THREE ESSAYS ON MANAGERIAL INCENTIVES

by

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ABSTRACT

AHMET NART. Three Essays on Managerial Incentives. (Under the direction of DR. TAO-HSIEN DOLLY KING and DR. GENE C. LAI)

The dissertation consists of three essays. The first essay examines how a tournament among CEOs to progress within the CEO labor market changes their tendency toward corporate hedging policies. We exploit the textual analysis of 10-Ks to generate corporate hedging proxies. We find that the likelihood and intensity to hedge increases as the CEO labor market tournament prizes augment. We explore the mitigating impacts of corporate hedging on the adverse effects of risk-inducing industry tournament incentives (ITIs) on the cost of debt and stock price crash risk, which could be the possible reasons for the relation. Also, the relation between ITIs and corporate hedging is less pronounced for firms that demonstrate more financial distress and when CEOs are the founders or of retirement age. We identify a causal relation between ITIs and corporate hedging by using an instrumental variable approach and an exogenous shock sourced by the changes in the enforceability of non-competition agreements across states.

In the second essay, the effects of internal tournament incentives (ITTIs) on reserve management, performance and risk-taking in property-liability insurance firms are studied. We find that a positive relation between ITTIs and reserve errors, implying that a higher tournament prize is associated with more conservative loss reserve management. Unlike the literature on non-financial firms, we do not find a positive relation between ITTIs and risk-taking behavior or performance. The overall evidence indicates that VPs in tournaments focus on the strong financial health, not performance. Moreover, we find the positive impact of ITTIs on conservative reserve management is more pronounced for

larger, financially weaker and more geographically focused firms, and is mitigated for insurers with a higher percentage of claim loss reserve over total liability. Our results also suggest that the Sarbanes Oxley Act does not significantly impact reserve behaviors of executives. Finally, we find that insurers with more independent board members are likely to have more conservative reserve behavior in internal tournaments.

In the third essay, we investigate the relation between executive pay duration and the cost of debt. We find a positive relation between equity-based pay duration (Equity PD) and loan spread, implying that loan spread is increasing in a larger Equity PD. However, we explore a negative relation between equity&debt-based pay duration (Whole PD) and loan spread, which shows that debt-like compensation contributes to the agency conflict between managers and creditors not only through their sizes but also through their durations. Also, we illustrate that the executive labor market is a channel that drives the relations of both Equity PD and Whole PD with the cost of debt. Risk and information asymmetry channels are the other channels through which Equity PD impacts the cost of debt. Lastly, we show the association between Whole PD and borrowing costs is more pronounced for firms with better corporate governance and past performance.

To my beloved wife Leyla

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LIST OF ABBREVIATIONS

2SLS	Two-Stage Least Squares
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CMD	Commodity
CPI	Comsumer Price Index
CRSP	Center for Research in Security Prices
DID	difference-in-differences
EDF	Expected Default Frequency
Equity PD	Equity-based Pay Duration
FAS	Financial Accounting Standards
FAS123R	The regulation of Financial Accounting Standard (FAS) 123R enacted in 2005
FASB	Financial Accounting Standards Board
FF	Fama-French
FX	Foreign Exchange
GMM	Generalized Method of Moments
HHI	Herfindahl–Hirschman Index
IR	Interest Rate
ITIs	Industry Tournament Incentives
ITTIs	Internal Tournament Incentives
IV	Instrumental Variables

KFS	Kazenski, Feldhaus, and Schneider (1992)
LIBOR	London Interbank Offer Rate
M&A	Merger and Acquisition
MtB	Market-to-Book
ODC	Other Deferred Compensations
OLS	Ordinary Least Squares
P-L	Property-Liability
PSM	Propensity Score Matching
R&D	Research and Development
ROA	Return On Assets
ROE	Return On Equity
ROI	Return On Investment
S&P	Standard and Poor’s
SEC	U.S. Securities and Exchange Commission
SERP	Supplemental Executive Retirement Plans
SIC	Standard Industrial Classification
SOX	Sarbanes-Oxley Act
TW	Tenure Weighted
VPs	Vice Presidents
Whole PD	Equity&debt-based Pay Duration

CHAPTER I

INTRODUCTION

In this dissertation, the impacts of managerial incentives on corporate policy choices are examined. This topic has been investigated in various aspects in the corporate governance literature. We study this issue in the dimensions of tournament incentives and pay duration. Specifically, the first essay examines how industry tournament incentives (ITIs) affect corporate hedging policies. ITIs can be defined as an external job market setting in which CEOs want to assume the CEO position in the leading firm in their industries. Following Coles, Li, and Wang (2017), we define ITIs as the difference between the total compensation of the second-highest-paid CEO in the industry and the compensation of a CEO in consideration. Also, following the recent corporate hedging literature, we develop our hedging measures based on the textual analysis of 10-K statements (e.g., Wong, 2000; Kim, Mathur, and Nam, 2006; Almeida, Hankins, and Williams, 2017; Manconi, Massa, and Zhang, 2017; Hoberg and Moon, 2017; Qiu, 2019). We find that the likelihood and intensity to hedge increases as the CEO labor market tournament prizes augment. We explore the mitigating impacts of corporate hedging on the adverse effects of risk-inducing ITIs on the cost of debt and stock price crash risk, which could be the possible reasons for the relation. We identify a causal relation between ITIs and corporate hedging by using an instrumental variable approach and an exogenous shock sourced by the changes in the enforceability of non-competition agreements across states.

In the second essay, the effects of internal tournament incentives (ITTIs) on reserve management, performance and risk-taking in property-liability insurance firms are studied.

Internal tournaments indicate that vice presidents (VPs) or senior executives are in a race for the promotion to the CEO position. Following Kale et al. (2009), we measure ITTIs as the pay difference between a firm CEO and VPs. We follow Weiss (1985) and Kazenski, Feldhaus, and Schneider (1992) to measure reserve error. We find a positive relation between ITTIs and reserve errors, implying a higher tournament prize is associated with more conservative loss reserve management. Unlike the literature on non-financial firms, we do not find a positive relation between ITTIs and risk-taking behavior or performance. The overall evidence indicates that VPs in tournaments focus on the strong financial health, not performance.

In the third essay, we investigate the relation between executive pay duration and the cost of debt. Following Gopalan, Milbourn, Song, and Thakor, (2014), we measure equity-based pay duration (Equity PD) as the weighted average of the vesting periods of salaries, bonuses, options and restricted stocks. We also account deferred compensations to form equity&debt-based pay duration (Whole PD). We find a positive relation between Equity PD and loan spread, implying that loan spread is increasing in a larger Equity PD. However, we explore a negative relation between Whole PD and loan spread, which shows that debt-like compensation contributes to the agency conflict between managers and creditors not only through their sizes but also through their durations. Also, we illustrate that the executive labor market is a channel that drives the relations of both Equity PD and Whole PD with the cost of debt. Risk and information asymmetry channels are the other channels through which Equity PD impacts the cost of debt.

CHAPTER II

INDUSTRY TOURNAMENT INCENTIVES AND CORPORATE HEDGING POLICIES

II.1 Introduction

Even though active corporate risk management would be irrelevant under the perfect market assumption by Modigliani and Miller (1958), the usage of financial derivatives as hedging tools has been increasing around the world. Bartram, Brown, and Fehle (2009) report that about 60% of the firms exploit derivative instruments, about 45% exploit foreign exchange (FX) derivatives, about 33% exploit interest rate (IR) derivatives, and about 10% commodity (CMD) derivatives based on a sample of 7319 firms from 50 countries. According to the Bank for International Settlements (BIS), the notional value of outstanding FX, IR and CMD derivatives held by non-financial customers has increased from $3.3 trillion, $6.1 trillion, and $0.6 trillion to $11.8 trillion, $14.4 trillion and $2.1 trillion respectively from 2000 to 2018.

One of the main reasons for the hedging is flattening the firm performance to stabilize net incomes and cash flows. For example, Bartram, Brown, and Conrad (2011) find that derivative users have lower cash flow volatility, idiosyncratic volatility, and systematic risk.[1] As the real implications of hedging, Allayannis and Weston (2001), Carter, Rogers, and Simkins (2006), and Mackay and Moeller (2007) find a positive relation between

[1] Besides, there have been many articles attributing the reasons to hedge to tax convexity (Smith and Stulz, 1985; Graham and Smith, 1999) , reduction in bankruptcy cost (Smith and Stulz, 1985), lowering cost of debt (Smith and Stulz, 1985, Campello, Lin, Ma and Zou, 2011; Chen and King, 2014), agency problem (Nance, Smith and Smithson, 1993; Kumar and Rabinovitch, 2013; Huang, Peyer and Segal, 2014), managerial incentives (Smith and Stulz, 1985; Bakke, Mahmudi, Fernando and Salas, 2016), less information asymmetry (DeMarzo and Duffie, 1991), and financial flexibility (Francis, Gao, Young, and Sun, 2018; Graham and Rogers, 2002).

hedging and firm value.[2] Froot, Scharfstein, and Stein (1993) and Géczy, Minton and Schrand (1997) discover a negative relation between hedging and underinvestment problem, and Gay, Lin, and Smith (2011) detect that the cost of equity of derivatives users is lower than non-users by 24–78 basis points.[3] Further, a survey paper by Giambona, Graham, Harvey, and Bodnar (2018) document that around 90% of risk managers hedge to enlarge expected cash flows, and 70% to 80% of risk managers hedge to smooth earnings or to meet shareholders' expectations.[4]

This study aims to examine how industry tournament incentives (ITIs) affect corporate hedging policies. ITIs can be defined as an external job market setting in which CEOs want to assume the CEO position in the leading firm in their industries. Therefore, the CEOs are in a contest among one another, and they all compete for the highest-paid CEO position in the industry. The performance of CEOs are relatively evaluated, and the CEO with the highest performance move up and win the tournament. The winner of the tournament earns the difference between the highest-paid compensation in the industry and her original compensation as a tournament prize. The CEO external job market has a remarkable impact on a CEO's managerial decisions. Graham, Harvey, and Rajgopal (2005) document the superiority of upward mobility in the labor market over compensation schemes at the CEO's own firm in influencing a CEO's managerial decisions based on a survey including 401 CEOs of the U.S. firms. Therefore, the tournament incentives between managers have recently attracted researchers' attention. Coles, Li and Wang (2017) find that ITIs induce

[2] Jin and Jorion (2006) do not find a significant relation between hedging and firm value.
[3] Also, Minton and Schrand (1999) find positive association between cash flow volatility and the costs of accessing external capital.
[4] They survey more than 1,100 risk managers around the world.

CEOs to exert greater effort and to increase firm risk level, precipitating a positive association between ITIs and both firm performance and risky corporate policies.[5]

Promotion-based tournaments can be considered as an option, as the winner of the tournament obtains the entire tournament prize, and the others get nothing. They provide CEOs with convex pay-off (Kini and Williams, 2012). The option-like and convex tournament compensation scheme might induce CEOs for riskier corporate policies in order to increase their probability to win the tournament or to try to catch up with the leading firms (Hvide, 2002; Goel and Thakor, 2008; Chen, Hughson, and Stoughton, 2018; Kini and Williams, 2012; Coles et al. 2017). The *risk incentive hypothesis* predicts that risk-increasing incentives of ITIs might induce CEOs to refrain from hedging activities. On the other hand, according to the *risk management hypothesis*, CEOs might be induced to use hedging tools as a buffer against the side effects of ITIs. ITIs have been shown to have a positive association with the cost of borrowing (Kubick, Lockhart, and Mauer, 2018) and stock price crash risk (Kubick and Lockhart, 2018), which can hurt the firm's performance. This negative effect can damage the reputation of a CEO, and so curtail the probability to move up.[6] Consistently, Levine (2005) claims that financial derivatives make it possible to pursue high risk-high return projects. Hence, the *risk management hypothesis* requires higher hedging activities to mitigate the adverse effects of undertaking risky corporate policies incentivized by ITIs.

[5] Other studies investigating the effects of ITI on corporate policies include augmenting the level and marginal value of cash holdings (Huang, Jain and Kini, 2019), inducing myopic product innovation activities (Kong, Lonare, and Nart, 2020), and motivating tax aggressiveness (Kubick and Lockhart, 2016). Further, Kubick, Lockhart, and Mauer (2018) find a positive association between ITI and the cost of borrowing. Also, Kubick and Lockhart (2018) detect a positive association between ITI and stock price crash risk. However, Chowdhury, Haq, Hodgson, and Pathan (2018) detect that ITI negatively impact stock price crash risk.

[6] Firm performance is considered to be one of the major indicators of CEO capability by outsiders (Fee and Hadlock, 2004)

Coles et al. (2017) describe the desire to move up by CEOs as that such a position includes higher compensation, an enlarged span of control, higher visibility, and higher status. Following Coles et al. (2017), we define ITIs as the difference between the total compensation of the second-highest-paid CEO in the industry and the compensation of a CEO in consideration.[7] The industry classifications are determined using Fama-French 30 (henceforth FF30)[8] and size median Fama-French 30 (henceforth FF30 size-median). Following the recent corporate hedging literature, we develop our hedging measures based on the textual analysis of 10-K statements (e.g., Wong, 2000; Kim, Mathur, and Nam, 2006; Almeida, Hankins, and Williams, 2017; Manconi, Massa, and Zhang, 2017; Hoberg and Moon, 2017; Qiu, 2019). We apply three keyword lists related to FX, IR, and CMD hedging to generate binary variables to measure the likelihood to hedge. We also use the number of words related to financial hedging in 10-K statements to measure the intensity to hedge. The assumption we make here regarding the hedging proxy generated by counting words is that the more intensely a firm expresses its hedging policies, the more actively it manages.

Consistent with the *risk management hypothesis*, we find a positive association between ITIs and hedging practices, suggesting that a CEO motivated by higher visibility, status, a larger compensation package, and a span of control is more likely to engage in hedging activities. This result is consistent with the findings of Knopf, Nam, and Thornton (2002), Graham and Rogers (2002), Kumar and Rabinovitch (2013), and Huang et al.

[7] The compensation of the second highest-paid CEO instead of that of the highest-paid CEO is used in the literature to mitigate outlier effect.

[8] The details are available from http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_30_ind_port_old.html.

(2013), which find a CEO with an incentive compensation including more option delta hedges more.[9]

In addition, we explore the possible reasons to hedge more by a CEO induced by the external CEO labor market. The findings of Kubick, Lockhart, and Mauer (2018) and Kubick and Lockhart (2018) suggest that the corporate policies of a CEO motivated by ITIs lead to a higher cost of borrowing and a higher stock price crash risk. Hedging, however, can lower financing costs by alleviating cash flow variability (Smith and Stulz, 1985). Further, it is shown that firms can reduce their stock return exposure to exchange rate shocks by hedging (e.g., Allayannis and Ofek, 2001; Kim et al., 2006; Bartram, Brown, and Minton, 2010; Chang, Hsin, and Shiah-Hou, 2013). Thus, we test the impacts of hedging tools on the effects of ITIs on both the cost of debt and stock price crash risk. We discover the mitigating effects of hedging on the amplifier impacts of ITIs on both the cost of debt and stock price crash risk. Consistent with Levine (2005)'s arguments, these results suggest that a CEO incentivized by ITIs uses hedging instruments as a buffer to alleviate the anticipated negative impacts of her riskier corporate policies.

We also examine heterogeneity in the relation between ITIs and hedging behavior. We find that the effect of ITIs on hedging is less pronounced for the firms in distress, consistent with Purdanandam (2008) who shows firms in distress hedge less due to the increase in financial distress costs. Further, we examine the effects of CEO characteristics related to the likelihood to move up on the association between ITIs and hedging. We discover the less pronounced effect of ITIs on hedging if the CEO is a founder of the firm or if she is of retirement age. Lastly, we search for the heterogeneity in the positive effect of ITIs on

[9] On the other hand, Bakke et al. (2016) find that a reduction in option pay may result in an increase in hedging intensity.

hedging across different industries. We explore that this effect is stronger for oil, petroleum, natural gas, transportation, aircraft, ships and railroad equipment, mining and coal, retail and business equipment industries.

To identify the causal association between ITIs and corporate hedging, we use the instrumental variable approach. Also, following Huang et al. (2019), we utilize the change in the enforceability of non-competition employment agreements within states as an exogenous shock. By implementing difference-in-differences (DID) method, we find that the increase in enforceability lessens the positive effect of ITIs on corporate hedging as the number of competitors increases, which is consistent with Huang et al. (2019).

Our study contributes to the literature in the following ways. First, to the best of our knowledge, this paper is the first to examine the effects of ITIs on hedging behavior. Bakke et al. (2016) investigate the causal effect of risk-taking incentives provided by option compensation on corporate risk management policy. Different from them, we focus on convex payoff driven by the external CEO labor market instead of that driven by options in the compensation packages. Second, most of the previous studies examine a specific industry or a few industries (e.g., the oil and gas industries) when they investigate their corporate risk management policies using a limited sample (Tufano, 1996; Haushalter, 2000; Carter et al., 2006; Jin and Jorion, 2006; Mackay and Moeller, 2007; Kumar and Rabinovitch, 2013; Gilje and Taillard, 2017). Our sample consists of a relatively larger number of firms from various industries, which enables us to deduct general implications about firms' hedging attitudes induced by ITIs from the analysis results.

We also contribute the literature by finding another channel through which a CEO induced by ITIs may impact firm performance. Smith and Stulz (1985), Allayannis and

Weston (2001), Carter et al. (2006), Mackay and Moeller (2007), and Gilje and Taillard (2017) detect positive relation between hedging and firm performance. Thus, a CEO might be induced to hedge more in order to increase her probability of moving up through improving the firm performance. Lastly, we explore the reasons behind the positive association between ITIs and hedging, where the possible reasons are mitigating the amplifier impacts of risk-inducing ITIs on the cost of debt and stock price crash risk.

The rest of this paper is organized as follows. In Section II.2, we discuss our hypotheses. We describe our sample and variable constructions in Section II.3. In Section II.4, we first examine the relation between ITIs and corporate hedging; then we investigate the effect of ITIs on different types of hedging and search for possible reasons forming the association between ITIs and corporate hedging. In Section II.5, we examine heterogeneities in the relation between ITIs and corporate hedging. Section II.6 provides a conclusion of our findings. Appendices A, B, C, and D provide detailed information about the definition of variables and their methods of calculation.

II.2 Hypotheses development

Hedging is a risk management tool used by firms to shield against unpredicted shocks, which can have a potentially harmful impact on contingent firm values. The primary benefit of hedging is to secure adequate and stable internal cash flows, and to prevent a firm from the inefficient liquidation of its investment. In perfect capital markets, which form the neoclassical view of risk management, risk management does not have real impacts on firm economics (Modigliani and Miller, 1958). However, more recent hedging theories based on market imperfections support the real effects of hedging on firms. The major real benefits of hedging documented are enhancing firm value (Allayannis and

Weston, 2001; Carter et al., 2006; Mackay and Moeller, 2007), mitigating underinvestment problem (Froot et al., 1993; Géczy et al., 1997), and lowering the cost of capital (Smith and Stulz, 1985; Gay et al. 2011; Campello et al., 2011; Chen and King, 2014). Further, corporate hedging provides financial benefits, such as serving financial flexibility (Francis, Gao, Young, and Sun, 2018), reducing financial distress (Mayers and Smith, 1982; Smith and Stulz, 1985), and diminishing contracting costs (Mayers and Smith, 1987).

Beyond its real and financial benefits, the motivations behind corporate hedging have also been investigated, such as tax reduction (Smith and Stulz, 1985; Graham and Smith, 1999; Dionne and Garand, 2003), agency problem (Nance, Smith, and Smithson, 1993; Kumar and Rabinovitch, 2013; Huang et al., 2013), economies of scale (Mian, 1996), and information asymmetry (DeMarzo and Duffie, 1991). Also, managerial incentives play an essential role on corporate hedging. For instance, Bakke et al. (2016) find a significantly negative relation between CEO vega and hedging intensity.[10] However, the effect of tournament incentives, which are also considered as managerial incentives, on corporate hedging has not been scrutinized.

Initiated by Lazear and Rosen (1981), promotion-based tournament theory suggests that if it is costly to monitor and measure the efforts and outputs of employees, compensating them based on their positions in the firm can be an optimal compensation scheme to induce them for a greater effort. Compensating high-level employees based on their ordinal rank creates competition among them, which can also have some influence on their policy choices, including dealing with riskier firm activities (Hvide, 2002; Goel and

[10] The findings of Bakke et al. (2016) are consistent with the findings of Coles, Daniel, and Naveen (2006), who show a positive association between CEO vega, which is mainly driven by option pay, and firm risk level.

Thakor, 2008; Kini and Williams, 2012; Coles et al., 2017), more extensive acquisition policies (Nguyen and Phan, 2015), engaging in fewer corporate social responsibility activities (Chowdhury, Haq, Hodgson, and Pathan, 2017), being more tax aggressive (Kubick and Lockhart, 2016), engaging in more innovation activities (Shen and Zhang, 2017; Kong et al., 2020), preferring leasing activities over buying activities (Chowdhury and Rahman, 2018) and incrementing cash holdings (Huang et al., 2019).

Risk incentive hypothesis

In this study, we focus on tournaments among CEOs, where they compete to get the CEO position in the leading firms in their industries. Thus, the winner CEO moves up and assumes the CEO position in the leading firm. CEOs compete for the position because the aforementioned position includes a larger compensation scheme, an enlarged span of control, higher visibility, and status (Coles et al., 2017). Tournament incentives have been theoretically and empirically shown to serve as a risk incentive (Hvide, 2002; Goel and Thakor, 2008; Kini and Williams, 2012; Coles et al., 2017). CEOs tend to engage in riskier activities in order to increase their probability of winning the tournament as they try to catch up with the leading firm. Thus, a CEO is expected to be less risk-averse as she is induced by more ITIs. However, Smith and Stulz (1985) claim that managers are risk-averse due to being undiversified compared to shareholders, so they are likely to hedge to diminish their exposure to the firm (Giambona et al., 2018). Since ITIs act as risk-seeking incentives, they discourage a CEO from corporate hedging.

Further, tournament incentives are option-like because the winner of the tournament earns the tournament prize, and the other participants of the tournament receive nothing; therefore, they provide a convex managerial payoff (Kini and Williams, 2012). The risk-incentives of managerial option pay have been shown to have a negative impact on corporate hedging (Smith and Stulz, 1985; Tufano, 1996; Haushalter, 2000; Bakke et al., 2016). Consequently, the convexity inherent in option-like tournaments can discourage CEOs from corporate hedging. All these arguments predict a negative relation between ITIs and corporate hedging, and we refer to this hypothesis as the *risk incentive hypothesis*.

Risk management hypothesis

However, there are several reasons why CEOs may likely to hedge more while experiencing higher ITIs (we refer this to *risk management hypothesis* henceforth). First, hedging can facilitate to improve the firm value and mitigate the unfavorable effects of ITIs on the cost of borrowing and stock price crash risk. CEOs induced by higher ITIs are empirically shown to exert more effort (Coles et al., 2017). The reason for the positive relation between ITIs and firm value can be that firm performance is considered as one of the major indicators of CEO capability by outsiders (Fee and Hadlock, 2004). Several studies document that corporate hedging has a positive effect on firm value (e.g., Allayannis and Weston, 2001; Carter et al., 2006; Mackay and Moeller, 2007). Therefore, a CEO induced by ITIs might be more inclined to use hedging instruments to enhance firm value, so that she can increase her probability to move up. However, ITIs have also shown to increase the cost of debt (Kubick, Lockhart, and Mauer, 2018) and stock price crash risk (Kubick and Lockhart, 2018), which can negatively affect firm value. On the other hand, hedging derivatives are shown to reduce the cost of external financing (Campello et al., 2011; Chen and King, 2014) and stock price crash risk (Kim, Si, Xia, and Zhang, 2018).

Therefore, CEOs may hedge more to alleviate these adverse impacts of ITIs on firm value.[11]

Second, hedging makes the application of riskier policies more possible by a CEO motivated by ITIs. The *risk management hypothesis* is also consistent with Levine (2005), who documents that financial derivatives facilitate to pursue high risk-high return projects. Since ITIs motivate CEOs to choose riskier projects (Coles et al., 2017), hedging can enable them to implement risky projects without harming the firm value.

Third, CEOs might prefer hedging to influence the labor market's perception about their managerial ability (Froot et al., 1993; DeMarzo and Duffie, 1995) or to separate themselves from lower ability managers (Breeden and Viswanathan, 2016). Besides, CEOs can hedge to satisfy the expectation of shareholders. Campbell and Kracaw (1987) illustrate that since shareholders expect that hedging enhances managerial productivity, they want managers to hedge observable unsystematic risks.

Lastly, Smith and Stulz (1985) indicate that because managers have concave utility, they are risk-averse which induces them to hedge. The convexity in managerial payoff mitigates their risk-averseness, which discourages them from hedging. However, Carpenter (2000) and Ross (2004) provide evidence that the convexity in managerial compensation might not afford sufficient risk-seeking incentives, which can deter them from hedging. Hence, the *risk management hypothesis* predicts a positive association between ITIs and corporate hedging.

[11] Similarly, the findings of Francis, Gao, Young, and Sun (2018) provide some evidence of the reduction in the cost of debt through hedging because firms can stabilize cash flows through hedging, and thus enables them to use internal cash flows that is an alternative to costly external capital financing.

Overall, the relation between ITIs and corporate hedging will likely depend on the incentives to induce risk, a CEO's preferences, and her career concerns. On the one hand, if a CEO is not too risk-averse, the *risk incentive hypothesis* suggests that a CEO motivated by ITI, which are also risk-incentives, can avoid using hedging instruments. On the other hand, the *risk management hypothesis* can dominate; (i) if the positive effect of hedging on firm value attracts a CEO for hedging, (ii) if she prefers to hedge as a buffer against unpredicted adverse shocks, (iii) if she wants to improve the outsiders' perceptions about her ability, (iv) if she needs to separate herself from limited ability managers, or (v) if she is highly risk-averse that ITIs cannot induce her for risk-taking activities.

II.3 Data sources, variable construction, and sample description

II.3.1 Data sources

Our sample is constructed from the intersection of 10-K EDGAR filings, Compustat, and ExecuComp databases starting from the fiscal year 1998 up to 2016.[12] CEO compensation information is from the Standard and Poor's (S&P) ExecuComp database, stock return data is from the Center for Research in Security Prices (CRSP), firm characteristics are from the Compustat files. Following the convention in the finance literature, we exclude financial (SIC codes 6000–6999) and utility firms (SIC codes 4900–4999). We obtain 10-K statements from SEC EDGAR to compute the textual-based hedging measures and Fama-French 30 industry classification from the Fama-French data library.[13]

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[12] SEC EDGAR filings started in 1994 but the full coverage of public firms took three more years. Thus, we start our sample period from fiscal year 1998 to get the full coverage.

[13] The data is available on Kenneth French's website: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/ftp/Siccodes30.zip

Additionally, we gather information on loans from LPC DealScan database. We require that loans are US dollar-denominated. Following Bharath, Dahiya, Saunders, and Srinivasan (2009) and Kubick, Lockhart, and Mauer (2018), we merge Compustat and ExecuComp data to DealScan loan data by the calendar year if the loan's deal activation date is greater than five months after the calendar month of the firm's fiscal year-end, otherwise, we merge them with the previous fiscal year to the loan.[14] We use loan spread information to examine the channel through which ITIs influence corporate hedging.

The details about stock price crash risk variables are defined in Appendix C. Computation of expected default frequency (EDF) are provided in Appendix D. Changes in state-level noncompetition enforceability laws are obtained from Garmaise (2011), Jeffers (2017), and Huang et al. (2019). We also extend this data for the 2014–2016 period.

II.3.2 Measures of industry tournament incentives

We follow Coles et al. (2017) to measure ITIs as the total compensation difference (ExecuComp data item TDC1) between the CEO under consideration and the second highest-paid CEO in the same industry.[15] Following Coles et al. (2017), we use FF30 industry group and FF30 size-median industry group for computing a CEO industry pay gap.[16] We denote the CEO industry pay gap as *INDGAP1* for the FF30 industry group and

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[14] When we use the variables on loans, the sample period is from 1997 to 2015 due to the availibity of linking table between Compustat and Dealscan. We thank Micheal Roberts for sharing the linking table (Chava, and Roberts (2008)).

[15] As discussed in Coles et al. (2017), considering the second highest-paid CEO in the industry to compute ITI would eliminate outlier effect associated with the abnormal highest-paid CEO in the industry for a year.

[16] Firm size is considered for benchmarking compensation in the literature (e.g., Faulkender and Yang, 2010; Bizjak, Lemmon, and Nguyen, 2011; Coles et al., 2017). Following Coles et al., 2017, we partition each FF30 industry-year sample into two groups, below median firm size and above median firm size, where firm size is measured by net sales.

as *INDGAP2* for the FF30 size-median industry group. Specifically, ITIs are computed as follows;

INDGAP1 (or *INDGAP2*) = *Total compensation of the second highest-paid CEO in the same FF30* (*or FF30 size-median*) *industry*

– *Total compensation of the CEO in consideration.*

We also use the natural logarithm of *INDGAP1* (*INDGAP2*) in our regression tests to mitigate the influence of outliers. The higher value of *LN*(*INDGAP1* or *INDGAP2*) for a CEO (firm-year observation) denotes that the CEO is facing higher tournament incentives.

II.3.3 Hedging measures

FAS 133 rule, implemented on June 15, 2000, requires firms to report the fair market values of derivative contracts, but it does not require the disclosure of notional values. Without any information on the notional values of hedging instruments, measuring the extent of corporate derivative holdings could be undermined (Graham and Roger, 2002). Also, we generate a general proxy for corporate hedging that can be used across all industries. Being aware of the limitation of the corporate hedging and following the recent corporate hedging literature, we develop our hedging measures based on the textual analysis of 10-K statements (e.g., Wong, 2000; Kim et al., 2006; Almeida et al., 2017; Manconi et al., 2017; Hoberg and Moon, 2017; Qiu, 2019).

We first download 10-K, 10-K405, 10-KSB, 10-KT, 10KSB, 10KSB40, and 10KT405 filings from the SEC EDGAR server and search for hedging related keywords. We apply three keyword lists, related to FX hedging, IR hedging, and CMD hedging to generate binary variables (proxies for the likelihood to hedge) and the number of counts (proxies for hedging intensity). A binary variable is set to one if a firm mentions the use of related hedging instruments in its 10-K. We also generate the count variables for each hedging type. We then combine binary or count variables to form aggregated hedging variables. The binary variable *HEDGE* takes a value of one if a firm mentions the use of any hedging activity (FX hedge, CMD hedge, or IR hedge) in its 10-K for a given year and set to zero otherwise. *HEDGE count* is a count of the total number of times a firm mentions the use of any hedging instrument in its 10-K. Following hedging literature, we use the natural logarithm of one plus hedge count, *Ln(1+ HEDGE count)*, as a measure of hedging intensity in our regression tests.

When we create our hedging variables, we assume that firms expressing their hedging policies more intensely manage them more actively. It is possible that the external job market motivates a CEO to mislead investors by mentioning financial hedging more intensely. This concern is mitigated by the findings of Huang et al. (2013), who detect a high correlation (between 42% and 67%) between the notional values of hedging derivatives and hedging proxies based on the number of hedging related words in the 10-K. Also, Francis, Gao, Young, and Sun (2018) attribute their usage of binary variables to the inconsistency in the notional amount of derivative usage. A detailed discussion about hedging related word lists and the formation of hedging variables is provided in Appendix B.

II.3.4 Instrumental variables

Industry tournament incentives are documented as endogenous in the tournament incentives literature. We use instruments for the industry pay gap from Coles et al. (2017) and Huang et al. (2019). Our first instrumental variable is the sum of total compensation received by all other CEOs in the same industry, except the highest-paid CEO. As discussed in Coles et al. (2017), total industry CEO compensation reflects the ability of an industry to pay and is expected to be highly correlated with the industry pay gap. However, this industry-level total compensation variable is unlikely to be correlated with firm-level corporate hedging activities. Draw upon Huang et al. (2019), our second instrument is the number of higher-paid CEOs in the same industry group for each firm in the given year, *#Higher paid ind CEOs*. For a CEO, an increase in the number of higher-paid CEOs in the same industry is likely to increase in the pay gap between the CEO and the highest-paid CEO in the industry. Thus, the number of higher-paid CEOs in the same industry as an instrument for ITIs would likely satisfy the relevance condition. In our regression models, we mainly use the natural logarithm of *Ind CEO comp* and *#Higher paid ind CEOs* as instruments for our ITIs variable to minimize problems associated with outliers.

Additionally, we use another instrument following Coles et al. (2017) **—** the average total compensation received by all other CEOs who work at firms in different industries that are headquartered within a 250-km radius of the firm (*Geo CEO mean*). We use *Geo CEO mean* instead of *#Higher paid ind CEOs* variable whenever necessary.

II.3.5 Control variables

Kale et al. (2009) and Kini and Williams (2012) show that the pay gap between the CEO and other executives is positively related to firm riskiness and performance. Thus, following the literature, we control for firm-level internal promotion-based incentives (Kale et al., 2009; Kini and Williams, 2012; Coles et al., 2017; Huang et al., 2019). We compute *Firm gap*, the proxy of firm-level internal promotion-based incentives, as the difference between the CEO's total compensation and the median of vice presidents' total compensations. CEO incentives are documented as the determinants of corporate risk management (Smith and Stulz, 1985; Tufano, 1996; Bakke et al., 2016). Thus, we also include *CEO delta* and *CEO vega* in the regression, where CEO delta is defined as the change in executive wealth per $1,000 change in stock price and CEO vega is the change in the value of the CEO's wealth for a 0.01 change in the annualized standard deviation of stock returns.[17] We also control for CEO age and tenure as they are proved to affect a firm's hedging strategies (Croci, Del Giudice, and Jankensgard, 2017). Following Coles et al. (2017), we also control for the number of CEOs (firms) in the industry each year.

Following corporate hedging literature, we include firm-level control variables that affect corporate risk management. We control for firm size, investment in R&D expenditures scaled by total assets, book leverage scaled by total assets, growth opportunities (Tobin's Q), investment in fixed assets (capital expenditures scaled by total assets), profitability (ROA), asset tangibility (net property, plant, and equipment scaled by total assets), cash holding scaled by total assets, leverage, cash flow volatility, financial distress (Z-score), and firm age. Following Almeida et al. (2016), we control for Inventory (inventory divided by costs of goods sold), and Trade Credit (account payables divided by total assets). Additionally, we control for *Non-debt Tax Shield*, depreciation and amortization scaled by the total assets, following Purnanandam (2008). Detailed variable definitions and data sources are provided in Appendix A.

Following Kale et al. (2009) and Coles et al. (2017), we require the firm-year observations with *Firm gap* and *INDGAP1* (*INDGAP2)* variables greater than zero. In all our regression models, as hedging behavior is so industry-specific, we include year and

[17] Following Coles, Daniel, and Naveen (2006; 2013), we use the Black-Scholes option valuation model modified by Merton (1973) to account for dividends, and use the estimates in Bettis, Bizjak, and Lemmon (2005) to model how the holding period of stock options varies with volatility. We use the SAS code provided by Coles et al. (2013) to compute CEO delta and CEO vega.

industry fixed effects. We also show that our results are consistent by using CEO-firm fixed effects in Table 4. All the variables in dollars, including the industry pay gap, are CPI adjusted to the year 2006.

II.3.6 Summary statistics

Table 1 shows summary statistics for our variables, including binary and count hedging variables, incentive variables, firm and industry characteristics, CEO characteristics, crash risk measures, bank loan characteristics, and other control variables.

As shown in Table 1, the mean values of binary variables *HEDGE, FX hedge*, *IR hedge*, and *CMD hedge* are 0.69, 0.51, 0.45, and 0.14 respectively. As the proxies of ITIs, the mean (median) of the industry pay gap, *INDGAP1*, and the size-median industry pay gap, *INDGAP2*, using the second-highest CEO pay within FF30 industry classifications as the benchmarks are $25 million ($17.7 million) and $14.5 million ($8.1 million) respectively. Internal pay gap, *Firm gap*, has a mean (median) value of $3.1 million ($2 million), which is smaller than those of *INDGAP1*. The magnitudes of *INDGAP1*, *INDGAP2*, and *Firm gap* are similar to those reported in Coles et al. (2017). The means (medians) of *CEO delta* and *CEO vega* are $800 ($198) and $123 ($48) respectively. The means (medians) of *CEO tenure* and *Ind # CEOs* are 7.85 (5.67) and 110.4 (81) respectively.

Besides, the means of the measures of stock price crash risk, *CRASH*, *NCSKEW*, and *DUVOL*, are 0.36, 0.66 and 0.24 respectively. Also, the mean (median) of *Loan spread* is 179 (75) basis points.

II.4 Results

II.4.1 ITIs and corporate hedging

In this section, we examine the relation between ITIs and corporate hedging. We use two different corporate hedging variables. The first proxy for corporate hedging is the binary *HEDGE* variable, which is equal to one if a firm is defined to exploit hedging activity (either foreign exchange, interest rate, or commodity derivatives) in a given fiscal year and set to zero otherwise. The other dependent variable is *HEDGE count*, which is the number of hedging related words. These two variables are formed based on the textual analysis of 10-K statements. The details on hedging variables and all other variables are discussed in Appendix B and Appendix A, respectively.

We use regression analysis by performing ordinary least squares (OLS), Probit, two-stage least squares (2SLS) and instrumental variable (IV) Probit estimations. We employ Probit, 2SLS, and IV Probit models for regressions where the dependent variable is the binary variable *HEDGE*.[18] Also, we employ OLS and 2SLS models for regressions where the dependent variable is *HEDGE count*. We cluster standard errors by firms. All regressions incorporate year and industry fixed effects to control heterogeneity by year and industry. The reason we control industry fixed effects is that each industry has its own risk management characteristics. Additionally, following Coles et al. (2017) and Huang et al. (2019), we check the robustness of the relation between ITIs and corporate hedging by using CEO-firm and year fixed effects.

Coles et al. (2017) mention that the analysis of ITIs is unlikely to be contaminated by an endogeneity issue because the CEO's board of directors is unlikely to have control over

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[18] We do not report the results of OLS for *HEDGE* variable for brevity, but we obtain the similar results.

the external job market. However, since industry tournament incentives are defined as endogenous variables by Coles et al. (2017) and Huang et al. (2019), we perform instrumental variable analysis along with lags. The instruments used in the examination of the relation between ITIs and corporate hedging are *ln(Ind CEO comp)*, the natural logarithm of the sum of total compensations of all other CEOs in the same FF30 or FF30 size-median industry classifications, and *#Higher paid ind CEOs,* the total number of CEOs with higher compensation within the same FF30 or FF30 size-median industry classifications.

We report our findings regarding OLS, Probit, 2SLS, and IV Probit regressions in Table 2, where the industry pay gap is based on FF30 industry classification. The coefficients shown in Probit and IV Probit models (columns 1 and 6) are marginal effects at means. Columns (1), (4) and (6) show the results using binary *HEDGE* as the dependent variable. Columns (2) and (5) present the results regarding *HEDGE count* as the dependent variable. Columns (1) and (2) show the results regarding the Probit model and the OLS model, respectively. Columns (3)–(5) illustrate the results related to the 2SLS model and column (6) presents the results regarding the IV Probit model. The Hausman exogeneity tests in 2SLS and IV Probit regressions in columns (4), (5) and (6) reject the null hypothesis of exogeneity at the 5% or %10 significance level, which validates endogeneity of the variable *LN_INDGAP1*. Column (3) illustrates the results related to the first stage of 2SLS regression. The significance of the coefficients on the two IVs and the significance of *F*-statistics indicate the satisfaction of relevance criterion by instrumental variables. We also test the validity of the instruments by the overidentification test. Hansen's *J*-test statistics are 0.40 and 0.90 for the dependent variables *HEDGE* and *HEDGE count*, respectively, which suggests that the instruments exploited are unlikely to influence firm-level corporate hedging policy directly. We have similar results for *LN_INDGAP2* based on FF30 size-median industry classification in Table 3.

The coefficients on *LN_INDGAP1* in Table 2 and *LN_INDGAP2* in Table 3 are positive and statistically significant for all the Probit (column 1), OLS (column 2), 2SLS (columns 4 and 5) and IV Probit (column 6) regressions at the 1% significance level, except that the coefficient on *HEDGE* in the Probit model has significance at the 5% level. The positive effect of ITIs on corporate hedging activity seems to be economically significant. For instance, for the FF30 industry classification, in Table 2 (column 5), a one standard deviation increase in *LN_INDGAP1* is associated with a 14% (0.86 × 0.163) increase in *HEDGE count* in the next year.[19] Additionally, the marginal effect reported in column (6) suggests that a one standard deviation increase in *LN_INDGAP1* increases *HEDGE* by 23% (0.20 / 0.86).[20]

Further, following Coles et al. (2017) and Huang et al. (2019), we test the relation between ITIs and corporate hedging by using year and CEO-firm fixed effects. We perform 2SLS regression analysis, using binary *HEDGE* or *HEDGE count* variables. We use instruments *Ind CEO comp* and *Geo CEO mean*, the average total compensation received by all other CEOs working in the firms headquartered within a 250-km radius of the firm. We report the results in Table 4. Columns (1)–(3) show the results regarding ITIs based on FF30 industry classification, whereas columns (4)–(6) illustrate the results regarding ITIs based on FF30 size-median industry classification. Similar to the previous results,

[19] Similarly, for FF30 size-median industry classification, in Table 3 (column 5), a one standard deviation increase in *LN_INDGAP2* is associated with a 18% (1.77 × 0.099) increase in *HEDGE count* in the next year.
[20] Similarly, for FF30 size-median industry classification, the marginal effect reported in column (6) suggests that a one standard deviation increase in *LN_INDGAP2* increases the *HEDGE* by 4% (0.071 / 1.77).

Hausman exogeneity tests confirm the endogeneity of ITIs proxy, high first-stage *F*-statistics show the relevance of the instruments, and overidentification tests (Hansen's *J*-test) imply the validity of the instruments. Consistent with our earlier analyses, we find a significantly positive association between ITIs and corporate hedging at conventional levels.

These results are consistent with our *risk management hypothesis*, which suggests that the likelihood to hedge and the level of corporate hedging increases in the size of industry tournament prizes. These results also confirm that a CEO induced by ITIs is more inclined to hedge and tends to hedge more due to its benefits to her own career rather than refraining from hedging as a result of being motivated for risk-taking activities, which indicates the dominance of the *risk management hypothesis* over the *risk incentive hypothesis*. Similarly, we detect a positive association between internal tournament incentives, *Firm Gap*, and corporate hedging. This result shows that other senior executives, too, tend to hedge to get an upward leap to CEO position when they are induced by within-firm tournaments among vice presidents. This is consistent with the argument of Chava and Purnanandam (2010), who illustrate that senior executives below the rank of the CEO can also influence financial policies.[21] Kini and Williams (2012) find that internal tournament incentives induce next-level senior executives for riskier firm activities. However, contrary to the findings of Kini and Williams (2012), we show that the advantages of hedging prevail over the risk incentives of the internal tournament.

Consistent with Graham and Rogers (2002), Knopf et al. (2002), and Kumar and Rabinovitch (2013), we find a positive (albeit statistically insignificant) association

[21] The significance of the coefficients on both job market incentives on the CEO and lower rank senior executives suggests that both types of executives have a significant effect on risk management policies.

between CEO delta and corporate hedging in all regression models. This result is consistent with the argument of Smith and Stulz (1985) and Guay (1999a), which document that the lack of diversification of a CEO's wealth may lead her to be more conservative and risk-averse. The coefficients on *ln(1+ CEO vega)* are negative (albeit statistically insignificant) in all regressions shown in Tables 2 and 3. Rajgopal and Shevlin (2002), Coles et al. (2006), and Mao and Zhang (2018) report that CEO vega, which is defined as the sensitivity of managerial wealth to firm risk, maintains convexity in managerial compensation, so it incentivizes risk-taking activities. Thus, a CEO induced by CEO vega may be inclined to abstain from hedging, which can stabilize the volatility of cash flows.

We discover a positive relation between firm size and corporate hedging similar to the previous studies. Nance et al. (1993) and Mian (1996) explain this relation with the presence of fixed costs, which obstruct the feasibility of hedging for small firms. Also, we find a positive relation between leverage and corporate hedging. Nance et al. (1993) hypothesize that firms with higher leverage are more inclined to hedge due to stronger underinvestment problems. Further, we detect that corporate hedging is positively related to R&D activities and firm inventory levels. The firm might tend to hedge as it deals with more intense R&D activities and stockpiles more inventories so that it can mitigate firm risk level related to these activities. Also, we find a negative association between cash level and hedging, consistent with Francis, Gao, Young, and Sun (2018). Holmström and Tirole (2000) assert that firms tend to hold liquid assets as buffers against shocks. Accordingly, as cash holding reduces the need for risk management, it functions as a substitute for hedging. Lastly, signs of the coefficients on other control variables are mostly consistent with previous literature.

Overall, the findings are consistent with the *risk management hypothesis* that when the industry tournament prize is high, CEOs are more likely to hedge and have larger incentives to undertake more corporate hedging activities that have the potential to increase the probability to win the tournament.

II.4.2 ITIs and different types of hedging

In this section, we investigate how ITIs affect hedging of *different* types of risk, including FX risk, IR risk, and CMD risk. We employ IV Probit regression model for dichotomous variables of each hedging type (*FX hedge*, *IR hedge*, and *CMD hedge*) to test the likelihood to hedge, and use 2SLS regression model for continuous hedging variables (*FX count*, *IR count* and *CMD count*) to test the intensity to hedge under FF30 (*LN_INDGAP1*) and FF30 size-median (*LN_INDGAP2*) industry classifications. The instrumental variables used for IV Probit and 2SLS regressions are *Ind CEO comp* and *#Higher paid ind CEOs*. We report our findings in Table 5.

We explore a significantly positive association between ITIs and both the likelihood and the intensity of FX hedging, IR hedging and CMD hedging at various conventional significance levels, except we could not find a significant impact of ITIs on the likelihood to hedge CMD risk. [22] These results illustrate that, consistent with the *risk management*

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[22] The possible reasons for the weak association between ITI and the likelihood for commodity hedging might be as follows: Commodities are at the core of the firm business, whereas interest and foreign exchange risks are more likely to be related to financial instruments. Therefore, a CEO might not be willing to change the traditions about running the firm business. Also, different from other types of derivatives, commodity derivatives involve carrying costs, including interest, insurance and storage costs. The CEO has to manage commodity price risks as well as the costs associated with holding those commodities. Therefore, commodity hedging can be seen as more complicated in terms of managing risk. Further, Brogaard, Ringgenberg and Sovich (2019) show that index commodities damage firm performance following the financialization of commodity markets. Lastly, it is not always possible to find the same underlying commodity in financial markets as the firms' products. Therefore, perfect hedging related to commodity prices through financial markets can become impracticable. Hence, a CEO may not be motivated to hedge commodity risk by outside CEO labor market. Accordingly, INVERTO Raw Materials Study (2018) conducted with 112 managing directors, board members and purchasing managers from companies from some European countries in 2018

hypothesis, as the tournament prize augments the likelihood and intensity to hedge foreign exchange risk, interest rate risk, and intensity to hedge commodity risk increase.

II.4.3 Possible reasons for the link between ITIs and corporate hedging

We examine the possible reasons for the positive relation between ITIs and corporate hedging. Although Coles et al. (2017) report that ITIs, which are risk-incentive, have a positive effect on firm value, some papers also document the harmful effects of ITIs. Kubick and Lockhart (2018) detect a positive relation between ITIs and stock price crash risk. They argue that CEOs with stronger motivation to progress in the CEO labor market tournament have a higher propensity to withhold negative firm-specific information, and this inclination can result in large negative stock price corrections when the accumulated information is disclosed. On the other hand, Kim et al. (2018) uncover the mitigating effects of hedging on stock price crash risk by lowering information asymmetry and enhancing transparency.

In addition, Kubick, Lockhart, and Mauer (2018) find a positive association between ITIs and the cost of borrowing. They argue that greater risk-taking incentives associated with ITIs may induce a higher cost of bank loans because the increase in firm risk is harmful to creditors, and they try to protect themselves by charging higher interest rates. On the other side, Smith and Stulz (1985) assert that hedging reduces the probability of distress by alleviating the likelihood of violating a covenant. Thus, hedging might provide the borrower with an opportunity to negotiate contract terms with lenders. Consistently, Campello et al. (2011) explore a negative association between hedging and the cost of debt.

