ESSAYS ON CEO INSIDE DEBT

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ESSAYS ON CEO INSIDE DEBT

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Executive defined benefit pensions and deferred compensation are known as "inside debt". The reason is that their values depend on the ability of the firm to make future payments to its participant employees. Such plans have the potential of mitigating the risk-shifting problem of managers (Jensen and Meckling (1976)) because executives who own inside debt are worried about firm default risk and not only about shareholder return. In this dissertation, I examine the determinants of CEO inside debt and its components. I then use the inside debt as a measure of CEO risk preferences and examine its relation to firms' risk.

In Chapter one, I use the new SEC disclosure rule of 2006 to examine the determinants of CEO inside debt. I find that CEOs defer a larger fraction of their compensation when their cash compensation is high, firm liquidity is high, firm default risk is low, and when executive personal wealth is high. These findings are consistent with CEOs choosing to defer compensation when they least need the money and when they do not expect the firm to default. In contrast to previous studies, I find a non-linear inverted U-shape relation between firm leverage and CEO inside debt. In particular, CEOs reduce their inside-debt when the firm is highly levered.

Using novel data from executive deferred compensation, Chapter two presents new evidence on the relationship between CEO risk preference and firm risk (the volatility of firm performance measures such as stock return, earnings and operating cash flows). My results show a negative association between the CEO risk aversion (as measured by realized performance on inside debt) and the volatility of firm market performance: Firms with risk-averse CEOs have experience less stock price volatility. I also find that firms providing deferred compensation plans have lower performance volatility. The results contribute to the inside debt literature by showing that inside debt compensation is related to lower firm risk and lower firm market value.

BIOGRAPHICAL SKETCH

Wei Cen was born in Cixi, Zhejiang, China, on November 10, 1977. He spent most of his youth in Cixi until he finished his high school study at Cixi High School.

In 1996, Wei entered Xi'an Jiaotong University at Shaanxi, China, majoring in Material Science and Engineering. In 2000, he obtained his Bachelor's degree in Engineering as an honored student in his department and entered the Master's program in the Jinhe Center for Economic Research at Xi'an Jiaotong University, where he started his journey to Economics. Wei obtained a Master of Art in Economics at Xi'an Jiaotong University in 2003.

Between 2003 and 2004, Wei worked as a research assistant at Center for Chinese Agricultural Policy, Chinese Academy of Sciences, Beijing, China.

In 2004, Wei went to the United States of America and started his study at Rutgers, the State University of New Jersey at New Brunswick, where he earned his second Master's degree in Applied Economics in 2006.

In 2006, Wei entered the Ph.D. program in Applied Economics and Management at Cornell University. He earned assistantship from Cornell University during his study period. In 2011, Wei completed his Ph.D. degree at Cornell University.

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I owed a lot to my parents-in-laws, Jiguo Tong and Meiyu Lu, and to my parents, Guoqiang Cen and Liquan Shen, who sacrificed their time to take care of me and my family during my study in America. I also would like to thank my two daughters, Michelle J. Cen and Isabelle Y. Cen, for the immeasurable joy and inexpressible happiness they have brought to me after they came to my life.

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CHAPTER 1

THE DETERMINANTS OF CEO INSIDE DEBT AND ITS COMPONENTS

1 INTRODUCTION

Executive defined benefit pensions and deferred compensation are known as "inside debt". The reason is that their values depend on the ability of the firm to make future payments to its participant employees. Such plans have the potential of mitigating the risk-shifting problem of managers (Jensen and Meckling (1976)) because executives who own inside debt are worried about firm default risk and not only about shareholder return. Recent theoretical work by Edmans and Liu (2010) demonstrates that inside debt is potentially an efficient remedy to the asset substitution problem.

In a seminal study, Sundaram and Yermack (2006) find support for the role of inside debt in mitigating the agency problem. Sundaram and Yermack use the pension value of 237 large firms during the period of 1996-2002 as a proxy of inside debt to examine the determinants of inside debt and its relation with CEO turnover and firm default risk. They find that pension values are higher when firm leverage is higher, and CEOs tend to take conservative investment policies when their personal debt-to-equity ratio is higher than the firm leverage ratio. Their interpretation is that the probability of the firm defaulting on its external debt is reduced when the managers hold large inside debt positions.

The proxy of inside debt in Sundaram and Yermack (2006) is the pension obligations to the CEO. Unfortunately, due to data availability, they could not account for another significant component of inside debt—deferred compensation plans. This study expands Sundaram and Yermack's work by examining both pension obligations

and deferred compensation plans.

At the end of 2006, the SEC issued new requirements for additional disclosure of executive compensation. According to the new disclosure rule, firms are required to disclose the accumulated actuarial present value of each executive officer's pension plan, as well as the contributions, earnings, and balances of each executive officer's nonqualified deferred compensation account after fiscal year 2006.

This study documents the new disclosed information of CEOs' inside debt and examines its determinants and implications to agency theory. Using new disclosed information, I find that deferred compensation is in the same order of magnitude as pension. The average deferred compensation represents about 6.2% of a CEO's total compensation, whereas pension contribution represents about 5.5% of overall CEO compensation. In addition, the univariate and regression analysis in this study point to a nonlinear association between firm leverage and CEO inside debt. I find an inverted U-shape quadratic relation: CEOs whose firms are in the middle range of leverage have higher inside debt holdings than their counterparts in both low-leverage firms and high-leverage firms. In other words, inside debt initially increases with the firm leverage, but when firm leverage reaches a certain level, CEO inside debt holdings are negatively associated with the firm leverage. This finding casts doubt on previous findings and suggests that there are other reasons that affect inside debt use. Thus, potential explanations of these results are tested to understand the quadratic relation. The investigation shows that the underlying reason may relate to firm financial distress and CEO risk aversion.

The inverted U-shape relation is quite robust. It exists when the quadratic model is applied on the pension, total inside debt, the CEO's leverage ratio and the firm match rate for the CEO's deferred compensation. The only exception is the CEO's total deferred compensation. No association between the firm leverage and CEOs' deferred compensation is found, neither linear nor quadratic.

I further on investigate the determinants of deferred compensation by examining how CEOs determine their contributions to deferred compensation every year. I find that firm size, financial liquidity status, default risk, and CEO personal wealth are the main factors that affect the amount of or ratio of contribution to CEOs' deferred compensation account. Dynamic regression results show that the changes of CEOs' contribution to the deferred compensation plan are negatively associated with CEO wealth changes and return on deferred compensation investment. These results suggest that CEOs use the deferred compensation as both an income tax instrument and an investment instrument.

The above results are robust even after accounting for the endogeneity of firm leverage.

The results of this paper also shed light on how CEO power and board monitoring efficiency affects the inside debt compensations. I use executive tenure and CEO-chair duality to measure CEO power, and I use board size and independence to measure board efficiency. I find a positive association between the inside debt and CEO power and a negative association with board efficiency. These results may support the view that inside debt can be used by managers to extract additional rents as

suggested by Gerakos (2007).

