components and reexamine their relations with stock return volatility. The estimation results that we report in column 2 of Table 9 indicate that the predicted CEO pay gap has a negative and significant relation with stock return volatility, while the residual CEO pay gap has a positive and significant relation with stock

return volatility. Our findings imply that the portion of CEO pay gap explained by CEO productivity is associated with lower corporate risk taking, whereas the portion that represents tournament incentives is positively related to corporate risk taking as documented by Kini and Williams (2012). Although we cannot completely rule out tournament incentives as an explanation for CEO pay gap, our evidence suggests that CEO productivity is the main driver of the relation between CEO pay gap and debt contracting.

## **VI. Conclusion**

The existing literature suggests three possible explanations for CEO pay gap: intra-firm rank order tournaments, managerial agency problems, and CEO productivity. The tournament explanation argues that CEO pay gap represents the prize of winning the internal promotion tournament, and the option-like feature of CEO pay gap motivates senior managers to engage in risk-taking behavior to maximize outcomes used to rank them. According to the CEO productivity explanation, CEO pay gap signals a CEO's productivity relative to that of other senior executives, and associates a larger CEO pay gap with better firm performance and lower bankruptcy likelihood. Finally, the managerial agency hypothesis suggests that CEO pay gap reflects the relative bargaining power of CEOs. We find a positive relation between CEO pay gap and a firm's distance-to-default in the subgroup of firms with productive CEOs, which implies that CEO pay gap is associated with lower bankruptcy risk for firms with high CEO productivity. Exploiting the debt contract setting to examine the effects of CEO pay gap on debt terms, we find that bondholders view CEO pay gap of borrowing firms with highly productive CEOs favorably and, as a result, they provide longer-term debt, charge lower risk premiums, and impose fewer restrictive covenants on these borrowers. Overall, our evidence is consistent with the CEO productivity explanation, but is inconsistent with the tournament incentives and managerial agency explanations for the documented effects of CEO pay gap in debt contracting.

**Table 1: Summary Statistics**

The table reports the summary statistics of the key variables. CEO Pay gap, CEO delta, and CEO vega are adjusted for inflation using 1990 as the base year. CEO pay gap is the difference in CEO pay and the median pay of other senior executives. CEO delta measures change in CEO compensation, given a \$1 increase in stock price. CEO vega measures change in CEO compensation, given a 1% increase in stock return volatility. CEO productivity factors 1 and 2 are the first two factors drawn from principal component analysis based on productivity-related variables CEO tenure, industry-adjusted three-year operating profit growth rate, certified inside director (CID) dummy, and firm size. Size is the market value of assets, calculated as market value of equity plus book value of total assets minus book value of equity. Market-to-book ratio is the market value of total assets divided by book value of total assets. Financial leverage is the ratio of long-term debt to the market value of the firm. ST3 is the sum of debt in current liabilities, debt maturing in the second year, and debt maturing in the third year, all divided by total debt. All other variables are defined in the Appendix.

| Variables                    | N      | Mean       | 25%<br>percentile | 50%<br>percentile | 75%<br>percentile | Std.<br>deviation |
|------------------------------|--------|------------|-------------------|-------------------|-------------------|-------------------|
| <i>CEO compensation:</i>     |        |            |                   |                   |                   |                   |
| CEO Pay Gap (in 000s)        | 23,216 | 2,460.750  | 358.840           | 942.040           | 2,469.330         | 4,374.560         |
| CEO Delta (in 000s)          | 23,216 | 518.130    | 47.350            | 137.140           | 392.330           | 1,332.390         |
| CEO Vega (in 000s)           | 23,216 | 73.400     | 5.360             | 25.120            | 75.720            | 133.350           |
| <i>Firm Characteristics:</i> |        |            |                   |                   |                   |                   |
| Asset Maturity               | 23,216 | 11.070     | 4.150             | 7.750             | 14.540            | 10.190            |
| BCF Index                    | 23,216 | 2.286      | 1.000             | 2.000             | 3.000             | 1.364             |
| Distance-to-Default          | 20,199 | 7.360      | 4.050             | 6.570             | 9.770             | 4.650             |
| Financial Leverage           | 23,216 | 0.160      | 0.060             | 0.130             | 0.230             | 0.130             |
| Market-to-book               | 23,216 | 1.840      | 1.190             | 1.480             | 2.050             | 1.310             |
| Ownership                    | 23,216 | 0.020      | 0.000             | 0.010             | 0.020             | 0.050             |
| S&P Debt Rating dummy        | 23,216 | 0.590      | 0.000             | 1.000             | 1.000             | 0.490             |
| Return on Sales              | 23,216 | 0.200      | 0.120             | 0.190             | 0.270             | 0.100             |
| Stock Return Volatility      | 23,216 | 0.070      | 0.040             | 0.050             | 0.080             | 0.050             |
| Size (\$ million)            | 23,216 | 11,414.070 | 951.880           | 2,626.820         | 8,527.190         | 30,518.680        |
| ST3                          | 15,214 | 0.400      | 0.140             | 0.320             | 0.600             | 0.320             |
| Productivity1                | 23,216 | 0.000      | -0.950            | -0.040            | 0.800             | 1.270             |
| Productivity2                | 23,216 | 0.000      | -0.580            | -0.270            | 0.160             | 1.020             |
| <i>New Debt Issues:</i>      |        |            |                   |                   |                   |                   |
| Maturity                     | 23,216 | 12.370     | 5.190             | 10.140            | 10.400            | 10.860            |
| Yield Spread (%)             | 23,216 | 1.880      | 0.770             | 1.330             | 2.360             | 1.710             |
| Total Proceed (\$ million)   | 23,216 | 401.680    | 148.960           | 296.990           | 499.290           | 422.010           |
| Number of Debt Covenants     | 1,843  | 1.720      | 1.000             | 2.000             | 2.000             | 0.890             |

**Table 2: CEO Pay Gap and Distance-to-Default**

This table reports results of OLS regressions with distance-to-default as the dependent variable. The sample covers the period 1993-2011. Distance-to-default is the estimated z-score based on Merton (1974) model, in which the equity of the firm is considered as a call option on the underlying value of the firm, and the strike price equals the value of the firm's debt. CEO pay gap is the difference between a CEO's compensation and the median compensation of the next group of executives of the firm. High CEO productivity is a dummy variable that equals one if both CEO productivity factor 1 and CEO productivity factor 2 are above their respective sample medians. CEO productivity factors 1 and 2 are the first two factors drawn from principal component analysis based on productivity-related variables CEO tenure, industry-adjusted three- year operating profit growth rate, certified inside director (CID) dummy, and firm size. Industry median CEO pay gap and succession plan dummy are used as instruments for firm CEO pay gap. Industry median CEO delta and industry median CEO vega are used as instruments for firm CEO delta and CEO vega, respectively. Entrenched CEO is a dummy variable that equals one if the BCF index value is above the sample median, and zero otherwise. The regressions control for firm and year fixed effects. Other variables are defined in the Appendix. *t*-statistics based on heteroskedasticity-robust standard errors clustered by firms are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1%, 5% and 10% levels, respectively.