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find that hedging methods are only rarely used by the sample companies due to a lack of hedging knowledge and skills as well as the acceptance that there are not enough hedging instruments for most raw materials.

Similarly, Bessembinder (1991) indicates that hedging can reduce the agency cost of benefiting shareholders at the expense of lenders by weakening the probability of default. Lastly, Stulz (1996) argues that firms hedge in order to assure against the possibility of costly lower-tail outcomes.

Further, hedging provides a shield against unpredicted shocks, securing adequate and stable internal cash flows, and preventing a firm from inefficient liquidation. Thus, it has a mitigating impact on firm risk levels. Therefore, we argue that a CEO anticipating the amplifier impacts of ITIs on the cost of debt and stock price crash risk can use hedging derivatives to alleviate these effects, which makes the application of riskier policies more possible (Levine, 2005). To test whether hedging mitigates the amplifier effects of ITIs on the cost of debt and stock price crash risk, we analyze the models for subsamples of hedger and non-hedger. We define hedgers and non-hedgers based on the binary variable *HEDGE* (i.e. whether a firm mentions the use of the hedging instrument in its 10-K). Alternatively, we add hedge count variables and the interaction between hedge count variables and the industry pay gap into the regression models.

Following Kubick, Lockhart, and Mauer (2018), we measure the cost of debt as the amount the firm pays in basis points above LIBOR plus any additional fees for each dollar drawn down from the loan facility. Following the literature on the stock price crash risk (Dimson, 1979; Scholes and Williams, 1977; Chen, Hong, and Stein, 2001; Kim, Li, and Zhang, 2011), we form *CRASH* (a dummy variable set to one if the firm has a weekly return that is less than 3.2 standard deviations below the average weekly return for the entire fiscal year), *DUVOL* (the natural logarithm of the ratio of the standard deviation of weekly returns for below-average weeks to the standard deviation of weekly returns for above-average weeks, over the fiscal year), and *NCSKEW* (the negative conditional skewness of firm-specific weekly returns during the entire fiscal year).[23]

For the impact of hedging on the relation between ITIs and stock price crash risk, following Kubick and Lockhart (2018), we employ Tobit regression for the dependent variable of binary *CRASH*, and OLS regressions if the dependent variable is *DUVOL* or *NCSKEW*.[24,25] Table 6 shows the findings of the impact of hedging on the relation between ITIs and stock price crash risk. Columns (1)–(6) show the results regarding the subsample analyses of hedgers and non-hedgers, and columns (7)–(9) show the findings with the interaction between *LN_INDGAP1* and *HEDGE count*. In columns (1)–(9), consistent with the results of Kubick and Lockhart (2018), the coefficients on *LN_INDGAP1* are positive. In columns (1) and (2), we find that the likelihood of a stock price to crash is significantly higher only for non-hedgers, as the CEO tournament prize increases. The results related to the models (3)–(6) illustrate that the effect of ITIs on stock price crash risk is more pronounced in terms of significance and magnitude for non-hedgers compared to hedgers. Also, the coefficients on the interaction between *LN_INDGAP1* and *HEDGE count* are significantly negative in model (7) and model (8) at the 5% and 10% levels, respectively.

For the impact of hedging on the relation between ITIs and the cost of debt, we employ 2SLS regression models. The instruments used are *Ind CEO comp*, *#Higher paid ind CEOs*, the interaction between *HEDGE count* and *Ind CEO comp*, and the interaction between *HEDGE count* and *#Higher paid ind CEOs*. Table 7 indicates the results of the investigation of the effect of hedging on the association between ITIs and the cost of

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[23] The details about the proxies of stock price crash risk are in Appendix C.
[24] We also get similar results when we use Probit model for *CRASH* variable.
[25] The reason to use Tobit and OLS models is to mimic the models used by Kubick and Lockhart (2018).

borrowing. Columns (1) and (2) illustrate the results regarding the subsample analyses of hedgers and non-hedgers, and column (3) shows the findings related to the model including the interaction between *LN_INDGAP1* and *HEDGE count*. In models (1)–(3), consistent with the findings of Kubick, Lockhart, and Mauer (2018), the coefficients on *LN_INDGAP1* are significantly positive. In models (1) and (2), the results illustrate that the effect of ITIs on the cost of borrowing is more pronounced in terms of significance and magnitude for non-hedgers compared to hedgers. Further, in model (3), the coefficient on the interaction between *LN_INDGAP1* and *HEDGE count* is negative and statistically significant at the 5% level.

Accordingly, these results provide supporting evidence that corporate hedging has a mitigating effect on the magnifying impact of ITIs on stock price crash risk and cost of debt, which can be among possible reasons for using hedging tools by a CEO anticipating the impact besides other reasons under the *risk management hypothesis*.

II.5 Heterogeneities in the association between ITIs and corporate hedging

II.5.1 Financial distress and the effect of ITIs on corporate hedging

In this section, we test how financial distress affects the relation between ITIs and hedging practices. As we find in Section II.4.3, one of the possible reasons for the positive relation between ITIs and corporate hedging is that hedging decreases the adverse impact of ITIs on the cost of debt. In this context, hedging mitigates cash flow volatility and thus curtails the probability of distress (Smith and Stulz, 1985). Therefore, hedging cuts down the likelihood of violating a covenant. Also, Bessembinder (1991) indicates that hedging can reduce the agency cost of benefiting shareholders at the expense of lenders by weakening the probability of default. Further, Stulz (1996) argues that firms hedge to assure against the possibility of costly lower-tail outcomes. Additionally, Campello et al. (2011) explore the mitigating impact of hedging on the cost of debt is stronger in firms near distress. Lastly, Gilje (2016) finds that when firms approach financial distress, they tend to cut down investment risks.

On the other hand, Purdanandam (2008) models the impact of financial distress on hedging and empirically support his model. The model forecasts a nonlinear association between financial distress and hedging, and a U-shaped association between costs regarding financial distress and hedging. Consistently, it empirically discovers a negative relation between leverage and hedging for highly leveraged firms despite the finding of a positive relation between leverage and hedging for gently leveraged firms. [26] Therefore, we expect a CEO working at a firm in financial distress is likely to influence hedging, but we do not predict the sign of this effect.

We use Modified Altman's (1968) Z-score, Merton model expected default frequency (EDF), and Naïve model expected default frequency (EDF) as proxies for firm-specific financial distress. The Merton EDF is computed following the Merton (1974) bond pricing model, and the Naïve EDF is computed based on the "simplified" Merton model probability of default following Bharath and Shumway (2008). The details of Merton EDF and Naïve EDF are reported in Appendix D. A lower value of Altman Z-score and higher values of EDFs show more financial distress among the firms.

Table 8 shows how financial distress impacts the relation between ITIs and corporate hedging. We report the results of the 2nd stage of IV estimation of ITIs on *ln(1+HEDGE count)* across firms with different levels of financial distress. The sample is grouped into

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[26] Purdanandam (2008) uses the leverage as a proxy for financial distress.

two subsamples based on the sample-year median of the financial distress variables. The instruments used are *Ind CEO comp* and *#Higher paid ind CEOs*. The coefficients on *LN_INDGAP1* in models (1), (3), and (5) are larger and significant at the 1% level, where those in models (2), (4), and (6) are insignificant. Consistent with the arguments of Purdanandam (2008), these findings suggest that the effect of ITIs on hedging is significantly less pronounced for financially distressed firms.

II.5.2 CEO characteristics that affect CEO mobility

This section covers the examination of the effect of CEO characteristics related to the likelihood of a CEO to move up on the relation between corporate hedging and ITIs. A retiring or a founder CEO might have less motivation to transfer to the leading firm compared to other CEOs so the external job market might not seem so attractive for herself. Similarly, Coles et al. (2017) find that if CEOs are close to the retirement or a founder, the incentive of the external CEO labor market to exert greater effort and engage in riskier firm activities vanishes. Thus, we test how being at the retirement age or being a founder influences a CEO’s motivation to hedge induced by ITIs.

A CEO is defined as the founder CEO based on ExecuComp’s title, and as the retiring CEO if her age is greater than 65 years. The full sample is partitioned into two subsamples based on whether a CEO is a founder or not, or whether she is of the retirement age or not. As shown in Table 9, the likelihood of hedging and the intensity to hedge significantly increase when CEOs are not a founder (columns 2 and 4) or not of the retirement (columns 6 and 8). However, similar to the findings of Coles et al. (2017), those effects disappear when a CEO is a founder (columns 1 and 3) or of the retirement age (columns 5 and 7).

II.5.3 The enforceability of non-competition agreements

Non-competition agreements in the employment contracts are designed to mitigate the possibility that employees or executives accept offers from the competitors (Garmaise, 2011; Jeffers, 2017). Therefore, the enforceability of non-competition agreements can reduce the ability of managers to accept offers from the leading competitor in the industry, and thereby decreases the impacts of tournament incentives. Thus, the staggered changes in the enforceability of non-competition agreements across states provide an identification strategy to examine a causal relation between ITIs and corporate hedging.

Following Garmaise (2011), Jeffers (2017), and Huang et al. (2019), we construct a variable *NON_COMPETE* takes on the value of +1 for firms headquartered in Florida from 1997–2016, in Kentucky from 2007–2016, in Idaho and Oregon from 2009–2016, in Texas and Wisconsin from 2010–2016, in Colorado and Georgia from 2012–2016, in Illinois from 2012–2013, and in Virginia from 2014–2016; takes the value of –1 for firms in Texas from 1995–2006, in Louisiana from 2002–2003, in South Carolina from 2011–2016, and in Montana from 2012–2016; and is set to equal 0 otherwise. We then interact *NON_COMPETE* variable with the industry pay gap variable, *LN_INDGAP1*. CEOs in the firms having enforced the non-competition agreements have less ability to move to the leading firm in the industry, and therefore we predict a negative coefficient on the interaction of *NON_COMPETE* and *LN_INDGAP1*.

Garmaise (2011) claims that the importance of within-state competition enhances for the firms exposed to a higher number of within-state competitors due to the limited geographic scope for non-compete covenants and their ease to impose within a state. Therefore, the impact of the exogenous shocks caused by the enforceability of non-compete agreements on the relation between ITIs and corporate hedging is likely to be more pronounced with the higher number of within state competitors. Accordingly, we expect that the negative coefficient on the interaction of *NON_COMPETE* and *LN_INDGAP1* to be significantly stronger when the number of in-state competitors is higher.

We employ the DID approach to investigate the effect of the exogenous shock on the association between ITIs and corporate hedging. Panel A of Table 10 reports the OLS estimates of the DID approach. We estimate our specification for three subsamples based on the number of in-state competitors each year, whether they are above 25^{th}, 50^{th}, and 75^{th} percentiles (5, 14, and 43 number of in-state competitors respectively). As seen in Panel A of Table 10, the coefficient on *NON_COMPETE* × *LN_INDGAP1* is negative and significant only when the number of in-state competitors is above the 75^{th} percentile. This is consistent with Garmaise (2011) and Huang et al. (2019), which assert the enhancement of the non-competition enforceability with the number of rivals in the state.

Furthermore, we perform a subsample analysis using IV estimation. We partition our sample into two subsamples based on whether a firm is headquartered in a state having enforced non-competition agreement in the year.[27] We report the analyses results in Panel B of Table 10. As seen in the results, the positive effect of ITIs on corporate hedging is significant only for the group with the absence of enforceability of non-competition law in the state, where *ENFORCE* is equal to 0.

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[27] We construct a variable, *ENFORCE,* which is set equal to 1 if non-competition agreement is enacted in the state for the given year, otherwise set to zero.

Overall, the results from the quasi-natural experiment of the changes in the enforceability of non-compete agreements provide us with the identification of the causal relation between ITIs and corporate hedging.

II.5.4 Cross-industry variation in the effects of ITIs on corporate hedging

The CEO talent pool, which can be defined as the fraction of insider CEO hires, diversifies across industries (Cremers and Grinstein, 2009). Also, Parrino (1997) reports varying characteristics across industries that influence the CEO labor market. Further, each industry can have different tendencies toward risk management policy. Thus, we examine cross-industry variation in the incentive effects of CEO external job markets on corporate hedging.

We reestimate the second stage of 2SLS regression models in Table 2 for each FF30 industry classification to measure the relation between ITIs and corporate hedging in each industry. Table 11 illustrates the coefficients on *LN_INDGAP1* for each industry. Industries that display the strongest impacts of the ITIs on corporate hedging comprise Precious Metals, Non-Metallic, and Industrial Metal Mining, and Business Equipment. Also, we find significantly positive relations between ITIs and corporate hedging in Aircraft, Ships, and Railroad Equipment, Petroleum and Natural Gas, Transportation, Retail, and Other industries. However, we cannot discover significant associations between ITIs and corporate hedging for the rest of the industries. Overall, there appears to exist considerable variation in the effect of ITIs on corporate hedging across industries.

II.5.5 Additional robustness tests

In this section, we exploit additional measures of the industry tournament prize (industry pay gap) and use different industry classifications. Firstly, we scale the industry pay gap variable with the CEOs' total compensation under FF30 (FF30 size-median) industry classification, *Scaled_INDGAP1* (*Scaled_INDGAP2*). Further, we test the relation between ITIs and corporate hedging under Fama-French 48 (henceforth FF48)[28] and Fama-French 48 size-median industry classifications.

We report our robustness results in Table 12. As seen in the columns (1)–(4), our previous findings for the positive effects of ITIs on the likelihood and intensity of corporate hedging persist even if we scale the industry pay gap variable by the CEO total compensation. Moreover, we obtain similar results under FF48 and FF48 size-median industry classifications, reported in columns (5)–(8). Hence, our results are robust to using different measures of the industry pay gap and industry classifications.

II.6 Conclusion

Corporate hedging is mainly carried out by firms to protect themselves against unexpected shocks. The primary benefit of hedging is to prevent a firm from inefficient liquidation through securing adequate and stable internal cash flows. This paper investigates industry tournament incentives (ITIs) as a factor affecting corporate hedging policies. The promotion-based tournament theory suggests that competition among employees can induce them to work harder and change their risk appetite (Lazear and Rosen, 1981; Hvide, 2002; Goel and Thakor, 2008). Accordingly, Coles et al. (2017) claim that CEOs compete with one another to obtain CEO positions in the leading firms in their industries because these aimed positions incorporate higher compensation levels, status and visibility, and an enlarged span of control. They find a CEO motivated by the pay gap

[28] The details are available from https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_48_ind_port.html.

between her original compensation and the highest-paid CEO tend to increase her effort and engage in riskier activities, which can, in turn, impact her attitude toward corporate hedging.

Following Manconi et al. (2017), Hoberg and Moon (2017), and Qiu (2019), we benefit from textual analysis of 10-Ks to form corporate hedging proxies. In line with our *risk management hypothesis*, we find ITIs positively influence the likelihood to hedge and the hedging intensity. This finding indicates that industry tournament incentive is one of the motivations behind corporate hedging.

We then search for possible reasons for the positive relation between ITIs and corporate hedging. We discover that corporate hedging alleviates the amplifying impact of ITIs on the cost of debt and stock price crash risk, which can encourage CEOs to hedge. Additionally, we show that this relation is less pronounced for firms in more financial distress. Also, the association between ITIs and corporate hedging enhances when the likelihood of a CEO to move up soars.

Using an exogenous shock provided by the changes in the enforceability of non-compete agreements, we identify a causal relation between ITIs and corporate hedging. Overall, our analyses illustrate that the compensation gaps among CEOs are important incentive mechanisms that motivate them to influence corporate hedging policies.

CHAPTER III

TOURNAMENT INCENTIVES AND RESERVE MANAGEMENT

III.1 Introduction

This paper investigates how internal tournament incentives (ITTIs) affect reserve management in the property-liability (P-L) insurance industry. Tournament incentives theory is initiated by Lazear and Rosen (1981), who suggest that a compensation scheme based on worker's ordinal rank is an optimal scheme if it is too costly to monitor workers. Internal tournaments indicate that vice presidents (VPs) or senior executives are in a race for promotion to the CEO position. The literature examines the relationships between ITTIs and corporate finance decisions. For example, Kale, Reis, and Venkateswaran (2009) and Haß, Müller, and Vergauwe (2015) show that ITTIs are positively related to firm performance (ROA).[29] In the theoretical framework, Goel and Thakor (2008) show that executives prefer to raise the firm risk level in the form of a tournament to enhance their chance of promotion. Kini and Williams (2012) find empirical evidence that at non-financial firms as well as financial firms except insurance firms, internal tournaments induce VPs to boost their firm risks by pursuing riskier policies.[30] Surprisingly no papers have examined the relationship between tournament incentives and corporate finance

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[29] Tournament incentives are measured as the difference in compensation between a CEO and the next layer of senior executives.

[30] Coles, Li, and Wang (2017), in which internal tournament incentives are controlled, find a positive relation between industry tournament incentives and the firm risk level and performance. The extant literature has mostly focused on the inter-tournament because some argue senior executives below the rank of the CEO may not have a significant power in determining firm investment and financial policies. More recently, however, studies (e.g., Géczy, Minton, and Schrand, 2007; Jiang, Petroni, and Wang, 2010; Chava and Purnanandam, 2010) show that senior executive incentives also can influence financial policies.

decisions by insurers. This article intends to fill this gap. Specifically, we examine the relationship between ITTIs and reserve management.

Many studies examine reserve management and how firm executives take advantage of their discretion to manage earnings in the insurance industry. For example, Eckles and Halek (2010) show that managers with compensation packages including bonuses are inclined to increase reserve errors which is consistent with the tendency to inflate their compensation. They also find that managers who hold restricted stocks have a tendency to underestimate their loss reserves. Eckles, Halek, He, Sommer and Zhang (2011) find that managers who have compensation with more bonuses and more restricted stocks are more inclined to manipulate earnings but this tendency is mitigated by corporate governance through board monitoring. Although reserve management-related issues have been examined extensively, none of the literature has examined the relation between tournament incentives and reserve management.

Reserve management in the insurance industry is similar to earnings management in non-financial industries. As mentioned above, the literature finds a positive relationship between tournament incentives and firm performance (ROA) at non-financial firms. Grace (1990) and Petroni (1992) find that insurance executives manipulate the loss reserve to smooth earnings. Based on the literature, we suggest that tournament incentives may influence a firm’s loss-reserve management because loss reserves are strongly related to the performance of the insurers. VPs may manipulate their firm’s loss reserve to increase their chance of promotion to the rank of CEO.

Applying the literature of non-financial industries to the P-L industry, one would expect to see that VPs try to increase the perceived probability of promotion to CEO through less conservative reserve behavior in the short-run by underestimating the loss reserve, which results in higher earnings at the current time. In this case, one would expect a negative relationship between ITTIs and reserve estimates. By contrast, we argue that the relationship between internal tournament incentive and reserve estimates is positive. Insurance executives might try to increase the perceived probability of promotion to CEO through overestimating reserves because financial health is more important to stakeholders (both stockholders and policyholders) of insurers. Overestimating reserves improves financial health and decreases the probability of insolvency. The insolvency of insurers is highly regulated by insurance commissioners.

The reasons that we focus on the relationship between reserve management in the insurance industry and tournament incentives are as follows. First, tournament incentives have an impact on earnings management which is related to firm performance. We utilize loss reserve errors as a proxy for earnings management and are highly reliable (Beaver, McNichols and Nelson, 2003; Han, Lai, and Ho, 2018). Insurers are required to disclose the originally estimated and revised loss reserves for their unpaid claims every year. This gives us an opportunity to compare the original reserve estimates and their revised estimates in later years. Therefore, we can obtain an objective measure of earnings management. Second, loss reserves are subject to managerial discretion. Senior executives such as VPs may manipulate loss reserves in order to be promoted to the CEO position. The most common form of manipulating financial performance in the insurance industry is through reserves management (e.g., Hsu, Huang, and Lai, 2019) because managers have considerable managerial discretion and loss reserves account for the highest percentage of the balance sheet. Specifically, loss reserves are the largest liability in P-L insurance. Third, the insolvency is more critical to insurance policyholders than customers of non-financial industries because insurers sell promises, not products or services at the time of transaction. Moreover, unlike most other investments (e.g., stocks and bonds), insurance products or services are a necessity for most people. The consequence of an insurance firm's insolvency can be severe for policyholders because they could suffer millions of dollars in losses without guarantee funds, even they may pay only hundreds of dollars in insurance premiums.[31] Finally, the insurance industry is highly regulated, so we can investigate whether regulation has any impact on the relationship between ITTIs and reserve management.

Our sample consists of all publicly traded P-L insurers over the period 1996 to 2011. Following Kale et al. (2009), we measure the ITTIs as the gap between a CEO's total compensation and the median of VPs' total compensations. We use two types of reserve errors, which can be considered measures of potential managerial bias. One measure of reserve error, which compares the originally estimated loss reserve to a future revised estimate, is used by Kazenski, Feldhaus, and Schneider (1992). The other measure, which compares the originally estimated loss reserve to future claims paid, is used by Weiss (1985).

We find a positive relationship between ITTIs and reserve errors, implying that a larger pay gap as a tournament prize induces VPs to overestimate loss reserves more. In other words, a higher tournament prize is associated with more conservative loss reserve management which results in lower earnings. This evidence is in contrast to that of on non-financial firms where a positive relationship between tournament incentives and profits are

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[31] Most insurance products for consumers are protected by state guarantee funds. This is more evidence that insolvency risk is critical to insurance companies.

found. We also examine the relationship between tournament incentives and performance and risk-taking because performance and risk-taking behavior are related. We do not find a positive relation between tournament incentives and performance or risk-taking behavior. This evidence also differs from that in non-financial firms. Specifically, the literature shows that the relationship between tournament incentives and risk-taking is positive. Taken together, the evidence indicates that VPs in the insurance industry focus on the strong financial health of the insurer, instead of its profitability. In addition, we also find that the impact of ITTIs on reserve errors is more pronounced at larger, financially weaker and more geographically concentrated insurers, and is mitigated for a higher percentage of claim loss reserves over the total liability of insurers. The finding that weaker financial health insurers reserve more as tournament incentives increase supports our conclusion that VPs in a tournament focus on financial health, rather than earnings. Without considering tournament incentives, the literature shows that the relationship between reserve errors and weak financial health is negative, implying that weaker insurers reserve less. Our results also suggest that the Sarbanes–Oxley Act (SOX) does not have a significant influence on the relationship between internal tournaments and reserve management. Finally, we also find that, as board independence increases, VPs induced by promotion-based tournaments become more likely to display conservative reserve behavior.

Our research contributes to the existing literature in several ways. This paper is the first to examine the effects of tournament incentives on reserve management in the P-L insurance industry. Second, our results contrast with those of non-financial industries. Our results show that managers in tournaments are more likely to reserve more, which results in lower earnings. The evidence of the literature on non-financial firms shows that the relationship between tournament incentives and performance is positive. In addition, we do not find a positive relationship between tournament incentive and risk taking, which is shown in the non-financial industries. Third, we use a single industry as our sample which can reduce concern about a spurious relation caused by unobserved heterogeneity (Eckles et al., 2011). Finally, the extant literature focuses mostly on intra-tournaments because some argue that senior executives below the rank of the CEO may not have significant power in determining firm investment and financial policies. Recently, however, some studies (e.g., Géczy, Minton, and Schrand, 2007; Jiang, Petroni, and Wang, 2010; Chava and Purnanandam, 2010) have shown that senior executive incentives can also influence financial policies. For example, Jiang et al. (2010) and Chava and Purnanandam (2010) find that incentives of the chief financial officer (CFO) affect accrual management and debt decisions. In a similar vein, Kale et al. (2009) find that larger tournament incentives faced by senior executives are associated with better firm performance and firm value. We add to this recent literature by showing that senior executives who face option-like features in intra-organizational promotion tournaments affect reserve management. More important, we interviewed some VPs at insurance companies and executives at actuarial consulting firms. They indicate that VPs in all areas (e.g., operations and marketing as well finance or actuary) participate in the decisions making on reserve estimates.

The rest of this paper is organized as follows. The Literature Review and Hypotheses Development section provides an overview of tournament incentives and decision making in reserve management, risk-taking, and performance. The data, sample, variable definitions, and empirical methodology are described in Data and Methodology section. The Descriptive Statistics and Results section presents the descriptive statistics and main empirical results regarding firm risk and performance, and the Conclusions section concludes the paper.

III.2 Hypotheses Development

This section first provides information about the decision making on reserve estimates by insurers. We next develop our hypothesis about the relationship between tournament incentives and reserve management.

Reserve Management Decision Making

Our paper focuses on the relationship between tournament incentive and reserve management, so it is important to show that VPs influence the reserve estimates. We interviewed some VPs and executives at insurers. The question is: Does a senior executive (e.g., VP of chief actuary), who is in charge of reserve estimates, make the decision on reserve estimates alone? We find that the answer is no. In general, a VP in charge of reserve estimates is the VP of chief actuary or the VPs in Finance present different scenarios with different assumptions from a group of VPs in different areas (e.g., accounting, marketing, and operation). VPs in different areas give their inputs before the final decision is made. In other words, VPs make a group decision.

Tournament Incentives and Reserve Management

To develop our hypothesis on the relationship between tournament incentives and reserve management, we first review tournament theory and its empirical evidence.

In the tournament literature, Lazear and Rosen (1981) show that relative performance-based compensation might yield an optimal scheme when it is difficult and costly to observe labor output levels. Tournament prizes can induce all workers at a firm regardless of their level, including CEOs and the next-level executives (or VPs). VPs can be viewed as being in a contest to assume the CEO position and they will be evaluated based on their relative performance. In a tournament setting, as the tournament prize increases, contestants are expected to increase their effort level to win the tournament.[32] On average, firm performance and value increase as contestants increase their efforts. Kale et al. (2009) illustrate the existence of a positive relation between firm performance and the difference in compensation between the CEOs and VPs. In other words, the literature on industrial firms shows that the relationship between tournament incentives and firm performance (e.g., ROA) is positive.

Because earnings management can affect firm performance, we next review the literature related to earnings management at non-financial firms. Many studies investigate executive compensation and earnings management. For example, Aboody and Kasznik (2000) find that CEOs try to impact their stock option compensation by making voluntary disclosures. Healy, Kang, and Palepu (1987), Sloan (1993), Guidry, Leone, and Rock (1999), and Balsam (1998) review the management of bonus schemes through the manipulation of discretionary accruals. Burns and Kedia (2006) find a significantly positive relation between the CEO delta and the sensitivity of the CEO's option portfolio to the stock price, and the tendency to misreport. Similarly, Armstrong Larcker, and Ormazabal (2013) explore a positive relation between executives' portfolio vega and the proclivity to misreport. Shrieves and Gao (2002), Baker, Collins, and Reitenga (2003), Francis, Olsson, and Schipper (2004), and Bergstresser and Philippon (2006) illustrate an

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[32] Coles et al. (2017) examine the relationship between industry tournament incentives and firm performance. They use a contest approach, in which the tournament prize is the pay gap between the highest-paid CEO and the aspiring CEO and so the tournament has two players. In their approach, the aspiring CEO wins the prize if he/she can take the position of the highest-paid CEO, otherwise the highest-paid CEO continues to win the tournament prize. It should be noted that industry tournament is not the focus of the paper.

association between the magnitude of discretionary accruals and option-like compensation scheme. Also, Cheng and Warfield (2005) show how managers with high equity incentives are induced to engage in earnings management. Finally, Jiang et al. (2010) document that a greater role is played by CFO equity incentives than the CEO in earnings management, as the magnitude of accruals is more sensitive to CFO equity incentives than to those of the CEO. In summary, the prior literature suggests that managers are willing to engage in earnings management for compensation.

Reserve management in the insurance industry is similar to earnings management in non-financial industries because reserve management has a major impact on the earnings of insurers. We, thus, review the literature on reserve management. Like earnings management in non-financial industries, reserve management has been examined extensively in the insurance literature. For example, Eckles and Halek (2010) indicate that bonus schemes influence managerial behavior in terms of their tendency to shape reserve management, and Eckles et al. (2011) illustrate that this tendency is alleviated by corporate governance.[33]

If one follows the arguments and evidence on nonfinancial industries, one would expect the relation between tournament incentives and earnings is positive. In other words, managers in the tournaments in the P-L insurance industry are more likely to underestimate reserves to show higher earnings.[34] Based on the literature on nonfinancial industries, higher earnings help VPs to obtain a CEO position.

[33] The literature also examines the relation between tournament incentives and other issues. For example, previous studies find a positive relation between tournament incentives and sabotage (Harbring and Irlenbusch, 2011), dishonest reporting of performance (Conrads, Irlenbusch, Rilke, Schielke, and Walkowitz, 2014) and corporate fraud (Haß et al., 2015).

[34] The reasons for reserve management examined in the literature include tax minimization (Grace, 1990), income smoothing (Weiss, 1985; Grace, 1990; Beaver et al., 2003), financial weakness (Petroni, 1992; Gaver

Conversely, we argue that in the P-L industry managers in tournaments are more likely to overestimate reserves, instead of underestimate reserves. The reason is that underestimation of reserves at insurance companies can increase the insolvency risk. The insolvency of an insurer can have a severely negative impact on the stakeholders, especially policyholders, and is more critical to policyholders of insurance than customers in nonfinancial industries because insurers sell promises, not products or services. In other words, unlike customers in nonfinancial or service industries, policyholders do not receive the products or services at the time of the transaction. Moreover, unlike most other investments (e.g., stocks and bonds), insurance products or services are a necessity for most people. The consequence of insolvency at an insurance firm can be severe for policyholders because they might suffer millions of dollars in losses without guarantee funds even they may pay only hundreds of dollars in insurance premiums.[35] Therefore, VPs in the insurance industry are more likely to overestimate reserves to protect the firm's financial health.

In addition, these types of reserve (earnings) manipulation can be detected by regulators. The fact that the P-L industry is heavily regulated might also motivate VPs to be more conservative and lead them to overestimate reserves to avoid insolvency risk and unwanted regulatory attention. Highly profitable financial conditions with underestimated reserves might trigger suspicions about the reliability of financial statements. Moreover, regulators are more sensitive about underestimation than overestimation of reserves, because underreserving behavior causes financial distress by insurers.

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and Paterson, 2004; Grace and Leverty, 2012), market value maximization (Petroni, Ryan and Wahlen, 2000; Beaver and McNichols, 1998) and price regulation (Nelson, 2000; Grace and Leverty, 2010, 2012).

[35] Most insurance products for consumers are protected by state guarantee funds. This is more evidence that insolvency risk is critical to insurance companies.

Although the appointment of CEOs is at the board of directors' discretion, the board cannot ignore the possibility of insolvency, which is monitored by regulators. Managers of insurers, thus, cannot focus solely on pleasing their shareholders. The financial health of publicly traded insurers is intensely monitored not only by regulators but by investors, rating agencies, and boards of directors. If managers underestimate reserves to obtain higher earnings in the short run but hurt the financial health of the insurers, the managers can lose their reputational capital or even their jobs. Managers who overestimate reserves are more likely to win tournaments because overreserving might be consistent with the objective of the board, which is good financial health, rather than good performance.

Board of directors have responsibilities to other stakeholders as well as shareholders.[36] Boards may prefer overestimation of reserves to underestimation because of the risk of insolvency. In addition, overestimated reserves enjoy tax-shield benefits. VPs might be aware of these kinds of inclination by the board and, thus, prefer a conservative reserve policy. In summary, the ITTIs can induce VPs to overreserve in order to increase their probability of promotion because the financial health of the insurers is important to their stakeholders.

Based on the literature on nonfinancial industries, one can predict that tournament incentives make it more likely that VPs will underreserve. At the same time, we argue that VPs are more likely to underreserve to protect the firm's financial health to win the tournament. Based on the two conflicting arguments, we propose that there is a relationship

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[36] Recently, the Business Roundtable released a statement "signed by 181 CEOs who commit to lead their companies for the benefit of all stakeholders—customers, employees, suppliers, communities and shareholders." Although the statement was not from the board of directors, it reflected the current trend in corporate governance. See https://www.businessroundtable.org/business-roundtable-redefines-the-purpose-of-a-corporation-to-promote-an-economy-that-serves-all-americans/.

between ITTIs and reserve behavior, but the sign of the relation in the P-L insurance industry cannot be determined. Although the main focus of this study is the relationship between tournament incentives and reserve management, we also need to examine risk-taking and performance because they are related to reserve management. Reserve management has an impact on risk-taking behavior through insolvency risk and on earnings through aggressive or conservative estimations of reserves.

Tournament Incentives and Risk-Taking

The literature shows that tournament incentives might change the risk behavior of executives. Winning a tournament has an option-like payoff, which provides executives with convexity in the executive compensation (Kini and Williams, 2012; Guay, 1999b). Smith and Stulz (1985) imply that if a manager’s compensation is a concave function of firm value, then she is induced to reduce risk for hedging purposes. Coles, Daniel, and Naveen (2006) suggest that as the sensitivity of CEO wealth to the stock price increases, CEOs are inclined to implement riskier policies. Goel and Thakor (2008) develop a theoretical model and show that executives are more likely to take on greater risk in the presence of tournaments. In a tournament for CEO promotion, senior executives have the same probability of being promoted if they have the same output, because of choosing the same level of risk. Other things being equal, executives are more likely to obtain higher output if they take on riskier projects. The board of directors promotes the executive with the highest output because the board cannot discern whether the higher output is the result of higher project risk or executive ability. Kini and Williams (2012) test the proposition of Goel and Thakor (2008) and provide evidence that senior executives are induced to increase firm risk through an intra-organizational tournament to become the CEO of the firm.[37] Moreover, Coles, Li, and Wang (2017) document a positive relationship between industry tournament incentives and firm risk and the riskiness of firm investment and financial policies.

Although the literature shows a positive relation between tournament incentives and firm risk in nonfinancial industries, the relation may not be positive for the P-L insurance industry. Risk-taking behavior in the P-L insurance industry can be different from that nonfinancial industries for two reasons. First, the insurance industry sells promises, not physical goods or services. The negative consequence of insolvency is much higher for policyholders than for customers of nonfinancial companies because customers do not obtain products after a transaction with insurers.[38] Second, the insurance industry is in a highly regulated environment. ITTIs might incentivize executives toward more conservative and less risky financial activities in P-L insurance firms because regulators' main concern is the solvency of insurers.

The financial health of publicly traded insurers is intensely monitored not only by regulators, but by investors, rating agencies, and boards of directors. Our arguments about the relation between tournament incentives and risk-taking are similar to those about the relation between tournament incentives and earnings management. The reason is that underestimating reserves and high risk-taking behavior (underwriting risk and investment risk) have the same effect on the insolvency risk of the insurance companies. If these

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[37] They further show larger tournament incentives induce senior executives for more intensive R&D, higher leverage and firm focus and diminished capital expenditures. Here, VPs' promotion does not have to be realized to motivate them for higher effort or to choose riskier policies, since VPs are still compared with their peer group by their and other firms' board when their performances are evaluated. Further, Ma and Wang (2014) find that the sensitivity of CEO compensation to stock prices induces executives for riskier activities.

[38] Customers of durable goods might also care about the firms' insolvency risk because of warranties and the need for parts in the future.

incentives lead to a general change in the approach toward risk-taking behavior, this conservative perspective induced by promotion-based tournaments might lead to a decrease in firm riskiness in general.

As mentioned earlier, high-risk behavior can result in high insolvency risk in the P-L insurance industry, which is a major concern of regulators and all stakeholders including investors, rating agencies, policyholders and boards of directors. Also, any deterioration in the financial health of an insurance firm can undermine its executives', including VPs', reputation. Therefore, based on the above arguments, the relation between tournament incentives and risk-taking is negative.[39] Recall that in the literature on nonfinancial industries, the relationship between tournament incentives and risk-taking is positive. Based on the two conflicting arguments, a relation between internal tournament incentives and risk-taking behavior is to be expected, but the sign of the relation cannot be determined.

III.3 Data, Variable Definition, and Sample Description

Data and Methodology

Our sample includes only publicly traded P-L insurance firms. The sample consists of 47 firms over the period between 1996 and 2011[40]. The sample has a total of 464 firm-year observations. We have a relatively small number of firm-year observations because of the limited number of publicly-traded insurance firms. A small sample size is common in the literature examining publicly-traded insurance firms (e.g., Eckles and Halek, 2010; Huang, Lai, McNamara, and Wang, 2011; Miller, 2011; Ma and Wang, 2014; Han et al., 2018).

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[39] Reserve management is not the only channel through which an insurance firm can affect the firm risk level.
[40] We stop at 2011 because reserve error variables, which are the dependent variables, account the following five years of reserve estimates. Therefore, our panel data include P-L insurance firm observations between 1996 and 2016 from this perspective.

Compensation data are obtained from the ExecuComp database which provides data on executive salaries, option grants, stock awards, bonuses, and total compensation at public firms. We use TDC1 (total compensation), which consists of salary, option grants, restricted stock grants, bonus, long term incentive plan (LTIP) payouts,[41] and other annual payments. Insurance firm-specific data, including dependent variables, reserve errors, and firm characteristics, are obtained from the annual statutory statements filed with the National Association of Insurance Commissioners (NAIC). We obtain the stock return and Tobin's Q data from the Center for Research in Security Prices (CRSP) and Compustat, respectively. Lastly, co-option and tenure weighted (TW) co-option data are obtained from Lalitha Naveen's website (Coles, Daniel, and Naveen, 2014).

Variable Definition and Methodology

Tournament Incentives and Reserve Errors

We use an ordinary least squares (OLS) regression model and the two stage least squares (2SLS) method to investigate the effect of ITTIs on reserve errors. The main regression model performed is stated as follows.

$$
\begin{aligned}
&(Reserve\ Error\ /\ Asset)_{t+1} \\
&\qquad = \alpha_i + \beta_1\, ln(Firmgap)_{i.t} \\
&\qquad + \beta_2\, ln(CEO\ delta)_{i.t} + \beta_3\, ln(CEO\ vega)_{i.t} + \beta_4 Firm\ characteristics_{i.t} \\
&\qquad + \beta_5 Other\ control\ variables_{i.t} + \varepsilon_{i.t}
\end{aligned}
$$

[41] This is the amount paid out to the executive under the company's long-term incentive plan. These plans measure company performance over a period of more than one year (generally three years).

where *i* is firms. The dependent variables are either *KFS error/Asset* or *Weiss error/Asset*. All variables are defined below and in Appendix F.

Dependent variables: Reserve Errors

Loss reserves arise from unpaid claims on losses that occurred before the balance sheet date. Insurance firms have to disclose loss reserve estimates and any revisions made in these estimates each year. The revisions are an indication of the overestimation or underestimation of previously reported estimates of loss reserves. Insurers have to report and compile revisions over the previous 10-year estimates of loss reserves through Schedule P in their annual filings.

Schedule P includes loss estimates in the year incurred and its revised estimates in the following years. Therefore, the estimated amount of losses during the incident year and the subsequent adjustments in the estimate are disclosed. Incurred losses include both the losses paid and losses estimated by an insurer. Following Kazenski et al. (1992), we use *KFS error*, which is the difference between total incurred losses at year t and a revised estimate of incurred losses at year t+5 for firm i. KFS error can be calculated as follows:

$$KFS\ error_{i,t} = Incurred\ Losses_{i,t} - Incurred\ Losses_{i,t+5}$$

Also, Schedule P must include the gradual settlement of claims over time. We use Weiss error (1985) as a second measure of reserve error, which is the difference between total incurred losses at year t and developed losses paid at year t+5 for firm i. Weiss errors can be calculated as follows:

$$Weiss\ error_{i,t} = Incurred\ Losses_{i,t} - Developed\ Losses\ Paid_{i,t+5}$$

As the incurred losses include both developed losses paid (losses actually paid) and losses estimated to have happened, Weiss errors are expected to be greater than KFS errors.

Main variable of Interest

Our main variable of interest is tournament incentives. Following Kale et al. (2009), we measure ITTIs, *ln(Firmgap)*, as the natural logarithm of the pay difference between a firm CEO and the median of next-level firm executives (VPs). Specifically, *ln(Firmgap)* is calculated as follows:

ln(Firmgap) = ln(Total compensation of CEO - Median compensation of VPs)

Control Variables

The control variables in all the models include compensation incentives (CEO delta and CEO vega), firm characteristics, and other control variables. CEO delta is the sensitivity of CEO wealth to a $1,000 change in the stock price, whereas CEO vega is the sensitivity of CEO wealth to a 0.01 change in annual stock price volatility. We follow Coles, Daniel, and Naveen (2006, 2013) and use the Black and Scholes's model modified by Merton (1973) to account for dividends. Using the estimates in Bettis, Bizjak, and Lemmon (2005), we model the sensitivity of the holding period of stock options to volatility. We benefit from the SAS code provided by Coles et al. (2013) to compute the CEO delta and CEO vega. Further, we control for firm characteristics of insurers. For detailed information about the definition of variables, see Appendix F.

Instrumental Variables

Our sample consists of publicly traded insurers, which significantly reduce the likelihood that the results are due to a spurious correlation caused by unobserved heterogeneity (Eckles et al., 2011). Also, we use the lagged values of all independent variables, including $ln(Firmgap)_t$.

To address the endogeneity issue, we use the instrumental variable (IV) method. The IVs used are $\ln(Firmgap)_{t-1}$ (Chen, Hui, You and Zhang, 2016) and $ln(NoofVP)_t$ (Kale et al., 2009; Kini and Williams, 2012).[42] $ln(NoofVP)_t$ is the natural logarithm of the number of VPs in a firm-year observation. $Firmgap_{t-1}$ is not likely to be affected by reserve errors two years later because we regress reserve errors on one-year-lagged independent variables including $ln(Firmgap)_t$. In 2SLS regressions, we regress $ln(Firmgap)_t$ on $ln(Firmgap)_{t-1}$ in the first stage. Therefore, there is a two-year difference between the reserve error and the instrumented $ln(Firmgap)_t$. $ln(NoofVP)_t$ is not likely to have a direct effect on reserve errors. As the number of VPs increases, the probability of promotion declines, which implies a higher pay gap. All these variables are also defined in Appendix F.

Tournament Incentives and Risk-Taking Behavior

The literature on tournaments focuses on the relation between tournament incentives and risk-taking. We also examine the effects of ITTIs on risk-taking behavior and the performance of P-L insurance firms. Following previous studies on risk-taking, we use the standard deviation of the firm's loss ratio over five-year rolling periods, $Std_5(Loss\ ratio)$, where the loss ratio is the ratio of loss incurred divided by premiums earned, as a measure of underwriting risk. The standard deviation of the return on investment (ROI) over five-year rolling periods, $Std_5(ROI)$, where ROI is measured by the ratio of the net investment

[42] In their analyses, Kale et al. (2009) and Kini and Williams (2012) use *CFOisVP*, which can be defined as a dummy variable that equals 1 if there is a CFO in a firm-year observation, and 0 otherwise, as an instrument for *ln(Firmgap)*. However, as CFOs are directly involved in reserve management, we think that this variable is not exogenous, so we did not use it as an instrument.

gain divided by investment assets, is used as a measure of investment risk. We use the standard deviation of the return on assets (ROA) over five-year rolling periods, *Std_5(ROA)*, where ROA is calculated as the ratio of net income divided by net admitted assets, as a measure of total risk. Finally, we use *Var(Return)*, the variance in daily stock returns, within a year as a proxy for market risk-taking behavior The regression model is stated below.

$$(Risk\ taking\ variables)_{t+1}$$
$$= \alpha_i + \beta_1\, ln(Firmgap)_{i.t}$$
$$+ \beta_2\, ln(CEO\ delta)_{i.t} + \beta_3\, ln(CEO\ vega)_{i.t} + \beta_4 Firm\ characteristics_{i.t}$$
$$+ \beta_5 Other\ control\ variables_{i.t} + \varepsilon_{i.t}$$ [43]

The main variable of interest, *ln(Firmgap)*, is the natural logarithm of the pay difference between a firm CEO and the median of next level firm executives (VPs).

Tournament Incentives and Performance

$$(Performance)_{t+1}$$
$$= \alpha_i + \beta_1\, ln(Firmgap)_{i.t}$$
$$+ \beta_2\, ln(CEO\ delta)_{i.t} + \beta_3\, ln(CEO\ vega)_{i.t} + \beta_4 Firm\ characteristics_{i.t}$$
$$+ \beta_5 Other\ control\ variables_{i.t} + \varepsilon_{i.t}$$ [44]

[43] The control variables used in the regression model are ln(CEO delta), ln(CEO vega), ln(Total Asset), ROA, Leverage, Var(Return), Tobin's Q, Long tail, Weak, ln(Board size), Reinsurance ratio, Product HHI, Geographic HHI, Length, Malpractice ratio, Tax shield, and Tax rate.

[44] The control variables used in the regression model are ln(CEO delta), ln(CEO vega), ln(Total Asset), ROA, Leverage, Var(Return), Tobin's Q, Long tail, Weak, ln(Board size), Reinsurance ratio, Product HHI, Geographic HHI, Length, Malpractice ratio, Tax shield, and Tax rate.

We also examine the effects of ITTIs on the performance of P-L insurance firms. ROA, return of equity (ROE), sales growth and Tobin's Q as proxies for firm performance. Again the main variable of interest is *ln(Firmgap).* All these variables are defined in Appendix F.

III.4 Summary Statistics

Table 13 shows the descriptive statistics for the variables, including reserve errors, incentives, corporate governance, CEO and firm characteristics. The mean (median) of *KFS error/Asset* is 0.000017 (0.000022) and *Weiss error/Asset* is 0.000109 (0.000091). The results suggest that insurance firms in our sample overestimate total loss reserves. As expected, *Weiss error/Asset* is larger than *KFS error/Asset* on average. The other dependent variables are risk taking and performance variables. The risk-taking variables used are Std_5*(Loss ratio)*, Std_5*(ROI)*, and Std_5*(ROA)* whose means (medians) are 0.18 (0.06), 0.023 (0.01), and 0.03 (0.02), respectively. Also, the performance variables used are *ROA*, *ROE*, *Sales growth*, and *Tobin's Q* whose means (medians) are 0.03 (0.04), 0.083 (0.122), 0.08 (0.069), and 0.27 (0.13), respectively.

The evidence shows that the mean (median) of ITTIs (*Firmgap*) is \$3.4 million (\$2.0 million). The mean (median) of *CEO delta* and *CEO vega* is \$715,280 (\$264,270) per thousand dollars and \$106,430 (\$43,930) per thousand dollars, respectively. The mean (median) of industry tournament incentives *In(Indgap*) is \$22.2 million (\$21.6 million). For firm characteristics, the means (medians) of *Leverage, Weak*, *Reinsurance ratio*, *Product HHI, Geographic HHI, Length,* and *Tax shield* are similar to those reported by Han et al. (2018). The mean (median) number of VPs *NoofVP* and *Board size* is 5.1 (5) and 10.73 (11), respectively. Moreover, on average 46% of board members are co-opted. The mean (median) of tenure weighted *TW Co-option* is 0.31 (0.14).

Table 14 shows the Pearson correlation matrix between the main variables of interest. One major finding is that the *KFS error/Asset* is highly correlated with *Weiss error/Asset* (0.558 at the 1% level). The correlation between *ln(Firmgap)* and *KFS error/Asset* (*Weiss error/Asset*) is not statistically significant. However, *ln(Firmgap)* is positively and significantly related to *ln(CEO delta)* and *ln(CEO vega)* where the correlations are 0.365 and 0.329, *respectively*. In addition, the correlation between *ln(*CEO delta) and *ln(*CEO vega), 0.406, is statistically significant and positive.

III.5 Empirical Results

In this section, we examine the relation between reserve management and ITTIs using ordinary least square (OLS) and two-stage least square (2SLS) regressions. We cluster standard errors by firms to remove heteroskedasticity and serial correlation problems. The regressions include both firm and year fixed effects to capture firm and year specific features that are not captured by the main independent and control variables.

Table 15 reports the results from the regressions using *KFS error/Asset* and *Weiss error/Asset* as dependent variables in the columns (1) and (2), respectively. The adjusted R^2 of the first and second regressions is 61.5% and 61.8% respectively. We find significantly positive coefficients on *ln(Firmgap)* at the 5% (1%) level when the dependent variable is *KFS error/Asset (Weiss error/Asset*), implying that firms are likely to reserve more when tournament incentives are higher.

To address the issue of the endogeneity between reserve management and ITTIs, we employ the 2SLS regression approach. The IVs used for the endogenous variable *ln(Firmgap*) are one year lagged *ln(Firmgap)* and *ln(NoofVP).* Further, we use the lag of all independent variables.