This study makes three main contributions to the literature. First, it documents the use of deferred compensation in large public U.S. firms. Previous studies were not able to examine this component of compensation due to the lack of data. Second, it shows a non-linear relation between firm leverage and executive inside debt holding, which suggests that inside debt plays a more complex role than that proposed by Sundaram and Yermack in mitigating the asset substitution problem. Third, it provides supportive evidence of the arguments that inside debt can be used to extract additional rents.

This research adds to a number of new studies which examine the use of inside debt in executive compensations. Sundaram and Yermack (2006) and Gerakos (2007, 2008) are cross-sectional studies of inside debt's role in management compensation; Wei and Yermack (2010) is an event study of the announcement valuation effect of inside debt disclosure. In particular, Wei and Yermack's (2010) event study supports Sundaram and Yermack (2006) argument that firms use deferred compensations to reduce the potential agency costs of debt implicit in their capital structures. Unlike these four studies, I use the new information from the SEC disclosure rule on inside debt and find that the role of inside side is more complicated than what the previous studies have demonstrated.

The remaining sections of this chapter are organized as follows: Section 2 is the literature review of related research. Section 3 contains the introduction and documentation of newly disclosed executive deferred compensation. Section 4

describes the data, variables, and discussion of univariate analysis. Section 5 shows the results of regression analysis and provides accompanying discussion. Section 6 is the conclusion.

2 LITERITURE REVIEW

Existing theories on managerial compensation and agency problems make a great effort to explain and support the use of equity-like instruments in executive compensation packages. Since the seminal work of Jensen and Meckling (1976), which theorizes the agency costs of debt, few theoretical and empirical studies have been performed that discuss the role of debt instruments in management compensation. The new disclosure rule and Sundaram and Yermack's 2006 work draw the attention of public and financial economists to debt-like instruments such as pension and deferred compensation. Edmans and Liu (2010) is one of the few studies that attempt to build a theoretical framework to explain the findings in Sundaram and Yermack (2006) and exploit the empirical implications of debt-like instrument in executive compensation practice.

In corporate finance, there are two main types of agency problems: (1) stockholder-bondholder conflicts, and (2) manager-stockholder conflicts. In the first type, the agent is the manager, who is assumed to be perfectly aligned with stockholders, and the principal is the bondholders. In the second, managers again are the agent, but this time work in their own best interests and the principal is the stockholders.

Based on the agency theory beginning with Jensen and Meckling (1976), a firm's capital structure is one of the instruments used to reduce agency cost so that the capital structure affects the management compensation structure. Jensen and Meckling argue that both outside equity and outside debt finance create an agency problem: either a

moral hazard problem or a risk-shifting problem. They conjecture that wage compensation plus non-pecuniary benefits are sufficient to alleviate the agency problem. They do not incorporate the debt-like instruments into the manager's compensation. But the researchers do note that having managers hold a fraction of the total debt equal to their fraction of the total equity eliminates their incentive to reallocate wealth from debt holders to stockholders.

Jensen and Meckling's framework explains capital structure in terms of the incentive implications of return patterns associated with different mixes of instruments for outside finance. They did not incorporate any control rights. Dewatripont and Tirole (1994) describe a model in which multiple outside investors hold diverse securities (outside debt and outside equity) and debt holders are in control in bad states and equity holders are in control in good states. In the Dewatripont-Tirole model, the optimal contract ties managerial compensation to equity value rather than to firm value. However, debt is still not a part of the compensation package.

Other theoretic works, such as Brander and Poitevin (1992), Hirshleifer and Thakor (1992) and John and John (1993), proposed certain instruments that can alleviate the agency costs of debt. Hirshleifer and Thakor (1992) show that managerial reputation can prevent risk shifting problem. John and John (1993) propose two solutions to avoid risk-shifting: solvency-contingent bonuses and reduction of the manager's equity. Brander and Poitevin (1992) show that the bonus contract is an optimal contract, since through suitable choice of the target, it leads to the ex ante best outcome, maximizing the firm value. They present a general fixed bonus that may be contractually triggered at states other than solvency. Since these works seek to show

the effectiveness of their proposed solutions with regard to alleviating the agency costs of debt, they do not consider whether alternative mechanisms such as inside debt would be optimal or superior. No work discussed the optimality of the manager holding debt in executive compensation contract until Edmans and Liu (2010).

Edmans and Liu (2010) incorporate a set of standard securities—debt, equity and a fixed bonus—into a new executive compensation model. They demonstrate that inside debt can address the problem of the agency cost of debt and that it can do even better than the bonuses. Moreover, they show that inside debt could be a part of optimal compensation even when debt creditors' concerns are not only the risk of default but also the recovery value in default. The latter makes the inside debt a part of optimal compensation since inside debt not only reduces the possibility of bankruptcy but also keeps the highest payoff in bankruptcy while the other compensation instruments do not have this function. More generally, their model suggests that inside debt may be more superior to inside equity in firms with higher leverage in which risk-shifting problems may be more severe.

Even fewer empirical studies have been made concerning the role of inside debt in top executives' compensation. Previous works use the executive pension as a full proxy of inside debt due to the limited disclosure of deferred compensation. Sundaram and Yermack (2006) take the first step of studying the role of inside debt in top management compensation. They use CEO pension plan data in 237 SP500 firms to study the determinants of deferred compensation and how inside debt affects CEO turnover and a firm's risk of bankruptcy. They find evidence that CEO compensation exhibits a balance between debt and equity incentives, which is consistent with the

Jenson and Meckling's (1976) conjecture. Their findings of a positive relation between firm leverage and pension also support and prediction of Edmans and Liu (2010). However, the Sundaram and Yermack study is restricted by the data availability of another important part of inside debt: deferred compensation. In their paper, they argue that deferred compensation is usually "far less than the value of pensions, so the omission of deferred compensation…may not be serious." In my paper, however, I show that the value of deferred compensation is about the same size as pensions and that the incorporation of deferred compensation in the measure of inside debt will substantially affect the implications of inside debt in agency problems and in the CEO compensation discussion.

Wei and Yermack (2009) study the announcement effect of the disclosure of inside debt on stock and bond valuation. In their paper, they incorporate the deferred compensation into the definition of inside debt to show how the information of CEO inside debt holdings affects investors' valuation decision on the date that CEO inside debt is first disclosed. They find that when new disclosure rules took effect in early 2007, bond prices rise, equity prices fall, and the volatility of both securities drops upon disclosures for firms whose CEOs have significant inside debt holdings. They conclude that a CEO's inside debt holding may reduce the firm's risk and transfer value from equity holders to debt holders. Their findings are consistent with the results of Sundaram and Yermack (2006) in that firms use deferred compensation to reduce the potential agency costs of debt implicit in their capital structures.

A great deal of the literature related to my work is from taxation, law and labor economics. Much of the literature concerns the taxation role of pension for firms and

discusses the law and economic implication of why companies provide pension plans (Such as Sharpe (1976); Black (1980); Petersen (1992); Sunarensan and Zapatero (1997); Rauh (2009)). However, this literature focuses on the pension plans of workers or general salaried employees, and many of the conclusions of the literature may not apply for executive pensions for two reasons. First, the majority of CEO pension in the inside debt discussion is non-qualified for tax purposes, meaning that it is not required to follow the requirements of Internal Revenue Code ("IRC") or the Employee Retirement Income Security Act ("ERISA"). Second, CEOs are not only the participants in pension plans, but they may have the power to administrate them. Therefore, both the impact that pensions have on CEOs and CEOs' response to pension plans may differ substantially from those of regular workers.