*Panel A: CEO Pay Gap and Distance-to-Default – OLS Regressions*

|                        | OLS                   |                       |
|------------------------|-----------------------|-----------------------|
|                        | Distance-to-Default   | Distance-to-Default   |
| Log(CEO Pay Gap)       | 0.1116***<br>(3.85)   | 0.0959***<br>(3.17)   |
| Log(CEO Delta)         |                       | -0.0014<br>(0.04)     |
| Log(CEO Vega)          |                       | 0.0956<br>(1.57)      |
| Tenure                 |                       | 0.0147***<br>(3.16)   |
| Log(Size)              | -0.0522<br>(0.19)     | -0.0932<br>(0.34)     |
| Log(Size) <sup>2</sup> | -0.0212<br>(1.23)     | -0.02<br>(1.16)       |
| Tobin's Q              | 0.2128***<br>(3.54)   | 0.2114***<br>(3.48)   |
| Sales Growth           | -0.1362***<br>(2.81)  | -0.1363***<br>(2.81)  |
| Leverage               | -8.4470***<br>(17.17) | -8.4437***<br>(17.12) |
| ROA                    | 5.0777***<br>(7.37)   | 5.0844***<br>(7.37)   |
| Altman Z-Score dummy   | 0.0000***<br>(3.79)   | 0.0000***<br>(3.79)   |

|                         |                  |                      |
|-------------------------|------------------|----------------------|
| Number of Segments      | 0.0372<br>(1.10) | 0.0332<br>(0.98)     |
| Intercept               | 10.8122**<br>*   | 10.6960***<br>(9.62) |
| Number of observations  | 20,199           | 20,199               |
| Adjusted R <sup>2</sup> | 0.71             | 0.71                 |

*Panel B: CEO Pay Gap and Distance-to-Default – IV Regression*

|                            | First-stage Results   |                       |                       | Second-stage Results  |
|----------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                            | Log(CEO Pay Gap)      | Log(CEO Delta)        | Log(CEO Vega)         |                       |
| Industry-median CEO Pay    | 0.1950***<br>(11.60)  | 0.4119***<br>(35.50)  | 0.3636***<br>(43.84)  |                       |
| Industry-median CEO Delta  | 0.0869***<br>(6.54)   | 0.5379***<br>(60.09)  | 0.0380***<br>(5.35)   |                       |
| Industry-median CEO Vega   | 0.1019***<br>(8.28)   | -0.2691***<br>(31.85) | 0.2074***<br>(29.00)  |                       |
| Succession Plan Dummy      | -0.0132<br>(1.06)     | 0.0248***<br>(3.38)   | -0.0112**<br>(2.09)   |                       |
| Predicted Log(CEO Pay Gap) |                       |                       |                       | 2.6545*<br>(1.75)     |
| Predicted Log(CEO Delta)   |                       |                       |                       | -0.8907***<br>(5.59)  |
| Predicted Log(CEO Vega)    |                       |                       |                       | -1.4704*<br>(1.79)    |
| Tenure                     | 0.0023**<br>(2.32)    | 0.0149***<br>(25.47)  | 0.0026***<br>(6.17)   | 0.0175***<br>(4.43)   |
| Log(Size)                  | 0.8223***<br>(27.41)  | 0.0384**<br>(2.11)    | 0.1036***<br>(7.38)   | -0.6352<br>(0.54)     |
| Log(Size) <sup>2</sup>     | -0.0269***<br>(14.16) | 0.0039***<br>(3.37)   | 0.0020**<br>(2.10)    | 0.0204<br>(0.46)      |
| Tobin's Q                  | 0.0508***<br>(3.12)   | 0.0328***<br>(4.18)   | 0.0189***<br>(3.83)   | 0.0957<br>(1.55)      |
| Sales Growth               | 0.0062<br>(0.57)      | 0.005<br>(0.87)       | -0.0079*<br>(1.83)    | -0.2246***<br>(3.03)  |
| Leverage                   | -1.1816***<br>(15.57) | -0.5967***<br>(14.51) | -0.3561***<br>(13.50) | -12.1260***<br>(8.34) |
| ROA                        | -0.0063***<br>(3.88)  | 0.0028<br>(1.28)      | -0.0028***<br>(3.77)  | 0.0717**<br>(2.09)    |
| Altman Z-Score dummy       | 0.0001                | 0.0001**              | 0.0001                | 0.0001***             |

|  |           |            |           |           |
|--|-----------|------------|-----------|-----------|
|  | (0.99)    | (2.34)     | (0.22)    | (2.84)    |
| Number of Segments   | -0.0126** | -0.0179*** | 0.0026    | 0.1459*** |
|  | (2.18)    | (5.19)     | (0.96)    | (4.88)    |
| Intercept  | 0.0234    | 0.9692***  | 0.0795    | 8.8096*** |
|  | (0.13)    | (8.84)     | (1.03)    | (11.33)   |
| Number of observations   | 20,199    | 20,199     | 20,199    | 20,199    |
| F-statistics   | 198.98*** | 2111.56*** | 2102.60** |           |
| Anderson-Rubin Wald F-stat<br>for Joint Significance             |           |            | *         | 52.12***  |
| Hansen J Statistic   |           |            |           | 0.176     |
| Endogeneity Test<br>(Difference in Sargan-<br>Hansen Statistics) |           |            |           | 188.79*** |

*Panel C: CEO Pay Gap and Distance to Default - CEO Productivity vs. CEO Entrenchment*

|                        | OLS  |  |   |   |
|------------------------|--|--|---|---|
|                        | Distance to<br>Default<br>(High CEO<br>Productivity=1) | Distance to<br>Default<br>(High CEO<br>Productivity=0) | Distance to<br>Default<br>(Entrenched<br>CEO=1) | Distance to<br>Default<br>(Entrenched<br>CEO=0) |
| Log(CEO Pay Gap)       | 0.1271**   | -0.1525**  | 0.1070***                                       | 0.1610***                                       |
|                        | (2.05)   | (-2.19)  | (2.62)  | (2.60)  |
| Log(CEO Delta)         | 0.1714*  | -0.0864  | -0.0069   | -0.1179   |
|                        | (1.86)   | (-0.71)  | (-0.11)   | (-1.18)   |
| Log(CEO Vega)          | 0.0375   | 0.8034***  | -0.1664*  | -0.1231   |
|                        | (0.31)   | (5.40)   | (-1.82)   | (-0.86)   |
| Log(Size)              | 0.0096   | 0.0460**   | 0.0090  | 0.0205**  |
|                        | (0.80)   | (1.98)   | (1.45)  | (2.51)  |
| Log(Size) <sup>2</sup> | -0.6753  | -0.5422  | -0.0059   | -1.5506***                                      |
|                        | (-1.07)  | (-0.89)  | (-0.01)   | (-2.98)   |
| Leverage               | 0.0021   | 0.0027   | -0.0091   | 0.0563*   |
|                        | (0.06)   | (0.07)   | (-0.31)   | (1.77)  |
| Tobin's Q              | 0.1009**   | 0.3270***  | 0.3661***                                       | 0.2757***                                       |
|                        | (2.22)   | (2.82)   | (6.74)  | (5.20)  |
| Sales Growth           | -0.0744  | -0.0318  | -0.3966***                                      | -0.3692**                                       |
|                        | (-0.81)  | (-0.95)  | (-3.72)   | (-2.34)   |
| Leverage               | -4.9333***   | -7.8497***   | -7.9410***                                      | -6.3080***                                      |
|                        | (-4.31)  | (-11.91)   | (-21.74)  | (-10.35)  |
| ROA                    | 2.6509**   | 2.5817***  | 4.7626***                                       | 2.9268***                                       |
|                        | (2.24)   | (2.93)   | (7.09)  | (2.91)  |
| Altman Z-Score dummy   | -0.0000  | 0.0001**   | 0.0001  | 0.0000***                                       |

|                         |            |           |           |            |
|-------------------------|------------|-----------|-----------|------------|
|                         | (-0.03)    | (2.36)    | (1.02)    | (3.30)     |
| Number of Segments      | 0.0225     | -0.1030   | 0.0682    | 0.0035     |
|                         | (0.44)     | (-0.84)   | (1.52)    | (0.05)     |
| Intercept               | 12.6313*** | 9.1217*** | 9.8313*** | 17.7668*** |
|                         | (4.83)     | (3.98)    | (5.29)    | (7.77)     |
| Number of observations  | 5,529      | 4,121     | 7,807     | 4,051      |
| Adjusted R <sup>2</sup> | 0.80       | 0.69      | 0.79      | 0.79       |