We report our main findings from 2SLS in Table 16. Columns (1) and (2) present the results when the dependent variable is *KFS error/Asset*. Columns (3) and (4) show the results when the dependent variable is *Weiss error/Asset*. Columns (1) and (3) show the first stage results of the 2SLS regressions. Column (2) and (4) show the second-stage results of 2SLS regressions. In the first stage, the F statistic is 11.97, the Cragg-Donald Wald F statistics is 15.21 when the dependent variable is either *KFS error/Asset* or *Weiss error/Asset*, indicating that the instruments are relevant. Further, the p-values of Hansen J statistics are 30.85% when the dependent variable is *KFS error/Asset* and 56.35% when the dependent variable is *Weiss error/Asset*, demonstrating that there is no overidentification Finally, the adjusted R^2 is 40.4% and 6.4%, respectively.

As with the findings of OLS in 2SLS regression, we find that the coefficient of *ln(Firmgap)* is positive and significant at the 1% level when the dependent variable is *KFS error/Asset* or *Weiss error/Asset*, suggesting that a tournament among VPs induces them to reserve more. We also find that when *ln(Firmgap)* increases by one standard deviation, the standard deviation of loss reserves increases about 62.2% and 46.4% when the dependent variable is *Weiss error/Asset* and *KFS error/Asset*, respectively. This result suggests that the impact of ITTIs on loss reserves is economically significant. The overall evidence implies that VPs focus on strong financial health through conservative reserve behavior in order to increase their probability of promotion to CEO positions.

For control variables, the coefficients on *ln(CEO delta) and ln(CEO vega)* are not statistically significant in both measures of dependent variables. The coefficients on *ROA*, *Leverage*, and *Tax rate* are significantly positive, while the coefficient on *Tax shield* is negative in both 2SLS regressions. This tax rate result is consistent with the findings of

Grace and Leverty (2012), suggesting that insurers with high tax rates have greater reserve errors than insurers with low tax rates. An insurer's estimation of claim costs reduces taxable income and cash outflow in taxes (Grace, 1990). We also find that the coefficients on *Long tail, Product HHI and Geographic HHI* are positive in the *KFS error/Asset* regression, which is consistent with the findings of Grace and Leverty (2012). The evidence shows that as *Var(Return)* increases, insurance firms tend to reserve more. Lastly, we find that the coefficients on *Board size*, *Length*, and *Malpractice ratio* are not statistically significant.

Table 17 provides the results of the effects of various firm and board characteristics on the relation between ITTIs and loss reserve patterns. We also use the 2SLS approach, where the dependent variable is either *Weiss error/Asset* or *KFS error/Asset*. Because *ln(Firmgap)* is an endogenous variable, its interactions are endogenous. Therefore, we construct instruments for each interaction with *ln(Firmgap)* by interacting the instruments *lagged ln(Firmgap)* and *ln(NoofVP)* with different characteristics. Hence, we have sixteen endogenous variables and twenty-four instruments. In both regressions, we find significantly negative coefficients on the interaction terms between *ln(Firmgap)* and *Length.* The results imply that an increase in the percentage of claim loss reserve over total liabilities mitigates the positive impact of ITTIs on reserve errors. Specifically, *Length* measures the lag between the time a loss is incurred and its final claim settlement (Gaver and Paterson, 2001), and this lag appears to mitigate the impact of ITTIs on reserve management.

We find positive coefficients on the interaction term between *ln(Firmgap)* and *ln(Total Asset), Weak* and *Geographic HHI*. The evidence implies that insurers with larger assets, weak financial health, and more geographic concentration are more likely to reserve more as the tournament incentives increase. Larger insurance firms may be subject to more monitoring by the regulator because they expose the economy to greater systemic risk. The finding that insurers in weaker financial health reserve more as tournament incentives increase supports our conclusion that VPs in a tournament focus on the firm's financial health, rather than earnings. The literature that does not consider tournament incentives shows that the relationship between reserve errors and weak financial health is negative, implying that weaker insurers reserve less. The positive impact of *Geographic HHI* on the relation between ITTIs and reserve error implies that an increase in geographic concentration might motivate VPs to reserve more because it is riskier for insurers to concentrate on certain geographical areas. Lastly, we do not detect significant impacts from *ROA*, *Leverage*, *Var(Return)*, *Tobin's Q*, *Long tail*, *ln(Board size)*, *Reinsurance ratio, Malpractice ratio, Tax shield,* and *Product HHI* on the relation between tournament incentives and loss reserves.

Table 18 shows the impact of the SOX on the association between ITTIs (*ln(Firmgap)*) and reserve error (*KFS error/Asset* and *Weiss error/Asset*). We add a dummy variable *SOX*, which equals 1 in the post-SOX period and 0 otherwise, and its interaction with *ln(Firmgap)* to the model. We find that the coefficients on the SOX dummy are not significant for the dependent variables *Weiss error/Asset* and *KFS error/Asset*. One possible reason for the insignificant coefficient might be a trade-off between two opposing effects. First, the strict rules introduced by the SOX Act motivate managers to implement more conservative reserve management policies. However, as SOX imposes more regulation on publicly-traded insurance firms, managers reserve less because stakeholders are protected better since the implementation of SOX (He, El-Masry, and Wu, 2008). Hence, the probable reason is that the two effects offset each other. This result is consistent with the findings of Brandt, Ma and Pope (2013). They use a difference-in-difference approach and find that, although publicly traded insurers have indeed experienced a significant reduction in loss-reserve errors since the SOX took effect, the reduction is not attributable to it. Cazier, Rego, Tian, and Wilson (2015) and Han et al. (2018) show that the implementation of the SOX is not effective in the management of loss-reserve behavior by public insurers.

We also examine whether co-option can affect the relation between tournament incentives and reserve management. Coles et al. (2014) assert that *Cooption*, which is the share of the board consisting of directors appointed after the CEO assumed office, has greater explanatory power of monitoring effectiveness than the conventional measure of board independence because not all independent directors are effective monitors. They argue that co-opted directors, regardless of whether they are classified as independent using traditional definitions, are more likely to assign their allegiance to the CEO because the CEO was involved in their initial appointment. Following Coles et al. (2014), we use *Cooption* as a measure of board dependence, instead of a direct measure of the share of independent board members. Moreover, we also use *TW Cooption*, which is the ratio of the sum of the tenure of "co-opted" directors to the total tenure of all directors, as the second proxy for corporate governance. Based on Coles et al. (2014), we argue that as co-option or TW co-option increases, the independence of the board weakens.

Table 19 shows the coefficient of the interaction between *ln(Firm gap)* and *Cooption* is not statistically significant, but that of the interaction between *ln(Firmgap)* and *TW*

Cooption is significant and negative, implying that as the co-option (which is the measure of board dependence) increases the positive impact of ITTIs on reserve errors attenuates. The evidence suggests that as board independence grows, managers induced by promotion-based tournaments become inclined to reserve more.

Tournament Incentives and Risk-Taking Behavior and Performance

The literature on tournaments focuses on the relation between tournament incentives and risk-taking (performance). We next examine the effects of ITTIs on risk-taking behavior and performance of P-L insurance firms so that we can compare the evidence on P-L insurers with that of nonfinancial firms. Following previous related studies, we use Std_5*(Loss ratio)*, Std_5*(ROI)*, Std_5*(ROA)*, and *Var(Return)* as the variables for risk-taking in the Table 20.

Table 20 presents the results from a second-stage analysis of 2SLS regressions regarding the relation between ITTIs and firm risk-taking behavior. We find a significant and negative relation between ITTIs and investment risk levels. The relation between tournament incentives and underwriting risk (total risk) and its relation with stock return volatility, however, are not statistically significant at the 5% level. This evidence shows that VPs induced by promotion-based tournaments tend to have low investment risk, but the relation between tournament incentives and other risk measures (underwriting risk, total risk, and market volatility) are not statistically significant. In summary, in contrast to the literature, we do not find any evidence that tournament incentives are positively related to risk-taking behavior. This result enhances the main evidence that managers in tournaments focus on the strong financial health of insurers instead of high risk which may result in high profits.

In addition, we examine the impact of ITTIs on firm performance and report the results in Table 21, in which, we use *ROA*, *ROE*, *Sales growth* and *Tobin's Q* as measures of firm performance. We do not find a significant relation between ITTIs and firm performance measures. We detect a negative relation between ITTIs and Tobin's Q at the 10% significance level. This weak evidence indicates no positive relation between tournament incentives and performance when we use variables for sales growth and Tobin's Q. These results are different from those in the literature on nonfinancial firms. These results support the main evidence that managers in tournaments focus on the strong financial health of insurers, instead of performance.

III.6 Robustness Checks and Additional Tests

For robustness, we perform some additional tests on the positive relation between tournament incentives and loss reserves. First, we control for an additional variable, industry tournament incentives, in our analysis. Industry tournament incentives are related to the tournament among CEOs in their industry to compete to become the CEO of the leading firm in the same industry because VPs can also compete with CEOs of other firms in the same industry. Coles et al. (2017) find a positive relation between industry tournament incentives and firm performance (the riskiness of the firm overall and its financial policies). We calculate industry tournament incentives with our sample of insurance firms, with incentives equal to the pay gap (*Indgap*) between the highest-paid CEO's total compensation in the sample and CEO compensation by the firm. Table 22 demonstrates the 2SLS regression results when we control for industry tournament incentives. We find a significantly positive relation between ITTIs and reserve errors at the 5% significance level for the dependent variable *KFS error/Asset* and at the 1%

significance level for the dependent variable *Weiss error/Asset*. In other words, our main results remain the same.

Second, we focus on the accuracy level of the reserve estimations instead of their conservativeness. Specifically, we examine the relation between ITTIs and the absolute value of reserve errors and the relation between ITTIs and values of reserve errors where reserve errors are positive. Tables 23 and 24 show that the coefficient on *ln(Firmgap)* is not significant when the dependent variable is *Abs(KFS error/Asset)*. However, we find tournament incentives are significantly and positively associated with *Abs*(*Weiss measures)*, indicating that internal tournament incentives lead VPs to make a less accurate estimation of loss reserves. Our main results in the previous section show that VPs in tournaments prefer conservativeness in reserves. Thus, the inaccuracy of reserve estimation is due to conservative reserve behavior. The evidence also indicates that VPs prefer conservativeness in reserves to accuracy. These results are consistent with our other evidence that VPs in tournaments focus on the financial health of the insurers, not their performance.

As we examine publicly traded P-L insurance firms, we have only 464 observations, which is a small sample. We test the statistical significance of the coefficients in the regressions by bootstrapping in order to address the concerns about the limited number of observations in our analyses. We simulate the coefficients of the 2SLS regression 1,000 times based on normality assumption on the regression residual, where the dependent variable is *Weiss error/Asset* or *KFS error/Asset*. In the first stage of 2SLS, we obtain *Predicted ln(Firmgap)* by regressing *ln(Firmgap)* on all exogenous variables. In the second stage of 2SLS, we perform an auxiliary regression by regressing the dependent variable on all exogenous variables and *Predicted ln(Firmgap)* except for the variable tested. We obtain the regression residuals (ε_{it}) with the distribution of $N(\mu_{\varepsilon}, \sigma_{\varepsilon}^2)$ based on the assumption. We generate auxiliary residuals (ε_{it}^*) based on the distribution in each round of bootstrapping and construct the auxiliary dependent variable (y^*) by using auxiliary coefficients and auxiliary residuals. Then, we estimate the regression of the auxiliary dependent variable (y^*) on all the independent variables including the variable tested. We repeat this procedure 1000 times. Hence, we obtain 1,000 bootstrapped coefficients ($\tilde{\beta}$) and t-stats ($\tilde{t}$) for the variable tested.

The bootstrapping test results obtained are shown in Table 25. The coefficients illustrated are biased corrected coefficients which are obtained by the coefficient found in the original 2SLS regression model less the average of bootstrapped coefficients ($\hat{\beta} - Avg(\tilde{\beta})$). The probabilities (*p-value*) illustrated below the coefficients in Table 25 show the share of hitting or exceeding the *t*-stat generated in the original 2SLS regression model by the bootstrapped *t*-stats ($\tilde{t}$) in 1,000 rounds. We find significantly positive coefficients on *Predicted ln(Firmgap)* in both regressions where dependents variables are either *Weiss error/Asset* or *KFS error/Asset*. Also, we illustrate the bootstrapped t-stats in Figure 1. *T*-stats in the original 2SLS regressions are shown as a dotted red line. As seen in Figure 1, the *t*-stat computed in the main 2SLS regressions are at the right-hand side of the graph and far from the mean. These results suggest that the main regression results are robust to the bootstrapping approach.

III.7 Conclusion

This study investigates how ITTIs affect reserve management, risk-taking behavior, and performance at publicly traded property-liability insurance firms. We show a significantly positive relation between ITTIs and reserve errors, which implies that firms tend to overestimate reserves more as the pay gap between a firm CEO and VPs increases. In addition, we do not find a positive relation between risk taking behavior and performance. These findings vary from those in the literature on noninsurance firms, which finds a positive relation between ITTIs and risk-taking or performance. Taken together, the evidence indicates that VPs focus on the strong financial health of the firm instead of their performance. One possible reason is financial health is crucial for insurers and their stakeholders, such as stockholders, policyholders, and regulators. Although the board has the authority to promote an VP to become CEO, it cannot ignore the welfare of stakeholders.

We also examine how the relation between ITTIs and reserve errors is influenced by firm characteristics. We find that the impact of ITTIs on conservative reserve management is more pronounced at insurers with a larger size, more geographical concentration, and weaker financial conditions. The evidence shows a lag between the time that a loss is incurred and its final claim settlement and a high tax rate have mitigating impacts on the effect of ITTIs on reserve management. Also, we find that the SOX does not have a significant impact on the positive relation between industry tournament incentives and reserve error. One possible reason is that although strict rules motivate VPs to support conservative policies, they might choose more aggressive reserve policies because consumers are better protected since implementation of the SOX. We also find that insurers with more independent board members are likely to engage in more conservative reserve behavior in internal tournaments.

Our results are robust when we add industry tournament as an additional control variable and robust to the bootstrapping approach. Overall, our analysis indicates that tournament incentives are important motives for reserve management.

CHAPTER IV

PAY DURATION AND COST OF DEBT

IV.1 Introduction

Managerial compensations have been documented to have an impact on agency conflict between shareholders, managers, and debtholders in the finance literature. Managerial compensation contracts can be used to alleviate the conflict of interests between a firm's shareholders and bondholders (Brander and Poitevin, 1992). For instance, Duru, Mansi, and Reeb (2005) report that providing managers with a cash bonus mitigates risk-shifting incentives which is documented by Jensen and Meckling (1976) and thereby lowers the agency costs of debt. Also, the sensitivity of executives' wealth with respect to stock price changes (delta) and the inside debt, which can be defined as the total value of executives' pensions and other deferred compensations (ODC), have been documented to be related to lower cost of debt (Shaw, 2012; Brockman, Martin and Unlu, 2010; Edmans and Liu, 2011; Anantharaman, Fang, and Gong, 2013). On the other hand, borrowing costs have been shown to increase in the sensitivity of executives' wealth to stock price volatility (vega) and tournament incentives (Shaw, 2012; Kubick, Lockhart, and Mauer, 2018).

Recent literature has moved beyond these standard measures of managerial incentives by researching the impact of managerial pay duration – the weighted average vesting period of a manager's compensation - on the executives' policy choices. Main incentives of pay duration have been argued to be focusing more on the maximization of long-term shareholder value, mitigating managerial short-termism and extending managerial investment horizon (Stein, 1988; Stein, 1989; Bolton, Scheinkman, and Xiong, 2006;

Manso, 2011; Peng and Röell, 2014; Edmans, Gabaix, Sadzik, and Sannikov, 2012; Gopalan, Milbourn, Song, and Thakor, 2014; Edmans, Fang, and Lewellen, 2017). However, its impacts on the cost of debt have remained unknown. Therefore, the primary goal of this study is to examine the effects of the duration of executive compensation on the agency conflict between managers and creditors.

We specifically investigate the effects of equity-based pay duration (Equity PD) on loan pricing. We use the measure of Equity PD developed by Gopalan et al. (2014), which is the weighted average of the vesting periods of salaries, bonuses, options and restricted stocks of executives' compensation in a firm, to study the association between Equity PD and cost of debt. Gopalan et al. (2014) argue that longer Equity PD reduces short-termist behaviors and find a positive association between research and development (R&D) expenditures and Equity PD. Similarly, Edmans et al. (2017) show that short-term incentives motivate to cut down R&D expenditures. Thus, these studies briefly find a positive association between pay duration and R&D activities. R&D activities have been proved to lead to uncertainty (Lev and Sougiannis, 1996; Aboody and Lev, 1998; Chan, Lakonishok, and Sougiannis, 2001), generate information asymmetry and cause insider trading gains (Aboody and Lev, 2000). Creditors demand a greater spread if the borrower illustrates a higher degree of information asymmetry (Duffie and Lando, 2001; Yu, 2005; Chen, King, and Wen, 2019). Due to the increase in the risk level as well as the "transparency spread", we hypothesize a positive association between Equity PD and the cost of debt.

We also extend the measure of Equity PD formed by Gopalan et al. (2014) by accounting duration of executives' deferred compensations, where we name it as equity&debt-based pay duration (Whole PD).[45,46] Sample statistics show that deferred compensations on average boost the executives' pay duration. Because the executives risk their unvested compensation in case of insolvency of the firm, the increase in pay duration causes executives to be more dependent on the solvency of the firm and its liquidation value (Gopalan, Huang, and Maharjan, 2016). This might shape their attitude toward more conservative financial policies, which can align their interest with debtholders. Further, Marinovic and Varas (2019) argue that executives engage more in the manipulation of their performance metrics in their final years in the office. Similarly, Gopalan et al. (2014) find long-term contracts mitigate the CEO's motivation to engage in earnings-inflating accruals. Since earnings manipulation deteriorates the agency conflict between managers and lenders, it has been documented to increase borrowing costs (Shen and Huang, 2013). Hence, due to the contribution of long-term Whole PD in alleviating firm risk level and performance manipulation, we hypothesize a negative relation between Whole PD and the cost of debt.

To test these two hypotheses, we exploit a sample of 5,081 facility-year observations during the period between 2006 to 2017. We use facility-based Dealscan dataset for our analyses in this study. The reason to choose a sample after 2006 is the lack of pension and other deferred compensation data in Execucomp. We prefer using Equity PD for the period between 2006 and 2017 to provide comparability to the analysis results obtained with Whole PD. Further, we attach the analysis results using the dataset between 1998 and 2017

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[45] We include "debt" in its name because retirement benefits are accepted to have a debt feature. The firm is responsible to pay pensions and/or other deferred compensations to executives in the future. Since they have to be paid to executives employed by the firm, they are called "inside-debt".

[46] Whole PD is the weighted average vesting period of executives' salaries, bonuses, options, restricted stocks, pensions and other deferred compensations in a firm.

for the examination of the relation between Equity PD and the cost of debt in the Appendix K. We also attach analysis results regarding Equity PD and Whole PD using the firm-based dataset in Appendix L.

Focusing on bank loans serves a sturdy setting that we can investigate how the increments in pay duration impact loan spread. The theory suggests that banks are and should be close firm monitors (Schumpeter, 1939; Diamond, 1984; Boot and Thakor, 1997). Therefore, the terms of debt contracts with banks should be more sensitive to the changes in pay duration due to the closer relationship. Also, the larger number of observations compared to datasets regarding bonds provide more statistical significance. Lastly, since bank loans are the largest part of a firm's debt source (Colla, Ippolito, and Li, 2013), the impact of pay duration on bank loan contracts must be of interest.

We find that longer Equity PD is associated with a higher loan spread. Thus, a longer Equity PD leads to a higher cost of debt through inducing executives to implement riskier projects (i.e. R&D projects), projects creating more information asymmetry and to increase turnover. The additional risk and higher turnover along with "transparency spread" may be anticipated and priced by debtholders. To account for the endogeneity concerns, we conduct a Generalized Method of Moments (GMM) IV model and implement a quasi-natural experiment by using the exogenous shock provided by FAS123R, and our results continue to hold. We test the channels through which the Equity PD can influence the cost of debt, and find that they are risk, information asymmetry, and labor channels.

Also, we explore a negative relation between Whole PD and borrowing costs. This result represents that the duration of inside debt contributes to the mitigation of the agency conflict between executives and creditors by extending the executives' managerial compensation horizon. Our results are robust to exploiting the instrumental variable approach and firm fixed effects. We detect the impact of Whole PD on the executive labor market through turnover is the main channel through which the Whole PD can impact a firm's cost of debt. Moreover, we research some heterogeneities in the relation between Whole PD and the cost of debt. We find more pronounced impacts of Whole PD under poor corporate governance and higher previous firm performance.

Our paper contributes to the literature in some ways. Firstly, to the best of our knowledge, it is the first paper examining the impacts of pay duration on the agency conflict between executives and debtholders. The significant effects of bonus, tournaments, compensation delta and vega on the borrowing costs have been documented in the finance literature (Duru et al., 2005; Shaw, 2012; Brockman et al., 2010; Edmans and Liu, 2011; Anantharaman et al., 2013; Kubick, Lockhart, and Mauer, 2018). However, we enlarge the literature by associating pay duration, which is a new dimension of managerial incentives, to the agency cost of debt arising from various concerns including risk-shifting concern. Second, Edmans et al. (2017) argue that long-term compensation instigates executives to seek optimal investment strategies over the long-term. However, we show that the investments incentivized and turnover induced by long-term equity-based incentives increase the agency cost of debt, which might lead to a rise in the firm's cost of capital. Our findings suggest that the omission of inside debt duration causes an increase in the cost of debt, however, the inclusion of inside debt contributes to the agency conflict between executives and lenders by lengthening the managerial compensation horizon. This is consistent with the arguments of Marinovic and Varas (2019), who suggest that deferred compensation is a part of the optimal compensation scheme. Lastly, our paper illustrates that long-vesting executive contracts targeting to mitigate short-termism by motivating investments have an influence on firms' financing costs.

The rest of this paper is organized as follows. In Section IV.2, we discuss our hypotheses. We describe our sample and variable constructions in Section IV.3. In Section IV.4, we illustrate the summary statistics of our sample. We perform preliminary analyses in Section IV.5. In Section IV.6, we examine the relation of Equity PD and Whole PD with loan spread. Section IV.7 concludes. Appendices J, K, and L provide detailed information about the variable definitions and analysis results regarding Equity PD for the period between 1998 and 2017 and analysis results regarding Equity PD and Whole PD using the firm-based dataset.

IV.2 Hypothesis Development

Firms try to shape their executives' behaviors toward their aims and to alleviate agency conflict between managers and shareholders by using some executive contractual tools, like bonuses, options, and restricted stocks. These incentives have also been documented to affect the agency conflicts between managers and debtholders (Duru et al., 2005; Shaw, 2012; Brockman et al., 2010; Edmans and Liu, 2011; Anantharaman et al., 2013; Kubick, Lockhart, and Mauer, 2018). However, researchers have recently started to investigate the impacts of the duration of executive compensations, which is the different dimension of executive pay incentives, on the conflicts between managers, shareholders, and debtholders through changing their firm policy choices.

Finance literature has maintained positive and negative impacts of long-term managerial contract structures on the conflicts. Some argue that long-term compensation can be used to mitigate self-interested and myopic managerial behaviors (e.g. Bebchuk and

Fried, 2010). Similarly, Edmans et al. (2017) argue that it can be possible to motivate executives to pursue optimal investment strategies over the long-period by implementing long-vesting compensation policies and thus long-term vesting equity awards can weaken managerial short-termism. On the other hand, Bolton et al. (2006) focus on the positive aspects of an emphasis on short-term stock performance for the existing shareholders in a speculative market. In this study, we discuss the impacts of (either equity-based or equity&debt-based) pay duration on debt contracting, which has not been addressed yet.

Equity-based pay duration (Equity PD) and cost of debt[47]

Edmans et al. (2017) report that short-term incentives are associated with a reduction in the long-term R&D and capital investments in order to meet short-term targets. Edmans, Fang, and Lewellen (2013) argue this relation also holds for advertising expenditures. Similarly, some other studies have documented that executives with long-vesting contracts innovate more and chase more revolutionary, comprehensive and diverse innovations (Baranchuk, Kieschnick, and Moussawi, 2014; González-Uribe and Groen-Xu, 2017). Further, Gopalan, Milbourn, Song, and Thakor (2010) explore that executives with long-vesting compensational schedules have less tendency to lessen R&D expenditures and Ladika and Sautner (2018) document the tendency of executives with accelerated option vesting to cut investments in order to inflate short-term earnings. Also, Gao (2010), Cihan and Tuncez (2019), and Li and Peng (2019) find positive relations between long-term pay duration and merger and acquisition activities. The positive impacts of Equity PD on R&D, advertising, capital expenditures, and acquisitions can affect debt contracting in the aspects of firm risk level and information asymmetry.

[47] Equity PD includes salary, bonus, options and restricted stocks as components.

Prior literature has documented that R&D activities deepen uncertainty, thus risk level of a firm because they require a large amount of financial source with a relatively low probability of success (Lev and Sougiannis, 1996; Aboody and Lev, 1998; Chan, Lakonishok, and Sougiannis, 2001). Also, M&A activities are considered to be risky as a growth strategy, since they include both large up and downsides of a transaction (Rose, Sørheim, and Lerkerød, 2017). Consistently, Billett, King, and Mauer (2004) explore negative announcement period returns for acquiring firm bonds, which suggests an increase in acquiring firm bond yield due to a merger transaction. As an effect on direct outcomes, some studies find a longer pay duration induces for higher risk-taking and aggressive financial policies (Salitsky (2015); Welker, 2019). An increase in the overall risk of the firm can boost the agency cost of debt, as it reallocates wealth from debtholders to shareholders (Wei and Yermack, 2010).

In the aspect of information asymmetry, R&D activities have been documented to take longer for the market to comprehend and internalize, especially when they are linked to break-through innovations, so they develop information asymmetry and provoke insiders' trading return (Aboody and Lev, 2000). Also, Joseph and Wintoki (2013) argue the contribution of advertising investments to information asymmetry because advertising investments have a long-term payoff and insiders have a possibility to reach out to continuous information on the sales impact of advertising, initial sales reports, and future customer orders, whereas external investors can only obtain such information at discrete times. For similar reasons, Aboody and Lev (2000) discuss that all corporate investors produce information asymmetry. Previous studies note the creditors' requirement of "transparency spread" under a greater degree of information asymmetry (Duffie and Lando, 2001; Yu, 2005; Derrien, Kecskés, and Mansi, 2016; Chen et al., 2019).[48]

Besides, pay duration has been reported to have an influence on the labor market of executives. In their natural experiment analysis, Kleymenova and Tuna (2018) find a positive association between long-term compensation and executive turnover due to the dissatisfaction with the long-term vesting schedule. Prior literature has documented that the lack of control over labor creates additional insolvency concerns due to the inflexibility in responding the labor mobility, and creditors do not like low productivity and deficiency in technological advantages, which might expose a firm to higher borrowing costs (Donangelo, 2014; Chen et al., 2019). Similarly, Adams (2005) shows that CEO turnover events lead to higher yield spreads as they augment uncertainty related to firm prospects surrounding the executive turnover events.

Hence, our first hypothesis is as follows;

H1: There is a positive association between Equity PD and cost of debt

Equity&debt-based pay duration (Whole PD) and cost of debt

Compared to Equity PD, Whole PD has a broader scope because it also includes the duration of inside debt components. Because pay duration is the duration of all pay components weighted with their sizes, its incentives depend both on the size of the grant and the length of the remaining vesting schedule. Therefore, firstly, I briefly describe the inside debt and the contributions of itself (as size) in agency cost of debt.

[48] Easley and O'Hara (2004) show that shareholders require a higher return on stocks with larger private information.

Inside debts are fixed amounts that firms affirm to pay executives at or after their retirement as long as the firms are finally sound. Because these plans are not generally assured, the insolvency of a firm incorporates the risk of losing them, which is the main point making them "debt-like" managerial payment (Anantharaman et al., 2013).[49] As fixed claimants, creditors are concerned with both the probability of default and a firm's liquidation value in a bankruptcy. Inside debt provides a positive payoff in proportion to the recovery value in default, so it makes an executive sensitive to both the firm's liquidation value and the occurrence of bankruptcy, which is also sought by lenders (Edmans and Lui, 2011). Similarly, Sundaram and Yermack (2007) report the important role of inside debt in the alignment of interests between managers and debtholders. Prior literature documents that inside debt induce executives to pursue less risky investments in order to reduce the risk of losing their own pensions, which can moderate agency costs of debt caused by the "asset-substitution" or "risk-shifting" concerns (Sundaram and Yermack, 2007; Edmans and Lui, 2011; Phan, 2014). Consistently, Wei and Yermack (2010) explore a positive relation between announcements of large inside debt holdings and bond prices.

As for the pay duration part of Whole PD, firms commonly hold off stock and option components of the executive compensation and the pension itself is characterized as deferred compensation that is paid at or after retirement. Each grant of an executive's compensation is vested according to a schedule and an executive is not authorized to trade, exercise or hedge as long as it has been unvested. An executive voluntarily or involuntarily

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[49] Anantharaman et al. (2013) also documents some heterogeneities about pension benefits' protection placed in executives' contracts. Some contracts might allow withdrawal of pensions before retirement as a lump-sum or incorporate funding a trust in order to protect pension assets from the claims of creditors.

quitting a firm usually gives up her unvested equity grants. (Gopalan et al., 2016). Similarly, pension plans cannot typically be transferred from a firm to another (Begley, Chamberlain, Yang, and Zhang, 2015). Edmans et al. (2012) argue the deterrence of executives' risk appetite due to the compensation that an executive intends to keep for a long period. Further, Brisley (2006) demonstrates that unvested compensations may lead executives to dismiss risky projects since they tie up a considerable amount of the executives' wealth within the firm. Hence, the size and duration of unvested equity and deferred compensation ties up executives' wealth within the firm, which makes them more concerned about the firm's likelihood of default and its liquidation value. Therefore, if we account that debt-like compensation extends the managerial compensation horizon on average, executives are more likely to behave more conservatively and decrease firm risk level, which might lead to the alignment with the interests of debtholders.

Moreover, Whole PD can impact the cost of debt through mitigating executive manipulations. Prior literature documents that short-term compensation leads to myopic and/or manipulative actions, whereas long-term compensation mitigates this tendency (Gopalan et al., 2010; Gopalan et al., 2014; Ladika and Sautner, 2018; Edmans, Fang, and Huang, 2017). Also, Gibbons and Murphy (1992) and Marinovic and Varas (2019) argue that executives enhance performance manipulative actions and executive short-termism is intensified as they approach retirement. Similarly, Dechow and Sloan (1991) find that executives tend to engage in some activities to boost earnings so that they can gain larger annual cash bonuses. However, Prevost, Roa, and Skousen (2008) represent that creditors penalize firms for their performance manipulative actions by demanding a higher rate of return. Also, Shen and Huang (2013) explore that credit rating firms tend to downgrade ratings if they identify instances of earnings management, which causes an increase in borrowing costs. Marinovic and Varas (2019) discuss the optimality of deferred compensation as an instrument for mitigating the impacts of executive manipulation. Likewise, Edmans and Gabaix (2016) suggest that prolonging the vesting period can be a solution for executive manipulation and Kubick, Robinson, and Starks (2018) argue that longer duration curtails the opportunity for executives to manipulate information releases. Hence, a longer Whole PD might decrease the cost of debt by alleviating executive manipulation.

Gopalan et al. (2016) argue a lower inclination to encounter forced turnover and lower sensitivity of forced turnover to firm performance for the executives with relatively longer pay duration. Consistent with the arguments of Adams (2005), Donangelo (2014) and Chen et al. (2019), longer Whole PD might reduce borrowing costs by mitigating executive turnover.[50]

Ultimately, our second hypothesis is as follows;

H2: There is a negative association between Whole PD and the cost of debt.

IV.3 Data Sources, Variable Construction, and Sample Description

IV.3.1 Data Sources

Our main dataset is constructed from the interactions of Compustat, Center for Research in Security Prices (CRSP), Institutional Shareholder Services (ISS) Incentive Lab, Execucomp, Standard and Poor (S&P) Credit Ratings, and Dealscan databases. We exclude utilities and financial firms by following the convention in the literature. We use

[50] Adams (2005), Donangelo (2014) and Chen et al. (2019) argue positive associations between executive turnover and cost of debt.

facility data provided by Dealscan database merged with the other mentioned databases. We follow matching procedures implemented by Bharath, Dahiya, Saunders, and Srinivasan (2011) to make sure that loan characteristics data are matched with firm financial and executive compensation datasets available to creditors. We merge Dealscan dataset with other datasets by the calendar year if the loan activation date is 6 months or later the calendar month of the firm's fiscal year-end. If the loan activation date is less than six months after the fiscal year ending month, we merge the datasets for the previous fiscal year to the facility.

Our sample period is between 2006 and 2017. Execucomp database provides inside debt data, which is used to compute Whole PD, since 2006. We examine the effects of Equity PD on the cost of debt between 2006 and 2017 for the comparability of their results with those regarding Whole PD. However, we further illustrate the analysis results regarding Equity PD for the period between 1998 and 2017 in Appendix K due to the availability of the ISS Incentivelab database since 1998. The variables in dollars are CPI adjusted.

The loan sample consists of 5,081 firm-loan observations.[51] We also show analysis results using the firm-based dataset in Appendix L, where weighted average loan spread with respect to the loan size within a firm-year is used as the cost of debt. The firm-based dataset consists of 2,790 firm-year observations. The sample sizes in our multivariate analyses differ because of data limitations (e.g. missing data) for some variables exploited in our analyses.

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[51] Loan sample for the period from 1998 to 2017 consists of 11,148 firm-loan observations.

IV.3.2 Measures of Pay Duration Variables

We use two different pay duration variables: equity-based pay duration (Equity PD) and equity&debt-based pay duration (Whole PD). In general, pay duration can be defined as the weighted average vesting period of all components of the annual compensation paid to the executives in a firm, where the weights are the fair value of a grant component divided by the sum of fair values of all grant components paid to the executives. The two pay duration measures only differ based on their pay compositions. Following Gopalan et al. (2014), we form Equity PD measure by combining salaries, bonuses, options and restricted stocks. We can formulate Equity PD of an executive i as follows;

$$EPD_i = \frac{\sum_{k=1}^{K} Option_k \times t_k + \sum_{l=1}^{L} Restricted\ Stock_l \times t_l}{(Salary + Bonus) + \sum_{k=1}^{K} Option_k + \sum_{l=1}^{L} Restricted\ Stock_l}$$

where K and L are the number of option grants and restricted stock grants respectively; *Salary* are *Bonus* are the dollar values of salaries and bonuses granted to the firm's executives, which are assumed to have zero vesting periods; *Option* and *Restricted Stock* are the dollar values of options and restricted stocks granted to the executives with corresponding vesting periods t_k or t_l, respectively. We also define the firm-level Equity PD, $Equity\ PD_f$, which is the weighted average of $Equity\ PD_i$ of executives reported in ISS Incentive Lab, where the weights are the values of the equity compensation (salary + bonus + option + restricted stock) granted to executive i.

Next, we calculate Whole PD whose calculation incorporates deferred compensations, which are also named as "inside debt" in the literature, along with salaries, bonuses, options, and restricted stocks.[52] Following Kubick, Robinson, and Starks (2018), we exploit the difference between the age of executives and the age of 65 to estimate the duration of the deferred compensations (or inside debts), which include pensions (SERP) and other deferred compensations (ODC). If the executive is older than 65, we assume the executive has a zero inside debt duration. Another assumption is that the executives can exploit their accumulated deferred compensation as a lump-sum at retirement. We approximate the period in which executives will have liberation to exploit their pensions by this naïve approach, whereas we accept executives might fetch inside debt amounts later and/or firm can define varying minimum retirement ages for their executives. Sundaram and Yermack (2007) document that 3%, 11%, 9% and 76% of their sample firms decide minimum retirement ages of 55, 60, 62 and 65 for their CEOs respectively, which yields approximately an average minimum retirement age of 64, which is close to our assumption. Thus, inside debt duration of a firm is the weighted average duration of inside debts granted to executives with respect to the total values of executive deferred compensations (SERP + ODC). Hence, $Whole\ PD_f$, which is Whole PD at the firm level, is the weighted average of $Equity\ PD_f$ and inside debt duration at the firm level ($Inside\ Debt\ Duration_f$), where the weights are the values of equity compensation (salary + bonus + option + restricted stock) and inside debt (SERP + ODC), respectively. We can formulate $Whole\ PD_f$ of a firm f as follows;

[52] Gopalan et al. (2014) exclude inside debt (pension and other deferred compensations) in the calculation of pay duration measure due to the difficulty in obtaining their vesting schedules.

$$Whole\ PD_f = \frac{Inside\ Debt_f\ x\ Inside\ Debt\ Duration_f\ + Equity\ Compensation_f\ x\ Equity\ PD_f}{Inside\ Debt_f + \ Equity\ Compensation_f}$$

where $Inside\ Debt_f$ is the total value of executive inside debt granted by the firm (SERP + ODC) and $Equity\ Compensation_f$ is the total value of executive equity compensation (salary + bonus + option + restricted stock) granted by the firm in a year. We calculate SERP PD and ODC PD similarly. In the calculation of SERP PD, we compute the weighted average duration of Equity PD and SERP, whereas we compute the weighted average duration of Equity PD and ODC in the calculation of ODC PD.

IV.3.3 Debt Contracting

We obtain loan contract characteristics from Dealscan loan database. We use the all-in drawn spread to measure the cost of debt. This variable is the amount in basis point that a firm pays over LIBOR plus some additional fees, where we denote it as *Loan Spread*. We also exploit loan size and several loan type variables. Please see Appendix I for the details of loan types. In our analysis, we exploit the natural logarithms of loan spread and loan size, which are denoted as *ln(Loan Spread),* and *ln(Loan Size)* respectively.

IV.3.4 Instrumental Variables

We perform an instrumental variable (IV) estimation method to address endogeneity concerns regarding the Equity PD and Whole PD variables. Previous studies have used executive age, executive tenure, median pay duration of local peer firms, and 2-year lagged total value of vesting (or 2-year lagged large vesting) options and stocks as instruments for pay duration measures (Cheng, Cho and Kim, 2014; Gopalan et al., 2016; Edmans, Fang, and Lewellen, 2017; Francis, Maharjan, Teng, and Wud, 2018; Fu, Huang, and Tang, 2019; Li and Peng, 2019).

The instruments should meet the relevance and exogeneity requirements to be valid. For relevance requirement, Salitskiy (2015) finds a significantly negative relation between executive tenure and pay duration because of their reluctance to admit deferred compensation if they can foresee they will be able to work shortly at the firm. For executive age, Edmans et al. (2017) claim that younger executives can have greater career concerns, which might lead them to more short-termist activities. Li and Peng (2019) prefer to use the median pay duration of local peer firms as an instrument, since the prior literature documents that geographically close firms are inclined to share a similar compensation structure. Similarly, we prefer to use industry mean pay duration, *Ind Mean Equity PD*, as an instrument, as several previous studies show a high correlation between compensational structures of firms and their industries.

Also, short term concerns originate from how much equity or options an executive requires to sell or execute (Edmans et al., 2017). Therefore, Edmans et al. (2017) find a positive association between vesting equity and executives' short-term concerns. Thus, Francis, Maharjan, Teng, and Wud (2018) exploit total values of vesting stocks and options which happen two years ago as an instrument for pay duration measure.[53] However, Edmans et al. (2017) do not exploit the values of the sold equity or exercised options, since they can be endogenous with the investment amount which is the dependent variable they examine. However, as the loan spread is an outcome variable of a firm's financial situation, we think the value of exercised options can be a better measure of an executive's short-

[53] The value of vesting equity is lagged two years due to exogeneity concerns.

term concern. Therefore, I use the 2-year-lagged mean of executives' sum of values of vesting stocks (SHRS_VEST_VAL in Execucomp) and the value realized from option exercises (OPT_EXER_VAL in Execucomp) in a year as an instrument, where we denote it as $MeanVESTING_{t-2}$. 2-year lagging of *MeanVESTING* helps us with the exogeneity.

We also use firm age as another instrument. Welker (2015) explores a significantly negative relation between firm age and the probability of having a high pay duration.[54] Brown and Caylor (2006) find a positive relation between firm age and better corporate governance. Gopalan et al. (2014) claim that better corporate governance and longer pay duration can be a substitute and add that the board may decide to extend pay duration under poor governance and greater agency problems, where the direct monitoring of executives is costly because long-term firm performance can be more exploratory about the accurate performance of an executive. Hence, we think firm age and pay duration are relevant and negatively correlated.

Further, Kini and Williams (2012) use the number of vice presidents as an instrument for tournament incentives. Simon (1957) finds a negative association between compensation and the number of executives. Therefore, the number of executives in a firm can be effective in shaping executives' compensation structures. Lazarides and Drimpetas (2011) find a negative association between corporate governance quality and the number of executives, which implies that as the number of executives increases the impact of executives on the board might increase. Since executives are not happy with long-term compensation, a larger number of executives might be more effective to convince the board

[54] Firm size, firm age, and leverage are the only statistically significant predictors of the probability of having high duration

for a shorter pay duration. Thus, the number of executives in a firm is exploited as an instrument.

We use the natural logarithm of firm age, mean of executives' tenures, and *MeanVESTING*$_{t-2}$. Briefly, we use *ln(Mean Exec. Tenure)*, *Ind Mean Equity PD*, *ln(MeanVESTING*$_{t-2}$ *)*, *ln(Firm Age)*, and *Number of Executives* as instruments. We think these instruments meet the exogeneity condition, as they are not directly related to the cost of debt. The variables of *ln(Firm Age)*, *ln(Mean Exec. Tenure)*, and *ln(Ind Mean Equity PD)* are used for Equity PD, while the variables of *ln(Mean Exec. Tenure)*, *ln(MeanVESTING*$_{t-2}$ *)*, *ln(Firm Age)*, and *Number of Executives* are used for the Whole PD as instruments.

IV.3.5 Other Compensation Incentives

We also use delta and vega compensation incentives in our analyses. The delta represents the sensitivity of an executive's wealth to the change in the stock price of the firm the executive works for, while the vega shows the sensitivity of an executive's wealth with respect to a change in the volatility of the firm's stock price. Specifically, the delta is defined as the dollar change in the value of an executive's total options and stocks to %1 change in the stock price and vega is the dollar change in the value of an executive's total options to 0.01 change in the annualized standard deviation of stock returns. Following Core and Guay (2002), Bettis, Bizjak, and Lemmon (2005), and Coles, Daniel, and Naveen (2006; 2013), we use the Black and Scholes (1973) option valuation model modified by Merton (1973). We use the SAS code provided by Coles, Daniel, and Naveen (2013) to compute delta and vega variables.

As our pay duration is the weighted average of the durations of all compensation components granted to all executives, we include CEO delta, CEO vega as well as weighted average vega and weighted average delta of vice presidents (VPs), where the weights are the executives' firm related wealth. Firm related wealth includes the value of the option and restricted stock grants, shareholdings, and any restricted stock and option holdings. I take the natural logarithm of the deltas and vegas regarding the CEO and VPs to obtain and use *ln(CEO Delta)*, *ln(CEO Vega)*, *ln(VP Delta)* and *ln(VP Vega)*.

IV.4 Summary Statistics

Table 26 presents descriptive statistics for executive incentive variables and loan, executive, firm, and board characteristics. In order to avoid repetition, we report summary statistics regarding executive, firm, and board characteristics and executive incentive variables using the firm-based dataset.

As shown in Table 26, the mean (median) values of loan spread, number of banks, and loan size are 215.97 bps (175 bps), 10.33 (9), and $940 million ($500 million), respectively. 61% of the sample loans consist of general-purpose loans.

As our main variables of interest, the means (medians) of the *Equity PD*, *Whole PD*, *SERP PD*, and *ODC PD* are 26.40 (26.35) months, 50.27 (45.50) months, 41.96 (34.71) months, and 42.57 (37.54) months, respectively. The total size of the equity payment (salary, bonus, option, and stock) is $19.24 million, whereas the total inside debt payment is $17.92 million. As for other incentive variables, *CEO Delta*, *VP Delta*, *CEO Vega* and *VP Vega* have means (medians) of $880.94 ($345.52), $531.13 ($103.02), $179.32 ($94.47), and $62.47 ($28.65) thousand, respectively. The descriptive statistics of pay duration variables, other incentive variables, and loan characteristics are consistent with the previous literature.

Also, means (medians) of CEO age, mean executive age, CEO tenure, and mean executive tenure are 55.83 (56) years, 53.15 (53.20) years, 6.70 (5.00) years and 8.12 (6.61) years, respectively. Lastly, the means (medians) of leverage, total assets, number of executives and firm age are 26.9% (24.7%), $13.84 ($5.23) billion, 5.70 (5), and 30.08 (25) years, respectively.

IV.5 Preliminary Analyses

IV.5.1 The Relation Between Pay Duration Measures and Firm Risk Level

In this section, I examine the impacts of pay duration on firm risk level, which is one of the main factors accounted for in the pricing of debt contracts as it directly impacts firm default risk. Salitskiy (2015) find a positive association between Equity PD and firm risk level. Specifically, we test the impacts of pay duration measures on annualized-unlevered stock return volatility, *Return Vol.*, market-to-book ratio, *MtB*, and the number of mergers that a firm involved as an acquirer in a year, *1Y Merger Count*. Following Bernardo, Chowdhry, and Goyal (2007) and Klasa, Ortiz-Molina, Serfling, and Srinivasan (2018), we obtain unlevered daily stock return volatility by implementing the following equation;

$$\sigma_{UL} = \frac{\sigma_L}{1 + (1 - tax\ rate)\dfrac{Short - term\ debt + Long - term\ debt}{Market\ value\ of\ equity}}$$

where σ_{UL} is unlevered volatility and σ_L is levered (daily stock return) volatility. Following Graham (1996a) and Graham (1996b), we use after interest expense marginal tax rate in the transformation. Also, following Poon (2005), Areal and Taylor (2002) and Raberto, Scalas, Cuniberti, and Riani (1999), we annualize unlevered daily stock return volatility and quarterly cash flow volatility by performing $\sigma_{AN} = \sqrt{\frac{1}{\Delta t}}\sigma$, where σ_{AN} is annualized standard deviation, σ is the standard deviation and Δt is the fraction of a year.[55]

We perform the ordinary least square (OLS) estimation to examine the impacts of pay duration measures on *Return Vol.*, *MtB*, and *1Y Merger Count*. We use the same incentive variables and firm characteristics used in the main models implemented in Section IV.6 as control variables. We exploit standard errors clustered by firms. Also, we use firm-based dataset and year and industry fixed effects. The analysis results are shown in Table 27. We cannot find a significant association between *Equity PD* and *Return Vol.*, but consistent with the findings of Salitskiy (2015), we find a positive impacts of *Equity PD* on *MtB* and *1Y Merger Count*, which can imply a positive association between Equity PD and cost of debt. Differently, we explore significantly negative relation between *Whole PD* and *Return Vol.*, whereas we cannot detect a significant association between *Whole PD* and *1Y Merger Count*. On the other hand, we find a positive association between *Whole PD* and *MtB*.[56] These results imply some evidence of the negative relation between Whole PD and the cost of debt.[57]

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[55] Δt is 1/252 for the daily stock return volatility and 1/4 for the quarterly cash flow volatility.

[56] Even though we find a positive impact of *Whole PD* on *MtB*, we find insignificant relation between the two variables in our univariate analyses at the following section.

[57] The signs of the coefficients on ln(CEO Delta) and ln(CEO Vega) for the dependent variable of *Return Vol.* are inconsistent with the findings of Coles et al. (2006), who explore negative and positive impacts of delta and vega measures on firm risk level respectively. Coles et al. (2006) use a sample between 1992 and 2002, but our sample period is between 2006 and 2017. Also, they use levered stock return volatility. A recent research of Anantharaman et al. (2013), who use a sample after 2006, cannot find a significant impact of delta and vega measures on cost of debt. Consistently, we cannot find a significant impact of *ln(CEO Delta)*, *ln(VP Delta)*, and *ln(CEO Vega)* on firm risk level regarding the dependent variable of *CF Vol.*.