Another recent empirical work focusing on CEO pension is Gerakos (2007). Gerakos mainly tests the two arguments on the CEO pension problem: managerial power and optimal contracting. The managerial power view argues that CEO pensions are just a channel of rent extraction for managers under their entrenched managerial power. The optimal contracting view argues that CEO pensions are a tax-motivated optimal compensation contract that aligns manger interests with those of investors and reduces the agency costs. Gerakos finds supportive evidence for both views: optical contracting variables primarily determine the pension benefit levels while CEOs with stronger managerial power tend to receive higher pension benefits. Similar to Sundaram and Yermack (2006), however, Gerakos study does not incorporate the deferred compensation into the compensation of individual managers.

3 EXECUTIVE DEFERRED COMPENSATION PLANS

3.1 OVERVIEW

Although not used by all companies, pension benefits and deferred compensation are the two main components of inside debt. Sundaram and Yermack is the best source for CEO pension documentation. This paper is the first literature to document executive deferred compensation since the information has become publicly available.

Broadly speaking, the CEO pension benefit is just one type of deferred compensation. To avoid confusion with Sundaram and Yermack's discussion, I restrict my definition of deferred compensation to non-qualified deferred compensation in this study.

Unlike pension benefits, which usually accrue to employees under company-wide formulas established by each company, and which are based upon years of service and employees' average level of cash compensation, deferred compensation accrues if the executive agrees to have part of his or her current compensation (e.g., as regular salary, bonuses or any other type of compensation) withheld by the company, and given to him or her at some pre-specified date in the future (e.g., when he or she separates from service, attains normal retirement age, encounters unforeseeable financial hardship, becomes disabled, dies). As an incentive, firms usually match CEOs' contribution to deferred compensation with some contracted match rate. Deferred compensation is generally paid out to the executive at retirement although earlier withdrawals are permitted by some firms under certain limited circumstances. Deferred compensation is often invested either at a fixed rate of return, in the company's stock or in a menu of

stock or bond mutual funds chosen by the firm. Many companies allow managers to make frequent changes as to how their deferred compensation is invested (bi-weekly or weekly), though these investment decisions are not observable under current disclosure rules.

In addition to the incentive implications, a major motivation for executives to defer their compensation is that its taxation is almost always deferred until the executive receives actual payouts. On the other hand, for both pension benefits and deferred compensation balances, the amounts due to executives are almost always left unfunded and unsecured in order to preserve these tax benefits; these sums are at risk like other unsecured debt if the firm becomes financially distressed.

3.2 DISCLOSURE OF DEFERRED COMPENSATION PLANS

Before the SEC's new disclosure rules in 2006, firms were not required to disclose the information on executive deferred compensation, and the disclosures on executive pension plans were not well prescribed. The July 2006 amendments to executive compensation rules require that companies prepare a thorough discussion and analysis of compensation, broaden the scope of required narratives, and provide additional quantitative compensation information. Following the compensation discussion and analysis section of a firm's proxy statement, one of the new rules requires the disclosure of retirement and other post-employment compensation. These required disclosures are to include tabular disclosure of the actuarial present value of each executive officer's accumulated pension plan as well as of the contributions, earnings and balances of each executive officer's nonqualified deferred compensation account.

In firms' proxy statements or other SEC filings, deferred compensation plans for CEOs are usually called non-qualified deferred compensation plans (DCPs hereafter). That a plan is "non-qualified" here means that it is not required to meet the tax law requirements applicable to "qualified" plans (such as ordinary tax-qualified pension plans) under the Internal Revenue Code (IRC) or to restrictions under the Employee Retirement Income Security Act (ERISA). However, non-qualified DCPs are required to meet the requirements of IRC section 409A after year 2005, which section was created, in response to Enron's demise, to eliminate the ability of an employee to access their DCP early in exchange for a penalty. Under non-qualified compensation plans, employees are not taxed on deferred compensation until those compensations are actually received, at which time the employer is entitled to an income tax deduction of that amount.

Because non-qualified deferred compensation plans are not subject to the complex rules imposed on qualified retirement plans, they can be established for one individual employee or for a number of individuals selected at the complete discretion of the employer (for example, a plan for the named executive officers of the company). Employers are free to select which employees are eligible to participate, which conditions are to be met, and which method will be used to determine the amount of benefits to be paid. As a result, such plans offer an employer a unique opportunity to provide a benefit which can be customized to meet its particular objectives.

Although they can be ensured with insurance contracts as long as the premiums are paid by the employer, most DCPs are unfunded and unsecured in order to be exempt from a majority of the provisions of ERISA.

3.3 TYPES OF DEFERRED COMPENSATION PLANS

Unfunded DCP plans may be categorized into two groups on the basis the structure of the plan, elective and non-elective, which are listed in proxy statements in Non-Qualified Deferred Compensation and Pension Benefits respectively.

An elective DCP, which is the primary focus of this paper, is one under which the employee selects to receive less salary and bonus compensation than he or she would otherwise currently receive and to defer the reduced amount to a future date. The election is contained in a written agreement that specifies the amount or percentage of salary, bonus, or other deferrals and the time and method of payout distribution. Usually the election to defer income is made prior to the time the income is earned. Since the employee initiates the deferral of the income that he or she would otherwise be currently received, therefore, an elective deferral will usually be fully vested and payable in the situation of termination of employment for practically any reason.

On the other hand, a non-elective DCP provides a deferred compensation benefit in the form of a salary continuation agreement as a reward for valuable key employees. Under a non-elective DCP, the employer makes a legally obligatory agreement to pay supplemental compensation (in addition to regular salary and bonus), usually upon retirement. Because of its non-qualified characteristics, the company can make unlimited annual contributions to a non-elective DCP. This kind of plan is often called a supplemental employee retirement plan, or SERP. SERPs are frequently designed either as a standalone plan or paired with a qualified pension plan. SERPs are covered under the definition of CEO pension in Sundaram and Yermack and are excluded from the definition of non-qualified deferred compensation in this paper.

3.4 RELATED COMMON QUESTIONS

Since the deferred compensation plans were was not well exposed to the public, people may have some questions regarding the characteristics and functions of deferred compensation plans. Here I list and answer some of the most common questions such as: What is the difference between qualified and non-qualified retirement plans? What are the advantages of non-qualified retirement plans? What are the disadvantages of deferred compensation plan? How are DCPs invested and operated?

3.4.1 The Difference between Qualified and Non-Qualified Retirement Plans

A plan that meets the requirements of Internal Revenue Code Section 401(a) and the Employee Retirement Income Security Act of 1974 (ERISA) and is qualified for favorable tax treatment is called a qualified retirement plan. These plans offer a number of tax benefits. For instance, they allow employers to deduct annual allowable contributions for each participant, and contributions and earnings on those contributions are tax-deferred until withdrawn for each participant.

In contrast, a non-qualified retirement plan is a plan that does not meet the IRS 401(a) or ERISA requirements and consequently does not qualify for some of the favorable income tax treatment benefits afforded qualified retirement plans, nor do they qualify for the employee protection provisions of ERISA.