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**Table 3: CEO Pay Gap and Proportion of Short-term Debt**

This table reports results of OLS and instrumental variable (IV) regressions with ST3 (proportion of short-term debt) as the dependent variable. The sample covers the period 1993-2011. ST3 is the proportion of short-term debt maturing within 3 years to total debt. CEO pay gap is the difference between a CEO's compensation and the median compensation of the next group of executives of the firm. CEO delta is the change in CEO wealth, given a \$1 change in stock price. CEO vega is the change in CEO wealth, given a 0.01 change in stock return volatility. High CEO productivity is a dummy variable that equals one if both CEO productivity factor 1 and CEO productivity factor 2 are above the sample median, and zero otherwise. CEO productivity factors 1 and 2 are the first two factors drawn from principal component analysis, based on productivity-related variables CEO tenure, industry-adjusted three-year operating profit growth rate, CID dummy, and firm size. Entrenched CEO is a dummy variable that equals one if the BCF index value is above the sample median, and zero otherwise. Industry median CEO pay gap and inside promotion dummy are used as instruments for firm CEO pay gap. Industry median CEO delta and industry median CEO vega are used as instruments for firm CEO delta and CEO vega, respectively. Other variables are defined in Appendix A. The OLS regressions control for firm and year fixed effects. *t*-statistics based on heteroskedasticity-robust standard errors clustered by firms are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1%, 5% and 10% levels, respectively.

*Panel A: CEO Pay Gap and Proportion of Short-term Debt*

|                            | OLS                   |                       | IV(2SLS)             |
|----------------------------|-----------------------|-----------------------|----------------------|
|                            | ST3                   | ST3                   | ST3                  |
| Log(CEO Pay Gap)           | -0.0079***<br>(3.00)  | -0.0050*<br>(1.76)    |                      |
| Log(CEO Delta)             |                       | -0.0149***<br>(4.80)  |                      |
| Log(CEO Vega)              |                       | 0.0024<br>(1.22)      |                      |
| Predicted Log(CEO Pay Gap) |                       |                       | -0.0393***<br>(6.96) |
| Predicted Log(CEO Delta)   |                       |                       | -0.0633***<br>(4.20) |
| Predicted Log(CEO Vega)    |                       |                       | 0.0384***<br>(4.83)  |
| Log(Size)                  | -0.1026***<br>(4.47)  | -0.0940***<br>(4.08)  | 0.0274<br>(0.93)     |
| Log(Size) <sup>2</sup>     | 0.0039***<br>(2.76)   | 0.0039***<br>(2.75)   | 0.0002<br>(0.16)     |
| Leverage                   | -1.1056***<br>(33.75) | -1.1255***<br>(34.10) | -0.2935***<br>(7.83) |
| Asset Maturity             | -0.0001<br>(0.15)     | -0.0002<br>(0.36)     | -0.0019***<br>(4.41) |
| Ownership                  | 0.6309***<br>(4.49)   | 0.7125***<br>(5.04)   | 1.1304***<br>(3.26)  |
| Market/Book                | 0.0055**              | 0.0038                | 0.0339***            |



|   |            |            |            |
|---|------------|------------|------------|
|   | (2.11)     | (1.43)     | (5.07)     |
| Term Structure  | 0.0051     | 0.0055     | -0.0097*** |
|   | (0.96)     | (1.04)     | (3.43)     |
| Abnormal Earnings   | 0.0001     | -0.0001    | -0.0001    |
|   | (0.00)     | (0.07)     | (0.91)     |
| Return Volatility   | 0.2158***  | 0.1907***  | -0.085     |
|   | (3.29)     | (2.90)     | (0.51)     |
| S&P Debt Rating dummy                                     | -0.0613*** | -0.0615*** | -0.0232**  |
|   | (6.33)     | (6.35)     | (2.01)     |
| Altman Z-Score dummy                                      | -0.1182*** | -0.1148*** | 0.0101     |
|   | (11.82)    | (11.46)    | (1.11)     |
| Intercept   | -0.1026*** | -0.0940*** | 0.5084***  |
|   | (4.47)     | (4.08)     | (3.99)     |
| Number of observations                                    | 15,214     | 15,214     | 15,214     |
| Adjusted R <sup>2</sup>                                   | 0.55       | 0.55       |            |
| Anderson-Rubin Wald F-stat for Joint Significance         |            |            | 24.23***   |
| Hansen J Statistic  |            |            | 3.665      |
| Endogeneity Test (Difference in Sargan-Hansen Statistics) |            |            | 60.025***  |

*Panel B: CEO Pay Gap, Proportion of Short-term Debt, CEO Productivity, and CEO Entrenchment*

|                        | OLS                       |                           |                    |                    |
|------------------------|---------------------------|---------------------------|--------------------|--------------------|
|                        | ST3                       | ST3                       | ST3                | ST3                |
|                        | (High CEO Productivity=1) | (High CEO Productivity=0) | (Entrenched CEO=1) | (Entrenched CEO=0) |
| Log(CEO Pay Gap)       | -0.0121**                 | -0.0035                   | -0.0061            | -0.01              |
|                        | (2.15)                    | (0.47)                    | (1.51)             | (1.57)             |
| Log(CEO Delta)         | -0.009                    | -0.0344***                | -0.0190***         | -0.0045            |
|                        | (1.22)                    | (3.53)                    | (3.98)             | (0.65)             |
| Log(CEO Vega)          | 0.0016                    | 0.0044                    | 0.0056             | 0.0013             |
|                        | (0.35)                    | (0.71)                    | (1.57)             | (0.37)             |
| Log(Size)              | -0.1514***                | -0.007                    | -0.0872**          | -0.0431            |
|                        | (2.92)                    | (0.11)                    | (2.12)             | (0.68)             |
| Log(Size) <sup>2</sup> | 0.0075***                 | -0.0028                   | 0.0035             | 0.0005             |
|                        | (2.61)                    | (0.68)                    | (1.46)             | (0.13)             |
| Leverage               | -1.2236***                | -1.1983***                | -1.2100***         | -1.2741***         |
|                        | (18.10)                   | (14.97)                   | (25.50)            | (14.21)            |
| Asset Maturity         | -0.0002                   | -0.001                    | -0.0007            | 0.0031***          |
|                        | (0.24)                    | (0.99)                    | (0.84)             | (2.72)             |
| Ownership              | 1.3800***                 | 0.8605***                 | 1.1963***          | -0.1445            |
|                        | (3.86)                    | (2.75)                    | (4.57)             | (0.35)             |