IV.5.2 Univariate Analyses

Panel A of Table 28 illustrates the univariate analysis of loan and firm characteristics with respect to high and low Equity PD. It shows both loan (facility) and firm-based statistics. We divide the whole sample into two subsamples based on the median value of Equity PD. The average loan spread regarding the subsample with high Equity PD is statistically lower than that with low Equity PD in both facility-based and firm-based datasets, which is inconsistent with the hypothesis 1 (H1).

Besides, the average *Sales Growth*, *Leverage*, *ln(Total Assets)*, *Z-Score* and *ln(Asset Maturity)* and *CF Vol.* of the firms having lower Equity PD are 5.5%, 27.5%, 8.48, 15.1%, 1.91 and 9.1%, respectively, while those of the firms having higher Equity PD are 9.4%, 26.3%, 8.83, 49.2%, 1.80, and 9.9%, respectively. These results show that firms having greater Equity PD also have greater growth opportunities, lower leverage, larger size, higher Z-score, shorter asset maturity and larger cash flow volatility. We think the inconsistency of the univariate analysis with the H1 (which hypothesizes a positive relation between Equity PD and the cost of debt) is possibly caused by the subsample with high Equity PD on average having statistically lower leverage and higher Z-score, which is a measure for credit-strength. Also, consistent with the arguments of Edmans et al. (2017), Gopalan et al. (2014), Cihan and Tuncez (2019), and Li and Peng (2019), R&D intensity, market-to-book ratio and merger counts are higher for the firms with longer Equity PD.

We further analyze the relation of Whole PD with the loan and firm characteristics. Panel B of Table 28 shows a univariate analysis of loan and firm characteristics with respect to high and low Whole PD. We separate the whole sample into two subsamples based on the median value of Whole PD. Consistent with the hypothesis 2 (H2), we explore that the subsample having relatively higher Whole PD has statistically significantly lower loan spread, and larger loan size compared to those of the subsample having relatively lower Whole PD. These results hold for both facility-based and firm-based datasets. We cannot find a significant difference between *Leverage, 1Y Merger Count*, *3Y Merger Count* and *Z-score* of both subsamples. However, we detect that firms with higher Whole PD have significantly lower sales growth, larger firm size, longer asset maturity and lower cash flow volatility. Also, executive turnover and CEO turnover are also decreasing with the increase in Whole PD.

Panel C of Table 28 shows the Pearson correlation matrix for the executive incentive variables and loan characteristics. We find significantly positive correlations between pay duration measures (Equity PD, Whole PD, SERP PD, and ODC PD) at the 5% significance level. As can be seen from Panel C, Equity PD is significantly negatively correlated with loan spread, which is inconsistent with the hypothesis (H1) claiming a positive association between Equity PD and the cost of debt. On the other hand, consistent with hypothesis 2 (H2) alleging a negative relation between Whole PD and the cost of debt, the panel represents a negative correlation between Whole PD and loan spread. Further, we find negative correlations of *ln(Loan Spread)* with *ln(CEO Delta), ln(VP Delta), ln(CEO Vega)*, and *ln(VP Vega)*. *Equity PD* seems to have significantly positive correlations with *ln(CEO Delta)*, *ln(VP Delta)*, *ln(CEO Vega)*, and *ln(VP Vega)*, whereas Whole PD have significantly positive correlations with all *ln(CEO Delta)*, *ln(VP Delta)*, *ln(CEO Vega)*, and *ln(VP Vega)*.

IV.6 Empirical Methodologies and Results

IV.6.1 Equity PD and Cost of Debt

IV.6.1.1 Regression Analyses

In this section, we perform multivariate analyses to investigate the association between Equity PD and loan spread by implementing OLS estimation as well as instrumental variable methods. Specifically, following the previous literature, we regress *ln(Loan Spread)* on Equity PD, other executive incentive variables (*ln(CEO Delta)*, *ln(VP Delta)*, *ln(CEO Vega)*, *ln(VP Vega)*), firm characteristics (*Sales Growth*, *Leverage*, *ln(Total Assets)*, *Z-Score*, *ln(Asset Maturity)*, *Creditrating dummy*, *CF Vol.*), loan characteristics (*ln(Loan Size)*, *ln(Number of Banks)*, *Bridge Loan*, *Term Loan*, *Revolver Loan*, *General Purpose Loan*, *Working Capital Loan*, *Takeover Recap Loan*), macroeconomic variables (*Term Spread*, *Default Spread*, *Crisis*), and year and industry fixed effects (based on Fama-French 30 (FF-30) industry classifications). Please see Appendix I for detailed information about the variables. We cluster standard errors by firms to obtain standard errors robust to heterogeneity and serial correlation issues.

We report our main findings regarding OLS and GMM IV regressions in Table 29. We show analysis results using industry fixed effects in columns (1) and (2), and those using firm fixed effects in column (3) of Table 29. Column (1) of Table 29 illustrates OLS results. The coefficient on *Equity PD* in the OLS regression is insignificant at conventional levels. Thus, inconsistent with the first hypothesis (H1), we do not explore any significant association between the cost of debt and Equity PD using OLS regression.

However, our study is subject to a potential endogeneity issue if pay duration and cost of debt are both affected by common firm characteristics (some other underlying factors) that drives the results. Beyond the omitted variable issue, the endogeneity might also arise if the cost of debt impacts how firms establish their pay duration contracts. For example, less risky firms (with lower-cost debt) might increase pay duration to encourage innovation and executive risk-taking. Also, the board of directors may impose longer pay duration when they are uncertain about their firms' future prospects, where these firms also confront more rigorous debt terms. As the cost of debt is an outcome of a firm's performance and risk level, and the independent variables are related to the fiscal year prior to that of loan contract features, we think the omitted variable problem is more likely to occur than that of simultaneity. Ketokivi and McIntosh (2017) and Ullah, Akhtar, and Zaefarian (2018) claim that endogeneity bias might cause inconsistent estimates, incorrect inferences and even coefficients having wrong signs.

Thus, we implement an instrumental variable approach to address the endogeneity issue. Specifically, we perform the GMM IV method. We prefer to implement GMM because GMM leads to a more efficient estimation in the presence of heteroskedasticity, autocorrelation, and overidentification (Bascle, 2008).[58] We perform the Breusch-Pagan / Cook-Weisberg test for heteroskedasticity and found p-value < 0.001, which rejects the null hypothesis of no heteroskedasticity using 2SLS regression. We use *ln(Firm age)* and *Ind Mean Equity PD* as instruments for the endogenous independent variable *Equity PD*. Firm age is the total years that has lasted since the firm has firstly been seen in CRSP, while *Ind Mean Equity PD* is the average pay duration of firms within the same year and FF-30 industry classification.

[58] Even though both the two stage least squares (2SLS) and GMM estimation methods lead to consistent estimations, GMM is used for efficiency gain (Woodridge (2010)).

Columns (2) and (3) of Table 29 present the analysis results obtained through implementing GMM IV estimations. The significances of t-stats and first stage F-stats in all regressions in Table 29 indicate that the instruments meet the relevance criteria. Also, Hansen J-stats obtained in all the regressions are insignificant, which shows the exogeneity of the instruments. As can be seen from Table 29, the coefficient on predicted *Equity PD* variable in the model using industry fixed effects (model (2)) is significantly positive at 5% level. The significance of the coefficient vanishes if we use firm fixed effects, which is shown in column (3). Thus, consistent with the H1, we explore some evidence showing a significantly positive association between *Equity PD* and *ln(Loan Spread)*.

The results suggest that the increase in the average vesting periods leads to an increase in the loan spreads. Economically, a standard deviation rise in Equity PD is associated with an average of 11 bps or roughly a 5% increase in the average loan spread. The signs of the coefficients on incentive variables and other control variables are mainly consistent with the previous literature. We find significantly positive coefficients on *Sales Growth*, *Leverage*, *Term Spread*, *Default Spread*, *ln(Asset Maturity)*, *Bridge Loan* and *Term Loan*, on the other hand, we explore significantly negative coefficients on *ln(CEO Delta)*, *ln(Total Assets)*, *Z-Score*, *ln(Loan Size)*, *ln(Number of Banks)*, *General Purpose Loan*, and *Working Capital Loan*.

IV.6.1.2 Natural Experiment: FAS 123R

In this section, we utilize the quasi-natural experiment developed by the regulation of Financial Accounting Standard (FAS) 123R enacted in 2005. This regulation obliged firms to expense their executive stock options at their fair values. The Financial Accounting Standards Board (FASB) adopted the regulation in December 2004. The regulation became effective for the interim and annual financial statements that begin after December 15, 2005. Before FAS 123R, firms had to expense their executive stock options at their intrinsic values. Because the exercise prices of granted executive options were in general equal to the underlying stock prices when they were granted, the intrinsic values were mainly zero. Therefore, the regulation has caused an increase in the executive stock option costs recorded at firms' financial statements by the amount of time value of the options.

The increase in the executive stock option costs can have some impacts on Equity PD. The previous literature finds that firms shorten Equity PD following the adoption of FAS 123R (Ladika and Sautner, 2018; Fu et. al., 2019; Welker, 2019). Welker (2019) explains the decrease in the pay duration with the time value of an option. An option with a longer vesting period will have a greater fair value. Thus, Welker (2019) asserts that firms prefer to shrink Equity PD after FAS 123R, as it alleviates the effects of option expensing. Further, Ladika and Sautner (2018) and Fu et. al. (2019) describe the decline in the pay duration with the accelerated option vesting. FAS 123R covers both newly vesting, and granted but yet been unvested options. Firms were allowed to vest the granted but unvested existing options before the effectiveness of the regulation to evade the impact of expensing. Therefore, firms chose to accelerate unvested options and shorten the duration of new grants in 2005 (Ladika and Sautner, 2018; Fu et. al., 2019). This acceleration happens for new grants as well as previous grants (Fu et al., 2019). Additionally, Ladika and Sautner (2018) claim that the average vesting period remained short following 2005.

We also test the decrease in Equity PD since the fiscal year 2005 by using firm-year panel data (firm-based data) between 2003 and 2006. We define 2003 and 2004 as pre FAS 123R period and 2005 and 2006 as post FAS 123R period. Columns (1) and (2) of Table

30 show the results of the regression of *Equity PD* on *Post FAS123R*. Column (1) shows the results of the period between 2003 and 2006, whereas column (2) shows those of the period between 2004 and 2005. Consistent with the findings of the previous studies, we find significantly negative coefficients on Post FAS123R in both regressions, which confirms a decline in the Equity PD in post FAS 123R.

Further, we examine the sources of the decrease in the Equity PD in post FAS 123R. We regress the portions of the values of salaries plus bonuses, options and restricted stocks in the total values of a firm's executives' grants in a year. Columns (3)-(6) of Table 30 present the regression results. We find a significant decrease in the portion of option grants (*Option Ratio*), but a significant increase in the portion of the sum of salary and bonus (*Salary&Bonus Ratio*) during the post FAS 123R period. We cannot explore a significant change in the portion of restricted stock grants (*Restricted Stock Ratio*) in the post FAS 123R period. If we assume the executives' compensation sizes do not radically change post FAS 123R compared to pre FAS 123R, the increase in the portion of salaries and bonuses (*Salary&Bonus Ratio*) and the decrease in the portion of options (*Option Ratio*) imply a trade-off between options and salaries plus bonuses. Because bonuses and salaries have zero vesting period and options mainly have positive vesting periods, the trade-off might lead to a decrease in the Equity PD. The decrease in *Option Ratio* might also be caused by shortening the option vesting periods, i.e. the acceleration, which also leads to a reduction in Equity PD.[59] Hence, the results suggest that possible reasons for the decrease in the Equity PD post FAS 123R might be the acceleration and/or cutdown of executive options.

[59] The decrease in the duration of an option leads to a reduction in the time value of an option.

We define the fiscal year 2005 as the beginning of the post FAS 123R period. We follow Bakke, Mahmudi, Fernando, and Salas (2016) to identify treatment and control groups. There are two groups that are not probable to be influenced by FAS 123R. The first group includes firms which did not grant any stock option to their executives until the end of 2004. The second group contains firms that voluntarily started to expense fair values of their executive stock options prior to 2003. These two groups form our control group, as they are unlikely to be affected by the regulation in terms of expensing stock options. Hence, our treatment group consists of firms that were granting executive stock options but did not expense fair values of the options granted before the enactment of FAS 123R.

We hand-collect the data from firms' SEC Proxy Statements (DEF 14A) to define the firms voluntary expensing fair values of executive stock options. Our sample consists of 30 control firms in total. 6 out of 30 control firms are the firm voluntarily expensing executive stock options at their fair values. There are 664 treatment firms. The numbers of observations regarding control and treatment groups are 73 and 2,400 respectively. 33 out of 73 observations regarding the control group is related to the voluntary firms.

We implement a difference-in-difference (DID) method to investigate the impacts of FAS 123R on the loan spread of the treatment group for the period between 2003 and 2006. We refer to the treatment group as *FAS123R Treatment*, which is a dummy variable that equals 1 if the firm is in treatment, and 0 otherwise. Column (1) of Table 31 presents the results of the DID method, where the dependent variable is *ln(Loan Spread)*. We find a significantly negative coefficient on the interaction between *FAS123R Treatment* and *Post FAS123R*.

Since there is a massive difference in the number of observations regarding the control and treatment firms, we match control firms with the same number of treatment firms (30 treatment firms) based on their sales growth, leverage, size, and Z-score by performing Propensity Score Matching (PSM) method. After PSM, we have 132 and 73 observations regarding treated and control firms, respectively. Column (2) of Table 31 illustrates the results of DID analysis after the matching. We still find a significantly negative coefficient on the interaction between *FAS123R Treatment* and *Post FAS123R*.

These results suggest that the loans of treatment group firms have lower loan spread post FAS 123R period. Because firms have been previously proved and been shown in this study to have a shorter Equity PD post FAS 123R period, consistent with hypothesis 1 (H1), these results imply a positive association between Equity PD and loan spreads.

IV.6.1.3 Channels of the Relation Between Equity PD and Cost of Debt

In this section, we examine the channels through which the Equity PD affects loan spread. In section IV.2, we explain possible channels. We briefly categorize all possible channels into three subcategories: risk, information asymmetry, and labor market channels.

In terms of firm risk level, several studies find positive association of long-term compensations with mergers and acquisitions (Gao, 2010; Cihan and Tuncez, 2019; and Li and Pang, 2019), which are considered to be risky firm policies. Since the increase in firm risk causes a reallocation of wealth from creditors to shareholders, it can lead to a higher cost of debt (Wei and Yermack, 2010). Thus, we test the variables of *Return Vol.*, *MtB* and *3Y Merger Count* as possible channels. *Return Vol.* is the annualized standard deviation of daily stock returns adjusted for marginal tax rate and market leverage, which is called annualized unlevered stock return volatility. *MtB* is market-to-book ratio. *3Y Merger*

Dummy is the total number of mergers and acquisitions as an acquirer in the current and previous 2 years.

Edmans et al. (2013) document a positive association between long-term compensation and R&D, which is reported to deteriorate information asymmetry issues. Aboody and Lev (2000) documents that R&D expenditures are difficult to be understood by the market. Besides using R&D intensities, following Chen and King (2014), we exploit forecast dispersion by using IBES dataset, where the *Forecast Dispersion* is the standard deviation of analyst forecasts of earnings per share made in 3 months before fiscal year-end. Further, Chae (2005) claims that since traders are interested in publicly available price information of raw materials, industries regarding these raw materials are more transparent compared to others. Following Chae (2005), we define petroleum, mining, coal, paper, and printing industries as transparent industries. Therefore, we use an indicator variable of *Transp. Ind. Firms*, which equals 1 if a firm operates in one of those industries, and zero otherwise.

We also test whether the impacts of Equity PD on executive labor market is a channel of Equity PD since Kleymenova and Tuna (2018) find a positive association with turnover, which is shown to positively influence the cost of debt (Adams, 2005; Donangelo, 2014; Chen et al., 2019). We use both CEO turnover and, in a broader concept, executive turnover. *CEO turnover* is an indicator variable that equals to 1 if there is a change in the CEO position in that year and zero otherwise, while *Turnover* is an indicator variable that equals to 1 if there is a change in any of the executives' positions, including CEO and VPs, in a year, and zero otherwise.

We perform GMM IV estimation to examine how the hypothesized channels impact the relation between Equity PD and loan spread using year and industry fixed effects. We exploit *ln(Firm age)* and *Industry Mean Equity PD* as instruments.[60] The analysis results are reported in Table 32. The first three columns present the results regarding risk-taking channels, the next three columns present those of information asymmetry channels, and the last two columns show those of labor market channels. We find significant coefficients on the interactions of predicted *Equity PD* with all risk-taking channels, with *R&D/Assets* and *Transp. Ind. Firms* among information asymmetry channels and with both labor channels (*CEO turnover* and *Turnover*). Hence, the results suggest that Equity PD affects the cost of debt through risk, information asymmetry and labor channels.

IV.6.2 Whole PD and Cost of Debt

IV.6.2.1 Regression Analyses

We use OLS and GMM IV estimation to test whether Whole PD, SERP PD and ODC PD influence price loan features (loan spread). The key right-hand-side variables are the *Whole PD* (or *Predicted Whole PD*), *SERP PD* (or *Predicted SERP PD*), or *ODC PD* (or *Predicted ODC PD*). We exploit the same set of control variables as we use in the models regarding Equity PD. All variables are defined in Appendix I. We include year and industry fixed effects or firm fixed effects in the regressions. We use standard errors clustered by firm.

Table 33 reports OLS estimates using *Whole PD*, *SERP PD* and *ODC PD*. Columns (1), (2), and (3) depict OLS analysis results regarding *Whole PD*, *SERP PD*, and *ODC PD*, respectively. t-statistics using standard errors clustered by firms are documented in parentheses below parameter estimates. Consistent with our hypothesis 2 (H2) that loan

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[60] We additionally use *ln(Executive Mean Tenure)* as an instrument only at the examination of *R&D/Assets*.

spread is decreasing in the Whole PD, the coefficients on *Whole PD*, *SERP PD*, and *ODC PD* are negative and statistically significant.

Anantharaman et al. (2013) differentiate deferred compensation into executive pensions (SERP) and other deferred compensations (ODC). Even though there is some protection of ODCs, SERPs are mainly unfunded and unsecured. Therefore, they find that the negative impact of inside debt on borrowing costs are primarily driven by pension (SERP) benefits. Thus, one can expect a more pronounced effect of *SERP PD* on the cost of debt compared to that of *ODC PD*. The coefficient on *SERP PD* is -0.0021777, while that of *ODC PD* is -0.0014266. We find that they are significantly different at 10% level without correction in standard errors. Hence, consistent with the argument of Anantharaman et al. (2013), we detect that the SERP PD has more impact on loan spreads compared to the ODC PD.

We have similar endogeneity concerns regarding the Whole PD as in the Equity PD. Some underlying factors that are omitted in the regressions might drive the results. Therefore, we perform the GMM IV estimation method to address endogeneity problems. Breusch-Pagan / Cook-Weisberg tests result in a p-value of less than 0.001, which shows a significant heteroskedasticity using 2SLS regression. We exploit $ln(MeanVesting)_{t-2}$, *ln(Mean Exec. Tenure)* and *Number of Exec.* as instruments for the endogenous independent variables *Whole PD*, *SERP PD,* and *ODC PD*. For more information about the instruments, please see section IV.3.4 and Appendix I.

Table 34 illustrates GMM IV estimation results regarding the impacts of Whole PD and loan pricing. We use year and industry fixed effects in models (1), (3), and (5). We use firm fixed effects instead of industry fixed effects in models (2), (4), and (6). The first stage

F-stats are not very large in the regressions, but significances of t-stats of the instruments in the first stage in all columns presented in Table 34 indicate that the instruments are relevant to the dependent variables. Only *ln(Mean Exec. Tenure)* seems to be a relatively weaker instrument compared to other instruments, but we use it as an instrument because it especially has significant coefficients in the first stages in some regressions including firm fixed effects (columns (2) and (4)). Hansen J-stats are insignificant in all models.

We find significantly negative coefficients on *Whole PD*, *SERP PD*, and *ODC PD* in all specifications. These results are consistent with our hypothesis 2 (H2). In terms of economic significance, a one-standard-deviation increase in *Whole PD* decreases the spread of the average loan by 90 basis points, which is a decrease of 41% based on a sample mean loan spread of 216 basis points. As for *SERP PD*, and *ODC PD*, both coefficients are economically significant; a one-standard-deviation increase in SERP PD (ODC PD) increases the loan spread of the average loan by 110 basis points (83 basis points), which is an increase of 51% (38%).

Overall, our results suggest that creditors price the risks associated with longer Whole PD incentives and, holding the effects of other factors constant, are willing to contract at lower spread when executives have a greater Whole PD.

IV.6.2.2 Channels of the Relation Between Whole PD and Cost of Debt

We investigate channels that drive the association between Whole PD and loan spread. We classify possible channels into three groups: executive manipulation, risk, and labor market channels.

Previous literature documents that long-term compensation mitigates the tendency to manipulate earnings (Gopalan et al., 2010; Gopalan et al., 2014; Ladika and Sautner, 2018;

Edmans, Fang, and Huang, 2017). Also, Marinovic and Varas (2019) argue executive short-termism is intensified as they approach retirement, which implies that being far from retirement alleviates the incentive to manipulate financial figures. On the other hand, Prevost, Roa, and Skousen (2008) and Shen and Huang (2013) discuss that the cost of debt is increasing in the financial statement manipulation. Thus, extending the vesting period of the equity and debt-like compensation composition can mitigate the cost of debt through alleviating the tendency to manipulate. Hence, we use the absolute value of discretionary accruals (*Abs(DA/Assets)*), smoothing behavior (*Smooth*) and restatements (*Restatement dummy*) as possible manipulation channels. *Abs(DA/Assets)* is the discretionary part of accruals generated following Dechow, Sloan, and Sweeney (1995) and Jones (1991) (Modified Jone's Model). Following Tucker and Zarowin (2006), and Dhole, Manchiraju, and Suk (2016), *Smooth* is defined as the correlation between the change in discretionary accruals and the change in pre-managed income (return on asset - discretionary accruals) over the current and previous 4 years multiplied by (-1). *Restatement* is an indicator variable that equals 1 if a firm restates its previously announced financial statements by using the Audit Analytics database.[61]

In terms of firm risk level, executives' wealth is more bound to the firm they work for as their compensation duration increases. Therefore, executives can be more concerned with the firms' default risk and their liquidation values. Consistently, Brisley (2006) demonstrates that unvested compensations may lead executives to dismiss risky projects. Hence, an executive with longer Whole PD can decrease risky investments to reduce firm default risk, which might also cut down the firm's borrowing costs. Thus, we examine

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[61] Following Pittman and Zhao (2018), we exclude SAB 108 and FIN 48 restatements, and restatements made due to a change in accounting method, a change in estimate, or a change in accounting principle.

unlevered annualized stock return volatility (*Return Vol.*), market-to-book ratio (*MtB*), and the number of mergers and acquisitions that a firm involved in as an acquirer (*3Y Merger Dummy*) as possible channels.

Also, Gopalan et al. (2016) explore that executives with relatively longer pay duration face turnover, which is reported to have a positive relation with the cost of debt (Adams, 2005; Donangelo, 2014; Chen et al., 2019). Accordingly, we use *CEO turnover* and *Turnover* to test whether the impacts of Whole PD on the executive labor market is a channel through which Whole PD affects loan spread.

We implement GMM IV estimation to investigate how the hypothesized channels affect the association between Whole PD and loan spread. We use $ln(meanVESTING)_{t-2}$, *ln(Firm Age)*, *Number of Exec.*, and *ln(Mean Exec. Tenure)* as instruments. Table 35 presents the analysis results. The first three columns show the results regarding executive manipulation channels, the next three columns show those of risk channels, and the last two columns show those of labor market channels. The coefficients on all possible channel variables in manipulation and risk channel groups are insignificant, which suggests that the relation between Whole PD and loan spread is not driven by risk or executive manipulation channels. We detect a significant coefficient on the interaction between *Whole PD* and *Turnover* as a labor market channel. We cannot find a significant coefficient on the interaction between *CEO Turnover* and *Whole PD*. Hence, these results suggest that Whole PD can impact loan spread only through its impact on the executive labor market.

IV.6.2.3 Heterogeneities in the Relation Between Whole PD and Loan Spread

In this section, we investigate heterogeneities in the association between Whole PD and loan spread in terms of corporate governance and past firm performance.

The board may decide to extend pay duration under poor governance and greater agency problems, where the direct monitoring of executives is costly because long-term firm performance can be more exploratory about the accurate performance of an executive (Gopalan et al. (2014)). Consistently, Gopalan et. al (2010) explore that optimal pay duration is longer for firms having poor corporate governance. However, Gopalan et al. (2014) also discuss that a strong executive, especially the CEO, is able to devise short pay duration, as a weak board can easily be influenced by the executive. Therefore, the relation between Whole PD and loan spread can be more or less pronounced under poor corporate governance.

We regress *ln(Loan Spread)* on Entrenchment Index (*E-Index*) and *Co-option* variables. Entrenchment index, which is generated by Bebchuk, Cohen, and Ferrell (2009), is a measure of poor corporate governance. It is basically the count of six antitakeover provisions using data from ISS. A firm with higher E-Index has poorer corporate governance. Similarly, co-option is another poor corporate governance measure. Following Coles, Daniel, and Naveen (2014), co-option is defined as the portion of the board appointed after the CEO assumes the office, which is considered to have a more tendency to behave more cooperatively with the CEO and to exert less monitoring effort.[62]

Columns (1) and (2) of Table 36 show the results related to *E-Index* and *Co-option*, respectively. We find a significantly positive coefficient on the interaction between *E-Index* and *Whole PD*, which implies that poor corporate governance attenuates the effect of Whole PD on loan spread, in other words, better corporate governance enhances the relation between Whole PD and loan spread. We think this can also be caused by the impact

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[62] We obtain Co-option data from Lalitha Naveen's personal website.

of corporate governance on the cost of debt. Sengupta (1998) and Schauten and Blom (2006) find a negative association between better corporate governance applications and the cost of debt financing.[63]

Gopalan et. al (2014) find that firms with better past performance prefer to extend their executives' pay duration and attribute the reason for this to the inference of the past performance to their executives' ability and the board's intention to expose executives with a high cost of voluntary leave. If we account that better performance leads to a lower cost of debt, ceteris paribus, we expect a more pronounced impact of Whole PD on loan spread for the firm having better previous performance.

We use *ROA*, *ROE,* and *Z-Score* to test how a firm performance affects the relation between Whole PD on loan spread. Column (3), (4) and (5) of Table 36 show the analysis results. Beyond the interaction between the performance measures and *Whole PD*, we do not include the variables themselves in the regressions because of the existence of Z-score, which also includes performance, in the regression as a control variable. We find significantly negative coefficients on the interactions of *Whole PD* with *ROA*, *ROE,* and *Z-score*. These results show that the impact of Whole PD on loan spread is more pronounced for firms with better past performance.

IV.7 Conclusion

How the duration of an executive compensation impacts firm performance, risk or firm policy choices have attracted many researchers recently. Several previous studies have

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[63] On the other hand, Ji, Mauer and Zhang (2019) claim that entrenched executives interests are more aligned with lenders and they are more inclined to build empires, which provides creditors with more collaterals. Similarly, entrenched executives pursue less innovative projects (Chakraborty, Rzakhanov, and Sheikh, 2014) and more leverage (Nielsen, 2005). Klock, Mansi and Maxwell (2005) find that the cost of debt financing is decreasing in antitakeover governance provisions.

emphasized its importance in the maximization of long-term shareholder value, mitigating managerial short-termism and extending managerial investment horizon (Stein, 1988; Stein, 1989; Bolton, Scheinkman, and Xiong, 2006; Manso, 2011; Peng and Röell, 2014; Edmans, Gabaix, Sadzik, and Sannikov, 2012; Gopalan, Milbourn, Song, and Thakor, 2014; Edmans, Fang, and Lewellen, 2017). In a different aspect, in this paper, we examine the effects of this new dimension of compensational incentives on the agency conflict between managers and debtholders. Specifically, we investigate the effects of executive pay duration on loan spread.

We exploit Gopalan et. al's (2014) conventional equity-based pay duration (Equity PD) measure, which is the weighted average vesting period of salaries, bonuses, options and restricted stocks granted to executives documented by ISS Incentive Lab. However, this measure ignores the impacts of deferred compensations, which is also denoted as "inside debt" in the literature, on the managerial horizon. Therefore, we also use the pay duration measure that includes the durations of debt-like compensations, which we name it as debt&equity-based pay duration (Whole PD). We employ OLS and GMM IV instrumental approaches for testing the effects of both measures on loan spread. We also perform a quasi-natural experiment by using exogenous shocks provided by the regulation FAS 123R to specifically test the relation between Equity PD and loan spread.

We find some evidence showing that the cost of debt is increasing in Equity PD. Further, the natural experiment results also support the hypothesis claiming a positive association between Equity PD and the cost of debt. However, when we account for the duration of deferred compensations, we explore a negative association between Whole PD and loan spread. The common channel through which these both pay duration measures affect the cost of debt seems to be their impacts on the executive labor market through turnover. Risk and information asymmetry are the other channels that drive the relation between Equity PD and the cost of debt. Further, we find that the relation between Whole PD and loan spread is more pronounced with better corporate governance and past performance.

Overall, our analyses indicate that Equity PD leads to a higher loan spread, but when we consider the pay duration with all components of an executive's compensation (including both equity and debt-like compensation parts), in fact, loan spread is decreasing in a longer pay duration.

CHAPTER V

CONCLUSIONS

In this dissertation, three topics related to the impacts of managerial incentives on corporates in different aspects are studied using different dimensions of executive incentives. In the first part of the dissertation, the effects of tournament incentives on corporate risk management policies, specifically those of industry tournament incentives (ITIs) on corporate hedging likelihood and intensity is examined. Then, the association between internal tournament incentives (ITTIs) and reserve management in property-liability insurance industry firms is investigated. Lastly, we study the impacts of pay duration on the cost of debt.

In the first essay, consistent with our risk management hypothesis, we find ITIs positively affect the likelihood to hedge and the hedging intensity. This finding shows that ITIs are one of the motivations behind corporate hedging. We find that corporate hedging mitigates the amplifying impact of ITIs on the cost of debt and stock price crash risk, which can encourage CEOs to hedge. Additionally, we show that this relation is less pronounced for firms in more financial distress. The association between ITIs and corporate hedging strengthens when the likelihood of a CEO to move up boosts. Moreover, we identify a causal relation between ITIs and corporate hedging, using an exogenous shock provided by the changes in the enforceability of non-compete agreements.

In the second essay, we display that there is a significantly positive relation between ITTIs and reserve errors, which implies that firms tend to overestimate reserves more as the pay gap between a firm CEO and senior executives rises. In addition, inconsistent with the literature of non-insurance firms, we do not find a positive relation between risk taking behavior or performance, which shows that vice presidents (VPs) focus on the strong financial health of the firm instead of its profitability. We find the impact of ITTIs on conservative reserve management is more pronounced for insurers with a larger size, more geographical concentration, and weaker financial situation. Further, we illustrate that the Sarbanes–Oxley Act (SOX) does not have a significant impact on the positive relation between industry tournament incentives and reserve error.

In the third essay, we explore some evidence illustrating that the cost of debt is increasing in Equity PD. Also, the natural experiment results also support the hypothesis claiming a positive association between equity-based pay duration (Equity PD) and the cost of debt. On the other hand, when we account for the duration of deferred compensations, we find a negative association between equity&debt-based pay duration (Whole PD) and loan spread. The common channel through which these both pay duration measures impact the cost of debt appears to be their effects on the executive labor market through turnover. Risk and information asymmetry are the other channels that drive the relation between Equity PD and the cost of debt. Further, we find that the association between Whole PD and loan spread is stronger with better corporate governance and past performance.

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APPENDIX A

DATA SOURCES AND DEFINITIONS FOR CHAPTER II

Variable	Definition
A. Hedging variables (Source: 10-K statements from SEC)	
HEDGE	Dummy variable set to one if a firm mentions the use of any hedging instrument in its 10-K for a given year and set to zero otherwise, details in Appendix B.
HEDGE count	The number of times a firm mentions the use of any hedging instrument in its 10-K statement.
FX hedge	Dummy variable set to one if a firm uses foreign exchange hedging contracts in a year and zero otherwise, details in Appendix B.
FX count	The number of times a firm mentions foreign exchange hedging in a given year based on the combination of the words documented in Appendix B.
IR hedge	Dummy variable set to one if a firm uses interest rate hedging contract in a year and zero otherwise.
IR count	The number of times a firm mentions interest rate hedging in a given year, details in Appendix B.
CMD hedge	Dummy variable set to one if a firm uses commodity hedging contract in a year and zero otherwise.
CMD count	The number of times a firm mentions commodity hedging contract in a given year, details in Appendix B.

B. Incentives variables (Source: ExecuComp)	
Indgap1	The pay gap between the second-highest-paid CEO's total compensation within the same Fama-French 30-industry and the CEO's total compensation (CPI-adjusted).
Indgap2	The pay gap between the second-highest-paid CEO's total compensation within the same Fama-French 30- size-median industry and the CEO's total compensation (CPI-adjusted).
LN_INDGAP1	The natural logarithm of one plus *Indgap1*.
LN_INDGAP2	The natural logarithm of one plus *Indgap2*.
Firm gap	The pay gap between the CEO's total compensation and the median vice president total compensation (CPI-adjusted).
CEO delta	Dollar change in CEO wealth associated with a 1% change in the firm's stock price.
CEO vega	Dollar change in CEO wealth associated with a 0.01 change in the standard deviation of the firm's returns.
C. Firm characteristics (Source: Compustat and CRSP)	
Total assets	Book value of total assets in millions of constant dollars, CPI-adjusted.
R&D/Assets	R&D expenditures divided by total assets, set to 0 if missing.
Leverage	The ratio of long-term debt plus debt in current liabilities to total assets.
Tobin's Q	The market value of equity plus book value of assets minus book value of equity minus balance sheet deferred taxes, divided by book value of assets.
CAPX/Assets	Capital expenditures divided by total assets.
ROA	Operating income before interest divided by total assets.

MTB	The ratio of the market value of equity to book value of equity.
Cash/Assets	Cash divided by total assets.
PPE/Assets	Investment in property, plant, and equipment divided by total assets.
Cashflow vol	The standard deviation of annual operating cash flows (Compustat data item OANCF) over the past five fiscal years, divided by the total assets.
Z-score	Modified Altman's (1968) Z-score is computed as (1.2 working capital + 1.4 retained earnings + 3.3 EBIT + 0.999 sales) divided by total assets. We exclude (0.6 market value/liabilities) because a similar term, market-to-book, is used as a control variable in the regressions.
Firm age	One plus the difference between the year under investigation and the first year the firm appears on the CRSP tapes.
Non-debt tax shield	Depreciation divided by total assets.
Inventory	Inventory divided by costs of goods sold.
Trade credit	Account payables divided by total assets.
Asset maturity	Asset maturity is the book value-weighted maturity of long-term assets and current assets, where the maturity of long-term assets is computed as gross property, plant, and equipment divided by depreciation expense, and the maturity of current assets is computed as current assets divided by the cost of goods sold (see Kubick, Lockhart, and Mauer, 2018).
D. CEO characteristics (Source: ExecuComp)	
CEO founder	A dummy variable assigned to 1 if a CEO is also the founder of the firm, and set to 0 otherwise.
CEO retire	A dummy variable assigned to 1 if the CEO's age is more than 65 years, and set to 0 otherwise.

CEO tenure	The CEO's tenure at the firm, in years.
CEO age	The CEO's age, in years.
E. Industry and instrument variables (Source: ExecuComp)	
Ind # CEOs	The number of CEOs (or firms) within the same industry in the sample year.
Ind CEO comp	The sum of total compensation of all other CEOs in each Fama-French 30 industry, except the highest-paid CEO, CPI-adjusted.
Geo CEO mean	The average total compensation received by all other CEOs who work at firms in different industries which are headquartered within a 250-km radius of the firm, CPI-adjusted.
#Higher paid ind CEOs	The total number of CEOs with higher total compensation within the same Fama-French 30 (or FF30 size-median) industry.
F. Crash risk measures and related controls (Source: CRSP)	
CRASH	Dummy variable equal to one if the firm has a weekly return that is less than 3.2 standard deviations below the average weekly return for the entire fiscal year.
NCSKEW	Negative conditional skewness of firm-specific weekly returns during the entire fiscal year.
DUVOL	The natural logarithm of the ratio of the standard deviation of weekly returns for below-average weeks to the standard deviation of weekly returns for above-average weeks, for weekly returns over the fiscal year.
DTURN	The difference between average daily share turnover during the current fiscal year and the previous fiscal year. Daily stock turnover is calculated as the ratio of daily trading volume over the number of shares outstanding.

SIGMA	The standard deviation of firm-specific weekly stock returns over the fiscal year.
RET	Average firm-specific weekly return during the entire fiscal year.
OPAQUE	The absolute value of discretionary accruals, which are measured using the modified Jones model following Dechow et al. (1995) (Compustat).
G. Bank loan characteristics and related controls (Source: DealScan)	
Loan spread	Loan spread is measured as all-in spread drawn.
Loan maturity	Loan maturity measured in months.
Covenant count	A count of the number of covenants in the loan facility.
Loan Secured	A dummy variable equal to one if the loan facility is secured by collateral and zero otherwise.
Performance pricing	A dummy variable equal to one if the loan facility has a performance pricing feature and zero otherwise.
No. of Lenders	The number of lenders funding the loan facility (i.e., the size of the loan syndicate).
Loan amount	The loan amount measured in dollars, CPI-adjusted.
Term loan	A dummy variable equal to one if the loan facility is a term loan and zero otherwise.
Revolver loan	A dummy variable equal to one if the loan facility is a revolver or 364-day facility and zero otherwise.
Bridge loan	A dummy variable equal to one if the loan facility is a bridge loan and zero otherwise.

General purpose loan	A dummy variable equal to one if the loan purpose is for general corporate purposes, project finance, or other purpose and zero otherwise.
Takeover/recap loan	A dummy variable equal to one if the loan purpose is for a takeover or recapitalization and zero otherwise.
Working capital loan	A dummy variable equal to one if the loan purpose is to finance working capital and zero otherwise.
Rated dummy	Dummy variable equal to one if the firm has an S&P long-term debt rating.
H. Macroeconomic controls (Source: The Federal Reserve)	
Credit spread	The difference between BBB corporate bond yield and AAA corporate bond yield.
Term spread	The difference between the 10-year U.S. constant maturity Treasury yield and the 3-month constant maturity U.S. Treasury yield (see Kubick, Lockhart, and Mauer, 2018).
Crisis dummy	A dummy variable equal to one if the loan activation date falls in the calendar year 2007 or 2008 and zero otherwise.
Post-crisis dummy	A dummy variable equal to one if the loan activation date is after the calendar year 2008 and zero otherwise.

APPENDIX B

HEDGING VARIABLES FOR CHAPTER II

We develop hedging variables using textual analysis of 10-K statements. We search for 10-Ks to find if a firm utilizes hedging activities. First, we create measures for three different types of hedging: FX (foreign exchange) hedging, IR (interest rate) hedging, and CMD (commodity) hedging. Then we combine them to form an overall hedging variable. The details of these variables are as follows:

FX (foreign exchange) hedging:

We closely follow Chen and King (2014) and Huang, Peyer, and Segal (2014) to generate FX hedging variable. A firm is concluded to follow FX hedging in a year if it mentions any of the following combinations of the words in its 10-K statement:

(currency/ currency rate/ exchange/ exchange rate/ cross-currency) and (cap/ collar/ contract/ derivative/ floor/ forward/ future/ option/ swap) (e.g., the combination of two words from each list, such as currency cap, currency collar, currency contract)

We also exclude false positive hits by searching following different words that would make a firm not to use in FX hedging activities such as "in the future", "forward-looking", "not material", "do not engage in forward foreign exchange", "does not have any currency forward". We develop the following two FX hedging variables:

- *FX hedge* is set to one if a firm uses FX hedging contracts in a year and zero otherwise;
- *FX count* is the number of times a firm mentions FX hedging in a given year based on the combination of the words specified above.

IR (interest rate) hedging:

For IR hedging, we use the following list of words documented in Huang, Peyer, and Segal (2014): "interest rate swap", "interest rate cap", "interest rate collar", "interest rate floor", "interest rate forward", "interest rate option", "interest rate future". We develop the following two IR hedging variables:

- *IR hedge* is set to one if a firm mentions any of the word from the above IR word list in a year and zero otherwise;
- *IR count* is the total number of IR hedging words documented in the 10-K statement.

CMD (commodity) hedging:

For commodity hedging, we use the following word list documented in Almeida et al. (2017).

hedge fuel	uses derivative financial instruments to manage the price risk
fuel hedge	uses financial instruments to manage the price risk
fuel call option	uses derivative financial instruments to manage price risk
commodity derivative	uses derivatives to manage the price risk
commodity contract	uses derivatives to manage price risk
commodity forward	forward contracts for certain commodities
commodity future	forward contracts for commodities derivatives to mitigate commodity price risk
commodity hedge	futures to mitigate commodity price risk
commodity hedging	options to mitigate commodity price risk

commodity option	swaps to mitigate commodity price risk
commodity swap	corn future
hedges of commodity price	cattle future commodity price swap

We develop the following two commodity hedging variables:

- *CMD hedge* is set to one if a firm mentions any of the word from the above commodity word list in a year and zero otherwise;
- *CMD count* is the total number of commodity hedging words documented in the 10-K statement.

Finally, our two main overall hedging variables are formed as follow:

- *HEDGE* takes a value of one if any one of the hedging dummies (FX hedge, CMD hedge, or IR hedge) is one, zero otherwise.
- *HEDGE count* is the sum of FX count, CMD count, and IR count.

APPENDIX C

MEASURES OF STOCK PRICE CRASH RISK FOR CHAPTER II

For firm *i* during its fiscal year *t*, we first estimate firm-specific weekly residual returns from the expanded market model as follows:

$$r_{i,t} = \alpha_i + \beta_{1,i} r_{m,t-2} + \beta_{2,i} r_{m,t-1} + \beta_{3,i} r_{m,t} + \beta_{4,i} r_{m,t+1} + \beta_{5,i} r_{m,t+2} + \varepsilon_{i,t}, \tag{C1}$$

where $r_{i,\tau}$ is the return on stock *i* in week τ, and $r_{m,\tau}$ is the return on the CRSP value-weighted market index in week τ. The firm-specific weekly returns are then defined as

$$W_{i,t} = \ln\left(1 + \varepsilon_{i,t}\right). \tag{C2}$$

Following stock price crash risk literature, we form three measures of crash risk (Dimson, 1979; Scholes and Williams, 1977; Chen, Hong, and Stein, 2001; and Kim, Li, and Zhang, 2011). First, *CRASH* is a dummy variable that takes the value of one if the firm has experienced at least one weekly return $\left(W_{i,t}\right)$ 3.2 standard deviations below the average firm-specific weekly return during the entire fiscal year, and zero otherwise.

The second measure of crash risk is the firm-specific negative conditional skewness (*NCSKEW*). *NCSKEW* is defined as the standardized negative value of the third central moment of firm-specific weekly return scaled by its sample variance raised to the power of 3/2. More specifically, NCSKEW of stock *i* in its fiscal year *t* is calculated as

$$NCSKEW_{i,t} = -\frac{n\left(n-1\right)^{3/2} \sum W_{i,t}^{3}}{\left(n-1\right)\left(n-2\right)\left(\sum W_{i,t}^{2}\right)^{3/2}}, \tag{C3}$$

where *n* is the number of weekly observations in year *t*. A larger value of *NCSKEW* indicates more negatively skewed returns and thus greater crash risk.

Our third measure of crash risk is the firm-specific down-to-up volatility ratio measured over the entire fiscal year (*DUVOL*). *DUVOL* is computed as a natural logarithm of the ratio of the standard deviation of weekly returns for “down” weeks to the standard deviation of weekly returns for “up” weeks. The “down” weeks are the weeks during which the weekly return is less than the annual firm-specific mean and the “up” weeks are the weeks during which the weekly return is greater than the annual firm-specific mean. Larger values of *DUVOL* indicate greater crash risk.

APPENDIX D

COMPUTATION OF EXPECTED DEFAULT FREQUENCY (EDF) FOR CHAPTER II

Merton's expected default frequency: The Merton's expected default frequency (EDF) measure is computed using the Merton (1974) bond pricing model. Merton's model assumes that the total value of a firm follows a geometric Brownian motion,

$$dV = \mu V dt + \sigma_V V dW, \tag{D1}$$

where *V* is the value of the firm, μ is the expected continuously compounded return on *V*, σ_V is the volatility of firm value and *dW* is a standard Weiner process. Additionally, it assumes the firm has issued only one discount bond with maturity of *T* periods. Merton's expected default frequency is computed by the following three-steps procedure.

Step 1: The following two equations are solved numerically for *V* and σ_V :

$$E = VN\left(d_1\right) - e^{-rT} FN\left(d_2\right) \tag{D2}$$

and

$$\sigma_E = \left(\frac{V}{E}\right) N\left(d_1\right) \sigma_V, \tag{D3}$$

where *E* is the market value of equity, *F* is the face value debt, *r* is assumed to be constant risk-free rate, $N(.)$ is the cumulative standard normal distribution function, d_1 is given by

$$d_1 = \frac{ln\left(\frac{V}{F}\right) + \left(r + 0.5\sigma_V^2\right)T}{\sigma_V \sqrt{T}}, \tag{D4}$$

and $d_2 = d_1 - \sigma_V \sqrt{T}$.

Step 2: After obtaining numerical solution for V and σ_V, the distance to default is computed as

$$DD = \frac{ln\left(\frac{V}{F}\right) + \left(\mu - 0.5\sigma_V^2\right)T}{\sigma_V \sqrt{T}}, \tag{D5}$$

where μ is the expected annual returns.

Step 3: The implied probability of default or the Merton expected default frequency (EDF) is computed as

$$Merton\ EDF = N\left(-DD\right). \tag{D6}$$

I set the inputs to the above procedure following the literature (Vassalou and Xing, 2004; Sundaram and Yermack, 2007; Bharath and Shumway, 2008; Kubick, Lockhart, and Mauer, 2018). μ is set as EBITDA scaled by book value of total assets, σ_E is the annualized standard deviation of returns over the previous year, F is measured as (debt in current liabilities + 1.5 * long-term debt), E is measured as the end of the year common share price multiply by common shares outstanding, r is the one-year Treasury Constant Maturity Rate (obtained from the Federal Reserve Board's website: http://www.federalreserve.gov), and T is assumed as 1 year.

Naïve expected default frequency: The Naïve expected default frequency (EDF) measure is computed based on the "simplified" Merton model probability of default documented in Bharath and Shumway (2008). This procedure assumes the firm's market value of debt equal to its face value of debt (i.e., $D = F$) and the volatility of debt as $\sigma_D = 0.05 + 0.25 \times \sigma_E$. The total volatility of the firm's value is then estimated as

$$\sigma_V = \frac{E}{E+F}\sigma_E + \frac{F}{E+F}\sigma_D. \tag{D7}$$

The naïve distance to default is then computed as

$$Naive\ DD = \frac{\ln\left(\frac{E+F}{F}\right) + \left(\mu - 0.5\sigma_V^2\right)T}{\sigma_V\sqrt{T}} \quad \text{(D9)}$$

and the naïve expected default frequency is computed as

$$Naive\ EDF = N\left(\text{-}Naive\ DD\right) \quad \text{(D10)}$$

Higher values of Merton and Naïve EDF indicate a higher likelihood of default.

APPENDIX E

TABLES FOR CHAPTER II

Table 1: Summary statistics for chapter II

This table presents summary statistics for ExecuComp firms that have information on all the required variables, excluding financials and utility firms, from the period 1997 to 2016. *HEDGE* is a dummy variable assigned to one if a firm defined to use any hedging activity in a given year and set to 0 otherwise. *HEDGE* count is a count of the number of times a firm mentions the use of any hedging instrument in its 10-K statement. The details on the hedging variables are discussed in Appendix B. All the other variables are defined in Appendix A. All the continuous variables are winsorized at 1% and 99%.