3.4.2 The Advantages of Non-Qualified Retirement Plans

Even though non-qualified DCPs do not have favorable income tax treatment, they are

not subject to the requirements of ERISA and IRS. This is in fact the primary advantage of non-qualified DCPs. Non-qualified DCPs offer an opportunity for employers to make additional compensation (such as non-elective DCPs). And employers can customize the plans to meet specific needs. For instance, employers can align employees' goals with the company's long-term performance. Further, employers with temporary cash flow problems can offer greater deferred compensation packages to retain key employees. Deferred compensation plans can also enhance the financial statement by keeping the plan assets on the balance sheet while helping to reduce corporate exposure to accumulated earnings taxes.

On the other hand, employees can benefit from deferred compensation plans. For instance, employees who have high current compensations and higher current personal income tax rates could defer income until later when they would probably pay lower taxes. The plan can also help the employee to avoid penalty taxes on premature or tardy withdrawals, which may be imposed on qualified retirement benefits. In recent years, however, the advent of lower tax rates and IRC section 409A requirements have in some cases mitigated these traditional income tax advantages. But employees may still wish to lower their current income for reasons such as financial aid eligibility or planning for a forthcoming leave of absence.

3.4.3 The Disadvantages of Deferred Compensation Plans

There is no any disadvantage for employers who have a DCP. For employees, the drawback of a non-qualified compensation plan is that it keeps him or her from immediately receiving a full compensation package. Moreover, if the plan is invested in company stock and there is a correction in the market, the participant may lose

money even if he or she met all performance targets. Being part of a non-qualified deferred compensation plan also ties an employee to a company she may not want to be a part of long-term.

3.4.4 The Investment and Operation of DCPs

Most DCPs offer either a fixed rate of return on deferred compensation or the ability to invest in a limited number of mutual funds. Participant accounts in a DCP are referred to as hypothetical investments because they are only a measure of the amount owed the participant. The participant's account will be credited with gains or losses based upon the activity of the hypothetical investments. In general, the employee may express a preference for investments, but the employer cannot be obligated to invest according to the employee's preferences. In fact, the employers are not obligated to invest the contributions at all. In other words, the participant accounts will accumulate as if their contributions were invested in those preferences through a phantom or hypothetical investment account, and the employer is free to invest the deferrals.

In terms of the investment return of DCP, for sophisticated investors the returns earned inside the DCP plan may fall well short of the returns they generate outside the plan due to the unavailability of private equity and hedge fund investments inside the DCP. However the DCP investment might benefit from the tax-deferred accumulation of contributions if one assumes they enjoy the same return rates as the investment options outside the plan.

4 DATA AND VARIABLES

4.1 DATA AND DESCRIPTIVE STATISTICS

While executive compensation disclosures have been required since 1933, inside debt values were almost never disclosed before SEC's new disclosure rule in 2006. Prior 2006, firms were not required to report their executive deferred compensation plans, hence the deferred compensation balances held by individual managers were not observable. Firms were required to provide certain details about the pension benefits but the expected present value of an individual manager's pension was not given; therefore, it was very complicate to estimate its value (See Sundaram and Yermack (2006) for the estimation method). In July 2006, the SEC adopted new rules on executive compensations, one of which required companies to disclose and describe the retirement plans, deferred compensation and other post-employment payments and benefits. The present market values of these compensations are also required to be reported. The new disclosure rule of pensions and deferred compensation makes it possible to test the theory of inside debt and study its empirical implications.

Research sample for this study comes from COMPUSTAT Executive Compensation database from year 2006 to 2008. The universe of firms covers the S&P 1500 plus companies that were part of the S&P 1500 and are still trading. Firms without accounting data in COMPUSTAT or stock return data in CRSP are eliminated. This results in a sample of 1947 firms. Among these 1947 firms, 480 firms are from SP500 large-cap firms, 378 firms are from SP400 middle-cap firms and 571 firms are from SP600 small-cap firms. The other 518 firms were the once SP1500 firms (see Figure 1).

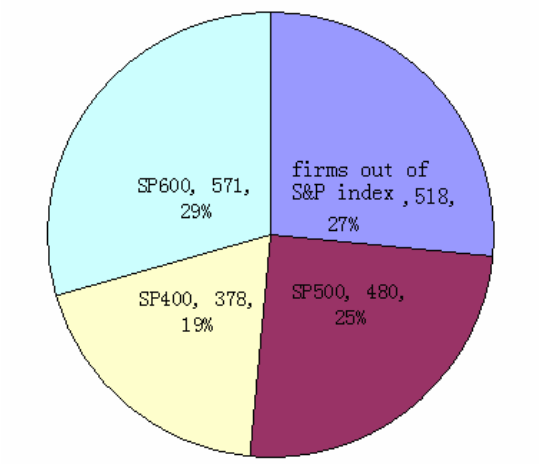

FIGURE 1: Sample Distribution

Figure 1: Sample Distribution. Among 1947 sample firms, 480 firms are from SP500 large-cap firms, 378 firms are from SP400 middle-cap firms and 571 firms are from SP600 small-cap firms. The other 518 firms were the once SP1500 firms.

Two main variables are obtained directly from Executive Compensation database (PENSION_VALUE_TOT and DEFER_BALANCE_TOT). The Total Pension Value (PENSION_VALUE_TOT) is the aggregate actuarial present value of the executive's accumulated benefit under the company's pension plans at the end of fiscal year and the Total Deferred Compensation Balance (DEFER_BALANCE_TOT) is the aggregate balance in non-tax-qualified deferred compensation plans at the end of fiscal year. All equity-based compensation arrangements in pension value and deferred compensation balance are estimated by fair value, which is the market value of the arrangement when it is reported. Total inside debt is the sum of pensions and deferred compensations.

Table 1 and Table 2 present the basic descriptive statistics of the data.

TABLE 1: Descriptive Statistics of CEO Related Variables

	Mean	Std Dev	25th%tile	Median	75th%tile
Age	55.12	7.22	50	55	60
Tenure	6.84	6.89	2	5	9
Pension value(mm.)	2.65	6.50	0	0	2.32
Deferred compensation(mm.)	2.28	8.93	0	0.09	1.48
Inside debt value(mm.)	4.99	12.31	0	0.68	4.83
Equity value(mm.)	227.62	6755.84	3.08	11.02	36.36
Inside debt / equity value	0.430	1.049	0	0.059	0.380
Inside debt /(inside debt + equity value)	0.178	0.241	0	0.061	0.288
Leverage indicator	0.348				
Annual Salary + Bonus(mm.)	2.00	2.83	0.788	1.29	2.35
Annual total compensation(mm.)	5.66	7.52	1.54	3.30	6.87
Annual pension increment(mm.)	0.411	1.65	0	0	0.216
Annual DCP increment(mm.)	0.356	2.839	0	0	0.143
Annual firm contribution to DCP(mm.)	0.127	2.404	0	0	0.029
Annual CEO contribution to DCP(mm.)	0.229	1.471	0	0	0.061
Firm contribution/ CEO contribution	0.162	0.521	0	0	0
Return on DCP (%)	-0.061	13.726	0	0	4.357
CEO percentage ownership	0.040	1.277	0.001	0.003	0.011
CEO-Chairman duality	0.505	0.500	0	1	1
CEO contribution/ (Salary+Bonus)	0.107	0.768	0	0	0.038

Note:
Descriptive statistics for variables related to CEO and firm characteristics for a sample of 1,947 observations from S&P 1500 companies over 2006 to 2008. Pension values are the aggregate actuarial present value of the executive's accumulated benefit under the company's pension plans at the end of fiscal year. Deferred compensation values are the aggregate balance in non-tax-qualified deferred compensation plans at the end of fiscal year. Inside debt values are the sum of pension and deferred compensation. Equity value equals the value of common stock plus stock options, calculated according to the reported market value at fiscal year end. Leverage indicator is an indicate variable is one if CEO inside debt/(inside debt+equity value) is higher than firm leverage and is zero otherwise. Data is from COMPUSTAT Execucomp.