|                         |                      |                      |                      |                      |
|-------------------------|----------------------|----------------------|----------------------|----------------------|
| Market/Book             | 0.0138**<br>(2.08)   | 0.0059<br>(0.74)     | 0.0125**<br>(2.40)   | 0.0178**<br>(2.34)   |
| Term Structure          | -0.0027<br>(0.29)    | 0.0023<br>(0.18)     | 0.0029<br>(0.42)     | 0.0209<br>(1.63)     |
| Abnormal Earnings       | 0.0001<br>(0.51)     | -0.0001<br>(0.22)    | -0.0001<br>(0.12)    | -0.0001<br>(0.15)    |
| Return Volatility       | -0.1484<br>(0.98)    | 0.3491**<br>(2.45)   | 0.2785***<br>(2.67)  | 0.3340*<br>(1.82)    |
| S&P Debt Rating dummy   | -0.0571***<br>(2.83) | -0.0521*<br>(1.89)   | -0.0697***<br>(4.84) | -0.0539**<br>(2.35)  |
| Altman Z-Score dummy    | -0.1091***<br>(6.41) | -0.1155***<br>(4.31) | -0.1178***<br>(8.52) | -0.1485***<br>(5.53) |
| Intercept               | 1.9129***<br>(7.41)  | 1.0844***<br>(3.83)  | 1.3438***<br>(7.42)  | 1.0856***<br>(3.79)  |
| Number of observations  | 4,280                | 3,578                | 4,399                | 2,822                |
| Adjusted R <sup>2</sup> | 0.65                 | 0.64                 | 0.57                 | 0.65                 |

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**Table 4: CEO Pay Gap and Maturity of New Debt Issues**

This table reports results of OLS and instrumental variable (IV) regressions with years to maturity of debt issues as the dependent variable. The sample covers the period 1993-2011. Maturity is the years to maturity of new debt issues. CEO pay gap is the difference between a CEO's compensation and the median compensation of the next group of executives of the firm. CEO delta is the change in CEO wealth, given a \$1 change in stock price. CEO vega is the change in CEO wealth, given a 0.01 change in stock return volatility. High CEO productivity is a dummy variable that equals one if both CEO productivity factor 1 and CEO productivity factor 2 are above the sample median, and zero otherwise. CEO productivity factors 1 and 2 are the first two factors drawn from principal component analysis based on productivity-related variables CEO tenure, industry-adjusted three-year operating profit growth rate, certified inside director dummy, and firm size. Entrenched CEO is a dummy variable that equals one if the BCF index value is above the sample median, and zero otherwise. Industry median CEO pay gap and succession plan dummy are used as instruments for firm CEO pay gap. Industry median CEO delta and industry median CEO vega are used as instruments for firm CEO delta and CEO vega, respectively. The OLS regressions control for firm and year fixed effects. Other variables are defined in the Appendix. *t*-statistics based on heteroskedasticity-robust standard errors clustered by firms are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1%, 5% and 10% levels, respectively.

*Panel A: CEO Pay Gap and Debt Maturity*

|                            | OLS                 |                   | IV (2SLS)            |
|----------------------------|---------------------|-------------------|----------------------|
|                            | Log(Maturity)       | Log(Maturity)     | Log(Maturity)        |
| Log(CEO Pay Gap)           | 0.0337**<br>(2.37)  | 0.0316*<br>(1.96) |                      |
| Log(CEO Delta)             |                     | 0.0146<br>(0.66)  |                      |
| Log(CEO Vega)              |                     | -0.0224<br>(1.62) |                      |
| Predicted Log(CEO Pay Gap) |                     |                   | 0.2494***<br>(4.73)  |
| Predicted Log(CEO Delta)   |                     |                   | 0.3193***<br>(3.86)  |
| Predicted Log(CEO Vega)    |                     |                   | -0.2105***<br>(3.69) |
| Log(Size)                  | 0.4232*<br>(1.79)   | 0.4292<br>(1.63)  | 0.0243***<br>(4.27)  |
| Log(Size) <sup>2</sup>     | -0.0221*<br>(1.82)  | -0.0219<br>(1.55) | -0.5855***<br>(4.36) |
| Leverage                   | -0.4826**<br>(2.03) | -0.3628<br>(1.61) | -1.0543***<br>(4.49) |
| Asset Maturity             | 0.0041<br>(1.52)    | 0.0047*<br>(1.76) | 0.0076***<br>(3.94)  |
| Ownership                  | -0.0618<br>(0.08)   | -0.0071<br>(0.01) | -5.4365***<br>(3.20) |
| Market/Book                | -0.0745***          | -0.0843***        | -0.1685***           |

|  |                      |                      |                      |
|--|----------------------|----------------------|----------------------|
|  | (3.28)               | (3.38)               | (6.45)               |
| Abnormal Earnings  | 0.001<br>(0.22)      | 0.001<br>(0.93)      | 0.001<br>(0.58)      |
| Return Volatility  | -1.8820***<br>(3.31) | -1.6325***<br>(2.85) | -2.9576***<br>(4.23) |
| Average Return   | 26.6093***<br>(3.99) | 29.2519***<br>(4.16) | 17.2729**<br>(2.19)  |
| Interest Coverage  | 0.0246<br>(0.79)     | 0.0472<br>(1.50)     | -0.0682***<br>(2.66) |
| Term Structure   | -0.0311***<br>(3.08) | -0.0268**<br>(2.33)  | -0.1779***<br>(3.10) |
| Altman Z-Score dummy   | 0.1116**<br>(2.23)   | 0.0818<br>(1.44)     | 0.0173<br>(0.87)     |
| Intercept  | 0.1507<br>(0.13)     | 0.045<br>(0.04)      | 3.4872***<br>(7.37)  |
| Number of observations                                       | 23,216               | 23,216               | 23,216               |
| Adjusted R <sup>2</sup>                                      | 0.13                 | 0.15                 |                      |
| Anderson-Rubin Wald F-stat for Joint Significance            |                      |                      | 15.67***             |
| Hansen J Statistic   |                      |                      | 0.012                |
| Endogeneity Test<br>(Difference in Sargan-Hansen Statistics) |                      |                      | 41.068***            |

*Panel B: CEO Pay Gap, Debt Maturity, CEO Productivity, and CEO Entrenchment*

|                         | OLS  |  |                                     |                                     |
|-------------------------|--|--|-------------------------------------|-------------------------------------|
|                         | Log(Maturity)<br>(High CEO Productivity=1) | Log(Maturity)<br>(High CEO Productivity=0) | Log(Maturity)<br>(Entrenched CEO=1) | Log(Maturity)<br>(Entrenched CEO=0) |
| Log(CEO Pay Gap)        | 0.0649**<br>(2.07)                         | 0.0206<br>(0.62)                           | -0.0028<br>(0.13)                   | -0.1118*<br>(1.86)                  |
| Log(CEO Delta)          | -0.0605<br>(1.50)                          | -0.0058<br>(0.16)                          | 0.035<br>(1.24)                     | -0.1325***<br>(3.60)                |
| Log(CEO Vega)           | 0.0317<br>(1.25)                           | -0.0332<br>(1.04)                          | -0.0332*<br>(1.65)                  | 0.1485***<br>(2.89)                 |
| Log(Size)               | 1.0573***<br>(3.80)                        | 0.1447<br>(0.57)                           | -0.5461**<br>(2.03)                 | -1.1879<br>(1.59)                   |
| Log(Size <sup>2</sup> ) | -0.0443***<br>(3.97)                       | -0.0089<br>(0.87)                          | 0.0274**<br>(1.98)                  | 0.0427<br>(1.44)                    |
| Leverage                | 0.7673**<br>(2.38)                         | -0.9268***<br>(4.31)                       | 0.2461<br>(0.85)                    | -0.8283***<br>(6.94)                |