	N	Mean	Std. Dev.	25th Pctl	Median	75th Pctl
A. Hedging variables						
HEDGE	19,705	0.69				
HEDGE count	19,705	13.93	19.24	0.00	6.00	21.00
FX hedge	19,705	0.51				
FX count	19,705	6.44	10.61	0.00	1.00	10.00
IR hedge	19,705	0.45				
IR count	19,705	5.88	10.38	0.00	0.00	8.00
CMD hedge	19,705	0.14				
CMD count	19,705	1.26	4.75	0.00	0.00	0.00
B. Incentives variables						
Indgap1 ($000)	19,705	24,997.49	26,506.09	10,272.00	17,669.78	29,627.48
Indgap2 ($000)	19,402	14,508.22	20,316.61	4,000.88	8,126.85	17,353.42
LN_INDGAP1	19,705	9.75	0.86	9.24	9.78	10.30
LN_INDGAP2	19,402	8.83	1.77	8.33	9.02	9.77
Firm gap ($000)	19,705	3,107.06	3,388.22	859.56	2,005.30	4,084.39
CEO delta ($000)	19,705	800.00	7,593.01	75.89	197.68	523.49
CEO vega ($000)	19,705	123.05	225.85	13.11	47.87	135.81
C. Firm characteristics						
Total assets	19,705	5,291.63	16,204.69	469.23	1,226.97	3,646.08
R&D/Assets	19,705	0.03	0.06	0.00	0.00	0.05
Leverage	19,705	0.20	0.17	0.04	0.19	0.32
Tobin's Q	19,705	2.01	1.29	1.21	1.61	2.33
CAPX/Assets	19,705	0.05	0.05	0.02	0.04	0.07
ROA	19,705	0.14	0.10	0.09	0.13	0.18
MTB	19,705	2.04	1.28	1.24	1.64	2.35
Cash/Assets	19,705	0.16	0.18	0.03	0.10	0.24
PPE/Assets	19,705	0.26	0.22	0.10	0.19	0.36
Cashflow vol	19,705	0.05	0.04	0.02	0.04	0.06
Z-score	19,705	1.82	1.61	1.16	1.92	2.69
Merton EDF (%)	16,502	0.26	2.35	0.00	0.00	0.00
Naive EDF (%)	16,502	0.21	1.78	0.00	0.00	0.00

Firm age (years)	19,705	27.87	19.17	13.00	22.00	40.00
Non-debt tax shield	19,705	0.04	0.03	0.03	0.04	0.05
Inventory	19,705	0.19	0.18	0.04	0.16	0.27
Trade credit	19,705	0.08	0.07	0.03	0.06	0.10
Asset maturity	19,692	7.76	5.68	3.71	6.18	10.32
D. CEO characteristics						
CEO founder	19,705	0.07				
CEO retire	19,705	0.07				
CEO tenure (years)	19,705	7.85	7.25	2.70	5.67	10.67
CEO age (years)	19,705	55.44	7.18	51.00	55.00	60.00
E. Industry and instrument variables						
Ind # CEOs	19,705	110.41	75.87	44.00	81.00	185.00
Ind CEO comp ($000)	19,705	485,622.94	358,818.90	157,455.91	454,482.38	792,448.81
Geo CEO mean ($000)	19,705	5,208.99	1,715.01	4,172.11	4,972.41	5,946.66
#Higher paid ind CEOs	19,705	52.95	50.45	15.00	34.00	77.00
F. Crash risk measures and related controls						
CRASH	15,449	0.36				
NCSKEW	15,449	0.66	1.74	-0.39	0.28	1.11
DUVOL	15,449	0.24	0.60	-0.13	0.13	0.44
DTURN	15,449	0.00	0.00	-0.00	0.00	0.00
SIGMA	15,449	0.06	0.04	0.03	0.05	0.07
RET	15,449	-0.00	0.01	-0.01	-0.00	0.00
OPAQUE	15,449	0.22	0.11	0.18	0.22	0.25
G. Bank loan characteristics and related controls						
Loan spread (bps)	13,822	179.08	150.00	136.25	75.00	250.00
Loan maturity (months)	13,822	48.80	60.00	21.93	36.00	60.00
Covenant count	13,822	1.53	2.00	1.42	0.00	3.00
Loan Secured	13,822	0.45	0.00	0.50	0.00	1.00
Performance pricing	13,822	0.50				
No. of Lenders	13,822	9.75	7.00	8.73	4.00	13.00
ln(Loan amount)	13,822	5.42	5.52	1.32	4.61	6.26
Term loan	13,822	0.26				
Revolver loan	13,822	0.71				
Bridge loan	13,822	0.02				
General purpose loan	13,822	0.43				
Takeover/recap loan	13,822	0.13				
Working capital loan	13,822	0.16				
Rated dummy	13,822	0.67				
H. Macroeconomic controls						
Credit spread	13,822	0.01	0.01	0.01	0.01	0.01
Term spread	13,822	0.02	0.02	0.01	0.01	0.04

Table 2: Industry tournament incentives and corporate hedging (based on FF30 industry)

This table presents the results of OLS and instrumental variables (IV) estimation of ITIs on corporate hedging with year and industry fixed effects. *HEDGE* is a dummy variable assigned to one if a firm is defined to use any hedging activity (foreign exchange, interest rate, or commodity derivatives) in a given fiscal year and set to 0 otherwise. *HEDGE count* is a count of the number of times a firm mentions the use of any hedging instrument in its 10-K statement. The details on these hedging variables are discussed in the Appendix B. *LN_INDGAP1* is the natural logarithm of one plus pay gap between the second-highest-paid CEO's total compensation within the same Fama-French 30 industry (FF30) and the CEO's total compensation. In the first stage, we regress *LN_INDGAP1* variable on contemporaneous control variables and instruments. The instruments are the natural logarithms of the sum of total compensation of all other CEOs in the same industry, *Ind CEO comp* and the total number of CEOs with higher total compensation within the same FF30 industry, *#Higher paid ind CEOs*. All the other variables are defined in Appendix A. Models (1), (4), and (6) present marginal effects of Probit (IVProbit) models at the mean. *T* (Z)-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
				2SLS		2nd stage
	Probit	OLS	1st stage	2nd stage	2nd stage	IVProbit
Dependent variable	$HEDGE_{t+1}$	ln(1+*HEDGE* $count_{t+1}$)	$LN\_INDGAP1_t$	$HEDGE_{t+1}$	ln(1+*HEDGE* $count_{t+1}$)	$HEDGE_{t+1}$
Predicted $\boldsymbol{LN\_INDGAP1_t}$				**0.059*****	**0.163*****	**0.200*****
				(4.07)	(3.54)	(3.97)
$\boldsymbol{LN\_INDGAP1_t}$	**0.043*****	**0.100*****				
	(4.72)	(3.95)				
ln(*Firm gap*$_t$)	0.024***	0.068***	0.055***	0.025***	0.075***	0.079***
	(3.69)	(3.81)	(9.56)	(3.99)	(4.15)	(4.02)
ln(1+*CEO delta*$_t$)	0.006	0.005	0.005	0.005	0.005	0.017
	(0.82)	(0.27)	(1.38)	(0.73)	(0.24)	(0.79)
ln(1+*CEO vega*$_t$)	-0.005	-0.007	0.004	-0.002	-0.007	-0.014
	(-0.97)	(-0.50)	(1.43)	(-0.54)	(-0.46)	(-0.91)
ln(*CEO tenure*$_t$)	-0.013	-0.035	0.004	-0.011	-0.034	-0.037
	(-1.56)	(-1.57)	(1.00)	(-1.48)	(-1.56)	(-1.56)
ln(*CEO age*$_t$)	0.005	-0.157	-0.039	-0.001	-0.155	0.017
	(0.08)	(-0.90)	(-1.30)	(-0.02)	(-0.89)	(0.09)
ln(*Total assets*$_t$)	0.061***	0.279***	0.000	0.056***	0.284***	0.187***
	(6.39)	(10.66)	(0.10)	(6.83)	(10.92)	(6.55)
$R\&D_t/Assets_t$	0.411**	1.266**	-0.151*	0.460**	1.288**	1.244**
	(2.15)	(2.33)	(-1.83)	(2.49)	(2.39)	(2.20)
$Leverage_t$	0.364***	1.443***	0.061**	0.336***	1.434***	1.064***
	(6.51)	(9.15)	(2.39)	(6.98)	(9.08)	(6.50)
Tobin's Q_t	-0.025***	-0.053***	0.004	-0.026***	-0.054***	-0.075***

	(-3.58)	(-2.81)	(1.13)	(-3.76)	(-2.83)	(-3.61)
CAPX$_t$/Assets$_t$	0.285	0.942*	0.006	0.202	0.914*	0.810
	(1.58)	(1.88)	(0.06)	(1.24)	(1.83)	(1.51)
ROA$_t$	0.102	0.006	-0.019	0.106*	0.022	0.321
	(1.37)	(0.04)	(-0.58)	(1.66)	(0.13)	(1.45)
Cash$_t$/Assets$_t$	-0.195***	-0.590***	0.032	-0.208***	-0.589***	-0.575***
	(-3.37)	(-3.69)	(1.32)	(-3.67)	(-3.69)	(-3.36)
PPE$_t$/Assets$_t$	-0.175**	-0.533**	-0.062**	-0.136**	-0.530**	-0.513**
	(-2.38)	(-2.48)	(-2.04)	(-2.05)	(-2.47)	(-2.36)
Cashflow vol$_t$	-0.290	-0.909*	0.192**	-0.330*	-0.913*	-0.868
	(-1.58)	(-1.85)	(2.06)	(-1.83)	(-1.86)	(-1.59)
Z-score$_t$	-0.007	0.010	0.005	-0.006	0.009	-0.022
	(-0.89)	(0.51)	(1.54)	(-0.81)	(0.43)	(-0.98)
ln(1+*Firm age$_t$*)	-0.039***	-0.095***	-0.002	-0.033***	-0.094***	-0.115***
	(-3.18)	(-2.92)	(-0.48)	(-3.22)	(-2.91)	(-3.18)
Non-debt tax shield$_t$	-0.090	0.224	0.202	-0.093	0.202	-0.297
	(-0.23)	(0.21)	(1.12)	(-0.27)	(0.19)	(-0.26)
Inventory$_t$	0.123**	0.292*	0.021	0.119**	0.286*	0.358**
	(2.10)	(1.78)	(0.92)	(2.23)	(1.76)	(2.07)
Trade credit$_t$	0.076	0.629	0.029	0.073	0.634	0.230
	(0.51)	(1.47)	(0.46)	(0.55)	(1.48)	(0.52)
ln(*Ind # CEOs$_t$*)	-0.147**	-0.409***	-1.307***	-0.127**	-0.419***	-0.449***
	(-2.54)	(-2.65)	(-25.50)	(-2.53)	(-2.72)	(-2.61)
ln(*Ind CEO comp$_t$*) (IV)			1.580***			
			(65.36)			
ln(*#Higher paid ind CEOs$_t$*) (IV)			0.420***			
			(33.51)			
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	19,631	19,631	19,631	19,631	19,631	19,631
Adj. R-squared		0.270	0.801	0.169	0.27	
Pseudo R-squared	0.146					
Endogeneity, relevance, and overidentification tests						
Exogeneity test (Wald/Hausman *p*-value)				0.071*	0.044**	0.041**
First-stage *F*-statistics				6361.44***	6361.44***	
Hansen *J* -test (*p*-value)				0.40	0.94	

Table 3: Industry tournament incentives and corporate hedging (based on FF30 size-median industry)

This table presents the results of OLS and instrumental variables (IV) estimation of ITIs on corporate hedging with year and industry fixed effects. *HEDGE* is a dummy variable assigned to one if a firm is defined to use any hedging activity (foreign exchange, interest rate, or commodity derivatives) in a given fiscal year and set to 0 otherwise. *HEDGE count* is a count of the number of times a firm mentions the use of any hedging instrument in its 10-K statement. *LN_INDGAP2* is the natural logarithm of one plus pay gap between the second-highest-paid CEO's total compensation within the same Fama-French 30 industry (FF30) size-median industry and the CEO's total compensation. In the first stage, we regress *LN_INDGAP2* variable on contemporaneous control variables and instruments. The instruments are the natural logarithms of the sum of total compensation of all other CEOs in the same industry, *Ind CEO comp* and the total number of CEOs with higher total compensation within the same industry, *#Higher paid ind CEOs*. All the other variables are defined in Appendix A. Models (1), (4), and (6) present marginal effects of Probit (IVProbit) models at the mean. *T* (Z)-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
				2SLS		2nd stage
	Probit	OLS	1st stage	2nd stage	2nd stage	IVProbit
Dependent variable	$HEDGE_{t+1}$	ln(1+$HEDGE\ count_{t+1}$)	$LN\_INDGAP2_t$	$HEDGE_{t+1}$	ln(1+$HEDGE\ count_{t+1}$)	
Predicted **$LN\_INDGAP2_t$**				**0.022*** **	**0.099*** **	**0.071*** **
				(2.80)	(3.99)	(2.62)
$LN\_INDGAP2_t$	**0.008** **	**0.028*** **				
	(2.38)	(2.90)				
ln($Firm\ gap_t$)	0.024***	0.075***	0.307***	0.029***	0.103***	0.090***
	(3.69)	(4.04)	(17.07)	(4.14)	(5.03)	(4.15)
ln(1+$CEO\ delta_t$)	0.006	0.009	0.012	0.006	0.011	0.020
	(0.86)	(0.44)	(0.93)	(0.88)	(0.54)	(0.92)
ln(1+$CEO\ vega_t$)	-0.006	-0.012	0.006	-0.003	-0.013	-0.017
	(-1.14)	(-0.86)	(0.69)	(-0.82)	(-0.91)	(-1.16)
ln($CEO\ tenure_t$)	-0.011	-0.035	0.007	-0.010	-0.036	-0.034
	(-1.42)	(-1.60)	(0.49)	(-1.39)	(-1.61)	(-1.45)
ln($CEO\ age_t$)	0.003	-0.145	-0.043	-0.004	-0.152	0.005
	(0.05)	(-0.82)	(-0.42)	(-0.07)	(-0.87)	(0.03)
ln($Total\ assets_t$)	0.055***	0.259***	0.374***	0.042***	0.231***	0.143***
	(5.47)	(9.51)	(23.99)	(4.63)	(7.78)	(4.32)
$R\&D_t/Assets_t$	0.390**	1.256**	0.886***	0.434**	1.253**	1.153**
	(2.02)	(2.30)	(3.27)	(2.34)	(2.31)	(2.03)
$Leverage_t$	0.365***	1.466***	-0.204**	0.339***	1.458***	1.075***
	(6.48)	(9.24)	(-2.30)	(6.99)	(9.22)	(6.54)
Tobin's Q_t	-0.026***	-0.055***	0.049***	-0.027***	-0.057***	-0.077***
	(-3.65)	(-2.88)	(3.98)	(-3.89)	(-2.98)	(-3.73)

$CAPX_t/Assets_t$	0.331*	1.121**	-0.391	0.256	1.127**	0.980*
	(1.85)	(2.24)	(-1.11)	(1.58)	(2.26)	(1.85)
ROA_t	0.101	0.002	-0.250**	0.108*	0.033	0.319
	(1.36)	(0.01)	(-2.18)	(1.70)	(0.19)	(1.45)
$Cash_t/Assets_t$	-0.195***	-0.582***	0.058	-0.203***	-0.550***	-0.554***
	(-3.35)	(-3.63)	(0.63)	(-3.57)	(-3.44)	(-3.22)
$PPE_t/Assets_t$	-0.179**	-0.554***	-0.556***	-0.134**	-0.517**	-0.501**
	(-2.45)	(-2.58)	(-4.34)	(-2.01)	(-2.42)	(-2.31)
Cashflow vol$_t$	-0.296	-0.937*	1.069***	-0.354*	-1.049**	-0.954*
	(-1.59)	(-1.89)	(3.29)	(-1.93)	(-2.10)	(-1.72)
Z-score$_t$	-0.007	0.010	0.038***	-0.007	0.003	-0.024
	(-0.89)	(0.50)	(3.86)	(-0.93)	(0.14)	(-1.07)
ln(1+*Firm age*$_t$)	-0.041***	-0.098***	0.036**	-0.035***	-0.101***	-0.122***
	(-3.27)	(-2.98)	(1.96)	(-3.39)	(-3.08)	(-3.35)
Non-debt tax shield$_t$	-0.096	0.130	2.157***	-0.139	-0.087	-0.424
	(-0.25)	(0.12)	(3.30)	(-0.39)	(-0.08)	(-0.37)
Inventory$_t$	0.134**	0.344**	-0.217***	0.139**	0.371**	0.415**
	(2.28)	(2.11)	(-2.76)	(2.57)	(2.31)	(2.40)
Trade credit$_t$	0.053	0.556	1.001***	0.024	0.431	0.074
	(0.35)	(1.29)	(4.93)	(0.18)	(0.99)	(0.17)
ln(*Ind # CEOs*$_t$)	-0.144***	-0.431***	0.064	-0.150***	-0.530***	-0.486***
	(-2.71)	(-2.79)	(0.34)	(-3.17)	(-3.34)	(-3.02)
ln(*Ind CEO comp*$_t$) (IV)			1.257***			
			(14.68)			
ln(*#Higher paid ind CEOs*$_t$) (IV)			1.641***			
			(36.78)			
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	19,274	19,274	19,274	19,274	19,274	19,274
Adj. R-squared		0.271	0.502	0.166	0.266	
Pseudo R-squared	0.145					
Endogeneity, relevance, and overidentification tests						
Exogeneity test (Wald/Hausman *p*-value)				0.00***	0.00***	0.03**
First-stage *F*-statistics				3534.63***	3534.63***	
Hansen *J* -test (*p*-value)				0.05	0.20	

Table 4: Industry tournament incentives and corporate hedging (with CEO-firm and year fixed effects)

This table presents the results of instrumental variables (IV) estimation of ITIs on corporate hedging with CEO-firm and year fixed effects. *HEDGE* is a dummy variable assigned to one if a firm is defined to use any hedging activity (foreign exchange, interest rate, or commodity derivatives) in a given fiscal year and set to 0 otherwise. *HEDGE count* is a count of the number of times a firm mentions the use of any hedging instrument in its 10-K statement. The details on these hedging variables are discussed in the Appendix B. *LN_INDGAP1* (*LN_INDGAP2*) is the natural logarithm of one plus pay gap between the second-highest-paid CEO's total compensation within the same FF30 industry (FF30 size-median) and the CEO's total compensation. In the first stage of 2SLS, we regress *LN_INDGAP1* (*LN_INDGAP1)* variable on contemporaneous control variables and instruments. The instruments are the natural logarithms of the sum of total compensation of all other CEOs in the same industry, *Ind CEO comp* and the average total compensation received by all other CEOs working in the firms in different industries that are headquartered within a 250-km radius of the firm, *Geo CEO mean*. All the other variables are defined in Appendix A. We include year fixed effects and CEO-firm fixed effects in all specifications. *T*-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	ITIs based on FF30 industry classification			ITIs based on FF30 size-median industry classification		
	1st stage	2nd stage 2SLS		1st stage	2nd stage 2SLS	
Dependent variable	$LN\_INDGAP1_t$	$HEDGE_{t+1}$	ln(1+$HEDGE$ $count_{t+1}$)	$LN\_INDGAP2_t$	$HEDGE_{t+1}$	ln(1+$HEDGE$ $count_{t+1}$)
Predicted $\boldsymbol{LN\_INDGAP1_t}$		**0.040*** **	**0.104*** **			
		(2.80)	(2.60)			
Predicted $\boldsymbol{LN\_INDGAP2_t}$					**0.037** **	**0.098** **
					(2.54)	(2.29)
ln($Firm\ gap_t$)	-0.158***	0.010**	0.024**	-0.490***	0.023***	0.055**
	(-22.73)	(2.39)	(1.99)	(-19.32)	(2.82)	(2.38)
ln(1+$CEO\ delta_t$)	0.005	0.003	0.008	-0.021	0.003	0.012
	(0.64)	(0.45)	(0.48)	(-0.92)	(0.46)	(0.70)
ln(1+$CEO\ vega_t$)	-0.003	-0.003	0.008	0.006	-0.003	0.006
	(-0.54)	(-0.73)	(0.73)	(0.37)	(-0.74)	(0.58)
ln($CEO\ tenure_t$)	-0.003	0.011	0.058*	-0.011	0.013	0.064**
	(-0.21)	(1.10)	(1.94)	(-0.28)	(1.26)	(2.08)
ln($CEO\ age_t$)	-1.005**	-0.141	0.429	-3.610***	-0.055	0.620
	(-2.32)	(-0.35)	(0.38)	(-2.74)	(-0.14)	(0.53)
ln($Total\ assets_t$)	-0.043**	0.048***	0.201***	0.307***	0.036**	0.171***
	(-2.53)	(3.15)	(4.33)	(5.65)	(2.22)	(3.34)
$R\&D_t/Assets_t$	-0.380*	0.126	0.499	0.668	0.111	0.480
	(-1.84)	(0.79)	(1.19)	(0.89)	(0.67)	(1.11)
$Leverage_t$	0.082*	0.081*	0.704***	0.049	0.078*	0.708***
	(1.65)	(1.78)	(5.10)	(0.30)	(1.68)	(5.02)
$Tobin's\ Q_t$	-0.001	-0.004	-0.011	0.025	-0.005	-0.014

	(-0.13)	(-0.77)	(-0.83)	(1.17)	(-0.94)	(-1.01)
CAPX$_t$/Assets$_t$	-0.194	-0.039	-0.024	-0.374	-0.037	-0.062
	(-1.46)	(-0.31)	(-0.08)	(-0.70)	(-0.29)	(-0.19)
ROA$_t$	-0.205**	-0.017	-0.117	-0.232	-0.017	-0.111
	(-2.46)	(-0.25)	(-0.64)	(-0.80)	(-0.24)	(-0.59)
Cash$_t$/Assets$_t$	-0.023	-0.096**	-0.222*	-0.345**	-0.084*	-0.190
	(-0.43)	(-2.19)	(-1.70)	(-2.12)	(-1.88)	(-1.41)
PPE$_t$/Assets$_t$	0.043	-0.004	-0.102	-0.287	0.006	-0.083
	(0.45)	(-0.05)	(-0.39)	(-0.93)	(0.07)	(-0.31)
Cashflow vol$_t$	0.014	-0.246*	-0.537	0.258	-0.262**	-0.559
	(0.09)	(-1.91)	(-1.47)	(0.45)	(-1.99)	(-1.50)
Z-score$_t$	0.016*	-0.004	0.002	0.097***	-0.006	-0.004
	(1.90)	(-0.53)	(0.09)	(3.70)	(-0.80)	(-0.22)
ln(1+*Firm age$_t$*)	0.201***	-0.061	-0.131	0.620***	-0.076	-0.178
	(3.47)	(-1.18)	(-0.85)	(3.67)	(-1.44)	(-1.14)
Non-debt tax shield$_t$	0.463	0.144	0.316	2.904**	0.037	0.153
	(1.35)	(0.49)	(0.36)	(2.47)	(0.12)	(0.17)
Inventory$_t$	0.051	0.019	-0.003	0.071	0.018	-0.006
	(0.79)	(0.39)	(-0.02)	(0.36)	(0.35)	(-0.05)
Trade credit$_t$	-0.215	-0.057	-0.401	0.221	-0.054	-0.409
	(-1.20)	(-0.38)	(-0.85)	(0.44)	(-0.36)	(-0.85)
ln(*Ind # CEOs$_t$*)	-1.333***	-0.039*	-0.125	-0.624***	-0.057**	-0.182**
	(-25.62)	(-1.82)	(-1.64)	(-3.95)	(-2.16)	(-2.06)
ln(*Ind CEO comp$_t$*) (IV)	1.738***			1.690***		
	(54.63)			(15.58)		
ln(*Geo CEO mean$_t$*) (IV)	-0.049**			0.019		
	(-2.44)			(0.29)		
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
CEO-firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	18,899	18,899	18,899	18,555	18,555	18,555
Adj. R-squared	0.795	0.064	0.126	0.487	0.035	0.098
Endogeneity, relevance, and overidentification tests						
Exogeneity test (Hausman *p*-value)		0.00***	0.00***		0.01***	0.02**
First-stage *F*-statistics		2628.41***	2628.41***		244.68***	244.65***
Hansen *J* -test (*p*-value)		0.91	0.28		0.98	0.17

Table 5: Industry tournament incentives and different types of hedging activities

This table presents the results of the 2nd stage of instrumental variables (IV) estimation of ITIs on different types of hedging instruments. *FX hedge*, *IR hedge*, and *CMD hedge* are dummy variables that set equal to one if a firm is defined to use the foreign exchange hedging, interest rate hedging, and commodity hedging, respectively, set to zero otherwise. *FX count*, *IR count*, and *CMD count* is the number of times a firm mentions its foreign exchange hedging, interest rate hedging, and commodity hedging, respectively in the 10-K statement. The details on these hedging variables are discussed in the Appendix B. *LN_INDGAP1* (*LN_INDGAP2)* is the natural logarithm of one plus pay gap between the second-highest-paid CEO's total compensation within the same FF30 (FF30 size-median) industry and the CEO's total compensation. The controls are the same as in Table 2. In the first stage, we regress *LN_INDGAP1* (*LN_INDGAP2*) variable on contemporaneous control variables and instruments. The instruments are the natural logarithms of the sum of total compensation of all other CEOs in the same industry, *Ind CEO comp*, and the total number of CEOs with higher total compensation within the same industry, *#Higher paid ind CEOs*. All the other variables are defined in Appendix A. For dummy dependent variables, we report the marginal effects of IVProbit models at the mean. *T* (Z)-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Foreign exchange hedging				Interest rate hedging			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent var	$FX\ hedge_{t+1}$		$\ln(1+FX\ count_{t+1})$		$IR\ hedge_{t+1}$		$\ln(1+IR\ count_{t+1})$	
LN_INDGAP1$_t$	**0.115****		**0.050**		**0.010***		**0.094****	
	(2.30)		(1.21)		(1.90)		(2.31)	
LN_INDGAP2$_t$		**0.089*****		**0.077*****		**0.031**		**0.046****
		(3.39)		(3.49)		(1.31)		(2.23)
Controls$_t$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	19,631	19,274	19,631	19,274	19,631	19,274	19,631	19,274
Adj. R-squared			0.279	0.276			0.244	0.243
Exogeneity test	0.59	0.00***	0.56	0.01***	0.29	0.53	0.31	0.03**
First-stage *F*-stat			6361.44***	3534.62***			6361.44***	3534.62***
Hansen *J* -test (*p*)			0.86	0.38			0.16	0.08*

Table 5 (Continued)

	Commodity hedging			
	(9)	(10)	(11)	(12)
Dependent var	*CMD hedge*$_{t+1}$		ln(1+ *CMD count*$_{t+1}$)	
LN_INDGAP1$_t$	**0.001**		**0.086*** **	
	(0.02)		(3.54)	
LN_INDGAP2$_t$		**0.016**		**0.019***
		(0.47)		(1.73)
Controls$_t$	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	19,631	19,274	19,631	19,274
Adj. R-squared			0.331	0.335
Exogeneity test	0.12	0.99	0.00***	0.11
First-stage *F*-stat			6361.44***	3534.62***
Hansen *J* -test (*p*)			0.00***	0.00***

Table 6: The effect of ITIs on stock price crash risk differing in hedging activities

This table presents the results of OLS and Tobit estimation of the effect of ITIs on stock price crash risk in the firms differing in corporate hedging activities. We use three measures of crash risk: *CRASH* is a dummy variable set to one if the firm has a weekly return that is less than 3.2 standard deviations below the average weekly return for the entire fiscal year; *DUVOL* is the natural logarithm of the ratio of the standard deviation of weekly returns for below-average weeks to the standard deviation of weekly returns for above-average weeks, over the fiscal year; *NCSKEW* is the negative conditional skewness of firm-specific weekly returns during the entire fiscal year. The detailed formation of these measures are discussed in Appendix C. *HEDGE* is a dummy variable assigned to one if a firm is defined to use any hedging activity (foreign exchange, interest rate, or commodity derivatives) in a given fiscal year and set to 0 otherwise. *HEDGE count* is a count of the number of times a firm mentions the use of any hedging instrument in its 10-K statement. The details on these hedging variables are discussed in Appendix B. The subsample with hedge dummy is equal to one if defined as *Hedgers* and with hedge dummy as zero if defined as *Non-Hedgers*. *LN_INDGAP1* is the natural logarithm of one plus pay gap between the second-highest-paid CEO's total compensation within the same Fama-French 30 industry (FF30) industry and the CEO's total compensation. All the other variables are defined in Appendix A. Models (1), (2), and (7) present marginal effects of Tobit models at the mean. *T* (Z)-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Non-Hedgers	Hedgers	Non-Hedgers	Hedgers	Non-Hedgers	Hedgers
Dependent variable	$CRASH_{t+1}$	$CRASH_{t+1}$	$DUVOL_{t+1}$	$DUVOL_{t+1}$	$NCSKEW_{t+1}$	$NCSKEW_{t+1}$
	Tobit	Tobit	OLS	OLS	OLS	OLS
$LN\_INDGAP1_t$	**0.106*****	**0.028**	**0.055*****	**0.024****	**0.159*****	**0.063****
	(2.74)	(1.04)	(3.09)	(2.18)	(3.21)	(2.06)
ln(*Firm gap*$_t$)	0.047**	0.018	0.029***	0.009	0.077***	0.027
	(2.16)	(1.07)	(2.81)	(1.15)	(2.67)	(1.23)
ln(1+*CEO delta*$_t$)	0.054***	-0.000	0.030***	0.015**	0.113***	0.047**
	(2.67)	(-0.01)	(3.16)	(2.06)	(4.17)	(2.34)
ln(1+*CEO vega*$_t$)	-0.019	-0.027***	-0.011	-0.020***	-0.037*	-0.062***
	(-1.18)	(-2.66)	(-1.38)	(-4.39)	(-1.77)	(-4.92)
ln(*CEO tenure*$_t$)	-0.046*	0.037**	-0.016	0.013*	-0.050	0.036
	(-1.83)	(2.12)	(-1.47)	(1.65)	(-1.58)	(1.57)
ln(*CEO age*$_t$)	-0.253	-0.032	-0.081	0.023	-0.215	0.129
	(-1.60)	(-0.26)	(-1.14)	(0.43)	(-1.05)	(0.87)
$DTURN_t$	3.806	2.606	0.215	1.969	2.106	6.190
	(0.89)	(0.74)	(0.11)	(1.40)	(0.37)	(1.57)
$NCSKEW_t$	0.013	0.003	0.003	-0.005	0.007	-0.008
	(0.76)	(0.24)	(0.43)	(-0.89)	(0.30)	(-0.53)
$SIGMA_t$	1.258	0.517	0.526	0.955***	1.569	2.531***
	(1.59)	(0.87)	(1.50)	(3.72)	(1.58)	(3.55)
RET_t	17.132***	10.189***	10.456***	8.259***	28.652***	22.718***

	(5.85)	(4.34)	(8.26)	(8.51)	(8.04)	(8.16)
OPAQUE$_t$	-0.619***	-0.367*	-0.426***	-0.137	-1.291***	-0.320
	(-2.61)	(-1.76)	(-3.96)	(-1.50)	(-4.16)	(-1.21)
ln(*Total assets$_t$*)	-0.035	-0.012	0.005	0.012*	-0.009	0.008
	(-1.58)	(-0.76)	(0.47)	(1.78)	(-0.31)	(0.43)
MTB$_t$	0.026*	0.052***	0.042***	0.052***	0.135***	0.166***
	(1.67)	(3.45)	(4.87)	(5.96)	(5.66)	(6.66)
Leverage$_t$	0.004	-0.029	-0.091	-0.059	-0.245	-0.127
	(0.03)	(-0.31)	(-1.40)	(-1.48)	(-1.34)	(-1.15)
ROA$_t$	0.354*	0.751***	0.153	0.390***	0.066	0.766***
	(1.70)	(4.08)	(1.64)	(4.61)	(0.25)	(3.14)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,127	10,283	5,110	10,261	5,110	10,261
Adj. R-squared			0.081	0.056	0.093	0.061
Pseudo R-squared	0.027	0.019				

Table 6 (Continued)

Dependent variable	(7)	(8)	(9)
	Full sample with the interaction of ITIs on hedging		
	CRASH$_{t+1}$	*DUVOL*$_{t+1}$	*NCSKEW*$_{t+1}$
	Tobit	OLS	OLS
LN_INDGAP1$_t$	0.088***	0.050***	0.126***
	(3.31)	(4.29)	(3.86)
LN_INDGAP1$_t$ *** ln(1+*HEDGE count***$_t$**)**	**-0.017****	**-0.007***	**-0.015**
	(-1.99)	(-1.96)	(-1.47)
ln(1+*HEDGE count*$_t$)	0.189**	0.077**	0.165*
	(2.24)	(2.13)	(1.67)
ln(*Firm gap*$_t$)	0.030**	0.018***	0.049***
	(2.24)	(2.81)	(2.78)
ln(1+*CEO delta*$_t$)	0.023*	0.022***	0.076***
	(1.87)	(3.78)	(4.63)
ln(1+*CEO vega*$_t$)	-0.027***	-0.018***	-0.056***
	(-3.18)	(-4.50)	(-5.22)
ln(*CEO tenure*$_t$)	0.007	0.003	0.004
	(0.49)	(0.42)	(0.23)
ln(*CEO age*$_t$)	-0.119	-0.013	0.004
	(-1.22)	(-0.31)	(0.04)
DTURN$_t$	3.181	1.273	4.486
	(1.16)	(1.10)	(1.38)
NCSKEW$_t$	0.008	-0.001	-0.000
	(0.81)	(-0.29)	(-0.03)
SIGMA$_t$	0.896*	0.837***	2.258***
	(1.88)	(4.04)	(3.91)
RET$_t$	13.066***	9.177***	25.296***
	(6.96)	(11.90)	(11.47)
OPAQUE$_t$	-0.465***	-0.253***	-0.711***
	(-2.97)	(-3.65)	(-3.56)
ln(*Total assets*$_t$)	-0.021	0.009	0.001
	(-1.57)	(1.57)	(0.04)
MTB$_t$	0.039***	0.046***	0.149***
	(3.62)	(7.63)	(8.74)

$Leverage_t$	-0.012	-0.060*	-0.140
	(-0.15)	(-1.76)	(-1.49)
ROA_t	0.570***	0.291***	0.482***
	(4.19)	(4.72)	(2.75)
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Observations	15,410	15,372	15,372
Adj. R-squared		0.063	0.071
Pseudo R-squared	0.019		

Table 7: The effect of ITIs on loan spread differing in hedging activities

This table presents the results of the 2SLS estimation of the effect of ITIs on loan spread in the firms differing in corporate hedging activities. *HEDGE* is a dummy variable assigned to one if a firm is defined to use any hedging activity (foreign exchange, interest rate, or commodity derivatives) in a given fiscal year and set to 0 otherwise. *HEDGE count* is a count of the number of times a firm mentions the use of any hedging instrument in its 10-K statement. The details on these hedging variables are discussed in Appendix B. The subsample with hedge dummy is equal to one if defined as *Hedgers* and with hedge dummy as zero if defined as *Non-Hedgers*. *LN_INDGAP1* is the natural logarithm of one plus pay gap between the second-highest-paid CEO's total compensation within the same Fama-French 30 industry (FF30) industry and the CEO's total compensation. The instruments are the natural logarithms of the sum of total compensation of all other CEOs in the same industry (*Ind CEO comp*), the total number of CEOs with higher total compensation within the same industry (*#Higher paid ind CEOs*), and interactions of these two variables with *ln(1+HEDGE count)*. All the other variables are defined in Appendix A. The sample period is from 1997 to 2015. *T*-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
	Hedgers	Non-Hedgers	Full sample
Dependent variable		*Ln(Loan spread$_t$)*	
Predicted ***LN_INDGAP1$_{t-1}$***	**0.082****	**0.183*****	0.117***
	(2.14)	(2.69)	(3.23)
Predicted [***LN_INDGAP1$_{t-1}$* * ln(1+*HEDGE count$_{t-1}$*)**]			**-0.015****
			(-2.10)
ln(1+*HEDGE count$_{t-1}$*)			0.169**
			(2.48)
ln(1+*CEO delta$_{t-1}$*)	0.004	-0.014	-0.003
	(0.54)	(-1.01)	(-0.48)
ln(1+*CEO vega$_{t-1}$*)	-0.006	0.027**	0.001
	(-1.08)	(2.04)	(0.16)
ln(*Total assets$_t$*)	-0.014	-0.029	-0.026
	(-0.76)	(-0.82)	(-1.45)
ln(*MTB$_t$*)	-0.130***	-0.119***	-0.129***
	(-7.80)	(-5.04)	(-9.26)
Leverage$_t$	0.463***	0.288**	0.439***
	(6.24)	(2.00)	(6.39)
ROA$_t$	-0.021	-0.102	-0.043
	(-0.15)	(-0.31)	(-0.32)
Asset maturity$_t$	0.001	0.004	0.001
	(0.34)	(0.65)	(0.36)
(*PPE$_t$/Assets$_t$*)	-0.274***	-0.476***	-0.303***
	(-3.15)	(-2.70)	(-3.76)
Cashflow vol$_t$	2.204***	2.276***	2.241***
	(7.23)	(3.59)	(8.24)
Z-score$_t$	-0.069***	-0.028	-0.055***
	(-5.43)	(-1.11)	(-4.66)
Rated Dummy$_t$	0.042*	0.069	0.040*
	(1.75)	(1.40)	(1.76)
ln(*Loan maturity$_t$*)	0.171***	0.138***	0.165***
	(10.60)	(5.79)	(11.75)
Loan Secured$_t$	0.443***	0.554***	0.469***
	(22.02)	(14.71)	(25.93)
Covenant count$_t$	0.039***	0.033**	0.037***
	(5.26)	(2.34)	(5.49)

Performance pricing$_t$	-0.139***	-0.054	-0.115***
	(-7.97)	(-1.61)	(-7.12)
ln(*No. of Lenders$_t$*)	-0.018	0.036	-0.004
	(-1.50)	(1.58)	(-0.37)
ln(*Loan Amount$_t$*)	-0.170***	-0.210***	-0.182***
	(-14.94)	(-8.42)	(-16.54)
Term loan$_t$	-0.025	0.031	-0.008
	(-0.38)	(0.32)	(-0.14)
Revolver loan$_t$	-0.276***	-0.320***	-0.282***
	(-4.11)	(-3.10)	(-4.99)
Bridge loan$_t$	0.431***	0.302*	0.440***
	(4.85)	(1.84)	(5.51)
General purpose loan$_t$	0.005	0.028	0.018
	(0.20)	(0.66)	(0.92)
Takeover/Recap loan$_t$	0.096***	0.160***	0.121***
	(3.49)	(3.17)	(5.03)
Working capital loan$_t$	0.054**	0.078*	0.065***
	(2.24)	(1.66)	(3.12)
Credit spread$_t$	-9.923***	-0.981	-8.149***
	(-5.88)	(-0.28)	(-5.55)
Term spread$_t$	7.542***	3.772***	6.844***
	(11.40)	(2.86)	(11.24)
Crisis dummy$_t$	0.061	0.210***	0.090**
	(1.46)	(2.68)	(2.49)
Post-crisis dummy$_t$	0.587***	0.748***	0.609***
	(19.41)	(13.64)	(21.80)
ln(*Ind # CEOs$_t$*)	0.123	-0.198	0.048
	(1.56)	(-1.49)	(0.70)
Industry fixed effects	Yes	Yes	Yes
Observations	8,732	2,744	11,392
Adj. R-squared	0.598	0.601	0.613
Endogeneity, relevance, and overidentification tests			
Hausman *p*-value (Endogeneity test)	0.02**	0.00***	0.01**
First-stage *F*-statistics: *LN_INDGAP1*	52.39***	21.22***	40.44***
First-stage F-statistics: *LN_INDGAP1* * ln(1+*HEDGE count*)			4212.19***
Hansen *J* -statistics	52.46	11.14	83.21

Table 8: Industry tournament incentives and corporate hedging (financial distress analysis)

This table presents the results of 2nd stage of instrumental variables (IV) estimation of ITIs on hedging varying across firms with different levels of financial distress. The dependent variable is the natural logarithm of one plus *HEDGE* count, which is a count of the number of times a firm mentions the use of any hedging instrument in its 10-K statement. The sample is grouped in two subsamples based on whether a firm has below or above sample-year median Altman *Z*-score, Merton model expected default frequency (EDF), and Naïve model expected default frequency (EDF). The Altman's *Z*-score is the modified Altman (1968) *Z*-score, where a below-median value indicates a higher likelihood of default (High distress). The Merton EDF is computed following the Merton (1974) bond pricing model, and the Naïve EDF is computed based on the "simplified" Merton model probability of default following Bharath and Shumway (2008). The above-median values of Merton and Naïve EDF indicate a higher likelihood of default (High distress). The details are in Appendix D. *LN_INDGAP1* is the natural logarithm of one plus pay gap between the second-highest-paid CEO's total compensation within the same FF30 industry and the CEO's total compensation. In the first stage, we regress *LN_INDGAP1* variable on contemporaneous control variables and instruments. The instruments are the natural logarithms of the sum of total compensation of all other CEOs in the same industry, *Ind CEO comp*, and the total number of CEOs with higher total compensation within the same industry, *#Higher paid ind CEOs*. All the other variables are defined in Appendix A. *T*-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Altman's Z-score		Merton EDF		Naïve EDF	
	(1)	(2)	(3)	(4)	(5)	(6)
	Low distress	High distress	Low distress	High distress	Low distress	High distress
Dependent variable	ln(1+*HEDGE count*$_{t+1}$)					
Predicted ***LN_INDGAP1***$_t$	**0.216*****	**0.086**	**0.238*****	**0.033**	**0.237*****	**0.036**
	(3.73)	(1.37)	(3.61)	(0.53)	(3.60)	(0.58)
ln(*Firm gap*$_t$)	0.054**	0.065***	0.099***	0.038	0.099***	0.039
	(2.33)	(2.65)	(3.57)	(1.43)	(3.57)	(1.45)
ln(1+*CEO delta*$_t$)	-0.010	0.042	-0.008	0.037	-0.009	0.038
	(-0.36)	(1.54)	(-0.26)	(1.40)	(-0.28)	(1.42)
ln(1+*CEO vega*$_t$)	0.017	-0.042**	0.011	-0.034*	0.011	-0.034*
	(0.94)	(-2.15)	(0.55)	(-1.70)	(0.57)	(-1.73)
ln(*CEO tenure*$_t$)	-0.058**	-0.011	-0.052	-0.036	-0.051	-0.037
	(-2.04)	(-0.41)	(-1.55)	(-1.27)	(-1.54)	(-1.28)
ln(*CEO age*$_t$)	-0.036	-0.204	0.181	-0.201	0.183	-0.201
	(-0.17)	(-0.87)	(0.70)	(-0.85)	(0.70)	(-0.85)
ln(*Total assets*$_t$)	0.324***	0.220***	0.240***	0.274***	0.240***	0.275***
	(9.24)	(6.53)	(6.08)	(8.40)	(6.05)	(8.44)
R&D$_t$*/Assets*$_t$	1.318*	1.112*	0.735	0.455	0.739	0.450
	(1.93)	(1.80)	(0.85)	(0.66)	(0.85)	(0.65)
Leverage$_t$	2.069***	0.832***	1.860***	0.853***	1.867***	0.851***
	(8.84)	(4.10)	(7.02)	(4.19)	(7.05)	(4.18)
Tobin's Q$_t$	-0.022	-0.105**	-0.034	-0.054	-0.033	-0.057
	(-1.11)	(-2.18)	(-1.25)	(-1.53)	(-1.21)	(-1.62)

$CAPX_t/Assets_t$	1.016	0.910	1.772**	0.409	1.784**	0.392
	(1.49)	(1.44)	(2.11)	(0.69)	(2.12)	(0.66)
ROA_t	-0.491	0.501	-0.345	0.197	-0.351	0.193
	(-1.37)	(1.63)	(-0.72)	(0.63)	(-0.73)	(0.62)
$Cash_t/Assets_t$	-0.221	-1.130***	0.029	-0.864***	0.028	-0.860***
	(-1.22)	(-5.00)	(0.12)	(-3.85)	(0.12)	(-3.83)
$PPE_t/Assets_t$	-1.098***	-0.339	-0.828**	-0.297	-0.826**	-0.298
	(-3.45)	(-1.37)	(-2.50)	(-1.25)	(-2.50)	(-1.25)
Cashflow vol$_t$	0.345	-1.436**	-0.471	-1.500**	-0.448	-1.508**
	(0.50)	(-2.44)	(-0.58)	(-2.33)	(-0.55)	(-2.34)
Z-score$_t$	0.019	0.027	-0.005	0.001	-0.004	-0.000
	(0.54)	(1.17)	(-0.13)	(0.02)	(-0.10)	(-0.02)
ln(1+*Firm age*$_t$)	-0.111*	-0.062	-0.101*	-0.068	-0.097	-0.070
	(-1.96)	(-1.26)	(-1.71)	(-1.39)	(-1.64)	(-1.44)
Non-debt tax shield$_t$	2.063	-0.368	2.580	-0.981	2.608	-0.976
	(1.44)	(-0.29)	(1.51)	(-0.75)	(1.52)	(-0.75)
Inventory$_t$	0.624***	-0.180	0.486**	-0.081	0.481**	-0.075
	(3.42)	(-0.84)	(2.02)	(-0.41)	(2.00)	(-0.38)
Trade credit$_t$	0.362	0.794	0.486	0.721	0.470	0.724
	(0.63)	(1.60)	(0.74)	(1.43)	(0.71)	(1.44)
ln(*Ind # CEOs*$_t$)	-0.407**	-0.341*	-0.318	-0.443**	-0.318	-0.445**
	(-1.98)	(-1.72)	(-1.57)	(-2.03)	(-1.57)	(-2.03)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,817	9,814	8,270	8,264	8,271	8,263
Adj. R-squared	0.182	0.127	0.123	0.122	0.122	0.122
Endogeneity, relevance, and overidentification tests						
Exogeneity test (*p*-value)	0.20	0.20	0.04**	0.56	0.04**	0.57
First-stage *F*-statistics	3567.20***	2883.91***	2564.14***	2579.08***	2562.26***	2584.37***
Hansen *J* -test (*p*-value)	0.38	0.95	0.81	0.93	0.83	0.92

Table 9: Untangling the effect of ITIs on corporate hedging based on the likelihood of a CEO to move