Table 1 indicates that the mean of the CEO equity values (229.62 millions) are far higher than the mean of the CEO inside debt holdings (4.99 millions). The data in Table 1 also indicates that the deferred compensations are significant parts of the over all CEO compensations. The mean ratios of total inside debt increment to total CEO compensation and deferred compensation to total CEO compensation are 11.7% and 6.2%, respectively.

TABLE 2: Descriptive Statistics of Firm Characteristics Related Variables

	Mean	Std Dev	25th%^{ile}	Median	75th%^{ile}
Total assets(bn.)	17.25	100.35	0.65	1.99	6.96
Total net sales(bn.)	6.48	20.23	0.53	1.47	4.61
Equity market capitalization (bn.)	7.791	24.847	0.580	1.577	4.808
Leverage (book value of equity)	0.180	0.187	0.017	0.145	0.279
Leverage (market value of equity)	0.191	0.200	0.015	0.136	0.294
Research & development / sales	0.067	0.734	0	0	0.029
Capital expenditures/total assets	0.048	0.056	0.014	0.032	0.062
Return on assets (EBITDA/total assets)	0.118	0.148	0.07	0.118	0.174
Annual stock return	0.955	0.441	0.675	0.95	1.183
Tax loss carry-forward indicator	0.428				
Negative operating income indicator	0.109				
Founder CEO indicator	0.177				
Years since date of founding	24.9	18.8	11	19	35
Number of industry segments	3.58	2.09	2	3	5
Board size	9.3	2.5	8	9	11
Percent of outside directors	0.829	0.087	0.778	0.857	0.889
Top 5 institutional investors ownership	0.294	0.928	0.233	0.291	0.351

Note:
Descriptive statistics for variables related to CEO and firm characteristics for a sample of 1,947 observations from S&P 1500 companies over 2006 to 2008. Leverage equals total long-term dent divided by total debt plus the book value (or market value) of equity. Data is from COMPUSTAT Execucomp and the institutional ownership information is from the CDA/Spectrum database of 13Fs.

Figure 2 shows that within the sample firms, about 52% firms do not offer CEO pension plans and 33% firms do not offer CEO deferred compensation plans.

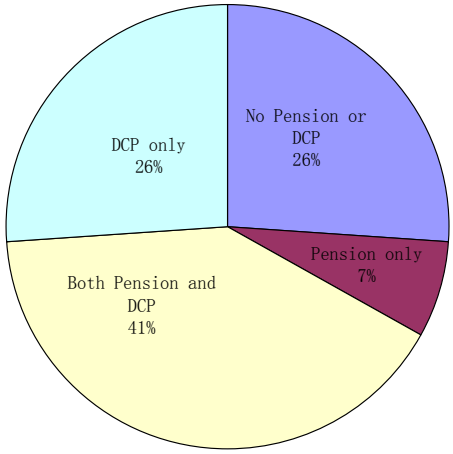

FIGURE 2: Distribution of Firms with Pension Plan and DCPs

Figure 2: Distribution of Firms with Pension Plan and DCPs. Within the sample firms, about 52% firms do not offer CEO pension plans and 33% firms do not offer CEO deferred compensation plans. The percentage of firms with no pension or DCP is higher in small-cap firms than that in large-cap firms. Firm groups with higher leverages are more likely to provide CEO pensions and CEO deferred compensation plans, but this likelihood becomes lower for the group with the highest leverage. In addition, older firms and firms with less growth opportunities (using Tobin's Q or R&D expenses/sales) are more likely to offer CEO pension and deferred compensation plans.

Figure 3 further shows that, for CEOs in firms that offer pension plans and deferred compensation plans, about 11% CEOs do not choose pension plans and 16% CEOs do not choose deferred compensation plans (firm years with CEO turn over have been excluded).

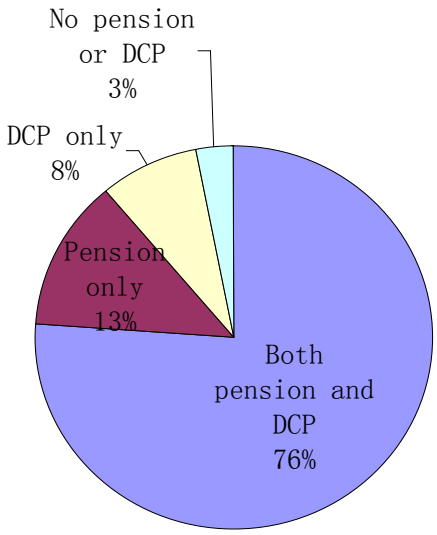

FIGURE 3: Distributions of CEOs with Pension Plan and DCPs

Figure 3: Distributions of CEOs with Pension Plan and DCPs. For CEOs in firms that offer pension plans and deferred compensation plans, about 11% CEOs do not have pension plans and 16% CEOs do not have deferred compensation plans (firm years with CEO turn over have been excluded).

Consistent with Sundaram and Yermack (2006), Table 3 shows that CEOs' leverages increase with the firm size. While middle-cap firms and large-cap firms have similar firm leverages, larger firms have higher CEO leverages and large percentage of CEOs whose personal leverages are higher than firm leverage ratio.

TABLE 3: Mean Values of Related Variables, by Firm Size

	SP600	SP400	SP500
Total assets(bn.)	1.234	3.953	47.607
Total net sales(bn.)	0.940	2.514	18.186
Pension value(mm.)	0.729	2.146	5.782
Deferred compensation(mm.)	0.564	2.358	4.831
Inside debt value(mm.)	1.304	4.521	10.722
Equity value(mm.)	22.528	67.476	730.892
Inside debt /(inside debt + equity value)	0.135	0.158	0.215
Inside debt / equity value	0.349	0.394	0.508
Leverage indicator	0.305	0.358	0.429
Annual Salary + Bonus(mm.)	1.104	1.777	3.623
Annual total compensation(mm.)	2.379	4.712	11.143
Annual pension increment(mm.)	0.125	0.386	0.891
Annual DCP increment(mm.)	0.087	0.359	0.654
Annual firm contribution to DCP(mm.)	0.031	0.123	0.127
Annual CEO contribution to DCP(mm.)	0.056	0.236	0.527
Leverage (book value of equity)	0.135	0.189	0.188
Leverage (market value of equity)	0.148	0.190	0.182
Firm match ratio of DCP	0.115	0.135	0.253
CEO contribution/ (Salary+Bonus)	0.048	0.162	0.171

Note:
Descriptive statistics for variables related to CEO and firm characteristics for a sample of 1,947 observations from S&P 1500 companies over 2006 to 2008. Data is from COMPUSTAT Execucomp.