|                         |            |            |            |           |
|-------------------------|------------|------------|------------|-----------|
| Asset Maturity          | 0.0175*    | -0.0034    | -0.0017    | -0.0189   |
|                         | (1.90)     | (0.28)     | (0.31)     | (1.07)    |
| Ownership               | -6.3229*** | -0.1472    | 0.3168     | 22.7615   |
|                         | (3.14)     | (0.29)     | (0.34)     | (1.25)    |
| Market/Book             | -0.0555    | -0.1760*   | -0.0987*** | -0.174    |
|                         | (0.76)     | (1.80)     | (2.99)     | (1.17)    |
| Abnormal Earnings       | -0.0001*   | 0.0001     | 0.0001     | 0.0001    |
|                         | (1.72)     | (0.49)     | (0.76)     | (1.23)    |
| Return Volatility       | -2.3409**  | 1.4842     | -2.9634*** | 4.6331    |
|                         | (2.13)     | (1.41)     | (3.94)     | (1.35)    |
| Average Return          | 41.4056*** | 18.8074*** | 17.6017**  | 0.1632    |
|                         | (9.11)     | (4.18)     | (2.10)     | (0.01)    |
| Interest Coverage       | -0.0252    | -0.0221    | 0.1203***  | 0.242     |
|                         | (0.45)     | (0.29)     | (3.23)     | (1.17)    |
| Term Structure          | -0.0865*** | -0.0815*** | 0.0046     | 0.0133    |
|                         | (5.67)     | (4.85)     | (0.34)     | (0.82)    |
| Altman Z-Score dummy    | 0.2275**   | 0.2625**   | 0.0853     | -0.8387   |
|                         | (2.05)     | (2.18)     | (1.17)     | (1.37)    |
| Intercept               | -5.0239*** | 2.2931     | 4.7865***  | 11.3567** |
|                         | (2.96)     | (1.48)     | (3.64)     | (2.45)    |
| Number of observations  | 6,477      | 5,357      | 6,099      | 5,844     |
| Adjusted R <sup>2</sup> | 0.13       | 0.16       | 0.3        | 0.07      |

**Table 5: CEO Pay Gap and Cost of Debt**

This table reports results of OLS and IV regressions with the yield spread as the dependent variable. The sample covers period 1993-2011. Yield spread is the difference between the yield to maturity of new debt issues and the corresponding Treasury benchmark yield. CEO pay gap is the difference between a CEO's compensation and the median compensation of the next group of executives of the firm. CEO delta is the change in CEO wealth, given a \$1 change in stock price. CEO vega is the change in CEO wealth, given a 0.01 change in stock return volatility. High CEO productivity is a dummy variable that equals one if both CEO productivity factor 1 and CEO productivity factor 2 are above the sample median, and zero otherwise. CEO productivity factors 1 and 2 are the first two factors drawn from principal component analysis based on productivity-related variables CEO tenure, industry-adjusted three-year operating profit growth rate, CID dummy, and firm size. Entrenched CEO is a dummy variable that equals one if the BCF index value is above the sample median, and zero otherwise. CEO tenure and number of VPs are used as instruments for firm CEO pay gap. Industry median CEO delta and industry median CEO vega are used as instruments for firm CEO delta and CEO vega, respectively. The OLS regressions control for firm and year fixed effects. Other variables are defined in Appendix A. *t*-statistics based on heteroskedasticity-robust standard errors clustered by firms are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1%, 5% and 10% levels, respectively.

*Panel A: CEO Pay Gap and Cost of Debt*

|                            | OLS                  |                      | IV (2SLS)            |
|----------------------------|----------------------|----------------------|----------------------|
|                            | Yield Spread         | Yield Spread         | Yield Spread         |
| Log(CEO Pay Gap)           | -0.0006***<br>(3.14) | -0.0010***<br>(5.23) |                      |
| Log(CEO Delta)             |                      | 0.0001<br>(0.96)     |                      |
| Log(CEO Vega)              |                      | 0.0016***<br>(8.77)  |                      |
| Predicted Log(CEO Pay Gap) |                      |                      | -0.0176***<br>(4.07) |
| Predicted Log(CEO Delta)   |                      |                      | -0.0212***<br>(5.03) |
| Predicted Log(CEO Vega)    |                      |                      | 0.0118***<br>(4.62)  |
| Return Volatility          | -0.0044<br>(0.37)    | -0.0193<br>(1.52)    | 0.2334***<br>(8.97)  |
| Average Return             | -0.3200***<br>(7.33) | -0.2496***<br>(5.82) | -0.8915***<br>(4.06) |
| Log(Total Proceeds)        | 0.0092***<br>(17.41) | 0.0059***<br>(11.84) | 0.0277***<br>(3.63)  |
| Leverage                   | 0.0141***<br>(11.65) | 0.0136***<br>(11.10) | 0.0007***<br>(2.85)  |
| Interest Coverage          | -0.0027***<br>(5.55) | -0.0033***<br>(6.28) | -0.0006<br>(0.43)    |
| Return on Sales            | -0.0004***           | -0.0005***           | -0.0575***           |

|  |            |            |            |
|--|------------|------------|------------|
|  | (4.52)     | (5.04)     | (4.99)     |
| Treasury Benchmark Yield                                     | 0          | 0          | -0.0032*** |
|  | (0.01)     | (0.02)     | (5.73)     |
| Yield Curve Slope  | -0.0010*** | -0.0009*** | -0.0008*   |
|  | (2.79)     | (2.63)     | (1.70)     |
| Intercept  | 0.0069     | 0.0061     | 0.2290***  |
|  | (1.37)     | (1.20)     | (5.91)     |
| Number of observations                                       | 23,216     | 23,216     | 23,216     |
| Adjusted R <sup>2</sup>                                      | 0.53       | 0.54       |            |
| Anderson-Rubin Wald F-stat for<br>Joint Significance         |            |            | 94.62***   |
| Hansen J Statistic   |            |            | 1.727      |
| Endogeneity Test (Difference in<br>Sargan-Hansen Statistics) |            |            | 243.753*** |