This table presents the results of instrumental variables (IV) estimation of ITIs on corporate hedging differing in the likelihood of a CEO to move. CEO is defined as a founder CEO based on ExecuComp's title variable. CEO is defined as a retiring CEO if the age of CEO is greater than 65 years. *HEDGE* is a dummy variable assigned to one if a firm is defined to use any hedging activity (foreign exchange, interest rate, or commodity derivatives) in a given fiscal year and set to 0 otherwise. *HEDGE count* is a count of the number of times a firm mentions the use of any hedging instrument in its 10-K statement. The details on these hedging variables are discussed in the Appendix B. *LN_INDGAP1* is the natural logarithm of one plus pay gap between the second-highest-paid CEO's total compensation within the same Fama-French 30 industry and the CEO's total compensation. In the first stage, we regress the industry pay gap variable on contemporaneous control variables and instruments. The instruments are the natural logarithms of the sum of total compensation of all other CEOs in the same industry, *Ind CEO comp* and the total number of CEOs with higher total compensation within the same industry, *#Higher paid ind CEOs*. All the other variables are defined in Appendix A. We use 2SLS model for *HEDGE count* variable and IVProbit model for *HEDGE* variable. Models (3), (4), (7), and (8) present marginal effects of IVProbit models at the mean. *T* (Z)-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Founder CEO	Non-Founder CEO	Founder CEO	Non-Founder CEO	Retiring CEO	Non-Retiring CEO	Retiring CEO	Non-Retiring CEO
Dependent variable	ln(1+*HEDGE count*$_{t+1}$)		*HEDGE*$_{t+1}$		ln(1+*HEDGE count*$_{t+1}$)		*HEDGE*$_{t+1}$	
Predicted ***LN_INDGAP1***$_t$	**0.106**	**0.158*** **	**0.117**	**0.190*** **	**0.202**	**0.154*** **	**0.198**	**0.193*** **
	(0.80)	(3.33)	(0.57)	(3.64)	(1.35)	(3.25)	(1.08)	(3.70)
ln(*Firm gap*$_t$)	-0.006	0.083***	-0.047	0.080***	-0.011	0.086***	-0.023	0.090***
	(-0.11)	(4.33)	(-0.65)	(3.91)	(-0.21)	(4.71)	(-0.36)	(4.54)
ln(1+*CEO delta*$_t$)	-0.095	0.015	-0.081	0.028	0.030	0.006	0.096*	0.009
	(-1.50)	(0.74)	(-0.93)	(1.23)	(0.66)	(0.26)	(1.65)	(0.39)
ln(1+*CEO vega*$_t$)	0.048	-0.013	0.068	-0.020	0.019	-0.011	-0.006	-0.013
	(1.19)	(-0.86)	(1.19)	(-1.31)	(0.57)	(-0.72)	(-0.13)	(-0.83)
ln(*CEO tenure*$_t$)	-0.131	-0.041*	-0.107	-0.044*	-0.020	-0.038*	-0.062	-0.036
	(-1.35)	(-1.81)	(-0.75)	(-1.83)	(-0.35)	(-1.67)	(-0.87)	(-1.46)
ln(*CEO age*$_t$)	0.278	-0.231	1.012	-0.060	-0.627	-0.133	-0.474	-0.050
	(0.61)	(-1.27)	(1.41)	(-0.31)	(-0.47)	(-0.69)	(-0.28)	(-0.24)
ln(*Total assets*$_t$)	0.400***	0.277***	0.465***	0.181***	0.372***	0.276***	0.281***	0.180***
	(5.37)	(10.39)	(4.22)	(6.22)	(6.17)	(10.34)	(3.43)	(6.17)
R&D$_t$*/Assets*$_t$	-0.933	1.666***	1.302	1.222**	0.462	1.330**	0.579	1.192**
	(-0.84)	(2.87)	(0.75)	(2.04)	(0.28)	(2.44)	(0.28)	(2.10)
Leverage$_t$	1.684***	1.424***	2.219***	1.055***	1.966***	1.374***	1.792***	1.033***
	(3.93)	(8.68)	(3.93)	(6.16)	(4.92)	(8.51)	(3.56)	(6.15)
Tobin's Q$_t$	0.038	-0.060***	-0.004	-0.076***	-0.022	-0.054***	-0.046	-0.071***
	(0.66)	(-2.99)	(-0.06)	(-3.49)	(-0.48)	(-2.74)	(-0.71)	(-3.27)

$CAPX_t/Assets_t$	-1.329	1.011*	-0.420	0.861	-0.632	1.027**	0.262	0.863
	(-1.06)	(1.92)	(-0.26)	(1.53)	(-0.50)	(2.02)	(0.14)	(1.58)
ROA_t	-0.150	-0.079	-0.700	0.230	-1.763**	0.087	-1.276	0.298
	(-0.19)	(-0.31)	(-0.58)	(0.79)	(-2.26)	(0.34)	(-1.32)	(1.01)
$Cash_t/Assets_t$	-1.361***	-0.507***	-1.571***	-0.462***	-0.793	-0.569***	-1.238**	-0.548***
	(-3.29)	(-3.11)	(-2.68)	(-2.60)	(-1.48)	(-3.59)	(-2.11)	(-3.17)
$PPE_t/Assets_t$	0.655	-0.587***	0.293	-0.526**	0.159	-0.558***	-0.184	-0.521**
	(1.12)	(-2.70)	(0.37)	(-2.37)	(0.29)	(-2.59)	(-0.27)	(-2.39)
Cashflow vol_t	-1.209	-0.880*	-1.505	-0.764	-0.220	-0.977*	-2.712	-0.857
	(-0.75)	(-1.73)	(-0.65)	(-1.36)	(-0.14)	(-1.94)	(-1.39)	(-1.55)
$Z\text{-}score_t$	-0.028	0.020	0.007	-0.011	0.035	0.008	0.034	-0.019
	(-0.49)	(0.94)	(0.08)	(-0.49)	(0.52)	(0.40)	(0.43)	(-0.82)
ln(1+*Firm* age_t)	-0.067	-0.091***	-0.255	-0.113***	-0.034	-0.099***	-0.232**	-0.106***
	(-0.57)	(-2.74)	(-1.34)	(-3.05)	(-0.42)	(-2.98)	(-2.13)	(-2.90)
Non-debt tax $shield_t$	2.342	0.293	3.358	-0.249	-3.960	0.482	-6.794*	0.173
	(0.83)	(0.27)	(0.76)	(-0.21)	(-1.43)	(0.45)	(-1.82)	(0.15)
$Inventory_t$	0.826*	0.235	0.820	0.349*	0.280	0.321*	0.748	0.352**
	(1.78)	(1.40)	(1.36)	(1.93)	(0.68)	(1.95)	(1.56)	(1.99)
Trade $credit_t$	0.546	0.640	1.349	0.055	0.243	0.618	0.471	0.166
	(0.50)	(1.45)	(0.88)	(0.12)	(0.22)	(1.41)	(0.33)	(0.37)
ln(*Ind # CEOs*$_t$)	-0.535	-0.389**	-2.206**	-0.400**	-0.732*	-0.388**	-0.575	-0.418**
	(-1.05)	(-2.44)	(-2.52)	(-2.26)	(-1.74)	(-2.41)	(-1.01)	(-2.33)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,446	18,185	1,384	18,185	1,400	18,231	1,370	18,231
Adj. R-squared	0.471	0.268			0.349	0.268		
Endogeneity, relevance, and overidentification tests								
Exogeneity test (Hausman/Wald *p*-value)	0.20	0.06*	0.59	0.07*	0.19	0.11	0.27	0.08*
First-stage *F*-statistics	275.39***	5823.15***			293.59***	5924.73***		
Hansen *J* -test (*p*-value)	0.10	0.99			0.50	0.80		

Table 10: Effect of enforceability of non-competition agreements on the relation between ITIs and corporate hedging

This table presents the results of OLS and instrumental variables (IV) estimation of ITIs on corporate hedging differing in enforceability of non-competition agreements. *NON_COMPETE* takes on the value of +1 for firms headquartered in Florida from 1997-2016, in Kentucky from 2007-2016, in Idaho and Oregon from 2009-2016, in Texas and Wisconsin from 2010-2016, in Colorado and Georgia from 2012-2016, in Illinois from 2012-2013, and in Virginia from 2014-2016; takes the value of -1 for firms in Texas from 1995-2006, in Louisiana from 2002-2003, in South Carolina from 2011-2016, and in Montana from 2012-2016; and is set to equal 0 otherwise. Panel A reports OLS estimation for each group partitioned based on the number of in state competitors in the year greater than 5, 14, and 43 (25^{th}, 50^{th}, and 75^{th} percentiles, respectively). Panel B reports the second stage of IV estimation where *ENFORCE* is set equal to one if non-competition agreement is enacted in the state for the given year, otherwise set to zero. *HEDGE* is a dummy variable assigned to one if a firm is defined to use any hedging activity (foreign exchange, interest rate, or commodity derivatives) in a given fiscal year and set to 0 otherwise. *HEDGE count* is a count of the number of times a firm mentions the use of any hedging instrument in its 10-K statement. *LN_INDGAP1* (*LN_INDGAP2*) is the natural logarithm of one plus pay gap between the second-highest-paid CEO's total compensation within the same Fama-French 30 industry (FF30 size-median) and the CEO's total compensation. For Panel B, in the first stage, we regress industry pay gap variables on contemporaneous control variables and instruments. The instruments are the natural logarithms of the sum of total compensation of all other CEOs in the same industry, *Ind CEO comp*, and the total number of CEOs with higher total compensation within the same industry, *#Higher paid ind CEOs*. All the other variables are defined in Appendix A. We use 2SLS model for *HEDGE count* variable and IVProbit model for indicator *HEDGE* variable. Models (1), (2), (5), and (6) in Panel B present marginal effects of IVProbit models at the mean. *T* (Z)-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: OLS estimation for enforceability of non-competition agreements on the relation between ITIs and corporate hedging

	ITIs based on FF30 industry classification			ITIs based on FF30 size-median industry classification		
Dependent var = ln(1+*HEDGE count*$_t$)	(1) #In-state competitors > 5	(2) #In-state competitors > 14	(3) #In-state competitors > 43	(4) #In-state competitors > 5	(5) #In-state competitors > 14	(6) #In-state competitors > 43
LN_INDGAP1$_t$* NON_COMPETE$_t$	**-0.007**	**0.031**	**-0.130****			
	(-0.22)	(0.90)	(-2.51)			
LN_INDGAP1$_t$	0.105***	0.080*	0.144**			
	(3.12)	(1.89)	(2.21)			
LN_INDGAP2$_t$* NON_COMPETE$_t$				**-0.027**	**0.010**	**-0.127****
				(-0.86)	(0.28)	(-2.42)
LN_INDGAP2$_t$				0.049***	0.057***	0.090***
				(3.44)	(3.11)	(3.16)
NON_COMPETE$_t$	0.063	-0.244	1.316***	0.245	-0.049	1.260***
	(0.22)	(-0.75)	(2.79)	(0.86)	(-0.15)	(2.59)
ln(*Firm gap$_t$*)	0.066***	0.073***	0.092***	0.071***	0.082***	0.102***
	(2.91)	(2.97)	(2.77)	(3.06)	(3.25)	(3.03)
ln(1+*CEO delta$_t$*)	-0.016	-0.017	0.014	-0.015	-0.016	0.016

	(-0.68)	(-0.61)	(0.36)	(-0.66)	(-0.58)	(0.42)
ln(1+*CEO vega*$_t$)	-0.021	-0.021	-0.029	-0.021	-0.022	-0.035
	(-1.11)	(-0.91)	(-0.87)	(-1.14)	(-0.97)	(-1.05)
ln(*CEO tenure*$_t$)	-0.003	-0.001	-0.081*	-0.003	0.001	-0.081*
	(-0.12)	(-0.02)	(-1.69)	(-0.11)	(0.02)	(-1.69)
ln(*CEO age*$_t$)	-0.075	-0.186	0.020	-0.086	-0.206	-0.012
	(-0.34)	(-0.74)	(0.06)	(-0.39)	(-0.82)	(-0.03)
ln(*Total assets*$_{t-1}$)	0.311***	0.334***	0.337***	0.287***	0.310***	0.301***
	(9.61)	(9.03)	(7.23)	(8.49)	(8.03)	(6.01)
R&D$_{t-1}$*/Assets*$_{t-1}$	0.721	0.692	1.041	0.711	0.690	1.041
	(1.20)	(1.09)	(1.39)	(1.19)	(1.09)	(1.39)
Leverage$_{t-1}$	1.364***	1.163***	0.926***	1.378***	1.170***	0.938***
	(6.90)	(4.87)	(3.20)	(6.99)	(4.91)	(3.23)
Tobin's Q$_{t-1}$	-0.025	-0.032	-0.048*	-0.025	-0.033	-0.046*
	(-1.20)	(-1.44)	(-1.76)	(-1.23)	(-1.46)	(-1.68)
CAPX$_{t-1}$*/Assets*$_{t-1}$	-0.027	-0.217	-0.840	0.050	-0.144	-0.716
	(-0.04)	(-0.33)	(-0.97)	(0.08)	(-0.22)	(-0.83)
ROA$_{t-1}$	-0.189	-0.160	-0.050	-0.196	-0.160	-0.077
	(-0.63)	(-0.50)	(-0.13)	(-0.66)	(-0.50)	(-0.20)
Cash$_{t-1}$*/Assets*$_{t-1}$	-0.915***	-0.815***	-0.933***	-0.895***	-0.791***	-0.913***
	(-4.87)	(-3.75)	(-3.89)	(-4.76)	(-3.64)	(-3.80)
PPE$_{t-1}$*/Assets*$_{t-1}$	0.014	-0.105	0.353	0.019	-0.101	0.350
	(0.05)	(-0.33)	(0.82)	(0.07)	(-0.32)	(0.82)
Cashflow vol$_{t-1}$	-0.404	-0.910	-1.307	-0.464	-0.985	-1.462*
	(-0.70)	(-1.42)	(-1.55)	(-0.80)	(-1.53)	(-1.73)
Z-score$_{t-1}$	0.021	0.018	0.022	0.020	0.016	0.020
	(0.90)	(0.76)	(0.76)	(0.86)	(0.66)	(0.67)
ln(1+*Firm age*$_{t-1}$)	-0.179***	-0.182***	-0.337***	-0.181***	-0.182***	-0.337***
	(-3.39)	(-2.81)	(-3.44)	(-3.43)	(-2.83)	(-3.46)
Non-debt tax shield$_{t-1}$	-0.133	0.084	0.947	-0.199	0.058	0.911
	(-0.11)	(0.06)	(0.55)	(-0.16)	(0.04)	(0.53)
Inventory$_{t-1}$	0.037	0.018	0.017	0.057	0.039	0.032
	(0.20)	(0.08)	(0.06)	(0.30)	(0.18)	(0.12)
Trade credit$_{t-1}$	0.305	0.744	1.252	0.229	0.645	1.123
	(0.54)	(1.18)	(1.52)	(0.41)	(1.02)	(1.35)
ln(*Ind # CEOs*$_t$)	-0.358	-0.202	-0.043	-0.338	-0.175	0.118
	(-1.58)	(-0.63)	(-0.08)	(-1.56)	(-0.57)	(0.22)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,455	7,700	3,924	11,455	7,700	3,924
Adj. R-squared	0.293	0.314	0.354	0.293	0.316	0.356

Panel B: IV estimation for enforceability of non-competition agreements on the relation between ITIs and corporate hedging

	ITIs based on FF30 industry classification			
	(1)	(2)	(3)	(4)
	ENFORCE = 1	ENFORCE = 0	ENFORCE = 1	ENFORCE = 0
Dependent variable	$HEDGE_{t+1}$		ln(1+$HEDGE\ count_{t+1}$)	
Predicted ***$LN\_INDGAP1_t$***	**-0.184**	**0.221*****	**-0.046**	**0.176*****
	(-1.18)	(4.24)	(-0.35)	(3.80)
ln($Firm\ gap_t$)	0.021	0.076***	0.039	0.072***
	(0.34)	(3.66)	(0.68)	(3.88)
ln(1+$CEO\ delta_t$)	-0.042	0.031	0.004	0.006
	(-0.81)	(1.34)	(0.08)	(0.29)
ln(1+$CEO\ vega_t$)	-0.019	-0.019	-0.015	-0.012
	(-0.52)	(-1.22)	(-0.48)	(-0.80)
ln($CEO\ tenure_t$)	-0.052	-0.037	-0.041	-0.034
	(-0.78)	(-1.51)	(-0.73)	(-1.51)
ln($CEO\ age_t$)	-0.031	0.005	-0.336	-0.120
	(-0.06)	(0.02)	(-0.78)	(-0.68)
ln($Total\ assets_t$)	0.351***	0.176***	0.365***	0.273***
	(4.66)	(5.82)	(5.78)	(10.00)
$R\&D_t/Assets_t$	-1.526	0.561	0.941	0.696
	(-0.63)	(0.96)	(0.50)	(1.34)
$Leverage_t$	1.451***	1.098***	1.647***	1.440***
	(3.24)	(6.59)	(4.20)	(9.16)
$Tobin's\ Q_t$	-0.088	-0.067***	-0.090*	-0.045**
	(-1.34)	(-3.13)	(-1.80)	(-2.36)
$CAPX_t/Assets_t$	1.454	0.538	0.103	0.785
	(1.00)	(0.98)	(0.10)	(1.55)
ROA_t	-0.037	0.318	-0.473	0.053
	(-0.04)	(1.04)	(-0.74)	(0.21)
$Cash_t/Assets_t$	0.253	-0.836***	1.084**	-0.855***
	(0.39)	(-4.77)	(2.04)	(-5.48)
$PPE_t/Assets_t$	-0.083	-0.488**	0.538	-0.565**
	(-0.18)	(-2.05)	(1.29)	(-2.49)
$Cashflow\ vol_t$	-1.293	-0.692	-1.656	-0.558

	(-0.85)	(-1.23)	(-1.32)	(-1.12)
Z-score$_t$	0.028	-0.022	0.037	0.007
	(0.44)	(-0.94)	(0.69)	(0.36)
ln(1+*Firm age$_t$*)	-0.311***	-0.080*	-0.155*	-0.070
	(-2.67)	(-1.67)	(-1.79)	(-1.57)
Non-debt tax shield$_t$	-2.176	-0.299	-1.455	-0.021
	(-0.70)	(-0.26)	(-0.57)	(-0.02)
Inventory$_t$	-0.269	0.285	-0.316	0.247
	(-0.51)	(1.59)	(-0.79)	(1.51)
Trade credit$_t$	1.034	-0.148	2.122**	0.190
	(0.90)	(-0.31)	(2.28)	(0.42)
ln(*Ind # CEOs$_t$*)	0.752	-0.534***	0.178	-0.544***
	(1.21)	(-2.94)	(0.34)	(-3.39)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes
Observations	2,296	17,335	2,296	17,335
Adj. R-squared			0.224	0.190
Endogeneity, relevance, and overidentification tests				
Exogeneity test (Hausman/Wald *p*-value)	0.05*	0.03**	0.30	0.06*
First-stage *F*-statistics			671.12***	5911.47***
Hansen *J* -test (*p*-value)			0.64	0.95

Panel B: IV estimation for enforceability of non-competition agreements on the relation between ITIs and corporate hedging (Continued)

	ITIs based on FF30 size-median industry classification			
	(5) ENFORCE = 1	(6) ENFORCE = 0	(7) ENFORCE = 1	(8) ENFORCE = 0
Dependent variable	$HEDGE_{t+1}$		ln(1+$HEDGE\ count_{t+1}$)	
Predicted ***LN_INDGAP2$_t$***	**0.060**	**0.076*****	**0.075**	**0.101*****
	(0.80)	(2.73)	(1.26)	(4.00)
ln(*Firm gap$_t$*)	0.085	0.086***	0.098	0.096***
	(1.15)	(3.77)	(1.47)	(4.58)
ln(1+*CEO delta$_t$*)	-0.041	0.035	0.011	0.012
	(-0.78)	(1.50)	(0.22)	(0.56)
ln(1+*CEO vega$_t$*)	-0.025	-0.023	-0.024	-0.017
	(-0.68)	(-1.48)	(-0.76)	(-1.15)
ln(*CEO tenure$_t$*)	-0.039	-0.035	-0.045	-0.034
	(-0.57)	(-1.43)	(-0.78)	(-1.52)
ln(*CEO age$_t$*)	-0.062	-0.007	-0.287	-0.125
	(-0.12)	(-0.04)	(-0.67)	(-0.70)
ln(*Total assets$_t$*)	0.349***	0.129***	0.342***	0.220***
	(4.35)	(3.70)	(5.06)	(7.09)
$R\&D_t/Assets_t$	-1.488	0.461	1.179	0.645
	(-0.62)	(0.79)	(0.64)	(1.23)
$Leverage_t$	1.394***	1.112***	1.625***	1.461***
	(3.10)	(6.64)	(4.13)	(9.23)
Tobin's Q_t	-0.066	-0.069***	-0.080	-0.048**
	(-1.03)	(-3.28)	(-1.64)	(-2.52)
$CAPX_t/Assets_t$	1.369	0.772	0.308	0.997**
	(0.94)	(1.41)	(0.29)	(1.96)
ROA_t	-0.218	0.293	-0.592	0.061
	(-0.26)	(0.96)	(-0.92)	(0.24)
$Cash_t/Assets_t$	0.365	-0.808***	1.172**	-0.818***
	(0.55)	(-4.58)	(2.14)	(-5.23)
$PPE_t/Assets_t$	-0.116	-0.485**	0.483	-0.548**
	(-0.25)	(-2.07)	(1.15)	(-2.43)
Cashflow vol$_t$	-1.939	-0.785	-2.045	-0.701

	(-1.29)	(-1.37)	(-1.57)	(-1.38)
Z-score$_t$	0.013	-0.024	0.026	0.002
	(0.20)	(-0.98)	(0.49)	(0.10)
ln(1+*Firm age*$_t$)	-0.323***	-0.089*	-0.165*	-0.078*
	(-2.72)	(-1.83)	(-1.89)	(-1.73)
Non-debt tax shield$_t$	-1.735	-0.412	-1.249	-0.317
	(-0.56)	(-0.36)	(-0.49)	(-0.30)
Inventory$_t$	-0.235	0.342*	-0.125	0.301*
	(-0.42)	(1.92)	(-0.29)	(1.85)
Trade credit$_t$	0.917	-0.308	1.939**	-0.009
	(0.77)	(-0.64)	(2.02)	(-0.02)
ln(*Ind # CEOs*$_t$)	0.628	-0.573***	0.119	-0.662***
	(1.04)	(-3.43)	(0.23)	(-4.10)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes
Observations	2,242	17,032	2,197	17,074
Adj. R-squared			0.229	0.185
Endogeneity, relevance, and overidentification tests				
Exogeneity test (Hausman/Wald *p*-value)	0.81	0.02**	0.80	0.00***
First-stage *F*-statistics			309.95***	3242.49***
Hansen *J* -test (*p*-value)			0.35	0.13

Table 11: Industry tournament incentives and corporate hedging in various industries

This table presents the results of 2SLS estimation of ITIs on corporate hedging for different Fama-French 30 (FF30) industries. Due to a small number of firms, we combine firms in Food Products, Beer and Liquor, and Tobacco Products together. We also merge firms in Mines and Coal industry due to the same reason. We separately run our main model in Table 2 for each FF30 industry. We report the coefficients on predicted *LN_INDGAP1* variable in the 2nd stage regression where the dependent variable is ln(1+*HEDGE count*). *HEDGE count* is the count a firm mentions the use of any hedging instrument in its 10-K statement. *LN_INDGAP1* is the natural logarithm of one plus pay gap between the second-highest-paid CEO's total compensation within the same Fama-French 30 industry and the CEO's total compensation. In the first stage, we regress *LN_INDGAP1* variable on contemporaneous control variables and instruments. The instruments are the natural logarithms of the sum of total compensation of all other CEOs in the same industry, *Ind CEO comp* and the total number of CEOs with higher total compensation within the same industry, *#Higher paid ind CEOs*. All the control variables are defined in Appendix A. *T*-statistics are computed using robust standard errors corrected for clustering of observations at the firm level. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Fama French-30 Industry	Coefficient on Predicted $LN\_INDGAP1_t$	*T*-statistics	N
Food Products, Beer and Liquor, and Tobacco	0.077	0.30	667
Games & Recreation	0.205	0.65	299
Books, Printing and Publishing	0.128	0.41	285
Household Consumer Goods	-0.161	-0.33	406
Clothing and Accessories	-0.830	-1.44	382
Healthcare, Medical Equip. & Pharmaceuticals	0.151	0.54	2,093
Chemicals	-0.082	-0.24	674
Textiles	1.607	1.32	104
Construction and Construction Materials	-0.156	-0.41	723
Steel Works	0.114	0.45	411
Fabricated Products and Machinery	0.362	1.30	968
Electrical Equipment	0.739	1.46	288
Automobiles and Trucks	-0.235	-0.58	409
Aircraft, Ships and Railroad Equipment	0.635**	2.37	161
Mines & Coal	1.295***	3.23	180
Oil, Petroleum and Natural Gas	0.598**	2.28	960
Telecommunications	-0.484	-1.17	469
Personal and Business Services	0.258	0.63	2,585
Business Equipment	0.580***	2.60	3,126
Paper and Business Supplies	-0.361	-1.29	548
Transportation	0.609*	1.77	714
Wholesale	0.128	0.24	869
Retail	0.482**	1.97	1,561
Restaurants, Hotels, Motels	0.015	0.05	441
Others	0.799*	1.92	308

Table 12: Robustness check: scaled measure of ITIs and FF48 industry classification

This table presents the 2nd stage results of instrumental variables (IV) estimation of ITIs on corporate hedging. *HEDGE* is a dummy variable assigned to one if a firm is defined to use any hedging activity (foreign exchange, interest rate, or commodity derivatives) in a given fiscal year and set to 0 otherwise. *HEDGE count* is a count of the number of times a firm mentions the use of any hedging instrument in its 10-K statement. The details on these hedging variables are discussed in the Appendix B. *INDGAP1* (*INDGAP2*) is the pay gap between the second-highest-paid CEO's total compensation within the same Fama-French 30 or 48 (size-median) industry and the CEO's total compensation. *Scaled_INDGAP1* (*Scaled_INDGAP2*) is the *INDGAP1 (INDGAP2*) divided by CEO's total compensation. *LN_INDGAP1* **(***LN_INDGAP2***)** is the natural logarithm of one plus the industry pay gap variable. The controls are the same as in Table 2. In the first stage, we regress respective industry pay gap variable on contemporaneous control variables and instruments. The instruments are the natural logarithms of the sum of total compensation of all other CEOs in the same industry, *Ind CEO comp*, and the total number of CEOs with higher total compensation within the same industry, *#Higher paid ind CEOs*. For the models using scaled variables on industry pay gap, we also use scaled variable on *Firm gap* by dividing it by the CEO's total compensation. All the other variables are defined in Appendix A. Models (1), (3), (5), and (6) present marginal effects of IVProbit models at the mean. *T* (Z)-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Scaled measure of ITIs based on FF30 industry		Scaled measure of ITIs based on FF30 size-median industry	
	(1)	(2)	(3)	(4)
Dependent variable	*HEDGE*$_{t+1}$	ln(1+*HEDGE count*$_{t+1}$)	*HEDGE*$_{t+1}$	ln(1+*HEDGE count*$_{t+1}$)
Scaled_INDGAP1$_t$	**0.011*****	**0.009*****		
	(3.72)	(3.23)		
Scaled_INDGAP2$_t$			**0.014*****	**0.019*****
			(2.63)	(3.63)
Controls$_t$	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	19,631	19,631	19,274	19,274
Adj. R-squared		0.260		0.263
Endogeneity, relevance, and overidentification tests				
Exogeneity test (Wald/Hausman *p*-value)	0.00***	0.00***	0.00***	0.00***
First-stage *F*-statistics		1178.70***		2545.67***
Hansen *J* -test (*p*-value)		0.60		0.57

Table 12 (continued)

	ITIs based on FF48 industry		ITIs based on FF48 size-median industry	
	(5)	(6)	(7)	(8)
Dependent variable	$HEDGE_{t+1}$	ln(1+$HEDGE\ count_{t+1}$)	$HEDGE_{t+1}$	ln(1+$HEDGE\ count_{t+1}$)
***LN_INDGAP1**$_t$*	**0.192*** **	**0.162*** **		
	(3.78)	(3.55)		
***LN_INDGAP2**$_t$*			**0.071*** **	**0.071*** **
			(2.71)	(2.94)
Controls$_t$	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Observations	19,628	19,628	19,293	19,293
Adj. R-squared		0.283		0.281
Endogeneity, relevance, and overidentification tests				
Exogeneity test (Wald/Hausman *p*-value)	0.05**	0.01***	0.03**	0.00***
First-stage *F*-statistics		4838.35***		2297.16***
Hansen *J* -test (*p*-value)		0.66		0.08*

APPENDIX F

DATA SOURCES AND DEFINITIONS FOR CHAPTER III

Variable	Definition
Panel A: Dependent variables	
Reserve Error variables	
KFS error/Asset	Reserve error measure computed as the difference between cumulative incurred losses at year t and year t+5 scaled by total net admitted assets. (NAIC)
Weiss error/Asset	Reserve error measure computed as the difference between cumulative incurred losses at year t and cumulative developed losses paid at year t+5 scaled by total net admitted assets. (NAIC)
Risk-Taking variables	
Std_5(Loss ratio)	The standard deviation of the firm's loss ratio over five-year rolling periods, where the loss ratio is the ratio of loss incurred divided by premiums earned. (NAIC)
Std_5(ROI)	The standard deviation of return on investment (ROI) over five-year rolling periods, where ROI is measured by the ratio of net investment gain divided by investment assets. (NAIC)
Std_5(ROA)	The standard deviation of return on assets (ROA) over five-year rolling periods, where ROA is calculated as the ratio of net income divided by net admitted assets. (NAIC)
Var(Return)	Return volatility, Variance of one year of daily stock returns in a year (CRSP)
Performance variables	

ROA	Net income divided by total net admitted assets (NAIC)
ROE	Net income divided by equity (NAIC)
Sales growth	The percentage change in sales compared to the previous year's sales (Compustat)
Tobin's Q	The ratio of the sum of the market value of equity and the book value of debt to total assets (Compustat)
Panel B: Independent variables	
Incentive variables	
Firm gap ($000)	The pay gap between the CEO's total compensation and the median VP total compensation (ExecuComp)
CEO delta ($000)	(Shares owned at the beginning of the year + Average delta of prior option grants × No. of options)/Number of shares outstanding (ExecuComp)
CEO vega ($000)	The dollar change in the CEO's wealth for a 0.01 change in the standard deviation of stock returns (ExecuComp)
Indgap ($000)	The pay gap between the highest-paid CEO's total compensation within the sample and the CEO's total compensation (ExecuComp)
CEO total compensation ($000)	Salary + bonus + restricted stock grants + option grants + LTIP + other annual payments. TD1 variable from ExecuComp. (ExecuComp)
Cooption	Co-option is the ratio of the number of directors appointed after the CEO assumes office, who are considered to be "co-opted", to the total number of board members.
TW cooption	TW Co-option is the ratio of the sum of the tenure of "co-opted" directors to the total tenure of all directors.
Panel D: Firm characteristics	

Total asset	Total net admitted assets (NAIC)
Ln(Total asset)	Natural logarithm of total net admitted assets (NAIC)
Leverage	1 minus the surplus-to-asset ratio (NAIC)
Return volatility	Variance of one year of daily stock returns in a year (CRSP)
Long tail	The premiums of long-tail lines divided by total net premiums written (NAIC)
Weak	A dummy variable = 1 if an insurer has four or more than four unusual IRIS (Insurance Regulatory Information System) ratios, and 0 otherwise (NAIC)
Ln(Board size)	Natural logarithm of number of board members in the sample year (ISS)
Reinsurance ratio	The ratio of reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed (NAIC)
Product HHI	Sum of the squares of the value of net premiums written in line i divided by the insurer's total net premiums written (NAIC)
Geographic HHI	Sum of the squares of the value of net premiums written in state *i* divided by the insurer's total net premiums written (NAIC)
Length	Percentage of claim loss reserve over total liabilities (NAIC)
Malpractice ratio	Percentage of net premiums written from malpractice insurance (NAIC)
Tax shield	Sum of net income and estimated reserve scaled by total assets (NAIC)
Tax rate	A dummy variable =1, taking on the value of one in year t if insurer i either paid taxes or received a refund of prior taxes, and 0 otherwise (NAIC)
SOX dummy	A dummy variable = 1 if year >= 2003, and 0 otherwise
Panel E: Instrumental variables	
NoofVP	Number of vice presidents (VP) (ExecuComp)

APPENDIX G

TABLES FOR CHAPTER III

Table 13: Summary statistics for chapter III

This table presents summary statistics for publicly-traded property liability insurance firms, from 1996 to 2011. For variable definitions, see Appendix F.

Variable	N	Mean	Median	Std. Dev	10th Percentiles	90th Percentiles
KFS error/Asset	353	0.000017	0.000022	0.000081	-0.000061	0.000096
Weiss error/Asset	353	0.000109	0.000091	0.000102	0.000000	0.000237
Std_5(Loss ratio)	392	0.18	0.06	0.90	0.03	0.20
Std_5(ROI)	392	0.023	0.01	0.09	0.003	0.03
Std_5(ROA)	392	0.03	0.02	0.053	0.007	0.046
Return volatility	458	0.0008	0.0003	0.0020	0.0001	0.0014
ROA	402	0.03	0.04	0.08	-0.01	0.09
ROE	402	0.083	0.122	0.523	-0.027	0.285
Sales growth	452	0.080	0.069	0.192	-0.033	0.238
Tobin's Q	464	0.27	0.13	0.33	0.03	0.66
Firmgap ($000)	462	3,355.65	2,018.56	4,232.55	464.25	7,727.14
CEO delta ($000)	450	715.28	264.27	1,579.03	33.58	1,512.39
CEO vega ($000)	450	106.43	43.93	163.86	0.00	305.38
Indgap ($000)	459	22,209.37	21,634.39	7,749.315	12,678.66	32,761.12
CEO total comp. ($000)	462	5,148.67	3,461.80	5,357.32	1,064.21	10,509.96
Cooption	300	0.46	0.40	0.32	0.09	1.00
TW Cooption	300	0.31	0.14	0.36	0.01	1.00
Total Asset ($000,000)	402	8,640.00	3,910.00	13,600.00	945.00	23,200.00
Ln(Total Asset)	402	15.97	15.18	16.43	13.76	16.96
ROA	402	0.03	0.04	0.08	-0.01	0.09
Leverage	402	0.69	0.70	0.11	0.58	0.80
Var(Return)	458	0.0008	0.0003	0.0020	0.0001	0.0014
Tobin's Q	464	0.27	0.13	0.33	0.03	0.66
Long tail	377	0.64	0.71	0.30	0.00	0.96
Weak	402	0.07	0.00	0.25	0.00	0.00
Board size	314	10.73	11.00	2.00	8.00	13.00
Reinsurance ratio	402	0.21	0.11	0.23	0.02	0.60
Product HHI	377	0.40	0.28	0.32	0.12	1.00
Geographic HHI	384	0.15	0.07	0.19	0.04	0.35
Length	402	0.48	0.50	0.20	0.16	0.70
Malpractice ratio	377	0.13	0.03	0.24	0.00	0.26
Tax shield	353	0.04	0.04	0.06	0.00	0.09
Tax rate	402	0.88	1.00	0.33	0.00	1.00
NoofVP	336	5.10	5.00	1.28	4.00	7.00

Table 14: Pearson's correlation matrix

Pearson's correlation matrix of the main variables of interest.

Variables	KFS error/Asset	Weiss error/Asset	ln(Firmgap)	ln(CEO delta)	ln(CEO vega)
KFS error/Asset	1				
Weiss error/Asset	0.5575*	1			
	(0.0000)				
ln(Firmgap)	0.0276	0.0121	1		
	(0.6126)	(0.8237)			
ln(CEO delta)	0.0467	-0.0577	0.3649*	1	
	(0.3915)	(0.2894)	(0.0000)		
ln(CEO vega)	0.0261	0.0787	0.3295*	0.4055*	1
	(0.6492)	(0.1688)	(0.0000)	(0.0000)	

Table 15: Tournament incentives and reserve management (OLS)

The dependent variables are KFS error/Asset and Weiss error/Asset, which are types of reserve error measures. The detailed information about their computation can be found in section III.3. The data include publicly-traded property liability insurance firms, from 1996 to 2011. We include year fixed effects and firm fixed effects in all specifications and T-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
	OLS	OLS
Variables	KFS error/Asset$_{t+1}$	Weiss error/Asset$_{t+1}$
ln(Firmgap)$_t$	0.000013**	0.000016***
	(2.377)	(3.054)
ln(CEO delta)$_t$	-0.000002	0.00000003
	(-0.440)	(0.00557)
ln(CEO vega)$_t$	-0.000003	-0.000012**
	(-0.737)	(-2.620)
ln(Total Asset)$_t$	-0.000012	-0.000043**
	(-0.509)	(-2.097)
ROA$_t$	0.0556**	0.0343
	(2.387)	(1.401)
Leverage$_t$	0.000359**	0.000337*
	(2.629)	(2.037)
Var(Return)$_t$	-0.0294***	-0.00900
	(-7.819)	(-1.598)
Tobin's Q$_t$	0.000048***	0.000036**
	(3.848)	(2.527)
Long tail$_t$	0.000277**	0.000189
	(2.426)	(1.080)
Weak$_t$	-0.000004	-0.000012
	(-0.258)	(-0.728)
ln(Board size)$_t$	-0.000017	-0.000019
	(-0.740)	(-0.705)
Reinsurance ratio$_t$	0.000209	0.00021*
	(1.841)	(1.910)
Product HHI$_t$	0.000123*	0.000040
	(1.985)	(0.650)
Geographic HHI$_t$	0.000239	-0.000031
	(1.461)	(-0.231)
Length$_t$	0.000195**	0.000204*
	(2.190)	(1.778)
Malpractice ratio$_t$	-0.000105	-0.000016
	(-1.012)	(-0.172)
Tax shield$_t$	-0.0553**	-0.0342
	(-2.374)	(-1.392)
Tax rate$_t$	0.000044**	0.000059**
	(2.316)	(2.558)
Year fixed effect	Yes	Yes
Firm fixed effect	Yes	Yes
Observations	187	187
Adj. R-squared	0.615	0.618

Table 16: Tournament incentives and reserve management (2SLS)

The dependent variables are KFS error/Asset and Weiss error/Asset, which are types of reserve error measures. The detailed information about their computation can be found in section III.3. The data include publicly-traded property liability insurance firms, from 1996 to 2011. We include year fixed effects and firm fixed effects in all specifications and T-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	2SLS		2SLS	
	1st Stage	2nd Stage	1st Stage	2nd Stage
Variables	$\ln(\text{Firmgap})_t$	KFS error/Asset_{t+1}	$\ln(\text{Firmgap})_t$	Weiss error/Asset_{t+1}
Predicted $\ln(\text{Firmgap})_t$		0.000043***		0.000054***
		(2.590)		(3.406)
$\ln(\text{Firmgap})_{t-1}$	0.365565***		0.365565***	
	(3.24)		(3.24)	
$\ln(\text{NoofVP})_t$	-0.444443**		-0.444443**	
	(-2.07)		(-2.07)	
$\ln(\text{CEO delta})_t$	-0.006083	-0.000002	-0.006083	0.000003
	(-0.12)	(-0.453)	(-0.12)	(0.853)
$\ln(\text{CEO vega})_t$	-0.006396	0.000002	-0.006396	-0.000003
	(-0.10)	(0.420)	(-0.10)	(-0.464)
$\ln(\text{Total Asset})_t$	0.394596	0.000001	0.394596	-0.000004
	(1.09)	(0.0281)	(1.09)	(-1.281)
ROA_t	67.1287	0.0500*	67.1287	0.0664**
	(0.25)	(1.855)	(0.25)	(2.338)
Leverage_t	0.448800	0.000391***	0.448800	0.000503***
	(0.19)	(3.372)	(0.19)	(2.648)
Var(Return)_t	-275.2189***	-0.00120	-275.2189***	0.0244***
	(-4.46)	(-0.336)	(-4.46)	(2.828)
Tobin's Q_t	0.135701	0.000017	0.135701	-0.000016
	(0.77)	(1.603)	(0.77)	(-1.184)
Long tail_t	-1.791838	0.000508**	-1.791838	0.000284
	(-0.61)	(2.009)	(-0.61)	(0.758)
Weak_t	-0.373900	-0.000015	-0.373900	-0.000023
	(-1.45)	(-0.935)	(-1.45)	(-1.119)
$\ln(\text{Board size})_t$	0.769001	-0.000049	0.769001	-0.000039
	(1.46)	(-1.193)	(1.46)	(-0.962)
Reinsurance ratio_t	0.567012	0.000147	0.567012	0.000048
	(0.30)	(0.947)	(0.30)	(0.412)
Product HHI_t	0.282588	0.000145*	0.282588	0.000093
	(0.37)	(1.949)	(0.37)	(0.934)
Geographic HHI_t	-1.053638	0.000335**	-1.053638	0.000089
	(-0.62)	(2.416)	(-0.62)	(0.660)
Length_t	1.993397	-0.000038	1.993397	-0.000043
	(1.40)	(-0.296)	(1.40)	(-0.226)
Malpractice ratio_t	2.376519**	-0.000165	2.376519**	-0.000006
	(2.32)	(-1.175)	(2.32)	(-0.0459)
Tax shield_t	-66.52139	-0.0497*	-66.52139	-0.0663**

	(-0.25)	(-1.844)	(-0.25)	(-2.329)
Tax rate$_t$	0.066182	0.000042**	0.066182	0.000073**
	(0.25)	(2.355)	(0.25)	(2.195)
First Stage F Stat		11.97		11.97
Cragg-Donald Wald F stat		15.21		15.21
Hansen J Stat (p-value)		0.3085		0.5635
Firm fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Observations	162	162	162	162
Adj R-squared	0.385	0.404	0.385	0.064

Table 17: Firm characteristics interaction effects

The table reports the second-stage of IV regression models of reserve error on the predicted values of internal tournament incentives and their interactions with various factors. The dependent variables are KFS error/Asset and Weiss error/Asset. The detailed information about its computation can be found in section III.3. The data include publicly-traded property liability insurance firms, from 1996 to 2011. We include year fixed effects and firm fixed effects in all specifications and T-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Variables	2SLS KFS error/Asset$_{t+1}$	2SLS Weiss error/Asset$_{t+1}$
ln(Firmgap)$_t$	-0.000450	-0.00190**
	(-0.745)	(-1.985)
ln(Total Asset)$_t$*ln(Firmgap)$_t$	0.000021	0.000063**
	(0.945)	(2.130)
ln(Total Asset)$_t$	-0.000186	-0.000526**
	(-1.008)	(-1.993)
ROA$_t$*ln(Firmgap)$_t$	0.0119	0.0367
	(0.297)	(0.894)
ROA$_t$	-0.0797	-0.258
	(-0.256)	(-0.826)
Leverage$_t$*ln(Firmgap)$_t$	0.000427	0.000611
	(1.210)	(1.414)
Leverage$_t$	-0.00308	-0.00418
	(-1.139)	(-1.240)
Var(Return)$_t$ *ln(Firmgap)$_t$	-0.0256	-0.0124
	(-1.407)	(-0.428)
Var(Return)$_t$	0.183	0.101
	(1.357)	(0.475)
Tobin's Q$_t$*ln(Firmgap)$_t$	-0.000032	0.000008
	(-0.872)	(0.183)
Tobin's Q$_t$	0.000269	-0.000075
	(0.901)	(-0.203)
Long tail$_t$*ln(Firmgap)$_t$	-0.000049	0.000081
	(-0.606)	(0.719)
Long tail$_t$	0.00110	0.000036

	(1.503)	(0.0367)
$Weak_t$*ln(Firmgap)$_t$	0.000177**	0.000221*
	(2.018)	(1.771)
$Weak_t$	-0.00136**	-0.00170*
	(-1.979)	(-1.753)
ln(Board size)$_t$*ln(Firmgap)$_t$	-0.000046	0.000077
	(-0.476)	(0.589)
ln(Board size)$_t$	0.000350	-0.000609
	(0.455)	(-0.595)
Reinsurance ratio$_t$*ln(Firmgap)$_t$	-0.000041	0.000068
	(-0.560)	(0.668)
Reinsurance ratio$_t$	0.000466	-0.000428
	(1.004)	(-0.682)
Product HHI$_t$*ln(Firmgap)$_t$	-0.000111	-0.000094
	(-1.448)	(-0.978)
Product HHI$_t$	0.000761	0.000560
	(1.295)	(0.752)
Geographic HHI$_t$*ln(Firmgap)$_t$	0.000646***	0.000937**
	(2.578)	(2.351)
Geographic HHI$_t$	-0.00428**	-0.00666**
	(-2.250)	(-2.318)
Length$_t$*ln(Firmgap)$_t$	-0.000158**	-0.000241**
	(-2.144)	(-2.396)
Length$_t$	0.00131**	0.00218***
	(2.080)	(2.876)
Malpractice ratio$_t$*ln(Firmgap)$_t$	-0.000111	-0.000112
	(-0.936)	(-0.519)
Malpractice ratio$_t$	0.000462	0.000540
	(0.483)	(0.337)
Tax shield$_t$*ln(Firmgap)$_t$	-0.0125	-0.0371
	(-0.314)	(-0.903)
Tax shield$_t$	0.0848	0.261
	(0.273)	(0.835)
Taxrate$_t$*ln(Firmgap)$_t$	-0.000029	-0.000068
	(-0.349)	(-0.746)
Taxrate$_t$	0.000287	0.000604
	(0.430)	(0.839)
ln(CEO delta)$_t$	0.000003	0.000014**
	(0.566)	(2.090)
ln(CEO vega)$_t$	0.000006	0.000004
	(0.757)	(0.290)
Year fixed effect	Yes	Yes
Firm fixed effect	Yes	Yes
Observations	141	141
Adj. R-squared	0.121	-0.034

Table 18: SOX effect

The table reports the second-stage of IV regression models of reserve error on the predicted values of internal tournament incentives and their interactions with SOX dummy. The dependent variables are Weiss error/Asset and KFS/Asset. The detailed information about their computation can be found in section III.3. The data include publicly-traded property liability insurance firms, from 1996 to 2011. We include year fixed effects and firm fixed effects in all specifications and T-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Variables	KFS error/Asset$_{t+1}$	Weiss error/Asset$_{t+1}$
Predicted ln(Firmgap)$_t$	0.000060***	0.000048
	(3.174)	(1.454)
SOX$_t$*Predicted ln(Firmgap)$_t$	-0.000033	-0.000006
	(-1.517)	(-0.169)
SOX$_t$	0.000289*	0.000090
	(1.652)	(0.308)
ln(CEO delta)$_t$	-0.000002	0.000002
	(-0.642)	(0.854)
ln(CEO vega)$_t$	0.0000004	-0.000006
	(0.0848)	(-1.228)
Other control variables	Yes	Yes
Year fixed effect	Yes	Yes
Firm fixed effect	Yes	Yes
Observations	162	162
Adj. R-squared	0.463	0.153

Table 19: The impact of co-option on the relation between internal tournament incentives and reserve error

The table reports the estimates of the regression of reserve errors on the predicted values of internal tournament incentives, their interactions with cooption measures and some control variables. Co-option is the ratio of the number of directors appointed after the CEO assumes office, who are considered to be "co-opted", to the total number of board members. TW Co-option is the ratio of the sum of the tenure of "co-opted" directors to the total tenure of all directors. The dependent variables are Weiss error/Asset and KFS/Asset. The detailed information about their computation can be found in section III.3. The data include publicly-traded property liability insurance firms, from 1996 to 2011. We include year fixed effects and firm fixed effects in all specifications and T-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Variables	KFS error/ $Asset_{t+1}$	Weiss error/ $Asset_{t+1}$	KFS error/ $Asset_{t+1}$	Weiss error/ $Asset_{t+1}$
Predicted $\ln(Firmgap)_t$	0.000073***	0.000095***	0.000063***	0.000079***
	(3.197)	(3.183)	(3.435)	(4.513)
Predicted $\ln(Firmgap)_t$*$Cooption_t$	-0.000054	-0.000081		
	(-1.496)	(-1.502)		
$Cooption_t$	0.000445	0.000643		
	(1.542)	(1.481)		
Predicted $\ln(Firmgap)_t$* TW $Cooption_t$			-0.000049**	-0.000067***
			(-2.120)	(-2.641)
TW $Cooption_t$			0.000412**	0.000545***
			(2.234)	(2.597)
$\ln(CEO\ delta)_t$	-0.000009**	0.000001	-0.000008**	0.000001
	(-2.273)	(0.157)	(-2.256)	(0.311)
$\ln(CEO\ vega)_t$	0.000003	-0.000003	0.000004	-0.000001
	(0.682)	(-0.467)	(1.034)	(-0.166)
Other control variables	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	144	144	144	144
Adj. R-squared	0.480	0.027	0.468	0.081

Table 20: The effect of internal tournament incentives on underwriting, investment, and total risks

The table reports the estimates of the regression of either underwriting risk, investment risk or total risk on the predicted values of internal tournament incentives and some control variables. $Std_5(\text{Loss ratio})_{t+1}$ is the standard deviation of the firm's loss ratio over five-year rolling periods, where the loss ratio is the ratio of loss incurred divided by premiums earned. $Std_5(\text{ROI})_{t+1}$ is standard deviation of return on investment (ROI) over five-year rolling periods, where ROI is measured by the ratio of net investment gain divided by investment assets. $Std_5(\text{ROA})_{t+1}$ is the standard deviation of return on assets (ROA) over five-year rolling periods, where ROA is calculated as the ratio of net income divided by net admitted assets. The data include publicly-traded property liability insurance firms, from 1996 to 2011. We include year fixed effects and firm fixed effects in all specifications and T-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Variables	Underwriting risk $Std_5(\text{Loss ratio})_{t+1}$	Investment risk $Std_5(\text{ROI})_{t+1}$	Total risk $Std_5(\text{ROA})_{t+1}$	Return volatility $Var(\text{Return})_t$
Predicted $\ln(\text{Firmgap})_t$	-0.0333	-0.0132**	-0.00448	-0.000535
	(-0.571)	(-1.993)	(-0.894)	(-0.773)
$\ln(\text{CEO delta})_t$	0.0129*	0.00130	0.000304	-0.000001
	(1.710)	(0.758)	(0.200)	(-0.011)
$\ln(\text{CEO vega})_t$	-0.00551	0.000873	0.00114	-0.000245
	(-0.411)	(0.460)	(0.595)	(-1.027)
Other control variables	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	167	167	167	169
Adj. R-squared	0.389	0.179	0.495	0.267