Both pension values and deferred compensation balances are sensitive to CEO ages due to the conditions of these plans. When looking at the association between CEO personal leverage and CEO age in Table 4, I find an inverted U-shape: CEOs personal leverages increase when CEOs grow older until the CEOs reach the age of 65, afterwards, the CEOs personal leverages decrease.

TABLE 4: Mean Values of Related Variables, by CEO Age

	45-	46-50	51-55	56-60	61-65	66+
Salary (mm.)	0.592	0.687	0.756	0.819	0.803	0.807
Bonus (mm.)	0.147	0.287	0.293	0.339	0.274	0.870
Stock awards (mm.)	1.167	1.462	1.695	1.806	1.649	0.965
Option awards (mm.)	1.385	1.244	1.330	1.498	1.449	0.889
Annual Salary+Bonus (mm.)	0.747	1.050	1.218	1.413	1.351	1.746
Annual pension increment(mm.)	0.046	0.171	0.410	0.675	0.643	0.240
Annual total compensation(mm.)	4.108	4.892	5.641	6.577	6.216	5.222
Pension value(mm.)	0.210	0.793	2.283	4.037	4.301	2.764
Deferred compensation(mm.)	1.439	1.716	1.920	2.991	3.101	1.934
Inside debt value(mm.)	1.715	2.588	4.236	7.081	7.453	4.724
Equity value(mm.)	31.85	35.13	38.26	39.03	62.94	112.9
Inside debt /(inside debt + equity value)	0.069	0.126	0.164	0.237	0.199	0.130
Leverage indicator	0.179	0.273	0.349	0.448	0.382	0.281
Annual CEO contribution to DCP(mm.)	0.207	0.134	0.247	0.267	0.220	0.333
CEO contribution/ (Salary+Bonus)	0.169	0.067	0.118	0.110	0.089	0.112

Note:
Descriptive statistics for variables related to CEO and firm characteristics for a sample of 1,947 observations from S&P 1500 companies over 2006 to 2008. Data is from COMPUSTAT Execucomp.

This pattern is consistent with Sundaram and Yermack(2006)'s findings and suggests that not only pension values but also the total inside debt tend to increase more rapidly than the value of CEOs' equity holdings as CEOs grow older when managers' interest are aligned more closer with the interests of debt holders. The fraction of CEOs whose personal leverage is higher than the firm leverage also has an inversed U-shape relation with the CEO's age (See Figure 4).

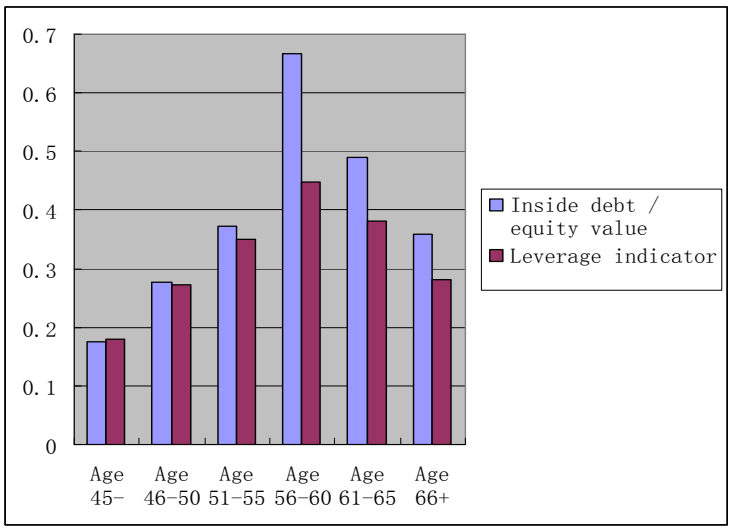

FIGURE 4: Average CEO Personal Leverage, by CEO Age

Figure 4: Average CEO Personal Leverage, by CEO Age. CEOs personal leverages increase when CEOs grow older until the CEOs reach the age of 65, afterwards, the CEOs personal leverages decrease. The pension value, deferred compensation and overall total inside debt follow the same patterns as that of the CEO personal leverage ratio.

The absolute value of pension value, deferred compensation and overall total inside debt follow the same inversed-U patterns as CEOs grow older (See Figure 5).

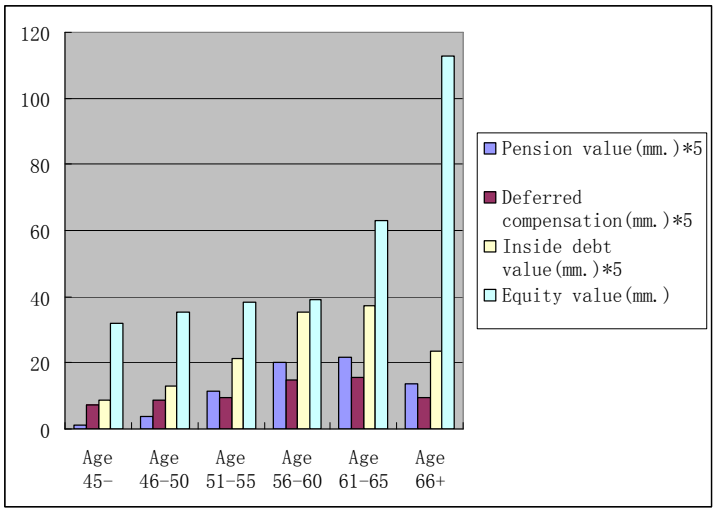

FIGURE 5: Average Inside Debt and Its Components, by CEO Age

Figure 5: Average Inside Debt and Its Components, by CEO Age. CEOs inside debt and its components show an inverted U-shape relation with CEO age: CEO inside debt increases when CEOs grow older until the CEOs reach the age of 65, afterwards, the CEOs inside debt decreases.

Meanwhile, contrasting with the equity value change, for the age group above 60 years, CEOs' average equity values jump from 39 million to 63 million, then to 113 million for the group older than 65 years. Comparing to the other age groups whose equity values are varying between 50 and 100 million, this jump may suggest that for most CEOs might convert their inside debts to equities when their deferred compensation plans vest.

I then study the relation between the CEO personal leverage and the firm leverage. Interestingly, the monotone relation in Sundaram and Yermack(2006) is not observed. Instead, I find an inverted U-shape relation: CEO's personal leverage increases when the firm leverage (accounting value) becomes higher until the firm leverage reaches a point, then the CEO's personal leverages decrease with the increasing level of the firm leverage(See Table 5 and Figure 6). Furthermore, by examining the association between the firms' match rate and the firm leverage, I do not find the evidence that higher levered firms have monotone incentive to encourage CEOs adopting higher personal leverage to decrease the agency cost of debt.