*Panel B: CEO Pay Gap, Cost of Debt, CEO Productivity, and CEO Entrenchment*

|                          | OLS  |  |  |                                       |
|--------------------------|--|--|--|---------------------------------------|
|                          | Yield Spread<br>(High CEO<br>Productivity=1) | Yield Spread<br>(High CEO<br>Productivity=0) | Yield<br>Spread<br>(Entrenched<br>CEO=1) | Yield Spread<br>(Entrenched<br>CEO=0) |
| Log(CEO Pay Gap)         | -0.0011*                                     | 0.0009                                       | -0.0007                                  | 0.001                                 |
|                          | (1.79)                                       | (1.40)                                       | (1.42)                                   | (1.49)                                |
| Log(CEO Delta)           | 0.0001                                       | -0.0026***                                   | -0.0015***                               | -0.0014***                            |
|                          | (0.17)                                       | (2.88)                                       | (2.96)                                   | (2.59)                                |
| Log(CEO Vega)            | -0.0016***                                   | -0.0001                                      | -0.0018***                               | 0.0015*                               |
|                          | (2.62)                                       | (0.12)                                       | (5.24)                                   | (1.95)                                |
| Return Volatility        | 0.0047                                       | -0.0729***                                   | 0.0213                                   | 0.0059                                |
|                          | (0.21)                                       | (2.91)                                       | (1.08)                                   | (0.18)                                |
| Average Return           | -0.1338**                                    | -0.6090***                                   | -1.3731***                               | 0.2740*                               |
|                          | (2.40)                                       | (16.78)                                      | (6.33)                                   | (1.95)                                |
| Log(Total Proceeds)      | 0.0164***                                    | 0.0373***                                    | -0.0208**                                | -0.02                                 |
|                          | (7.66)                                       | (5.99)                                       | (2.35)                                   | (1.64)                                |
| Leverage                 | 0.0283***                                    | 0.0489***                                    | 0.0329***                                | -0.003                                |
|                          | (5.33)                                       | (7.69)                                       | (5.71)                                   | (0.95)                                |
| Interest Coverage        | -0.0035***                                   | -0.0047**                                    | -0.0012                                  | -0.0049***                            |
|                          | (3.50)                                       | (2.34)                                       | (1.37)                                   | (2.84)                                |
| Return on Sales          | -0.0008***                                   | 0.0001                                       | 0.0006**                                 | -0.0012***                            |
|                          | (3.57)                                       | (1.42)                                       | (2.51)                                   | (4.39)                                |
| Treasury Benchmark Yield | 0.0003                                       | 0.0006***                                    | -0.0025***                               | -0.001                                |
|                          | (0.42)                                       | (6.07)                                       | (3.21)                                   | (0.71)                                |

|                         |                    |                      |                     |                    |
|-------------------------|--------------------|----------------------|---------------------|--------------------|
| Yield Curve Slope       | 0.0008**<br>(2.30) | 0.0022***<br>(6.48)  | -0.0022**<br>(2.12) | -0.0018<br>(1.63)  |
| Intercept               | 0.0078<br>-0.79    | -0.0554***<br>(8.20) | 0.0383***<br>-6.06  | 0.0507***<br>-3.15 |
| Number of observations  | 6,477              | 5,357                | 6,099               | 5,844              |
| Adjusted R <sup>2</sup> | 0.52               | 0.76                 | 0.77                | 0.25               |

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**Table 6: CEO Pay Gap and Number of Debt Covenants**

This table reports results of OLS and IV regressions with the number of debt covenants as the dependent variable. The sample covers the period 1994-2011. Number of debt covenants is the total number of debt covenants per debt issue. CEO pay gap is the difference between a CEO's compensation and the median compensation of the next group of executives of the firm. CEO delta is the change in CEO wealth, given a \$1 change in stock price. CEO vega is the change in CEO wealth, given a 0.01 change in stock return volatility. High CEO productivity is a dummy variable that equals one if both CEO productivity factor 1 and CEO productivity factor 2 are above the sample median, and zero otherwise. CEO productivity factors 1 and 2 are the first two factors drawn from principal component analysis based on productivity-related variables CEO tenure, industry-adjusted three-year operating profit growth rate, certified inside director dummy, and firm size. Entrenched CEO is a dummy variable that equals one if BCF index is above the sample median, and zero otherwise. Industry median CEO pay gap and inside promotion dummy are used as instruments for firm CEO pay gap. Industry median CEO delta and industry median CEO vega are used as instruments for firm CEO delta and CEO vega, respectively. The OLS regressions control for firm and year fixed effects. Other variables are defined in the Appendix. *t*-statistics based on heteroskedasticity-robust standard errors clustered by firms are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1%, 5% and 10% levels, respectively.

*Panel A: CEO Pay Gap and Debt Covenants*

|                            | OLS                           |                               | IV(2SLS)                      |
|----------------------------|-------------------------------|-------------------------------|-------------------------------|
|                            | Log(Number of Debt Covenants) | Log(Number of Debt Covenants) | Log(Number of Debt Covenants) |
| Log(CEO Pay Gap)           | -0.0206*<br>(-1.93)           | -0.0371***<br>(-2.96)         |                               |
| Log(CEO Delta)             |                               | 0.0210<br>(1.25)              |                               |
| Log(CEO Vega)              |                               | 0.0289**<br>(2.41)            |                               |
| Predicted Log(CEO Pay Gap) |                               |                               | -0.1018**<br>(-2.57)          |
| Predicted Log(CEO Delta)   |                               |                               | 0.0375<br>(0.53)              |
| Predicted Log(CEO Vega)    |                               |                               | -0.0363<br>(-0.86)            |
| Log(Maturity)              | -0.0095<br>(-0.94)            | -0.0105<br>(-1.02)            | 0.0365**<br>(2.12)            |
| Leverage                   | 0.6320***<br>(4.59)           | 0.5888***<br>(3.98)           | 0.9208***<br>(5.67)           |
| Asset Maturity             | 0.0048***<br>(2.82)           | 0.0065***<br>(3.45)           | -0.0059***<br>(-5.24)         |
| Market/Book                | -0.0003<br>(-0.01)            | -0.0524<br>(-1.51)            | -0.0729**<br>(-2.23)          |
| Return Volatility          | 1.3433***                     | 1.6744***                     | 4.6033***                     |

|  |            |            |           |
|--|------------|------------|-----------|
|  | (3.29)     | (3.64)     | (8.39)    |
| Ownership  | -0.6209    | -0.5616    | -0.0504   |
|  | (-1.05)    | (-0.89)    | (-0.06)   |
| Abnormal Earnings  | -0.0000*** | -0.0000*** | -0.0000** |
|  | (-5.29)    | (-4.74)    | (-2.36)   |
| Altman Z-Score dummy   | -0.0424    | -0.0610*   | 0.1709*** |
|  | (-1.29)    | (-1.79)    | (3.82)    |
| Intercept  | 0.3771***  | 0.3298**   | 0.7842*** |
|  | (3.36)     | (2.57)     | (3.48)    |
| Number of observations                                       | 1,843      | 1,843      | 1,843     |
| Adjusted R <sup>2</sup>                                      | 0.83       | 0.83       |           |
| Anderson-Rubin Wald F-stat<br>for Joint Significance         |            |            | 3.92***   |
| Hansen J Statistic   |            |            | 0.557     |
| Endogeneity Test (Difference<br>in Sargan-Hansen Statistics) |            |            | 14.037*** |

*Panel B: CEO Pay Gap and Debt Covenants - CEO Productivity and CEO Entrenchment*

|                   | OLS  |  |  |  |
|-------------------|--|--|--|--|
|                   | Log(Number of<br>Debt Covenants)<br>(High CEO<br>Productivity=1) | Log(Number of<br>Debt Covenants)<br>(High CEO<br>Productivity=0) | Log(Number<br>of Debt<br>Covenants)<br>(Entrenched<br>CEO=1) | Log(Number of<br>Debt Covenants) <sub>t</sub><br>(Entrenched<br>CEO=0) |
| Log(CEO Pay Gap)  | -0.0684***<br>(2.91)   | 0.0171<br>(0.78)   | -0.0463***<br>(2.78)   | -0.2980***<br>(6.75)   |
| Log(CEO Delta)    | -0.1352***<br>(7.65)   | -0.0678***<br>(2.96)   | -0.0536***<br>(3.62)   | 0.1942***<br>(3.78)  |
| Log(CEO Vega)     | 0.0683***<br>(3.24)  | -0.0121<br>(0.44)  | -0.0065<br>(0.43)  | -0.1163***<br>(2.80)   |
| Log(Maturity)     | 0.0757***<br>(3.39)  | 0.0228<br>(0.52)   | -0.0485**<br>(2.12)  | -0.1382***<br>(2.77)   |
| Leverage          | 0.5086***<br>(3.07)  | 1.0121***<br>(4.09)  | 0.9112***<br>(6.48)  | -0.6156<br>(1.20)  |
| Asset Maturity    | -0.0065***<br>(3.74)   | -0.0122***<br>(4.90)   | -0.0061***<br>(3.29)   | 0.0143***<br>(2.93)  |
| Market/Book       | -0.0371<br>(0.95)  | -0.0205<br>(0.49)  | -0.0309<br>(1.22)  | -0.3646***<br>(3.90)   |
| Return Volatility | 6.3399***<br>(7.35)  | 4.4083***<br>(4.87)  | 3.8055***<br>(5.98)  | 9.2637***<br>(5.14)  |