Table 21: The effect of internal tournament incentives on performance

The table reports the estimates of the regression of either ROA, ROE or Sales Growth on the predicted values of internal tournament incentives and some control variables. ROA is the net income divided by net admitted assets. ROE is the net income divided by equity. Sales Growth is the percentage change in sales compared to the previous year's sales. The data include publicly-traded property liability insurance firms, from 1996 to 2011. We exclude ROA from the models where ROA and ROE are the dependent variables and exclude Tobin's Q from the models where Sales Growth and Tobin's Q are the dependent variables. We include year fixed effects and firm fixed effects in all specifications and T-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Variables	ROA_{t+1}	ROE_{t+1}	Sales $growth_{t+1}$	Tobin's Q
Predicted $\ln(Firmgap)_t$	0.0212	0.1278	0.0035	-0.2162*
	(1.098)	(1.112)	(0.167)	(-1.912)
$\ln(\text{CEO delta})_t$	-0.001	-0.0126	0.0091	0.0361
	(-0.299)	(-1.000)	(1.136)	(1.137)
$\ln(\text{CEO vega})_t$	0.0001	-0.004	-0.0086*	-0.0863**
	(0.014)	(-0.190)	(-1.723)	(-2.162)
Other control variables	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes	Yes
Observations	167	167	169	169
Adj. R-squared	0.415	0.466	0.456	-0.153

Table 22: Robustness (controlling industry tournament incentives)

We control industry tournament incentives in our analysis. The dependent variables are Weiss error/Asset and KFS/Asset. The detailed information about their computation can be found in section III.3. The data include publicly-traded property liability insurance firms, from 1996 to 2011. We include year fixed effects and firm fixed effects in all specifications and T-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Variables	KFS error/Asset$_{t+1}$	Weiss error/Asset$_{t+1}$
Predicted ln(Firmgap)$_t$	0.000046**	0.000060***
	(2.360)	(3.380)
ln(Indgap)$_t$	0.000015	0.000041
	(0.716)	(1.563)
ln(CEO delta)$_t$	-0.000003	-0.0000002
	(-0.644)	(-0.0478)
ln(CEO vega)$_t$	0.000003	-0.0000005
	(0.545)	(-0.0682)
Other control variables	Yes	Yes
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
Observations	162	162
Adj. R-squared	0.388	0.050

Table 23: Robustness (the effect of internal tournament incentives on the absolute value of reserve error)

We examine the effect of internal tournament incentives on the absolute value of reserve error. The dependent variables are Weiss error/Asset and KFS/Asset. The detailed information about their computation can be found in section III.3. The data include publicly-traded property liability insurance firms, from 1996 to 2011. We include year fixed effects and firm fixed effects in all specifications and T-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Variables	Abs(KFS error/Asset$_{t+1}$)	Abs(Weiss error/Asset$_{t+1}$)
Predicted ln(Firmgap)$_t$	-0.000017	0.000042***
	(-1.283)	(2.584)
ln(CEO delta)$_t$	0.000003	0.000005
	(0.982)	(1.330)
ln(CEO vega)$_t$	0.000003	-0.000003
	(0.933)	(-0.491)
Other control variables	Yes	Yes
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
Observations	162	162
Adj. R-squared	0.423	0.031

Table 24: Robustness (the effect of internal tournament incentives on the positive value of reserve error)

We examine the effect of internal tournament incentives on the value of reserve error, where the sample is restricted with the ones having positive reserve errors. The dependent variables are Weiss error/Asset and KFS/Asset. The detailed information about their computation can be found in section III.3. The data include publicly-traded property liability insurance firms, from 1996 to 2011. We include year fixed effects and firm fixed effects in all specifications and T-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Variables	Positive(KFS error/Asset$_{t+1}$)	Positive(Weiss error/Asset$_{t+1}$)
Predicted ln(Firmgap)$_t$	0.000013	0.000051***
	(0.686)	(4.391)
ln(CEO delta)$_t$	-0.000002	0.000005
	(-0.745)	(1.627)
ln(CEO vega)$_t$	0.000003	-0.000002
	(0.841)	(-0.283)
Other control variables	Yes	Yes
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
Observations	106	144
Adj. R-squared	0.005	0.082

Table 25: Robustness (testing the significance of the coefficients with bootstrapping)

We test the regression by bootstrapping 1000 times based on the normal distribution and the probabilities of the coefficients refer to how many times t-stats of coefficients found by bootstrapping exceed the t-stat of a coefficient found by 2SLS. The coefficients are found by adjusting the coefficients found in 2SLS by subtracting the mean of bootstrapped coefficients, i.e. biased-corrected coefficients. We include year fixed effects and firm fixed effects in all specifications. P-values are shown in parentheses below the coefficients and illustrate the percentage of t-stats of coefficients found by bootstrapping exceeding the t-stat found by the original 2SLS model out of 1000 times. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

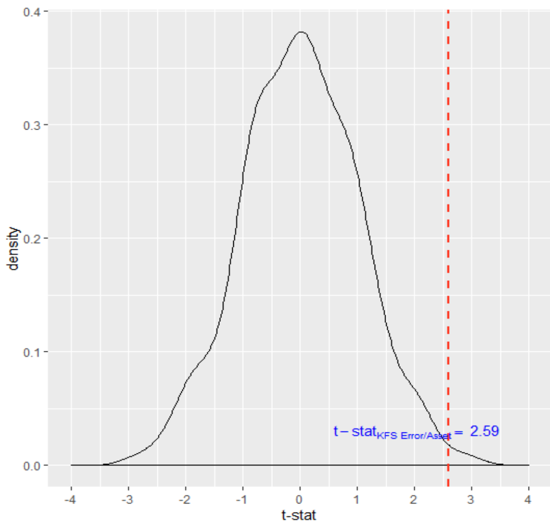
Variables	KFS error/Asset$_{t+1}$	Weiss error/Asset$_{t+1}$
ln(Firmgap)$_t$	0.000043***	0.000054***
	(0.006)	(0.000)
ln(CEO delta)$_t$	-0.000002	0.000003
	(0.332)	(0.199)
ln(CEO vega)$_t$	0.000002	-0.000003
	(0.334)	(0.323)
ln(Total Asset)$_t$	0.000002	-0.000041*
	(0.475)	(0.093)
ROA$_t$	0.050042**	0.067038**
	(0.019)	(0.011)
Leverage$_t$	0.000391***	0.000503***
	(0.002)	(0.007)
Var(Return)$_t$	-0.001336	0.024406***
	(0.342)	(0.001)
Tobin's Q$_t$	0.000016*	-0.000015
	(0.054)	(0.124)
Long tail$_t$	0.000513**	0.000280652
	(0.025)	(0.237)
Weak$_t$	-0.000016	-0.000024
	(0.177)	(0.136)
ln(Board size)$_t$	-0.000048	-0.000038
	(0.116)	(0.189)
Reinsurance ratio$_t$	0.000144	0.000048
	(0.184)	(0.338)
Product HHI$_t$	0.000147**	0.000092
	(0.030)	(0.186)
Geographic HHI$_t$	0.000338**	0.000084
	(0.012)	(0.263)
Length$_t$	-0.000038	-0.000042
	(0.372)	(0.413)
Malpractice ratio$_t$	-0.000164	-0.000004
	(0.133)	(0.498)
Tax shield$_t$	-0.049185**	-0.066517**
	(0.031)	(0.012)
Tax rate$_t$	0.000042***	0.000073**
	(0.007)	(0.020)
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes

APPENDIX H

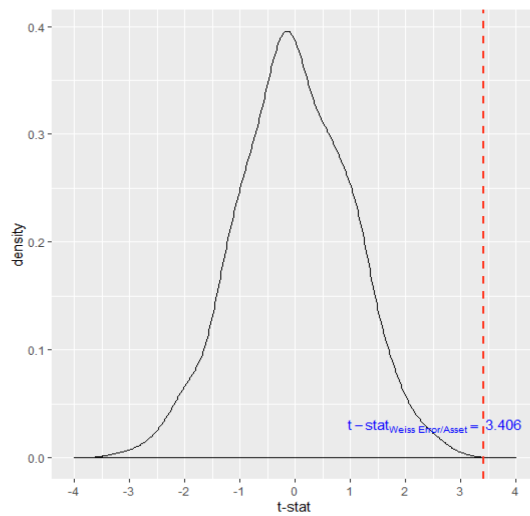
FIGURES FOR CHAPTER III

Figure 1: The Graphs Illustrating the Distribution of Bootstrapped t-stats and the Places of the t-stats in the Original (main) 2SLS regressions

KFS error/Asset



Weiss error/Asset



APPENDIX I

DATA SOURCES AND DEFINITIONS FOR CHAPTER IV

Variables	Definitions
Loan spread	The all-in drawn loan spread. The all-in drawn loan spread is the amount in basis point that a firm pays over LIBOR plus some additional fees for each dollar used from the loan facility. (Basis point (bps)) (Dealscan)
Equity PD	A firm's executives' weighted average vesting period of salary, bonus, restricted stocks, and options. For details, please see section IV.3.2. (months) (ISS Incentive Lab)
Whole PD	A firm's executives' weighted average vesting period of salary, bonus, restricted stocks, options, pensions (SERP) and other deferred compensations (ODC). For details, please see section IV.3.2. (months) (ISS Incentive Lab and Execucomp)
SERP PD	A firm's executives weighted average vesting periods of salary, bonus, restricted stocks, options and pensions (SERP). For details, please see section IV.3.2. (months) (ISS Incentive Lab and Execucomp)
ODC PD	A firm's executives weighted average vesting periods of salary, bonus, restricted stocks, options and other deferred compensations (ODC). For details, please see section IV.3.2. (months) (ISS Incentive Lab and Execucomp)
Salary&Bonus Ratio	The total portion of executive salary and bonus in total executive grants. (ISS Incentive Lab)
Option Ratio	The portion of executive options granted in total executive grants. (ISS Incentive Lab)

Restricted Stock Ratio	The portion of executive stocks granted in total executive grants. (ISS Incentive Lab)
CEO Delta	The dollar change in the value of a CEO’s total firm related wealth for a %1 change in the stock price, where the firm related wealth is the CEO's option and restricted stock grants, shareholdings, and any restricted stock and option holdings. ($000) (Execucomp)
VP Delta	The weighted average dollar change in the value of the vice presidents' total firm related wealth for a 1% change in the stock price, where the weights and the firm related wealth are the executives' options and restricted stock grants, shareholdings, and any restricted stock and option holdings. ($000) (Execucomp)
CEO Vega	The dollar change in the value of a CEO’s total firm related wealth for a 0.01 change in the annualized standard deviation of stock returns, where the firm related wealth is the CEO's option and restricted stock grants, shareholdings, and any restricted stock and option holdings. ($000) (Execucomp)
VP Vega	The weighted average dollar change in the value of the vice presidents' total firm related wealth for a 0.01 change in the annualized standard deviation of stock returns, where the weights and the firm related wealth are the executives' options and restricted stock grants, shareholdings, and any restricted stock and option holdings. ($000) (Execucomp)
Sales Growth	Sales growth is the growth in firm sales compared to the previous year. (Execucomp)
Leverage	The ratio of the book values of long-term debt plus debt in current liabilities to total book assets. (Execucomp)

Total Assets	Total book assets. ($000,000) (Execucomp)
Z-Score	Modified Altman's (1968) Z-score = (1.2 × working capital + 1.4 × retained earnings + 3.3 × EBIT + 0.999 × sales) / total book assets. Following Kubick, Lockhart, and Mauer (2018), we do not include a leverage variable, since leverage is already included in the regressions as a separate variable. (Execucomp)
Asset Maturity	The book value-weighted average of the maturities of current assets and gross property, plant, and equipment, where the maturity of current assets is defined as current assets divided by cost of goods sold, and the maturity of gross property, plant, and equipment is defined as gross property, plant and equipment divided by annual depreciation expense. (Execucomp)
Loan Size	Loan amount measured in dollars. ($000,000) (Dealscan)
Creditrating Dummy	An indicator variable that equals 1 if the firm has an S&P long-term debt rating. (dummy) (Execucomp)
CF Vol.	The standard deviations of the ratio of cash flow to total assets over from 8 quarters up to 40 quarters (current plus previous thirty-nine quarters). Cash flow is computed as operating income before depreciation minus interest expense, taxes, and dividend payments. (Execucomp)
Number of Banks	The number of creditors funding a loan facility, which refers to the size of a loan syndicate. (Dealscan)
Term Spread	The difference between the long term yield on U.S. government bonds and the U.S. Treasury-bill. (Amit Goyal's Website)
Default Spread	The difference between the long-term BAA corporate bond yield and the long-term AAA corporate bond yield. (Amit Goyal's Website)

Bridge Loan	An indicator variable that equals 1 if the loan facility is defined as a bridge loan, and zero otherwise. (dummy) (Dealscan)
Term Loan	An indicator variable that equals 1 if the loan facility is defined as a term loan, and zero otherwise. (dummy) (Dealscan)
Revolver Loan	An indicator variable that equals 1 if the loan facility is defined as a revolver or 364-day facility, and zero otherwise. (dummy) (Dealscan)
General Purpose Loan	An indicator variable that equals 1 if the loan is received for general corporate purposes, project finance, or other purpose, and zero otherwise. (dummy) (Dealscan)
Working Capital Loan	An indicator variable that equals 1 if the loan is funded to finance working capital, and zero otherwise. (dummy) (Dealscan)
Takeover Recap Loan	An indicator variable that equals 1 if the loan is funded for a takeover or recapitalization, and zero otherwise. (dummy) (Dealscan)
MeanVESTING	Executive mean of the sum of values of vesting stocks (SHRS_VEST_VAL) and the value realized from option exercises (OPT_EXER_VAL) in a year ($000) (Execucomp)
Number of Exec.	Number of executives. (Execucomp)
Firm Age	Total year a firm has been seen in CRSP. (years) (CRSP)
Mean Exec. Tenure	Mean of executives' tenures at the firm. (years) (Execucomp)
Ind Mean Equity PD	Industry mean of the firms' Equity PD in a Fama-French 30 industry. (months) (ISS Incentive Lab)
R&D/Assets	R&D expenditures divided by book value of total assets, missing values are assigned as 0. (Compustat)
Merger Count	Total number of mergers and acquisitions as an acquirer in the current and previous 2 years. (SDC Platinum)

Abs(DA/Assets)	The absolute value of abnormal discretionary accruals estimated through the modified Jones (1991) model, where total accruals are ([Change in current assets - change in cash] - [change in current liabilities - change in current maturities of long-term debt - change in income taxes payable] - depreciation and amortization expense) divided by the book value of total assets. (ISS)
Smooth	The correlation between the change in discretionary accruals and the change in pre-managed income (return on asset - discretionary accruals) over the current and previous 4 years multiplied by (-1). (ISS)
Turnover	An indicator variable that equals 1 if there is a change in the composition of executives in a year compared to the previous year, and zero otherwise. (dummy) (Execucomp)
CEO turnover	An indicator variable that equals 1 if there is a change in the CEO in a year compared to the previous year, and zero otherwise. (dummy) (Execucomp)
E-index	Entrenchment Index. Sum of indicator variables for six antitakeover provisions: staggered boards, limits to shareholder bylaw amendments, poison pills, golden parachutes, and supermajority requirements for mergers and charter amendments. (ISS)
Co-option	The portion of the board appointed after the CEO assumes the office. (Lalitha Naveen's website)
CEO Age	The CEO’s age. (Execucomp)
CEO Tenure	The CEO’s tenure. (Execucomp)

Return Vol.	The annualized standard deviation of 5 year rolling daily stock returns adjusted for marginal tax rate and market leverage. For details, please see section IV.5.1. (CRSP, Graham (1996a, 1996b), Compustat)
Forecast Dispersion	The standard deviation of analyst forecasts of earnings per share made 3 months before the fiscal year-end. (IBES)
Transp. Ind. Firms	Transparent Industry Firms. An indicator variable that equals 1 if a firm is in coal, mining, petroleum, printing or paper industry, and zero otherwise. (dummy) (Compustat)
MtB	(Common Shares Outstanding * Fiscal Closing Price + Book Value of Debt + Preferred Stock Redeemable - Deferred Taxes and Investment Tax Credits)/Book Value of Total Assets (Compustat)
Restatement	An indicator variable that equals 1 if a firm announces a restatement regarding its previously disclosed financial statements. (dummy) (Audit Analytics)
ROA	Return on assets. (Compustat)
ROE	Return on equity. (Compustat)

APPENDIX J

TABLES FOR CHAPTER IV

Table 26: Summary statistics for chapter IV

This table presents summary statistics of the sample loan and firms excluding financials and utility firms and the loans received by these firms, for the period from 2006 to 2017. Loan characteristics are reported using the facility-based dataset, but the executive incentive, executive, firm and board characteristics are reported using the firm-based dataset. Appendix I defines all the variables. The signs ***, **, * indicate the significance of the correlation coefficients at the 1%, 5%, and 10% levels, respectively. All the continuous variables are winsorized at 1% and 99%.

Variables	# of obs.	Mean	Median	Std. Dev.	p10	p90
Loan characteristics (facility-based data)						
Loan Spread (bps)	5,081	215.968	175.000	145.168	87.500	400.000
Number of Banks	5,081	10.331	9	7.625	3	20
Loan Size ($000,000)	5,081	940.000	500.000	1,660.000	75.000	2,000.000
Bridge Loan (dummy)	5,081	0.046	0	0.210	0	0
Term Loan (dummy)	5,081	0.315	0	0.465	0	1
Revolver Loan (dummy)	5,081	0.599	1	0.490	0	1
General Purpose Loan (dummy)	5,081	0.605	1	0.489	0	1
Working Capital Loan (dummy)	5,081	0.092	0	0.289	0	0
Takeover Recap Loan (dummy)	5,081	0.133	0	0.339	0	1
Executive Incentive Variables (firm-based panel data)						
Equity PD (months)	2,790	26.401	26.353	9.093	15.510	37.588
Whole PD (months)	2,763	50.265	45.500	25.013	22.612	85.549
SERP PD (months)	2,763	41.962	34.711	24.251	18.880	77.119
ODC PD (months)	2,763	42.566	37.544	22.154	20.931	72.006
CEO Delta ($000)	2,790	880.943	345.516	2,018.091	52.635	1,761.091
VP Delta ($000)	2,790	531.130	103.023	8,862.307	21.426	519.360
CEO Vega ($000)	2,790	179.319	94.471	268.605	0.000	452.431
VP Vega ($000)	2,790	62.466	28.650	132.866	0.075	140.192
$MeanVESTING_{t-2}$ ($000)	2,725	2,441.991	1,210.788	3,471.099	67.755	6,451.001
Ind Mean Equity PD (months)	2,790	26.516	26.967	3.138	22.496	30.273
Salary&Bonus Ratio	2,790	0.404	0.381	0.172	0.199	0.647
Option Ratio	2,790	0.227	0.237	0.203	0	0.481
Restricted Stock Ratio	2,790	0.369	0.356	0.210	0.086	0.667

Executive characteristics (firm-based panel data)						
CEO Age (years)	2,775	55.829	56	6.477	48	64
Mean Exec. Age (years)	2,785	53.151	53.200	3.817	48.286	57.800
CEO Tenure (years)	2,769	6.696	5.003	6.537	1.000	14.008
Mean Exec. Tenure (years)	2,774	8.116	6.614	6.646	1.663	16.873
Turnover (dummy)	2,790	0.578	1	0.494	0	1
CEO Turnover (dummy)	2,764	0.109	0	0.311	0	1
Firm characteristics (firm-based panel data)						
Sales Growth	2,790	0.074	0.054	0.194	-0.113	0.277
Leverage	2,790	0.269	0.247	0.178	0.048	0.507
Total Assets ($000,000)	2,790	13,838.820	5,225.891	29,436.270	1,239.608	32,393.000
Z-Score	2,790	0.322	0.567	1.781	-1.569	2.177
Asset Maturity	2,790	8.667	6.883	13.074	2.154	16.726
Creditrating Dummy	2,790	0.748	1	0.434	0	1
Number of Executives	2,790	5.702	5	1.049	5	7
Firm Age (years)	2,790	30.083	25	17.940	9	57
Return Vol. (not unlevered)	2,790	0.367	0.313	0.193	0.189	0.611
Return Vol.	2,097	0.324	0.307	0.131	0.183	0.484
CF Vol.	2,790	0.095	0.083	0.048	0.053	0.148
MtB	2,866	1.592	1.303	1.066	0.385	6.920
Merger Count	2,790	2.659	2	3.354	0	6
R&D/Assets	2,790	0.021	0.001	0.036	0	0.069
Forecast Dispersion	2,262	1.066	0.877	0.741	0.315	2.035
Transp. Ind. Firms	2,790	0.136	0	0.343	0	1
DA/Assets	2,449	-0.004	0.001	0.095	-0.084	0.075
Abs(DA/Assets)	2,449	0.058	0.029	0.085	0.005	0.129
Smooth	2,326	0.765	0.937	0.372	0.272	0.996
Restatement Dummy	2,790	0.104	0	0.305	0	1
ROA	2,790	0.057	0.059	0.075	-0.014	0.135
ROE	2,785	0.145	0.135	0.410	-0.067	0.354
Board characteristics (firm-based panel data)						
E-index	2,016	3.746	4	1.293	2	5
Co-option	1,908	0.428	0.375	0.299	0.067	0.889

Table 27: OLS Regressions testing the effects of pay duration measures on firm risk levels

This table presents the effects of pay duration measures on annualized-unlevered stock return volatility (Return Vol.), MtB and 1Y Merger Count, using the firm-based dataset for the period from 2006 to 2017. Equity PD, Whole PD, SERP PD, and ODC PD denote the equity-based pay duration, equity&debt-based pay duration, equity&debt-based pay duration (SERP), and equity&debt-based pay duration (ODC), respectively. We do not report constant terms. Appendix I defines all the variables. The signs ***, **, * indicate the significance of the correlation coefficients at the 1%, 5%, and 10% levels, respectively. All the continuous variables are winsorized at 1% and 99%.

	(1)	(2)	(3)	(4)	(5)	(6)
	Return Vol.	Return Vol.	MtB	MtB	1Y Merger Count	1Y Merger Count
Equity PD	0.000		0.015***		0.006*	
	(1.02)		(6.11)		(1.81)	
Whole PD		-0.000*		0.005***		-0.002
		(-1.85)		(5.02)		(-1.39)
ln(CEO Delta)	0.009*	0.010**	0.258***	0.277***	0.168***	0.174***
	(1.84)	(2.02)	(5.55)	(5.92)	(2.92)	(2.98)
ln(VP Delta)	0.006	0.006	0.238***	0.257***	0.060	0.053
	(1.11)	(1.00)	(4.50)	(4.85)	(0.82)	(0.72)
ln(CEO Vega)	-0.021	-0.019	0.103	0.096	0.090	0.111
	(-1.36)	(-1.18)	(1.18)	(1.10)	(0.73)	(0.88)
ln(VP Vega)	0.025	0.028	-0.075	-0.020	-0.022	0.035
	(0.91)	(0.95)	(-0.53)	(-0.15)	(-0.08)	(0.12)
Leverage	0.103***	0.101***	0.528***	0.590***	0.264	0.274
	(4.35)	(4.23)	(3.93)	(4.23)	(1.38)	(1.44)
ln(Total Assets)	-0.246***	-0.247***	0.093	0.116	-0.183	-0.189
	(-12.04)	(-12.08)	(0.62)	(0.76)	(-0.91)	(-0.94)
Z-Score	-0.034***	-0.033***	-0.304***	-0.310***	0.204***	0.213***
	(-8.86)	(-8.32)	(-12.52)	(-12.62)	(3.62)	(3.79)
Sales Growth	-0.008***	-0.007***	0.178***	0.178***	0.039*	0.044**
	(-4.27)	(-3.82)	(9.25)	(9.13)	(1.85)	(2.11)
ln(Asset Maturity)	0.008	0.009	0.007	-0.003	-0.117*	-0.110*
	(1.33)	(1.53)	(0.18)	(-0.07)	(-1.89)	(-1.75)
Creditrating Dummy	-0.022***	-0.020**	-0.189***	-0.241***	-0.037	-0.046
	(-2.59)	(-2.43)	(-2.99)	(-3.69)	(-0.43)	(-0.53)
Observations	2097	2082	2790	2763	2790	2763
Adjusted R^2	0.474	0.478	0.481	0.477	0.129	0.131
Clustered Std. Err.	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes

Table 28: Univariate analysis of Equity PD and Whole PD

This table presents univariate analyses of the equity-based pay duration and equity&debt-based pay duration. Loan spread and loan size are analyzed using both the facility-based and the firm-based dataset. Other variables are analyzed using the firm-based dataset. We use a dataset for the period from 2006 to 2017. Panel A shows the analysis results of equity-based pay duration, Panel B shows the analysis results of equity&debt-based pay duration and Panel C shows Pearson correlation table at 5% significance levels. *Equity PD*, *Whole PD*, *SERP PD*, and *ODC PD* denote the equity-based pay duration, equity&debt-based pay duration, equity&debt-based pay duration (SERP), and equity&debt-based pay duration (ODC), respectively. Appendix I defines all the variables. The signs ***, **, * indicate the significance of the correlation coefficients at the 1%, 5%, and 10% levels, respectively. All the continuous variables are winsorized at 1% and 99%.

Panel A: Equity-based pay duration

	Facility-based data set			
	Low Equity PD	**High Equity PD**		
	Mean	**Mean**	**Difference**	**p-value**
ln(Loan Spread)	5.22	5.105	-0.114***	0.0000
ln(Loan Size)	5.914	6.219	0.305***	0.0000

	Low Equity PD	**High Equity PD**		
	Mean	**Mean**	**Difference**	**p-value**
ln(Loan Spread)	5.095	4.978	-0.111***	0.0000
ln(Loan Size)	6.082	6.360	0.277***	0.0000
Sales Growth	0.055	0.094	0.032***	0.0000
Leverage	0.275	0.263	-0.012**	0.0354
ln(Total Assets)	8.483	8.826	0.342***	0.0000
Z-Score	0.151	0.492	0.341***	0.0000
ln(Asset Maturity)	1.911	1.800	-0.112***	0.0001
Creditrating Dummy	0.763	0.732	-0.032**	0.0276
CF Vol.	0.091	0.099	0.008***	0.0000
Return Vol.	0.325	0.323	-0.002	0.3673
MtB	1.409	1.775	0.367***	0.0000
1Y Merger Count	0.737	1.096	0.359***	0.0000
3Y Merger Count	0.487	0.773	0.286***	0.0000
R&D/Assets	0.015	0.026	0.011***	0.0000
Forecast Dispersion	1.000	1.125	0.125***	0.0000
Transp. Ind. Firms	0.144	0.128	-0.015	0.1170
Turnover	0.590	0.567	-0.023	0.1100
CEO Turnover	0.124	0.093	-0.032***	0.0036
ln(Mean Exec. Tenure)	1.718	1.863	0.145***	0.0000
E-index	3.764	3.723	-0.034	0.2792
Co-option	0.391	0.463	0.072***	0.0000
ROA	0.050	0.064	0.014***	0.0000
ROE	0.151	0.139	-0.011	0.2374

Panel B: Equity&debt-based pay duration (Whole PD)

	Facility-based data set			
	Low Whole PD	**High Whole PD**		
	Mean	**Mean**	**Difference**	**p-value**
ln(Loan Spread)	5.255	5.090	-0.165***	0.0000
ln(Loan Size)	5.968	6.162	0.194***	0.0000

	Firm-based data set			
	Low Whole PD	**High Whole PD**		
	Mean	**Mean**	**Difference**	**p-value**
ln(Loan Spread)	5.133	4.969	-0.164***	0.0000
ln(Loan Size)	6.022	6.424	0.401***	0.0000
Sales Growth	0.093	0.055	-0.038***	0.0000
Leverage	0.270	0.271	0.001	0.4744
ln(Total Assets)	8.383	8.929	0.546***	0.0000
Z-Score	0.292	0.356	0.063	0.1745
ln(Asset Maturity)	1.765	1.949	0.184***	0.0000
Creditrating Dummy	0.676	0.818	0.141***	0.0000
CF Vol.	0.101	0.089	-0.012***	0.0000
Abs(DA/Assets)	0.003	0.002	-0.002***	0.0047
Smooth	0.756	0.774	0.018	0.1276
Restatement Dummy	0.122	0.085	-0.037***	0.0007
Return Vol.	0.342	0.307	-0.034***	0.0000
MtB	1.596	1.584	0.012	0.3806
1Y Merger Count	0.910	0.921	0.011	0.4215
3Y Merger Count	0.640	0.618	-0.022	0.3194
Turnover	0.613	0.552	-0.061***	0.0006
CEO Turnover	0.129	0.088	-0.041***	0.0003
Ln(Mean Exec. Tenure)	1.816	1.766	-0.051*	0.0674
Ln(Mean Exec. Age)	0.0003	0.000	-0.0003	0.4411
E-index	0.439	0.422	-0.017	0.1107
Co-option	0.050	0.063	0.013***	0.0000
ROA	0.121	0.169	0.049***	0.0010
ROE	0.068	0.047	0.022***	0.0000

Panel C: Pearson correlation table (5% significance level)

	ln(Loan Spread)	Equity PD	Whole PD	SERP PD	ODC PD	ln(CEO Delta)	ln(VP Delta)	ln(CEO Vega)	ln(VP Vega)
ln(Loan Spread)	1								
Equity PD	-0.0970*	1							
	(0.000)								
Whole PD	-0.1340*	0.2380*	1						
	(0.000)	(0.000)							
SERP PD	-0.1553*	0.2768*	0.7697*	1					
	(0.000)	(0.000)	(0.000)						
ODC PD	-0.0980*	0.3277*	0.7808*	0.3267*	1				
	(0.000)	(0.000)	(0.000)	(0.000)					
ln(CEO Delta)	-0.2312*	0.2161*	0.0484*	0.0619*	0.1005*	1			
	(0.000)	(0.000)	(0.0006)	(0.000)	(0.000)				
ln(VP Delta)	-0.1642*	0.0897*	-0.0575*	-0.0142	-0.0099	0.4358*	1		
	(0.000)	(0.000)	(0.000)	(0.3147)	(0.4804)	(0.000)			
ln(CEO Vega)	-0.2366*	0.2120*	0.1829*	0.2236*	0.1460*	0.5384*	0.3047*	1	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
ln(VP Vega)	-0.2155*	0.1958*	0.1060*	0.1489*	0.0980*	0.4180*	0.5723*	0.7336*	1
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	

Table 29: OLS and GMM IV regressions of loan spread on Equity PD

This table presents the results of OLS and GMM IV estimations of *Equity PD* on *ln(Loan Spread)*. The dependent variable all-in drawn cost of debt, *ln(Loan Spread)*, measures the natural logarithm of the amount in basis point that a firm pays over LIBOR plus some additional fees. Equity PD is the equity-based pay duration which is defined as the weighted average vesting period of salaries, bonuses, options and restricted stocks of executives reported in Incentive Lab. The details for computing Equity PD measure are discussed in section IV.3.2. The sample data includes the interactions of Compustat, CRSP, ISS Incentive Lab, Execucomp, Standard and Dealscan databases, excluding financials and utility firms, from 2006 to 2017. The instruments used in GMM IV estimations are industry average Equity PD, *ln(Industry mean Equity PD)*, using Fama-French 30 and the natural logarithm of the firm's age, *ln(Firm Age)*. We include year fixed effects in all specifications. We include industry fixed effects in models (1) and (2) and firm fixed effects in model (3). We do not report constant terms. T-statistics (in parentheses) are computed using standard errors clustered by firm. Appendix I defines all the variables. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	OLS (1) **ln(Loan Spread)**	GMM IV (2) **ln(Loan Spread)**	GMM IV (3) **ln(Loan Spread)**
Equity PD (or Predicted Equity PD)	-0.0007	0.010**	0.007
	(-0.51)	(1.97)	(1.25)
ln(CEO Delta)	-0.037*	-0.047**	-0.044*
	(-1.93)	(-2.35)	(-1.94)
ln(VP Delta)	-0.032	-0.020	-0.034
	(-1.06)	(-0.64)	(-1.22)
ln(CEO Vega)	-0.075	-0.098**	0.053
	(-1.63)	(-2.05)	(0.90)
ln(VP Vega)	0.019	-0.001	-0.012
	(0.21)	(-0.02)	(-0.11)
Sales Growth	0.089*	0.073	0.068
	(1.73)	(1.27)	(1.26)
Leverage	0.548***	0.567***	0.318**
	(7.27)	(7.34)	(2.39)
ln(Total Assets)	-0.049***	-0.059***	-0.018
	(-3.01)	(-3.09)	(-0.51)
Z-Score	-0.060***	-0.067***	-0.013
	(-7.63)	(-7.47)	(-0.68)
ln(Asset Maturity)	0.018	0.010	0.072**
	(1.03)	(0.51)	(2.02)
ln(Loan Size)	-0.114***	-0.118***	-0.109***
	(-8.25)	(-8.49)	(-7.60)
Creditrating Dummy	-0.006	0.017	-0.069
	(-0.18)	(0.49)	(-1.56)
CF Vol.	0.045	-0.156	0.206
	(0.16)	(-0.51)	(0.35)
ln(Number of Banks)	-0.067***	-0.067***	-0.087***
	(-4.32)	(-4.23)	(-6.07)
Term Spread	10.328***	10.353**	6.297*
	(2.62)	(2.47)	(1.68)
Default Spread	8.147	9.214*	8.484
	(1.58)	(1.79)	(1.62)
Bridge Loan	0.192***	0.187***	0.218***
	(2.83)	(2.77)	(3.98)

Term Loan	0.319***	0.307***	0.229***
	(6.80)	(6.14)	(5.72)
Revolver Loan	-0.011	-0.012	0.025
	(-0.22)	(-0.25)	(0.65)
General Purpose Loan	-0.366***	-0.355***	-0.282***
	(-11.11)	(-10.71)	(-8.23)
Working Capital Loan	-0.395***	-0.387***	-0.333***
	(-9.29)	(-8.92)	(-6.86)
Takeover Recap Loan	-0.076*	-0.057	-0.057
	(-1.79)	(-1.29)	(-1.46)
Crisis	0.025	0.041	0.043
	(0.25)	(0.40)	(0.41)
Instruments in the First Stage			
ln(Firm Age)		-0.573*	-0.302
		(-1.68)	(-0.15)
Ind Mean Equity PD		0.967***	0.703***
		(10.55)	(7.43)
Observations	5081	5081	5081
Adjusted R^2	0.478	0.438	0.249
Clustered Std. Err.	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	No
Firm fixed effects	No	No	Yes
First Stage F stat		49.52	28.15
Hansen J-stat (p-value)		1.0000	0.2832

Table 30: OLS regression analysis to test the decline in Equity PD

This table presents results of OLS estimation of post FAS 123R period on equity-based pay duration and the ratios of its components, salary, bonus, option and restricted stocks in total grants between 2003 and 2006. Only column (2) shows analysis results for the period between 2004 and 2005. The dependent variables are *Equity PD, Salary&Bonus Ratio, Option Ratio,* and *Restricted Stock Ratio*. *Equity PD* is the equity-based pay duration which is defined as the weighted average vesting period of salaries, bonuses, options and restricted stocks of executives reported in Incentive Lab. The details for computing Equity PD measure are discussed in section IV.3.2. *Salary&Bonus Ratio* is the ratio of total values of bonuses and salaries granted in the total value of executive grants. *Option Ratio* and *Restricted Stock Ratio* are defined as the ratios of option values and restricted stock values granted in the total value of executive grants respectively. The sample data includes the interactions of Compustat, CRSP, ISS Incentive Lab, Execucomp, Standard and Dealscan databases, excluding financials and utility firms. We do not report constant terms. Appendix I defines all the variables. We include year and industry fixed effects in all specifications. t-statistics (in parentheses) are computed using standard errors clustered by firm. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(4)	(5)	(6)
	Equity PD	**Equity PD**	**Salary&Bonus Ratio**	**Option Ratio**	**Restricted Stock Ratio**
Post FAS123R	-10.659***	-8.025*	0.164**	-0.208***	0.044
	(-3.36)	(-1.73)	(2.34)	(-2.94)	(0.64)
ln(CEO Delta)	1.457**	0.572	-0.020	0.019	0.001
	(2.22)	(0.64)	(-1.40)	(1.37)	(0.07)
ln(VP Delta)	-0.660	-0.341	0.007	0.016	-0.023
	(-0.76)	(-0.29)	(0.43)	(0.82)	(-1.31)
ln(CEO Vega)	0.518	1.072	-0.012	0.026	-0.014
	(0.35)	(0.54)	(-0.37)	(0.76)	(-0.40)
ln(VP Vega)	1.801	-0.383	-0.103**	0.148**	-0.044
	(0.70)	(-0.10)	(-2.09)	(2.48)	(-0.77)
Sales Growth	1.147	2.576	-0.032	-0.007	0.038
	(0.46)	(0.79)	(-0.74)	(-0.13)	(0.66)
Leverage	-1.553	-4.156	0.016	-0.018	0.001
	(-0.52)	(-1.01)	(0.26)	(-0.23)	(0.02)
ln(Total Assets)	1.304**	1.353*	-0.012	-0.009	0.021*
	(2.47)	(1.87)	(-1.23)	(-0.81)	(1.92)
Z-Score	0.059	-0.060	0.006	0.008	-0.013**
	(0.21)	(-0.15)	(1.03)	(1.38)	(-2.13)
ln(Asset Maturity)	-0.911	-1.062	0.006	-0.035**	0.028*
	(-1.20)	(-1.11)	(0.52)	(-2.23)	(1.78)
Creditrating Dummy	0.215	1.997	0.006	-0.022	0.016
	(0.16)	(1.06)	(0.27)	(-0.81)	(0.59)
CF Vol.	12.519	11.445	-0.110	-0.106	0.216
	(1.29)	(0.80)	(-0.52)	(-0.52)	(0.96)
Term Spread	-443.169***	6.612	8.041***	-7.758***	-0.283
	(-4.77)	(0.04)	(4.04)	(-3.84)	(-0.15)
Default Spread	1741.063***	3364.841***	-28.688**	39.531***	-10.843
	(3.28)	(2.61)	(-2.51)	(3.50)	(-0.99)
Observations	1007	506	1007	1007	1007

Adjusted R^2	0.095	0.040	0.150	0.134	0.042
Industry fixed effect	Yes	Yes	Yes	Yes	Yes
Clustered Std. Err.	Yes	Yes	Yes	Yes	Yes
Period	2003-2006	2004-2005	2003-2006	2003-2006	2003-2006

Table 31: DID method (OLS) results of testing the relation Equity PD and cost of debt

This table presents the results of difference-in-difference (DID) methods to examine the impacts of FAS 123R on the treatment group for the period between 2003 and 2006. The dependent variable all-in drawn cost of debt, *ln(Loan Spread)*, measures the natural logarithm of the amount in basis point that a firm pays over LIBOR plus some additional fees. *Post FAS123R* refers to the period for the post FAS 123R period. *FAS123R Treatment* is defined as an indicator variable the equals to 1 if a firm is in the treated group, and zero otherwise. The sample used in the model (1) is the whole sample between 2003 and 2006. The sample used in the model (2) includes the control group and their equal size matched treatment group between 2003 and 2006. The sample data includes the interactions of Compustat, CRSP, ISS Incentive Lab, Execucomp, Standard and Dealscan databases, excluding financials and utility firms. We do not report constant terms. Appendix I defines all the variables. We include year and industry fixed effects in all specifications. T-statistics (in parentheses) are computed using standard errors clustered by firm. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
	ln(Loan Spread)	**ln(Loan Spread)**
FAS123R Treatment	0.218	-0.072
	(1.57)	(-0.31)
FAS123R Treatment*Post FAS123R	-0.423**	-0.519**
	(-2.50)	(-2.16)
ln(CEO Delta)	-0.002	0.035
	(-0.06)	(0.30)
ln(VP Delta)	-0.033	0.205*
	(-0.75)	(1.88)
ln(CEO Vega)	-0.100	0.123
	(-1.29)	(0.48)
ln(VP Vega)	0.014	-0.951**
	(0.10)	(-2.03)
Sales Growth	0.030	0.107
	(0.24)	(0.32)
Leverage	1.271***	2.247***
	(7.64)	(3.04)
ln(Total Assets)	-0.090***	-0.011
	(-3.40)	(-0.18)
Z-Score	-0.106***	-0.055
	(-7.15)	(-0.88)
ln(Asset Maturity)	-0.001	0.110
	(-0.01)	(1.18)

ln(Loan Size)	-0.216***	-0.148***
	(-9.03)	(-4.46)
Creditrating Dummy	-0.051	0.114
	(-0.80)	(0.30)
CF Vol.	-1.009*	-4.280***
	(-1.75)	(-3.54)
ln(Number of Banks)	-0.050*	-0.183*
	(-1.88)	(-1.83)
Term Spread	-20.833***	24.015
	(-2.64)	(1.20)
Default Spread	-58.902*	26.002
	(-1.90)	(0.28)
Bridge Loan	0.215	0.615*
	(1.37)	(1.77)
Term Loan	0.194**	0.399
	(2.02)	(1.57)
Revolver Loan	-0.332***	0.043
	(-3.54)	(0.18)
General Purpose Loan	-0.447***	-0.488***
	(-9.01)	(-2.86)
Working Capital Loan	-0.441***	-0.185
	(-7.87)	(-0.94)
Takeover Recap Loan	-0.090	-0.519
	(-1.22)	(-1.50)
Observations	2473	205
Adjusted R^2	0.511	0.623
Industry fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Clustered Std. Err.	Yes	Yes
Period	2003-2006	2003-2006

Table 32: Channels for the impact of Equity PD on loan spread

This table presents the results of GMM IV estimations of the interactions between Equity PD and channels on *ln(Loan Spread)*. The dependent variable all-in drawn cost of debt, *ln(Loan Spread)*, measures the natural logarithm of the amount in basis point that a firm pays over LIBOR plus some additional fees. Channels examined are shown at the top of the table. Channels are categorized as risk, information asymmetry and labor market channels. Equity PD is the equity-based pay duration which is defined as the weighted average vesting period of salaries, bonuses, options and restricted stocks of executives reported in Incentive Lab. The details for computing Equity PD measure are discussed in section IV.3.2. The sample data includes the interactions of Compustat, CRSP, ISS Incentive Lab, Execucomp, Standard and Dealscan databases, excluding financials and utility firms, from 2006 to 2017. The instruments used are industry average Equity PD, *ln(Industry mean Equity PD)*, using Fama-French 30, the natural logarithm of the firm's age, *ln(Firm Age)*, the natural logarithm of executives' mean tenure, *ln(Mean Exec. Tenure)*, and the interaction of these variables with the channels. We do not report constant terms. Appendix I defines all the variables. We include year and industry fixed effects in all specifications. T-statistics (in parentheses) are computed using standard errors clustered by firm. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Risk Channels			**Information Asymmetry Channels**			**Labor Market Channels**	
Channels	**Return Vol.**	**MtB**	**3Y Merger Count**	**R&D/ Assets**	**Forecast Dispersion**	**Transp. Ind. Firms**	**Turnover**	**CEO Turnover**
Predicted Equity PD	-0.002	-0.019*	-0.003	0.004	0.004	0.012**	0.001	0.004
	(-0.24)	(-1.95)	(-0.43)	(1.21)	(0.64)	(2.07)	(0.16)	(1.22)
Predicted Equity PD x Channel	**0.034***	**0.020*****	**0.002****	**0.192***	**0.005**	**-0.023*****	**0.018****	**0.024*****
	(1.69)	**(2.88)**	**(2.05)**	**(1.79)**	**(0.85)**	**(-2.65)**	**(2.26)**	**(3.14)**
Channel	-0.509	-0.787***	-0.064**	-6.769**	-0.164	0.588*	-0.453**	-0.647***
	(-1.00)	(-3.64)	(-2.07)	(-2.12)	(-1.01)	(1.91)	(-2.11)	(-3.12)
ln(CEO Delta)	-0.056***	-0.001	-0.047**	-0.052**	-0.047**	-0.048**	-0.048**	-0.044***
	(-2.73)	(-0.07)	(-2.38)	(-2.54)	(-2.16)	(-2.37)	(-2.44)	(-3.71)
ln(VP Delta)	0.009	-0.011	-0.042	-0.030	-0.044	-0.019	-0.033	-0.026
	(0.31)	(-0.44)	(-1.35)	(-0.99)	(-0.80)	(-0.62)	(-1.13)	(-1.49)
ln(CEO Vega)	-0.092*	-0.052	-0.080*	-0.081*	-0.222*	-0.110**	-0.101**	-0.091***
	(-1.90)	(-1.03)	(-1.69)	(-1.75)	(-1.80)	(-2.31)	(-2.12)	(-3.09)
ln(VP Vega)	-0.077	-0.044	-0.014	0.002	0.351	-0.033	0.019	0.000
	(-0.88)	(-0.45)	(-0.15)	(0.03)	(0.94)	(-0.36)	(0.22)	(0.01)
Sales Growth	0.058	0.082	0.064	0.058	0.175	0.041	0.065	0.055
	(0.95)	(1.35)	(1.16)	(1.06)	(1.52)	(0.76)	(1.17)	(1.50)
Leverage	0.695***	0.630***	0.497***	0.505***	0.576***	0.543***	0.573***	0.553***
	(8.13)	(6.94)	(6.46)	(6.66)	(5.32)	(7.13)	(7.41)	(12.53)
ln(Total Assets)	-0.026	-0.105***	-0.041**	-0.052***	-0.052**	-0.051***	-0.061***	-0.049***
	(-1.41)	(-5.67)	(-2.18)	(-3.04)	(-2.20)	(-2.75)	(-3.25)	(-4.97)
Z-Score	-0.064***	-0.016	-0.060***	-0.065***	-0.070***	-0.064***	-0.066***	-0.064***
	(-7.24)	(-1.55)	(-6.75)	(-7.82)	(-6.53)	(-7.20)	(-7.48)	(-12.97)
ln(Asset Maturity)	-0.002	-0.025	0.010	0.008	-0.066	0.011	0.015	0.022**
	(-0.12)	(-1.27)	(0.50)	(0.44)	(-0.80)	(0.55)	(0.84)	(2.11)

ln(Loan Size)	-0.121***	-0.107***	-0.111***	-0.117***	-0.126***	-0.117***	-0.117***	-0.115***
	(-7.62)	(-8.01)	(-8.23)	(-8.47)	(-7.56)	(-8.45)	(-8.35)	(-16.30)
Creditrating Dummy	-0.005	-0.028	-0.000	0.014	0.031	0.020	0.013	0.008
	(-0.14)	(-0.81)	(-0.01)	(0.42)	(0.67)	(0.58)	(0.38)	(0.41)
CF Vol.	-0.344	0.801***	0.030	-0.107	-0.422	-0.101	-0.217	0.086
	(-1.05)	(2.70)	(0.10)	(-0.36)	(-1.15)	(-0.34)	(-0.72)	(0.51)
ln(Number of Banks)	-0.050***	-0.075***	-0.073***	-0.076***	-0.036*	-0.071***	-0.066***	-0.070***
	(-2.82)	(-4.77)	(-4.74)	(-4.77)	(-1.76)	(-4.56)	(-4.17)	(-6.26)
Term Spread	5.171	5.643	12.317***	10.439***	6.542	10.720**	10.303**	9.275***
	(1.13)	(1.31)	(3.16)	(2.64)	(1.27)	(2.55)	(2.30)	(2.97)
Default Spread	3.886	4.005	9.578*	7.541	6.128	9.550*	9.257*	8.493*
	(0.63)	(0.69)	(1.82)	(1.51)	(0.98)	(1.84)	(1.77)	(1.90)
Bridge Loan	0.223***	0.168**	0.192***	0.196***	0.224***	0.183***	0.192***	0.191***
	(3.09)	(2.39)	(2.83)	(2.88)	(2.63)	(2.71)	(2.86)	(3.16)
Term Loan	0.320***	0.268***	0.335***	0.331***	0.330***	0.312***	0.312***	0.326***
	(6.75)	(5.72)	(6.82)	(7.48)	(6.46)	(6.31)	(6.40)	(8.52)
Revolver Loan	-0.031	-0.042	-0.006	0.007	-0.002	-0.014	-0.002	0.002
	(-0.65)	(-0.88)	(-0.12)	(0.15)	(-0.04)	(-0.30)	(-0.05)	(0.05)
General Purpose Loan	-0.364***	-0.363***	-0.363***	-0.362***	-0.339***	-0.356***	-0.352***	-0.371***
	(-9.67)	(-10.54)	(-11.09)	(-10.98)	(-7.38)	(-10.91)	(-10.57)	(-15.87)
Working Capital Loan	-0.399***	-0.425***	-0.402***	-0.395***	-0.383***	-0.395***	-0.386***	-0.405***
	(-8.03)	(-9.42)	(-9.48)	(-9.20)	(-7.37)	(-9.19)	(-8.95)	(-12.80)
Takeover Recap Loan	-0.068	-0.032	-0.091**	-0.063	-0.062	-0.063	-0.051	-0.075**
	(-1.46)	(-0.66)	(-2.06)	(-1.45)	(-1.20)	(-1.42)	(-1.13)	(-2.54)
Crisis	0.040	0.103	0.022	0.052	-0.050	0.039	0.046	-0.002
	(0.31)	(0.98)	(0.21)	(0.48)	(-0.42)	(0.38)	(0.44)	(-0.03)
Observations	3743	4671	5081	4971	4011	5081	5081	5037
Adjusted R^2	0.489	0.443	0.429	0.460	0.454	0.453	0.430	0.470
Clustered Std. Err.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First Stage F stat	12.04	11.97	59.75	17.96	10.52	46.27	50.69	52.39
Hansen J-stat (p-value)	0.7600	0.5529	0.0016	0.9298	0.2448	0.2078	0.9883	0.0316