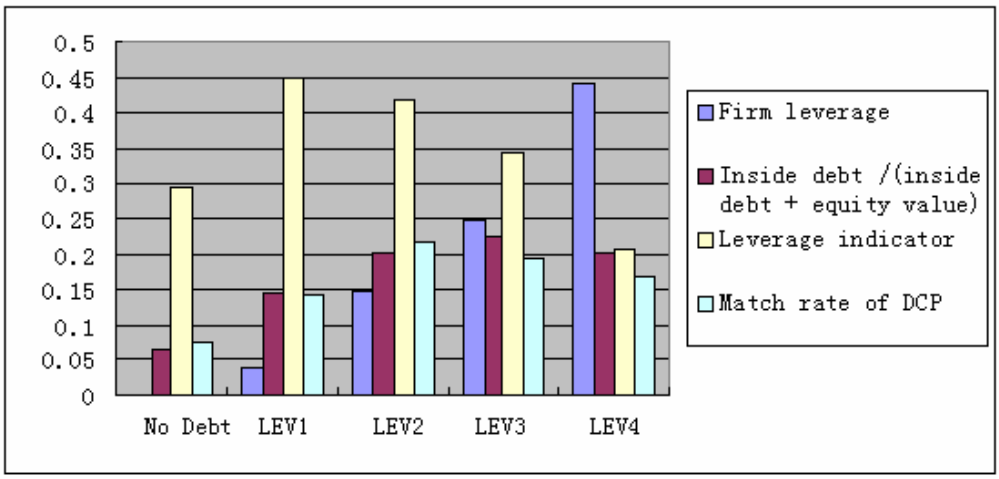

FIGURE 6: Average Inside Debt and Its Components, by Firm Leverage

Figure 6: Average Inside Debt and Its Components, by Firm Leverage. Figure 6 shows the relation between the CEO personal leverage and the firm leverage-an inverted U-shape relation: CEO's personal leverage increases when the firm leverage (accounting value) becomes higher, after the firm leverage reaches a point, the CEO's personal leverages decrease with the increasing level of the firm leverage. The association between the firms' match rates and the firm leverages follows a similar inverted U-shape pattern.

TABLE 5: Mean Values of CEO and Firm Variables, by Firm Leverage

	No debt	LEV1	LEV2	LEV3	LEV4
Total assets(bn.)	1.418	16.871	39.915	12.648	12.449
Leverage	0	0.039	0.148	0.248	0.443
Firm age	16.9	22.2	30.1	29.6	25.5
Pension value(mm.)	0.298	2.581	3.925	3.514	2.586
Deferred compensation(mm.)	0.367	2.666	2.958	2.629	2.483
Inside debt value(mm.)	0.606	5.355	6.928	6.256	5.110
Inside debt /(inside debt+equity value)	0.064	0.145	0.204	0.228	0.202
Leverage indicator	0.293	0.448	0.420	0.346	0.209
Annual firm contribution to DCP(mm.)	0.012	0.155	0.073	0.077	0.270
Annual CEO contribution to DCP(mm.)	0.041	0.324	0.316	0.249	0.181
Annual pension increment(mm.)	0.036	0.423	0.555	0.549	0.450
Annual DCP increment(mm.)	0.053	0.480	0.390	0.327	0.451
Match rate of DCP	0.073	0.144	0.218	0.195	0.169
CEO ownership percentage	0.032	0.026	0.018	0.016	0.099
CEO contribution/ (Salary+Bonus)	0.043	0.160	0.123	0.116	0.075

Note:
Descriptive statistics for variables related to CEO and firm characteristics for a sample of 1,947 observations from S&P 1500 companies over 2006 to 2008. Data is from COMPUSTAT Execucomp.

In addition, I find that CEO personal leverage is positively associated with firm age, consistent to Sundaram and Yermack(2006)'s results. Table 6 shows that CEOs in older firms have higher inside debts and personal leverages. And the older the firms are, the more likely the CEOs personal leverage will be higher than the firm leverage.

TABLE 6: Mean Values of CEO and Firm Variables, by Firm Age

	5-	6-10	11-20	21-30	31-40	40+
Total assets(bn.)	5.533	10.864	8.642	20.863	37.381	23.515
Total net sales(bn.)	2.893	3.195	3.474	6.369	7.982	16.681
Pension value(mm.)	0.918	1.196	1.120	2.114	3.835	7.395
Deferred compensation(mm.)	1.060	1.799	1.256	2.306	3.269	4.699
Inside debt value(mm.)	1.971	3.023	2.395	4.532	7.181	12.182
Equity value(mm.)	94.946	67.378	93.731	247.92	880.99	63.182
Inside debt /(inside debt+equity value)	0.089	0.109	0.114	0.152	0.262	0.325
Inside debt / equity value	0.181	0.272	0.270	0.369	0.694	0.865
Leverage indicator	0.221	0.237	0.258	0.329	0.508	0.573
Annual firm contribution to DCP(mm.)	0.082	0.107	0.046	0.172	0.082	0.354
Annual CEO contribution to DCP(mm.)	0.218	0.143	0.120	0.243	0.290	0.473
Match rate of DCP	0.140	0.126	0.141	0.125	0.212	0.228
CEO ownership percentage	0.041	0.141	0.022	0.023	0.019	0.013
CEO contribution/(Salary+Bonus)	0.179	0.081	0.063	0.105	0.144	0.128

Note:
Descriptive statistics for variables related to CEO and firm characteristics for a sample of 1,947 observations from S&P 1500 companies over 2006 to 2008. Data is from COMPUSTAT Execucomp.

Figure 7 show that CEOs' leverages increase with the firm size. Larger firms have higher CEO leverages and large percentage of CEOs whose personal leverages are higher than firm leverage ratio. It is consistent with Sundaram and Yermack (2006).

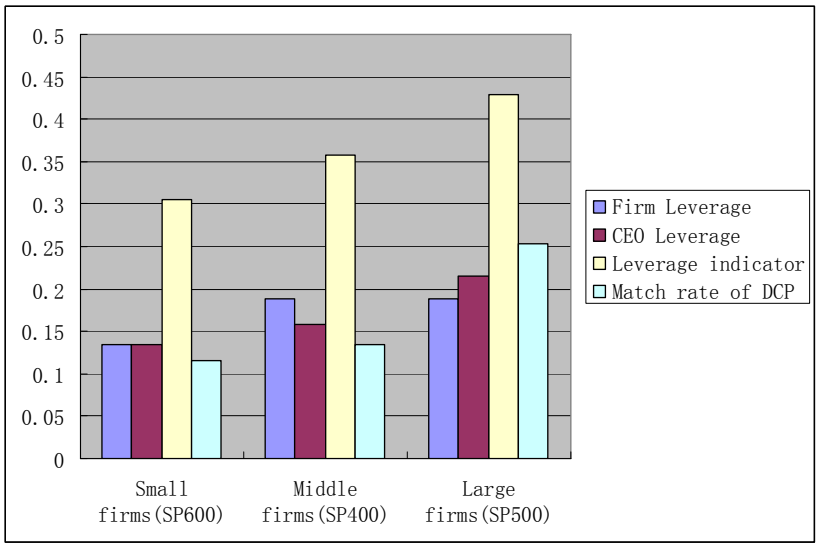

FIGURE 7: Average Firm Leverage and CEO Inside Debt, by Firm Size

Figure 7: Average Firm Leverage and CEO Inside Debt, by Firm Size. CEO leverage increases with the firm size. While middle-cap firms and large-cap firms have similar firm leverages, larger firms have higher CEO leverages and large percentage of CEOs whose personal leverages are higher than firm leverage ratio.