|                         |                     |                     |                     |                      |
|-------------------------|---------------------|---------------------|---------------------|----------------------|
| Ownership               | 9.0755**<br>(2.20)  | 0.0656<br>(0.18)    | -0.2997<br>(0.97)   | -1.9475<br>(0.07)    |
| Abnormal Earnings       | 0.0001***<br>(3.04) | -0.0001**<br>(2.55) | 0.0001<br>(1.05)    | -0.0001<br>(0.11)    |
| Altman Z-Score dummy    | 0.0099<br>(0.23)    | -0.1242**<br>(2.09) | 0.0582<br>(1.55)    | -0.7522***<br>(6.76) |
| Intercept               | 0.7746***<br>(4.47) | 0.5755**<br>(2.38)  | 0.9992***<br>(7.52) | 3.4766***<br>(10.74) |
| Number of observations  | 446                 | 364                 | 712                 | 672                  |
| Adjusted R <sup>2</sup> | 0.29                | 0.26                | 0.17                | 0.77                 |

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**Table 7: Executive Pay Disparity and Cost of Equity**

This table reports the results of cost of equity regressions. The sample covers period from 1993 to 2011. CPS is the proportion of CEO pay of the total pay of all top executives. CEO pay gap is the difference between a CEO's compensation and the median compensation of the next group of executives of the firm. Cost of equity is estimated as the internal rate of return that equates the current stock price to the present value of all future cash flows to shareholders. High CEO productivity is a dummy variable that equals one if both CEO productivity factor 1 and CEO productivity factor 2 are above the sample median, and zero otherwise. CEO productivity factors 1 and 2 are the first two factors drawn from principal component analysis based on productivity-related variables CEO tenure, industry-adjusted three-year operating profit growth rate, certified inside director dummy, and firm size. Entrenched CEO is a dummy variable that equals one if BCF index is above the sample median, and zero otherwise. Other variables are defined in the Appendix. The OLS regressions control for firm and year fixed effects. *t*-statistics based on heteroskedasticity-robust standard errors clustered by firms are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1%, 5%, and 10% levels, respectively.

*Panel A: Executive Pay Disparity and Cost of Equity*

|                             | OLS                  |                      |
|-----------------------------|----------------------|----------------------|
|                             | (1)                  | (2)                  |
| CPS                         | 0.0116***<br>(3.34)  |                      |
| Log(CEO Pay Gap)            |                      | -0.0008<br>(1.02)    |
| Market Beta                 | 0.0001<br>(0.04)     | -0.0035***<br>(3.99) |
| Idiosyncratic Volatility    | 0.0859***<br>(4.12)  | 0.1368***<br>(6.60)  |
| Size                        | -0.0057***<br>(7.63) | -0.0053***<br>(7.46) |
| Book-to-market              | 0.0140**<br>(2.15)   | 0.0121**<br>(2.32)   |
| Leverage                    | 0.0235***<br>(6.67)  | 0.0306***<br>(8.38)  |
| Analyst Forecast Dispersion | -0.0012**<br>(1.97)  | -0.0019***<br>(3.45) |
| Long-term Growth Rate       | -0.0037<br>(0.36)    | 0.0153<br>(1.61)     |
| Intercept                   | 0.0856***<br>(7.99)  | 0.1088***<br>(11.99) |
| Number of Observations      | 14,046               | 14,046               |
| Adjusted R <sup>2</sup>     | 0.24                 | 0.21                 |

*Panel B: Executive Pay Disparity and Cost of Equity-CEO Productivity*

OLS

|                             | (High CEO<br>Productivity=1<br>)<br>(1) | (High CEO<br>Productivity=0<br>)<br>(2) | (High CEO<br>Productivity=1<br>)<br>(3) | (High CEO<br>Productivity=0<br>)<br>(4) |
|-----------------------------|---|---|---|---|
| CPS                         | 0.0042<br>(0.85)                        | 0.0170**<br>(2.52)                      |   |   |
| Log(CEO Pay Gap)            |   |   | -0.0051***<br>(4.78)                    | 0.0016<br>(1.03)                        |
| Market Beta                 | 0.002<br>(1.55)                         | -0.0017<br>(1.04)                       | -0.0022*<br>(1.71)                      | -0.0038**<br>(2.48)                     |
| Idiosyncratic Volatility    | 0.0975***<br>(4.10)                     | 0.1307***<br>(4.16)                     | 0.1623***<br>(7.91)                     | 0.1749***<br>(6.81)                     |
| Size                        | -0.0043***<br>(7.23)                    | -0.0059***<br>(6.30)                    | -0.0033***<br>(5.12)                    | -0.0061***<br>(6.31)                    |
| Book-to-market              | 0.0309***<br>(9.17)                     | 0.0057<br>(1.15)                        | 0.0272***<br>(8.54)                     | 0.0054<br>(1.30)                        |
| Leverage                    | 0.0214***<br>(4.23)                     | 0.0232***<br>(3.46)                     | 0.0309***<br>(5.81)                     | 0.0290***<br>(4.31)                     |
| Analyst Forecast Dispersion | -0.0019***<br>(2.71)                    | -0.0012<br>(1.32)                       | -0.0023***<br>(3.39)                    | -0.0023**<br>(2.51)                     |
| Long-term Growth Rate       | -0.0094<br>(0.71)                       | -0.0033<br>(0.26)                       | 0.0082<br>(0.65)                        | 0.0112<br>(0.91)                        |
| Intercept                   | 0.0662***<br>(8.44)                     | 0.0917***<br>(6.26)                     | 0.1175***<br>(12.94)                    | 0.0938***<br>(7.15)                     |
| Number of observations      | 5,407                                   | 3,288                                   | 5,407                                   | 3,288                                   |
| Adjusted R <sup>2</sup>     | 0.31                                    | 0.20                                    | 0.15                                    | 0.09                                    |

**Table 8: CEO Pay Gap, Cost of Debt and Debt Maturity – Simultaneous Equations**

This table reports the results of simultaneous equations of debt maturity and cost of debt. The sample covers the period from 1993 to 2011. CEO pay gap is the difference between a CEO's compensation and the median compensation of the next group of executives of the firm. CEO delta is the change in CEO wealth, given a \$1 change in stock price. CEO vega is the change in CEO wealth, given a 0.01 change in stock return volatility. \*\*\*, \*\*, and \* denote significance at the 1%, 5% and 10% levels, respectively.