Table 33: OLS regressions of loan spread on Whole PD measures

This table presents the results of OLS estimations of *Whole PD*, *SERP PD*, and *ODC PD* on *ln(Loan Spread)*. The dependent variable all-in drawn cost of debt, *ln(Loan Spread)*, measures the natural logarithm of the amount in basis point that a firm pays over LIBOR plus some additional fees. *Whole PD* is the equity&debt-based pay duration which is defined as the weighted average vesting period of salaries, bonuses, options, restricted stocks, pensions and other deferred compensation of executives reported in Incentive Lab. *SERP PD* is the equity&debt-based pay duration which is defined as the weighted average vesting period of salaries, bonuses, options, restricted stocks, and pensions (SERP) of executives reported in Incentive Lab. *ODC PD* is the equity&debt-based pay duration which is defined as the weighted average vesting period of salaries, bonuses, options, restricted stocks, and other deferred compensations (ODC) of executives reported in Incentive Lab. The details for computing *Whole PD*, *SERP PD*, and *ODC PD* measures are discussed in section IV.3.2. The sample data includes the interactions of Compustat, CRSP, ISS Incentive Lab, Execucomp, Standard and Dealscan databases, excluding financials and utility firms, from 2006 to 2017. We do not report constant terms. Appendix I defines all the variables. We include year and industry fixed effects in all specifications. T-statistics (in parentheses) are computed using standard errors clustered by firm. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
	ln(Loan Spread)	**ln(Loan Spread)**	**ln(Loan Spread)**
Whole PD	-0.002***		
	(-4.26)		
SERP PD		-0.002***	
		(-4.24)	
ODC PD			-0.001***
			(-2.77)
ln(CEO Delta)	-0.035*	-0.036*	-0.033*
	(-1.89)	(-1.90)	(-1.76)
ln(VP Delta)	-0.042	-0.038	-0.036
	(-1.46)	(-1.31)	(-1.23)
ln(CEO Vega)	-0.085*	-0.080*	-0.096**
	(-1.89)	(-1.77)	(-2.11)
ln(VP Vega)	0.048	0.044	0.051
	(0.56)	(0.51)	(0.58)
Sales Growth	0.079	0.069	0.089*
	(1.57)	(1.38)	(1.76)
Leverage	0.532***	0.533***	0.528***
	(7.21)	(7.17)	(7.11)
ln(Total Assets)	-0.041***	-0.040**	-0.044***
	(-2.58)	(-2.52)	(-2.73)
Z-Score	-0.056***	-0.058***	-0.057***
	(-7.57)	(-7.81)	(-7.50)
ln(Asset Maturity)	0.028	0.028	0.021
	(1.54)	(1.56)	(1.17)
ln(Loan Size)	-0.113***	-0.113***	-0.113***
	(-8.28)	(-8.45)	(-8.07)
Creditrating Dummy	0.007	0.002	0.003
	(0.23)	(0.07)	(0.11)

CF Vol.	-0.035	0.014	-0.022
	(-0.13)	(0.05)	(-0.08)
ln(Number of Banks)	-0.066***	-0.066***	-0.067***
	(-4.36)	(-4.43)	(-4.37)
Term Spread	12.010***	12.336***	11.552***
	(3.12)	(3.21)	(3.04)
Default Spread	9.034*	9.360*	8.863*
	(1.76)	(1.82)	(1.72)
Bridge Loan	0.213***	0.214***	0.203***
	(3.18)	(3.18)	(3.01)
Term Loan	0.311***	0.313***	0.312***
	(6.75)	(6.71)	(6.74)
Revolver Loan	-0.009	-0.007	-0.012
	(-0.19)	(-0.14)	(-0.25)
General Purpose Loan	-0.357***	-0.356***	-0.357***
	(-11.02)	(-10.91)	(-11.00)
Working Capital Loan	-0.389***	-0.388***	-0.389***
	(-9.24)	(-9.19)	(-9.28)
Takeover Recap Loan	-0.082*	-0.081*	-0.079*
	(-1.93)	(-1.91)	(-1.85)
Crisis	0.009	0.005	0.000
	(0.09)	(0.05)	(0.00)
Observations	5033	5033	5033
Adjusted R^2	0.470	0.470	0.468
Clustered Std. Err.	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes

Table 34: GMM IV regressions of loan spread on Whole PD measures

This table presents the results of GMM IV estimations of *Whole PD*, *SERP PD*, and *ODC PD* on *ln(Loan Spread)*. The dependent variable all-in drawn cost of debt, *ln(Loan Spread)*, measures the natural logarithm of the amount in basis point that a firm pays over LIBOR plus some additional fees. *Whole PD* is the equity&debt-based pay duration which is defined as the weighted average vesting period of salaries, bonuses, options, restricted stocks, pensions and other deferred compensation of executives reported in Incentive Lab. *SERP PD* is the equity&debt-based pay duration which is defined as the weighted average vesting period of salaries, bonuses, options, restricted stocks, and pensions (SERP) of executives reported in Incentive Lab. *ODC PD* is the equity&debt-based pay duration which is defined as the weighted average vesting period of salaries, bonuses, options, restricted stocks, and other deferred compensations (ODC) of executives reported in Incentive Lab. The details for computing *Whole PD*, *SERP PD*, and *ODC PD* measures are discussed in section IV.3.2. The instruments used are the natural logarithm of the executive mean of total value of vested stocks and the value realized from option exercises two years ago, *ln(MeanVESTING)*$_{t-2}$, the natural logarithm of executives' mean tenure, *ln(Mean Exec. Tenure)*, and the number of executives reported in Execucomp, *Number of Exec.*. The sample data includes the interactions of Compustat, CRSP, ISS Incentive Lab, Execucomp, Standard and Dealscan databases, excluding financials and utility firms, from 2006 to 2017. We do not report constant terms. Appendix I defines all the variables. We include year and industry or firm fixed effects in all specifications. T-statistics (in parentheses) are computed using standard errors clustered by firm. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	ln(Loan Spread)	**ln(Loan Spread)**	**ln(Loan Spread)**	**ln(Loan Spread)**	**ln(Loan Spread)**	**ln(Loan Spread)**
Predicted Whole PD	-0.013***	-0.011**				
	(-3.55)	(-2.01)				
Predicted SERP PD			-0.018***	-0.016*		
			(-2.87)	(-1.89)		
Predicted ODC PD					-0.013***	-0.012**
					(-3.55)	(-2.05)
ln(CEO Delta)	-0.044**	-0.047*	-0.051**	-0.049*	-0.024	-0.032
	(-2.17)	(-1.72)	(-2.30)	(-1.67)	(-1.13)	(-1.10)
ln(VP Delta)	-0.088***	-0.069**	-0.078**	-0.064*	-0.065*	-0.062*
	(-2.60)	(-1.98)	(-2.22)	(-1.84)	(-1.95)	(-1.83)
ln(CEO Vega)	-0.010	0.098	0.061	0.142*	-0.061	0.097
	(-0.16)	(1.58)	(0.77)	(1.91)	(-1.11)	(1.49)
ln(VP Vega)	0.057	-0.028	0.034	-0.051	0.089	-0.005
	(0.63)	(-0.25)	(0.34)	(-0.42)	(0.96)	(-0.04)
Sales Growth	0.076	0.163***	-0.027	0.166**	0.165**	0.171***
	(1.24)	(2.68)	(-0.37)	(2.54)	(2.53)	(2.74)
Leverage	0.514***	0.386***	0.556***	0.395**	0.468***	0.359**
	(5.71)	(2.68)	(5.18)	(2.38)	(5.40)	(2.50)
ln(Total Assets)	-0.010	0.000	0.012	-0.007	-0.021	-0.014
	(-0.49)	(0.01)	(0.46)	(-0.17)	(-1.01)	(-0.35)
Z-Score	-0.036***	0.009	-0.040***	0.001	-0.037***	0.008
	(-3.44)	(0.41)	(-3.22)	(0.07)	(-3.41)	(0.38)
ln(Asset Maturity)	0.078***	0.094**	0.093***	0.093**	0.047*	0.100**
	(2.79)	(2.27)	(2.62)	(2.09)	(1.93)	(2.22)
ln(Loan Size)	-0.110***	-0.107***	-0.112***	-0.110***	-0.106***	-0.107***

	(-7.91)	(-6.75)	(-8.35)	(-6.71)	(-6.37)	(-6.70)
Creditrating Dummy	0.027	-0.100*	-0.005	-0.133*	0.005	-0.077*
	(0.73)	(-1.84)	(-0.10)	(-1.90)	(0.15)	(-1.67)
CF Vol.	-0.266	-0.492	-0.050	-0.687	-0.308	-0.440
	(-0.78)	(-0.71)	(-0.14)	(-0.93)	(-0.83)	(-0.64)
ln(Number of Banks)	-0.056***	-0.084***	-0.056***	-0.085***	-0.059***	-0.088***
	(-3.34)	(-6.00)	(-3.30)	(-5.69)	(-3.24)	(-6.37)
Term Spread	11.498**	8.902**	14.799***	10.933**	8.451*	7.183*
	(2.50)	(2.24)	(2.78)	(2.32)	(1.95)	(1.86)
Default Spread	6.444	8.161	8.405	10.757**	4.287	7.668
	(1.09)	(1.54)	(1.26)	(2.06)	(0.71)	(1.38)
Bridge Loan	0.299***	0.248***	0.325***	0.239***	0.243***	0.248***
	(4.15)	(4.37)	(3.96)	(4.01)	(3.42)	(4.38)
Term Loan	0.322***	0.222***	0.334***	0.214***	0.325***	0.227***
	(6.74)	(5.32)	(6.08)	(4.83)	(6.64)	(5.49)
Revolver Loan	0.028	0.018	0.054	0.012	0.007	0.020
	(0.59)	(0.45)	(0.95)	(0.28)	(0.14)	(0.49)
General Purpose Loan	-0.373***	-0.287***	-0.365***	-0.286***	-0.373***	-0.281***
	(-9.97)	(-8.21)	(-9.13)	(-7.68)	(-10.20)	(-7.93)
Working Capital Loan	-0.408***	-0.340***	-0.391***	-0.344***	-0.408***	-0.329***
	(-7.90)	(-6.61)	(-6.72)	(-6.31)	(-8.34)	(-6.33)
Takeover Recap Loan	-0.106**	-0.069	-0.105**	-0.065	-0.087*	-0.059
	(-2.17)	(-1.64)	(-1.99)	(-1.44)	(-1.81)	(-1.37)
Crisis	0.063	0.042	0.072	0.068	-0.012	0.022
	(0.53)	(0.39)	(0.53)	(0.60)	(-0.12)	(0.20)
Instruments in the First Stage						
$\ln(\text{MeanVesting})_{t-2}$	2.744***	1.859***	1.668**	1.125**	2.936***	1.884***
	(3.60)	(3.38)	(2.35)	(2.27)	(4.39)	(3.88)
ln(Mean Exec. Tenure)	-1.279	-2.232**	-1.652*	-1.336*	-0.051	-0.931
	(-1.38)	(-2.45)	(-1.91)	(-1.84)	(-0.06)	(-1.12)
Number of Exec.	-2.254***	-1.027**	-1.185**	-0.852**	-2.116***	-1.271***
	(-3.35)	(-2.13)	(-2.42)	(-2.01)	(-3.04)	(-2.80)
Observations	4831	4831	4831	4831	4831	4831
Adjusted R^2	0.343	0.179	0.224	0.102	0.340	0.166
Clustered Std. Err.	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	No	Yes	No	Yes	No
Firm fixed effects	No	Yes	No	Yes	No	Yes
First Stage F stat	5.78	6.45	7.62	3.54	3.78	7.32
Hansen J-stat (p-value)	0.9377	0.8156	0.5188	0.7841	0.8190	0.8388

Table 35: Channels for the impact of Whole PD on cost of debt

This table presents results of GMM IV estimations of the interactions between Whole PD and channels on *ln(Loan Spread)*. The dependent variable all-in drawn cost of debt, *ln(Loan Spread)*, measures the natural logarithm of the amount in basis point that a firm pays over LIBOR plus some additional fees. Channels examined are shown at the top of the table. Channels are categorized as manipulation, risk, and labor market channels. Whole PD is the equity-based pay duration which is defined as the weighted average vesting period of salaries, bonuses, options, restricted stocks, pensions and other deferred compensations of executives reported in Incentive Lab. The sample data includes the interactions of Compustat, CRSP, ISS Incentive Lab, Execucomp, Standard and Dealscan databases, excluding financials and utility firms, from 2006 to 2017. The instruments used are the natural logarithm of the executive mean of total value of vested stocks and the value realized from option exercises two years ago, *ln(MeanVESTING)*$_{t-2}$, the natural logarithm of executives' mean tenure, *ln(Mean Exec. Tenure)*, the number of executives reported in Execucomp, *Number of Exec.*, the natural logarithm of the firm age, *ln(Firm Age)*, and the interaction of these variables with the channels. We do not report constant terms. Appendix I defines all the variables. We include year and industry fixed effects in all specifications. T-statistics (in parentheses) are computed using standard errors clustered by firm. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Manipulation Channels			**Risk Channels**			**Labor Market Channels**	
	Abs(DA/ Assets)	**Smooth**	**Restatement Dummy**	**Return Vol.**	**MtB**	**3Y Merger Count**	**CEO Turnover**	**Turnover**
Whole PD	-0.008**	-0.009**	-0.009***	-0.011**	-0.009	-0.010***	-0.011***	-0.005*
	(-2.45)	(-2.06)	(-3.52)	(-2.28)	(-1.41)	(-3.05)	(-3.33)	(-1.78)
Whole PD x Channel	**-0.050**	**0.000**	**-0.001**	**0.011**	**0.001**	**-0.000**	**0.003**	**-0.008****
	(-1.29)	**(0.10)**	**(-0.17)**	**(0.67)**	**(0.30)**	**(-0.12)**	**(0.72)**	**(-2.26)**
Channel	1.812	-0.022	0.062	-0.339	-0.200	-0.002	-0.226	0.405**
	(1.17)	(-0.11)	(0.24)	(-0.43)	(-0.79)	(-0.10)	(-1.09)	(2.28)
ln(CEO Delta)	-0.037*	-0.047**	-0.047**	-0.044**	-0.020	-0.049**	-0.054***	-0.026
	(-1.89)	(-2.48)	(-2.47)	(-2.20)	(-0.97)	(-2.54)	(-2.67)	(-1.26)
ln(VP Delta)	-0.076**	-0.071**	-0.075**	-0.033	-0.040	-0.069**	-0.082***	-0.062**
	(-2.37)	(-2.19)	(-2.39)	(-1.04)	(-1.20)	(-2.16)	(-2.59)	(-2.03)
ln(CEO Vega)	-0.028	-0.028	-0.030	-0.040	-0.004	-0.018	-0.033	-0.025
	(-0.51)	(-0.50)	(-0.56)	(-0.78)	(-0.07)	(-0.34)	(-0.58)	(-0.46)
ln(VP Vega)	0.034	0.046	0.062	-0.008	0.035	0.057	0.071	0.017
	(0.41)	(0.56)	(0.72)	(-0.10)	(0.41)	(0.65)	(0.80)	(0.19)
Sales Growth	0.034	0.063	0.084	0.078	0.124**	0.093	0.079	0.078
	(0.45)	(1.04)	(1.52)	(1.22)	(2.25)	(1.64)	(1.38)	(1.33)
Leverage	0.608***	0.593***	0.532***	0.645***	0.500***	0.525***	0.521***	0.518***
	(7.25)	(7.23)	(6.64)	(7.57)	(6.36)	(6.35)	(6.23)	(6.10)
ln(Total Assets)	-0.014	-0.021	-0.022	0.004	-0.061***	-0.012	-0.014	-0.012
	(-0.77)	(-1.09)	(-1.19)	(0.25)	(-3.05)	(-0.62)	(-0.75)	(-0.67)
Z-Score	-0.037***	-0.041***	-0.042***	-0.049***	-0.024***	-0.043***	-0.040***	-0.045***
	(-3.82)	(-4.34)	(-4.61)	(-5.41)	(-2.92)	(-4.48)	(-4.26)	(-5.27)

ln(Asset Maturity)	0.056**	0.046*	0.061***	0.043*	0.042*	0.068***	0.066***	0.065***
	(2.36)	(1.84)	(2.59)	(1.70)	(1.76)	(2.77)	(2.59)	(2.81)
ln(Loan Size)	-0.112***	-0.113***	-0.109***	-0.115***	-0.108***	-0.113***	-0.111***	-0.110***
	(-7.93)	(-8.01)	(-8.05)	(-7.51)	(-8.01)	(-8.33)	(-8.57)	(-8.43)
Creditrating Dummy	-0.009	0.022	0.017	-0.026	-0.018	0.020	0.023	0.026
	(-0.25)	(0.63)	(0.50)	(-0.80)	(-0.46)	(0.59)	(0.66)	(0.75)
CF Vol.	-0.082	-0.237	-0.204	-0.136	0.626	-0.121	-0.226	-0.013
	(-0.24)	(-0.65)	(-0.67)	(-0.41)	(1.46)	(-0.38)	(-0.71)	(-0.04)
ln(Number of Banks)	-0.055***	-0.061***	-0.060***	-0.049***	-0.075***	-0.056***	-0.059***	-0.060***
	(-3.38)	(-3.72)	(-3.87)	(-2.80)	(-4.72)	(-3.61)	(-3.82)	(-3.86)
Term Spread	12.738**	9.938*	10.829**	8.429*	9.659**	10.920**	10.539**	12.747***
	(2.44)	(1.73)	(2.53)	(1.92)	(2.37)	(2.48)	(2.41)	(2.88)
Default Spread	8.173	8.070	7.174	4.427	5.792	6.559	5.855	9.274
	(1.23)	(1.17)	(1.28)	(0.65)	(1.03)	(1.16)	(1.02)	(1.60)
Bridge Loan	0.277***	0.230***	0.280***	0.271***	0.246***	0.277***	0.272***	0.274***
	(3.86)	(3.09)	(4.12)	(3.98)	(3.48)	(4.07)	(4.02)	(4.04)
Term Loan	0.332***	0.319***	0.333***	0.295***	0.288***	0.322***	0.319***	0.317***
	(6.86)	(6.44)	(7.32)	(6.05)	(6.18)	(6.98)	(6.88)	(6.72)
Revolver Loan	0.044	0.024	0.029	-0.018	-0.008	0.028	0.024	0.010
	(0.94)	(0.49)	(0.62)	(-0.39)	(-0.18)	(0.59)	(0.51)	(0.21)
General Purpose Loan	-0.365***	-0.362***	-0.375***	-0.349***	-0.380***	-0.370***	-0.370***	-0.365***
	(-9.98)	(-9.93)	(-10.74)	(-8.99)	(-10.83)	(-10.41)	(-10.21)	(-10.22)
Working Capital Loan	-0.403***	-0.385***	-0.405***	-0.369***	-0.432***	-0.391***	-0.395***	-0.396***
	(-7.97)	(-7.80)	(-8.53)	(-7.14)	(-9.25)	(-8.13)	(-8.06)	(-8.40)
Takeover Recap Loan	-0.083*	-0.073	-0.105**	-0.069	-0.082*	-0.098**	-0.104**	-0.113**
	(-1.71)	(-1.61)	(-2.32)	(-1.46)	(-1.77)	(-2.11)	(-2.20)	(-2.37)
Crisis	0.147	0.099	0.027	0.115	0.069	-0.018	0.042	0.050
	(1.19)	(0.85)	(0.24)	(0.73)	(0.63)	(-0.16)	(0.37)	(0.44)
Observations	4297	4071	4831	3623	4435	4831	4827	4831
Adjusted R^2	0.407	0.435	0.413	0.472	0.465	0.396	0.385	0.397
Clustered Std. Err.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First Stage F stat	5.64	10.33	5.76	6.49	5.97	5.54	5.59	5.81
Hansen J-stat(p-value)	0.9803	0.9352	0.9082	0.9166	0.1282	0.0932	0.8055	0.0928

Table 36: Heterogeneities in the impact of Whole PD on loan spread

This table presents the results of GMM IV estimations of the interactions between Whole PD and corporate governance and financial performance variables on *ln(Loan Spread)*. The dependent variable all-in drawn cost of debt, *ln(Loan Spread)*, measures the natural logarithm of the amount in basis point that a firm pays over LIBOR plus some additional fees. The related corporate governance and financial performance measures examined are shown at the top of the table. Whole PD is the equity-based pay duration which is defined as the weighted average vesting period of salaries, bonuses, options, restricted stocks, pensions and other deferred compensations of executives reported in Incentive Lab. The details for computing Whole PD measure are discussed in section IV.3.2. The sample data includes the interactions of Compustat, CRSP, ISS Incentive Lab, Execucomp, Standard and Dealscan databases, excluding financials and utility firms, from 2006 to 2017. The instruments used are the natural logarithm of the executive mean of total value of vested stocks and the value realized from option exercises two years ago, *ln(MeanVESTING)*$_{t-2}$, the natural logarithm of executives' mean tenure, *ln(Mean Exec. Tenure)*, the number of executives reported in Execucomp, *Number of Exec.*, and the natural logarithm of the firm age, *ln(Firm Age)*. We do not report constant terms. Appendix I defines all the variables. We include year and industry fixed effects in all specifications. T-statistics (in parentheses) are computed using standard errors clustered by firm. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	Corporate Governance		**Financial Performance**		
	E-index	**Co-option**	**ROA**	**ROE**	**Z-score**
Whole PD	-0.019*	-0.009*	-0.007**	-0.011***	-0.010***
	(-1.86)	(-1.66)	(-2.56)	(-3.66)	(-3.35)
Whole PD x Variable	**0.003***	**-0.004**	**-0.023*****	**-0.000***	**-0.002****
	(1.81)	**(-0.56)**	**(-6.14)**	**(-1.88)**	**(-2.40)**
Variable	-0.148	0.142			
	(-1.48)	(0.39)			
ln(CEO Delta)	-0.040	-0.008	-0.034*	-0.042**	-0.054***
	(-0.52)	(-0.12)	(-1.83)	(-2.10)	(-2.72)
ln(VP Delta)	-0.048	-0.078	-0.050*	-0.082**	-0.071**
	(-0.66)	(-1.13)	(-1.66)	(-2.57)	(-2.19)
ln(CEO Vega)	-0.060	-0.073	-0.012	-0.018	-0.020
	(-0.42)	(-0.52)	(-0.23)	(-0.32)	(-0.37)
ln(VP Vega)	0.060	0.121	0.012	0.067	0.055
	(0.37)	(0.72)	(0.14)	(0.76)	(0.62)
Sales Growth	0.030	0.063	0.108**	0.087	0.064
	(0.27)	(0.58)	(2.04)	(1.50)	(1.11)
Leverage	0.574***	0.574***	0.436***	0.508***	0.529***
	(5.37)	(4.85)	(5.58)	(5.98)	(6.51)
ln(Total Assets)	-0.016	-0.030	-0.028	-0.016	-0.025
	(-0.60)	(-1.18)	(-1.50)	(-0.81)	(-1.35)
Z-Score	-0.057***	-0.049***	-0.026***	-0.037***	0.075
	(-3.46)	(-4.09)	(-2.88)	(-3.79)	(1.52)
ln(Asset Maturity)	0.055*	0.076**	0.055**	0.073***	0.062**
	(1.81)	(2.55)	(2.41)	(2.84)	(2.51)
ln(Loan Size)	-0.128***	-0.127***	-0.108***	-0.111***	-0.111***
	(-6.83)	(-7.66)	(-7.62)	(-8.04)	(-8.21)

Creditrating Dummy	0.029	0.063	0.015	0.019	0.025
	(0.54)	(1.23)	(0.47)	(0.53)	(0.69)
CF Vol.	0.060	0.001	0.154	-0.278	-0.251
	(0.15)	(0.00)	(0.56)	(-0.87)	(-0.82)
ln(Number of Banks)	-0.038**	-0.055***	-0.065***	-0.058***	-0.059***
	(-2.00)	(-2.73)	(-4.33)	(-3.69)	(-3.77)
Term Spread	7.292*	3.438	11.088***	10.529**	10.318**
	(1.70)	(0.59)	(2.69)	(2.35)	(2.46)
Default Spread	7.509	7.879	5.158	6.648	6.537
	(0.85)	(0.90)	(0.95)	(1.16)	(1.19)
Bridge Loan	0.281***	0.309***	0.257***	0.278***	0.256***
	(3.59)	(3.85)	(3.89)	(4.05)	(3.74)
Term Loan	0.367***	0.332***	0.307***	0.319***	0.299***
	(5.09)	(4.43)	(6.84)	(6.82)	(6.33)
Revolver Loan	0.038	0.019	0.003	0.025	-0.001
	(0.67)	(0.27)	(0.08)	(0.53)	(-0.02)
General Purpose Loan	-0.399***	-0.415***	-0.362***	-0.372***	-0.377***
	(-9.21)	(-9.23)	(-10.75)	(-10.25)	(-10.69)
Working Capital Loan	-0.383***	-0.442***	-0.400***	-0.403***	-0.398***
	(-6.44)	(-7.22)	(-8.90)	(-8.12)	(-8.25)
Takeover Recap Loan	-0.088	-0.104*	-0.093**	-0.100**	-0.118**
	(-1.44)	(-1.70)	(-2.10)	(-2.13)	(-2.51)
Crisis	0.022	-0.074	0.019	0.031	0.015
	(0.12)	(-0.64)	(0.17)	(0.27)	(0.13)
Observations	3357	3188	4831	4824	4831
Adjusted R^2	0.432	0.387	0.441	0.378	0.382
Clustered Std. Err.	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes
First Stage F stat	6.27	5.97	5.71	5.72	5.56
Hansen J-stat (p-value)	0.5357	0.9608	0.2204	0.6079	0.8149

APPENDIX K

TABLES RELATED TO ANALYSIS REGARDING EQUITY PD FOR THE PERIOD BETWEEN 1998 AND 2017 FOR CHAPTER IV

Table 37: Univariate analysis of Equity PD between 1998 and 2017

This table presents univariate analyses of the Equity PD. Loan spread and loan size is analyzed using both facility-based and firm-based dataset. Other variables are analyzed using the firm-based dataset. Panel A shows the analysis results of Equity PD, and Panel B shows Pearson correlation table at 5% significance levels. Appendix I defines all the variables. The signs ***, **, * indicate significance of the correlation coefficients at the 1%, 5%, and 10% levels, respectively. All the continuous variables are winsorized at 1% and 99%.

Panel A: Equity-based pay duration high vs. low Equity PD comparison

	Facility-based data set			
	Low Equity PD	High Equity PD		
	Mean	Mean	Difference	p-value
ln(Loan Spread)	4.830	4.980	0.150***	0.0000
ln(Loan Size)	5.809	6.156	0.348***	0.0000

	Firm-based data set			
	Low Equity PD	High Equity PD		
	Mean	Mean	Difference	p-value
ln(Loan Spread)	4.667	4.833	0.165***	0.0000
ln(Loan Size)	5.972	6.290	0.317***	0.0000
Sales Growth	0.080	0.092	0.012**	0.0171
Leverage	0.275	0.264	-0.011**	0.0164
ln(Total Assets)	8.425	8.779	0.354***	0.0000
Z-Score	0.077	0.450	0.373***	0.0000
ln(Asset Maturity)	1.928	1.824	-0.104***	0.0000
Creditrating Dummy	0.797	0.768	-0.030***	0.0082
CF Vol.	0.103	0.101	-0.001	0.1940
Return Vol.	0.337	0.332	-0.005	0.1334
MtB	1.461	1.751	0.290***	0.0000
1Y Merger Count	0.787	1.056	0.269***	0.0000
3Y Merger Count	0.564	0.756	0.192***	0.0000
R&D/Assets	0.016	0.024	0.009***	0.0000
Transp. Ind. Firms	0.147	0.137	-0.010	0.1624
Turnover	0.522	0.563	0.041***	0.0032
CEO Turnover	0.130	0.111	-0.019**	0.0255

ln(Mean Exec. Tenure)	1.676	1.796	0.120***	0.0000
E-index	2.994	3.524	0.530***	0.0000
Co-option	0.409	0.453	0.044***	0.0000
ROA	0.048	0.062	0.013***	0.0000
ROE	0.128	0.151	0.023**	0.0330

Panel B: Pearson correlation table for the period between 1998 and 2017 (5% significance level)

	ln(Loan Spread)	Equity PD	ln(CEO Delta)	ln(VP Delta)	ln(CEO Vega)	ln(VP Vega)
ln(Loan Spread)	1					
Equity PD	0.1048*	1				
	(0.0000)					
ln(CEO Delta)	-0.2484*	0.1033*	1			
	(0.0000)	(0.0000)				
ln(VP Delta)	-0.2101*	0.0593*	0.4826*	1		
	(0.0000)	(0.0000)	(0.0000)			
ln(CEO Vega)	-0.3122*	0.1226*	0.5616*	0.3722*	1	
	(0.0000)	(0.0000)	(0.0000)	(0.0000)		
ln(VP Vega)	-0.2851*	0.1218*	0.4431*	0.6030*	0.7519*	1
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	

Table 38: OLS and GMM IV regressions of loan spread on Equity PD between 1998 and 2017

This table presents results of OLS and GMM IV estimations of *Equity PD* on *ln(Loan Spread)*. The dependent variable all-in drawn cost of debt, *ln(Loan Spread)*, measures the natural logarithm of the amount in basis point that a firm pays over LIBOR plus some additional fees. Equity PD is the equity-based pay duration which is defined as the weighted average vesting period of salaries, bonuses, options and restricted stocks of executives reported in Incentive Lab. The details for computing Equity PD measure is discussed in the section IV.3.2. The sample data includes the interactions of Compustat, CRSP, ISS Incentive Lab, Execucomp, Standard and Dealscan databases, excluding financials and utility firms, from 1998 to 2017. The instruments used in GMM IV estimations are industry average Equity PD, *ln(Industry mean Equity PD),* using Fama-French 30 and the natural logarithm of the firm's age, *ln(Firm Age)*. We include year fixed effects in all specifications. We include industry fixed effects in models (1) and (2) and firm fixed effects in model (3). T-statistics (in parentheses) are computed using standard errors clustered by firm. We do not report constant terms. Appendix I defines all the variables. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
	OLS	GMM IV	GMM IV
	ln(Loan Spread)	**ln(Loan Spread)**	**ln(Loan Spread)**
Equity PD (or Predicted Equity PD)	0.003**	0.018***	0.010***
	(2.22)	(4.73)	(2.80)
ln(CEO Delta)	-0.014	-0.015	-0.040*
	(-0.75)	(-0.78)	(-1.67)
ln(VP Delta)	-0.032	-0.010	-0.067**
	(-1.13)	(-0.32)	(-2.39)
ln(CEO Vega)	-0.121***	-0.143***	0.012
	(-2.75)	(-3.06)	(0.27)
ln(VP Vega)	0.034	0.022	-0.035
	(0.40)	(0.24)	(-0.45)
Sales Growth	0.035	0.083	-0.039
	(0.64)	(1.32)	(-0.74)
Leverage	0.926***	1.002***	0.593***
	(10.72)	(11.19)	(4.46)
ln(Total Assets)	-0.053***	-0.080***	0.034
	(-3.10)	(-4.14)	(1.00)
Z-Score	-0.087***	-0.095***	-0.040**
	(-9.29)	(-9.36)	(-2.05)
ln(Asset Maturity)	0.012	0.005	0.011
	(0.61)	(0.25)	(0.36)
ln(Loan Size)	-0.157***	-0.164***	-0.145***
	(-10.76)	(-10.81)	(-9.88)
Creditrating Dummy	-0.042	-0.029	-0.123**
	(-1.19)	(-0.81)	(-2.43)
CF Vol.	-0.889***	-1.148***	-1.296**
	(-3.07)	(-3.86)	(-2.46)
ln(Number of Banks)	-0.069***	-0.059***	-0.092***
	(-4.28)	(-3.48)	(-6.33)
Term Spread	5.400*	4.848	2.920

	(1.85)	(1.53)	(1.08)
Default Spread	6.338	8.026	8.346*
	(1.20)	(1.50)	(1.65)
Bridge Loan	0.228***	0.262***	0.226***
	(3.63)	(4.07)	(4.29)
Term Loan	0.301***	0.271***	0.231***
	(7.35)	(6.23)	(6.07)
Revolver Loan	-0.160***	-0.152***	-0.052
	(-3.76)	(-3.46)	(-1.38)
General Purpose Loan	-0.155***	-0.123***	-0.145***
	(-5.41)	(-3.83)	(-5.38)
Working Capital Loan	-0.063	-0.046	-0.116***
	(-1.55)	(-1.06)	(-2.96)
Takeover Recap Loan	0.097**	0.138***	0.098***
	(2.50)	(3.18)	(2.71)
Crisis	0.015	0.033	0.073
	(0.15)	(0.31)	(0.75)
Instruments in the First Stage			
ln(Firm age)		-0.793**	-1.896
		(-2.38)	(-1.42)
Ind Mean Equity PD		0.932***	0.758***
		(17.06)	(12.99)
Observations	7926	7926	7926
Adjusted R^2	0.529	0.139	0.346
Clustered Std. Err.	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	No
Firm fixed effects	No	No	Yes
First Stage F stat		61.50	86.32
Hansen J-stat (p-value)		1.0000	0.0064

APPENDIX L

TABLES RELATED TO ANALYSIS REGARDING EQUITY PD USING FIRM-BASED DATASET FOR CHAPTER IV

Table 39: OLS and GMM IV regressions of loan spread on Equity PD using firm-based dataset

This table presents results of OLS and GMM IV estimations of *Equity PD* on *ln(Loan Spread)*. The dependent variable all-in drawn cost of debt, *ln(Loan Spread)*, measures the natural logarithm of the amount in basis point that a firm pays over LIBOR plus some additional fees. We use weighted average of loan spreads, where the weights are the sizes of the loans the firm uses in a year. When compared to the model used for the facility-based dataset, we exclude variables *ln(Loan Size)*, *Number of Banks*, and loan types from the model because the variables are specific to a facility. *Equity PD* is the equity-based pay duration which is defined as the weighted average vesting period of salaries, bonuses, options and restricted stocks of executives reported in Incentive Lab. The details for computing Equity PD measure is discussed in the section IV.3.2. The sample data includes the interactions of Compustat, CRSP, ISS Incentive Lab, Execucomp, Standard and Dealscan databases, excluding financials and utility firms, from 2006 to 2017. The instruments used in GMM IV estimations are industry average Equity PD, *ln(Industry mean Equity PD)*, using Fama-French 30 and the natural logarithm of the firm's age, *ln(Firm Age)*. We include year fixed effects in all specifications. We include industry fixed effects in models (1) and (2) and firm fixed effects in model (3). T-statistics (in parentheses) are computed using standard errors clustered by firm. We do not report constant terms. Appendix I defines all the variables. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
	OLS	GMM IV	GMM IV
	ln(Loan Spread)	**ln(Loan Spread)**	**ln(Loan Spread)**
Equity PD (or Predicted Equity PD)	-0.002	0.025***	0.006
	(-1.23)	(3.44)	(0.82)
ln(CEO Delta)	-0.051**	-0.083***	-0.058**
	(-2.56)	(-3.26)	(-2.16)
ln(VP Delta)	-0.037	-0.032	-0.047*
	(-1.22)	(-0.86)	(-1.72)
ln(CEO Vega)	-0.117**	-0.172***	0.010
	(-2.26)	(-2.83)	(0.14)
ln(VP Vega)	0.070	0.063	0.078
	(0.73)	(0.53)	(0.65)
Sales Growth	0.140**	0.118*	0.022
	(2.39)	(1.66)	(0.39)
Leverage	0.762***	0.795***	0.250*
	(8.94)	(8.41)	(1.85)
ln(Total Assets)	-0.129***	-0.164***	-0.029
	(-7.24)	(-7.19)	(-0.75)
Z-Score	-0.073***	-0.086***	-0.052***
	(-8.39)	(-8.47)	(-2.60)

ln(Asset Maturity)	0.023	0.001	0.077**
	(1.24)	(0.06)	(2.13)
Creditrating Dummy	-0.015	0.042	-0.065
	(-0.46)	(1.05)	(-1.33)
CF Vol.	-0.110	-0.738**	0.491
	(-0.38)	(-2.14)	(0.92)
Term Spread	13.952***	14.316***	5.756
	(3.46)	(3.20)	(1.35)
Default Spread	14.110***	12.934**	7.883
	(2.69)	(2.30)	(1.53)
Crisis	0.123	0.138	0.090
	(1.20)	(1.23)	(0.92)
Instruments in the First Stage			
ln(Firm age)		-0.727**	-1.155
		(-2.30)	(-0.50)
Ind Mean Equity PD		0.920***	0.753***
		(12.14)	(7.94)
Observations	2790	2790	2790
Adjusted R2	0.382	0.306	-0.046
Clustered Std. Err.	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	No
Firm fixed effects	No	No	Yes
First Stage F stat		53.83	32.57
Hansen J-stat (p-value)		1.0000	0.1537

Table 40: OLS regressions of loan spread on Whole PD measures using firm-based dataset

This table presents results of OLS estimations of *Whole PD*, *SERP PD*, and *ODC PD* on *ln(Loan Spread)*. The dependent variable all-in drawn cost of debt, *ln(Loan Spread)*, measures the natural logarithm of the amount in basis point that a firm pays over LIBOR plus some additional fees. We use weighted average of loan spreads, where the weights are the sizes of the loans the firm uses in a year. When compared to the model used for the facility-based dataset, we exclude variables *ln(Loan Size)*, *Number of Banks*, and loan types from the model because the variables are specific to a facility. *Whole PD* is the equity&debt-based pay duration which is defined as the weighted average vesting period of salaries, bonuses, options, restricted stocks, pensions and other deferred compensation of executives reported in Incentive Lab. *SERP PD* is the equity&debt-based pay duration which is defined as the weighted average vesting period of salaries, bonuses, options, restricted stocks, and pensions (SERP) of executives reported in Incentive Lab. *ODC PD* is the equity&debt-based pay duration which is defined as the weighted average vesting period of salaries, bonuses, options, restricted stocks, and other deferred compensations (ODC) of executives reported in Incentive Lab. The details for computing *Whole PD*, *SERP PD*, and *ODC PD* measures are discussed in the section IV.3.2. The sample data includes the interactions of Compustat, CRSP, ISS Incentive Lab, Execucomp, Standard and Dealscan databases, excluding financials and utility firms, from 2006 to 2017. We do not report constant terms. Appendix I defines all the variables. We include year and industry fixed effects in all specifications. T-statistics (in parentheses) are computed using standard errors clustered by firm. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
	ln(Loan Spread)	**ln(Loan Spread)**	**ln(Loan Spread)**
Whole PD	-0.003***		
	(-5.08)		
SERP PD		-0.003***	
		(-4.40)	
ODC PD			-0.002***
			(-4.31)
ln(CEO Delta)	-0.050**	-0.052***	-0.046**
	(-2.55)	(-2.61)	(-2.36)
ln(VP Delta)	-0.047	-0.040	-0.043
	(-1.62)	(-1.39)	(-1.45)
ln(CEO Vega)	-0.117**	-0.111**	-0.132***
	(-2.32)	(-2.17)	(-2.62)
ln(VP Vega)	0.088	0.075	0.097
	(0.96)	(0.81)	(1.04)
Sales Growth	0.121**	0.112*	0.138**
	(2.12)	(1.96)	(2.42)
Leverage	0.746***	0.748***	0.740***
	(9.05)	(9.03)	(8.92)
ln(Total Assets)	-0.121***	-0.120***	-0.124***
	(-6.97)	(-6.99)	(-7.11)
Z-Score	-0.068***	-0.070***	-0.068***
	(-8.27)	(-8.49)	(-8.18)
ln(Asset Maturity)	0.031*	0.032*	0.023
	(1.69)	(1.70)	(1.26)
Creditrating Dummy	0.008	-0.004	0.004
	(0.24)	(-0.12)	(0.11)

CF Vol.	-0.235	-0.189	-0.218
	(-0.82)	(-0.66)	(-0.75)
Term Spread	15.049***	15.751***	14.404***
	(3.72)	(3.89)	(3.56)
Default Spread	14.062***	15.036***	13.737***
	(2.69)	(2.89)	(2.61)
Crisis	0.115	0.110	0.108
	(1.12)	(1.07)	(1.07)
Observations	2763	2763	2763
Adjusted R2	0.376	0.374	0.373
Clustered Std. Err.	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes

Table 41: GMM IV regressions of loan spread on Whole PD measures using firm-based dataset

This table presents results of GMM IV estimations of *Whole PD*, *SERP PD*, and *ODC PD* on *ln(Loan Spread)*. The dependent variable all-in drawn cost of debt, *ln(Loan Spread)*, measures the natural logarithm of the amount in basis point that a firm pays over LIBOR plus some additional fees. We use weighted average of loan spreads, where the weights are the sizes of the loans the firm uses in a year. When compared to the model used for the facility-based dataset, we exclude variables *ln(Loan Size)*, *Number of Banks*, and loan types from the model because the variables are specific to a facility. *Whole PD* is the equity&debt-based pay duration which is defined as the weighted average vesting period of salaries, bonuses, options, restricted stocks, pensions and other deferred compensation of executives reported in Incentive Lab. *SERP PD* is the equity&debt-based pay duration which is defined as the weighted average vesting period of salaries, bonuses, options, restricted stocks, and pensions (SERP) of executives reported in Incentive Lab. *ODC PD* is the equity&debt-based pay duration which is defined as the weighted average vesting period of salaries, bonuses, options, restricted stocks, and other deferred compensations (ODC) of executives reported in Incentive Lab. The details for computing *Whole PD*, *SERP PD*, and *ODC PD* measures are discussed in the section IV.3.2. The instruments used are the natural logarithm of the executive mean of total value of vested stocks and the value realized from option exercises two years ago, $ln(MeanVESTING)_{t-2}$, the natural logarithm of executives' mean tenure, *ln(Mean Exec. Tenure)*, and the number of executives reported in Execucomp, *Number of Exec.*. The sample data includes the interactions of Compustat, CRSP, ISS Incentive Lab, Execucomp, Standard and Dealscan databases, excluding financials and utility firms, from 2006 to 2017. We do not report constant terms. Appendix I defines all the variables. We include year and industry or firm fixed effects in all specifications. T-statistics (in parentheses) are computed using standard errors clustered by firm. Signs ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1) **ln(Loan Spread)**	(2) **ln(Loan Spread)**	(3) **ln(Loan Spread)**	(4) **ln(Loan Spread)**	(5) **ln(Loan Spread)**	(6) **ln(Loan Spread)**
Predicted Whole PD	-0.012***	-0.010*				
	(-3.46)	(-1.66)				
Predicted SERP PD			-0.016***	-0.014		
			(-3.01)	(-1.45)		
Predicted ODC PD					-0.010***	-0.009
					(-3.08)	(-1.39)
ln(CEO Delta)	-0.051**	-0.067**	-0.058**	-0.077**	-0.035*	-0.053*
	(-2.48)	(-2.21)	(-2.56)	(-2.37)	(-1.75)	(-1.65)
ln(VP Delta)	-0.075**	-0.074**	-0.060**	-0.068**	-0.055*	-0.065**
	(-2.43)	(-2.18)	(-2.00)	(-2.03)	(-1.82)	(-1.99)
ln(CEO Vega)	-0.053	0.049	0.020	0.107	-0.112**	0.012
	(-0.97)	(0.62)	(0.28)	(1.05)	(-2.24)	(0.16)
ln(VP Vega)	0.098	0.052	0.039	0.032	0.128	0.108
	(1.10)	(0.41)	(0.41)	(0.24)	(1.40)	(0.88)
Sales Growth	0.120**	0.091	0.050	0.090	0.188***	0.088
	(2.00)	(1.43)	(0.69)	(1.30)	(3.16)	(1.39)
Leverage	0.753***	0.363**	0.782***	0.334**	0.725***	0.345**
	(8.51)	(2.43)	(7.85)	(2.21)	(8.55)	(2.31)
ln(Total Assets)	-0.093***	-0.032	-0.075***	-0.035	-0.103***	-0.034
	(-4.49)	(-0.78)	(-3.03)	(-0.80)	(-5.27)	(-0.84)
Z-Score	-0.057***	-0.027	-0.059***	-0.031	-0.058***	-0.030
	(-5.57)	(-1.26)	(-5.24)	(-1.42)	(-5.96)	(-1.46)
ln(Asset Maturity)	0.069***	0.100**	0.088***	0.100**	0.031	0.100**

	(2.81)	(2.54)	(2.82)	(2.46)	(1.57)	(2.51)
Creditrating Dummy	0.036	-0.093*	-0.014	-0.114*	0.016	-0.077
	(0.91)	(-1.78)	(-0.35)	(-1.89)	(0.44)	(-1.60)
CF Vol.	-0.358	-0.054	-0.220	-0.234	-0.282	-0.038
	(-1.10)	(-0.09)	(-0.66)	(-0.36)	(-0.86)	(-0.06)
Term Spread	14.889***	6.881	19.709***	8.091*	12.454***	5.932
	(3.45)	(1.63)	(4.00)	(1.75)	(2.95)	(1.41)
Default Spread	12.780**	8.480	17.376***	10.988**	11.660**	8.359
	(2.25)	(1.63)	(3.00)	(2.21)	(2.03)	(1.51)
Crisis	0.161	0.126	0.145	0.147	0.129	0.111
	(1.43)	(1.17)	(1.19)	(1.24)	(1.23)	(1.03)
Instruments						
ln(MeanVesting)	2.918***	1.492***	1.573***	0.956*	3.163***	1.687***
	(4.72)	(2.90)	(2.57)	(1.80)	(5.88)	(3.53)
ln(Mean Exec. Tenure)	-1.756**	-1.777**	-2.258***	-0.881	0.341	-0.606
	(-2.10)	(-2.24)	(-2.73)	(-1.22)	(0.45)	(-0.83)
Number of Exec.	-1.998***	-1.104**	-1.269**	-0.834*	-1.948***	-1.172**
	(-3.56)	(-2.38)	(-2.37)	(-1.84)	(-3.86)	(-2.55)
Observations	2642	2642	2642	2642	2642	2642
Adjusted R2	0.282	-0.154	0.181	-0.251	0.317	-0.126
Clustered Std. Err.	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	No	Yes	No	Yes	No
Firm fixed effects	No	Yes	No	Yes	No	Yes
First Stage F stat	6.59	5.65	8.71	2.29	4.50	6.17
Hansen J-stat (p-value)	0.9302	0.5912	0.5857	0.4935	0.2254	0.3770