|                          | Yield Spread           | Log(Maturity)          |
|--------------------------|------------------------|------------------------|
| Log(Maturity)            | 0.4229***<br>(10.73)   |                        |
| Yield Spread             |                        | 0.6696***<br>(16.95)   |
| Log(CEO Pay Gap)         | -0.2360***<br>(-20.91) | 0.1416***<br>(12.03)   |
| Log(CEO Delta)           | -0.0571***<br>(-7.49)  | 0.0282***<br>(3.67)    |
| Log(CEO Vega)            | 0.2702***<br>(27.95)   | -0.1505***<br>(-12.17) |
| Return Volatility        | 17.7864***<br>(37.52)  | -7.5705***<br>(-13.04) |
| Average Stock Returns    | -19.9637***<br>(-7.37) |                        |
| Return on Sales          | -0.1594***<br>(-5.24)  |                        |
| Leverage                 | 0.7039***<br>(8.45)    | -1.3324***<br>(-20.09) |
| Interest Coverage        | -0.2673***<br>(-14.68) |                        |
| Log(Total Proceeds)      | 0.0053<br>(1.07)       |                        |
| Benchmark Treasury Yield | -0.1387***<br>(-5.28)  |                        |
| Yield Curve Slope        | 0.0162<br>(0.72)       | 0.0497***<br>(2.82)    |
| Log(Size)                |                        | (5.97)<br>-0.0128***   |
| Log(Size)2               |                        | (-5.28)<br>0.0040***   |
| Asset Maturity           |                        | (3.38)<br>-1.0502*     |
| Ownership                |                        | (-1.79)                |

|                        |                    |                        |
|------------------------|--------------------|------------------------|
| Market/Book            |                    | 0.0251<br>(1.36)       |
| Abnormal Earnings      |                    | -0.0000***<br>(-14.80) |
| Altman Z-Score dummy   |                    | 0.1189***<br>(3.50)    |
| Intercept              | -0.0654<br>(-0.44) | -0.2194<br>(-0.59)     |
| Number of observations | 23,216             | 23,216                 |
| R <sup>2</sup>         | 0.34               | 0.04                   |

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**Table 9: CEO Pay Gap, CEO Productivity, and Firm Risk**

This table reports results of the OLS regressions with stock return volatility as the dependent variable. The sample covers the period 1993-2011. Stock return volatility is the standard deviation of daily stock returns over the year. CEO pay gap is the difference between a CEO's compensation and the median compensation of the next group of executives of the firm. Predicted CEO pay gap is the predicted value when regressing CEO pay gap on CEO productivity factors 1 and 2. Residual CEO pay gap of CEO productivity is the difference between the actual and predicted CEO pay gap. CEO productivity factors 1 and 2 are the first two factors drawn from principal component analysis based on productivity-related variables CEO tenure, industry-adjusted three-year operating profit growth rate, CID dummy, and firm size. The regressions control for industry and year fixed effects. Other variables are defined in the Appendix. *t*-statistics based on heteroskedasticity-robust standard errors clustered by firms are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1%, 5% and 10% levels, respectively.

|                            | OLS                      |                          |
|----------------------------|--------------------------|--------------------------|
|                            | Stock return             | Stock return volatility  |
| Log(CEO Pay Gap)           | 0.0051***<br>(3.5280)    |                          |
| Predicted Log(CEO Pay Gap) |                          | -0.0024***<br>(-5.5498)  |
| Residual Log(CEO Pay Gap)  |                          | 0.0023*<br>(1.6714)      |
| Log(Size)                  | -0.0031***<br>(-45.1434) | -0.0029***<br>(-37.7973) |
| Tobin's Q                  | 0.0007***<br>(17.2661)   | 0.0013***<br>(18.9575)   |
| Sales Growth               | 0.0007***<br>(5.3780)    | 0.0004**<br>(2.5253)     |
| Leverage                   | 0.0200***<br>(26.3604)   | 0.0222***<br>(26.5229)   |
| ROA                        | -0.0299***<br>(-39.4688) | -0.0312***<br>(-37.1956) |
| Intercept                  | -0.0159<br>(-0.9542)     | 0.0333**<br>(2.0106)     |
| Number of observations     | 24,493                   | 24,493                   |
| Adjusted R <sup>2</sup>    | 0.4045                   | 0.3977                   |



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## Appendix: Variable Definitions

| Variable                        | Description  |
|---------------------------------|--|
| Abnormal Earnings               | (earnings in year t+1 minus earnings in year t)/(share price*number of shares outstanding in year t)   |
| Altman Z-Score dummy            | Equals one if a firm has Altman Z-Score greater than 1.81 and zero otherwise   |
| Asset Maturity                  | Book value-weighted average of maturities of property, plant and equipment, and current assets   |
| Average Return                  | Average daily stock returns over the 180-day period prior to the debt issue  |
| BCF Index                       | Consists of six provisions limiting shareholders' power proposed by Bebchuck, Cohen, and Farrell (2009)  |
| CEO Delta                       | Change in CEO wealth given a \$1 increase in stock price   |
| CEO Vega                        | Change in CEO wealth given a 0.01 increase in stock return volatility  |
| CEO Pay Gap                     | Difference in CEO pay and the median pay of other senior executives  |
| CEO Pay Slice (CPS)             | Proportion of CEO pay of the sum of total pay of top executives  |
| CEO Tenure                      | Number of years in the CEO position of the current firm  |
| Certified Inside Director (CID) | Inside director with outside directorship  |
| CFO as VP                       | Equals one if CFO is VP and zero otherwise   |
| Cost of Equity                  | The internal rate of return that equates the current stock price to the present value of all future cash flows to the shareholders   |
| Inside Promotion                | Equals one if the current CEO is promoted from within the firm and zero otherwise  |
| Interest Coverage               | The natural log transformation of the pre-tax interest coverage ratio  |
| Financial Leverage              | Long-term debt divided by the market value of the firm   |
| Market-to-book ratio            | Market value of total assets divided by book value of total assets   |
| Maturity                        | Years to debt maturity   |
| Number of VPs                   | Number of VPs of a firm in a given year  |
| Ownership                       | CEO ownership, calculated as number of shares owned by CEO scaled by total shares outstanding  |
| Productivity 1                  | The first factor obtained from principal component analysis using variables including certified inside director (CID) dummy, CEO tenure, firm size, and industry-adjusted operating income growth rate over the prior three years  |
| Productivity 2                  | The second factor obtained from principal component analysis using variables including certified inside director (CID) dummy, CEO tenure, firm size, and industry-adjusted operating income growth rate over the prior three years |

|                          |   |
|--------------------------|---|
| S&P Debt Rating dummy    | Equals one if a firm has an S&P rating on long-term debt and zero otherwise   |
| Return on Sales          | Operating income before depreciation divided by sales   |
| Return Volatility        | Standard deviation of the monthly stock return in a fiscal year multiplied by the ratio of market value of equity to market value of assets |
| Size                     | Market value of assets, calculated as market value of equity plus book value of total assets minus book value of equity                     |
| Yield Spread             | Difference between a bond's yield to maturity and the yield to maturity of the corresponding Treasury benchmark with similar maturity       |
| ST3                      | The sum of current liabilities, debt maturing in the second year, and debt maturing in third year, all divided by total debts               |
| Succession Plan          | Equals one if a VP is either president or COO but not chairman, and zero otherwise.   |
| Number of debt covenants | Total number of covenants of a debt issue   |
| Term Structure           | Difference between 10-year and 6-month Treasury rate at the fiscal-year end   |
| Total Proceeds           | Total proceeds of a new debt issue  |
| Treasury Benchmark Yield | Treasury rate with terms that corresponds most closely to the maturity-term of a new debt issue   |
| Yield Curve Slope        | Difference between 10-year and 2-year Treasury rate at the fiscal-year end  |

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