4.2 VARIABLES

4.2.1 Pension Valuation and Deferred Compensation Balance

Since year 2006, firms are required to report the present value of their pension value and deferred compensation balances. Same as Wei and Yermack(2010), I directly use the pension value and deferred compensation balance in COMPUTATE to calculate the inside debt. I compared the results of firm reported pension value with the

estimated pension value in Sundaram and Yermack (2006). The basic statistics of two valuations are quite close and I believe the reported present value of pension and deferred compensation are comparable with the estimated value in Sundaram and Yermack (2006).

4.2.2 Dependent Variables

This paper studies the determinants of inside debt and its components. I obtain the main components of inside debt from COMPUSTAT Executive Compensation data base. ***PENSION_VALUE_TOT*** is the present value of CEO pension and ***DEFER_BALANCE_TOT*** is the present value of deferred compensation. The total inside debt is the sum of total pension value and deferred compensation balance. Then I use the estimated inside debt to calculate the CEO debt-to-equity ratio or CEO personal leverage, ***CEO_LEV***. ***CEO_LEV*** is calculated by total inside debt over total CEO equity holdings plus total inside debt. The CEO equity holdings are the sum of the market value of CEO's stock and option holdings. Another dependent variable, ***MATCH_RATE*** is used to measure the firm's willingness to encourage the CEO's contributions to deferred compensation. ***MATCH_RATE*** is the ratio of annual firm match contribution to deferred compensation account (DEFER_CONTRIB_CO_TOT) and annual executive contribution to deferred compensation account (DEFER_CONTRIB_EXEC_TOT).

In studying the determinants of deferred compensation, I use another two dependent variables: the CEO contribution to deferred compensation account (***DEFER_CONTRIB_EXEC_TOT***) and the ***CEO contribution ratio***. CEO contribution ratio is the ratio of the CEO contribution

(DEFER_CONTRIB_EXEC_TOT) over the annual cash compensation (Salary + Bonus + Non-Equity Incentive Plan Compensation). I choose cash compensation instead of total compensation because for the majority of the firms CEOs are usually allowed to defer their cash compensation only.

4.2.3 Explanatory Variables

A. Firm Characteristics

Firm leverage: the firm leverage ratio LEVERAGE is measured as the ratio of long term debt to the book value of total assets. And I also build a dummy variable as one if CEO personal leverage ratio is higher than firm leverage ratio, zero otherwise. ***Firm Size***: I use the natural logarithm of total assets LOGAT to control for size effect. ***Liquidity***: I measure the firms' cash flow condition, LIQUIDITY, as an indicator variable that equals one if the firm has negative operating cash flow. ***Growth***: To measure investment opportunities, I use the ratio of the research and development expenditures to total sales, GROWTH, as a proxy for growth opportunities. ***Tax status***: I include an indicator variable TAX for whether the firm has net operating loss carry forwards on its balance sheet as a proxy for its tax status. ***Firm age***: I include the firm age YEARS to control potential firm age effect on growth, corporate governance quality, and CEO compensation.

B. CEO Characteristics

CEOs with more control power over their boards or more negotiation power in contracting employment agreement may influence their compensation and benefit packages. I use following variables to measure the CEO's control power or negotiation

power: ***Tenure***: TENURE is the natural logarithm of CEO tenure. On one hand, senior CEOs with longer tenures are more likely powerful over the board; On the other hand, pension benefits and deferred compensation typically increase monotonically in CEOs' years with firms. ***CEO hired from outside***: I also include a dummy variable OUTSIDER to indicator whether CEOs are hired from outside the firm. As discussed in Sundaram and Yermack (2006) this variable may control for the negotiation on special pension or deferred compensation provisions in employment contracts of new CEOs from outside. ***Founder CEO***: FOUNDER is an indicator variable coded as one if the CEO is one of the founders, and zero otherwise. CEOs who are founders are assumed to be relatively more powerful. ***CEO duality***: I also include CEO-chairman duality dummy CEODUAL.

C. Performance of DCP Investment and Firm Performance

Return of DCP: I estimate the return of DCP, RET_DCP, by dividing the earnings of DCP (DEFER_EARNINGS_TOT) by deferred compensation balance (DEFER_BALANCE_TOT) in the beginning of the fiscal year. For those firms missing the last deferred compensation balance observations, I estimate them by subtracting the CEO contribution to DCP (DEFER_CONTRIB_EXEC_TOT), firm contribution to DCP (DEFER_CONTRIB_CO_TOT) and current year earnings in DCP (DEFER_EARNINGS_TOT) from the deferred compensation balance (DEFER_BALANCE_TOT) at year end.

Firm Performance: Firm performance can affect the level of inside debt because both pension and deferred compensation are partially functions of salary and bonus. To

control for performance, I use two variables: ***ROA*** is the ratio of net operating income to the book value of assets; ***RET*** is the annual return on common equity (monthly compounded).

D. Other Control Variables

I include the control variables used in Sundaram and Yermack (2006) such as board characteristics and institutional investors. They are used to proxy the corporate governance quality: ***BOARD SIZE*** is the natural logarithm of the number of directors. CEOs of firms with larger boards are assumed to have more power because of increased coordination costs (Yermack 1996). ***OUTSIDE DIRECTORS*** is the percentage of outsiders on the board, with a higher percentage of outsiders expected to decrease CEO power because CEOs have more influence over the careers of insiders (Byrd and Hickman 1992). To measure the level and quality of institutional investor influence, I use ***AVGTOP5HLD***, the percentage of top five institutional investors' equity holdings. The institutions may serve a monitoring role in mitigating the agency problem between shareholders and managers. Evidences show that institutional ownership concentration is positively related to the pay-for-performance sensitivity of executive compensation and negatively related to the level of compensation (Hartzell and Starks, 2003). Institutional ownership is taken from the CDA/Spectrum database of 13Fs. ***Distance to Default*** (***DtD***), the number of standard deviations between the mean of the distribution of a firm's asset value and the default point (DPT) (where DPT = (short-term debt) + 1/2 (long-term debt)). DtD is a widely accepted indicator of default likelihood.

5 REGRESSION ANALYSES

5.1 DEVELOPMENT OF HYPOTHESES

In this section I develop hypotheses to study the determinants of inside debt and its components. Specifically, I develop hypotheses about the determinants of deferred compensation and CEO's contribution to deferred compensation.

5.1.1 The Determinants of Inside Debt

The importance of inside debt in compensation of individual managers was not well addressed until the theoretical work of Edmans and Liu (2007). In a standard executive compensation and agency problem, equity-like compensation improves the managerial incentives to exert effort and aligns managers' interests with equity holders' benefit. But it may exacerbate a risk-shifting problem which conflicts with debt holders' benefit. Firms can align manager interests with those of debt holders by including debt-like compensation in managerial contracts. Therefore, my first hypothesis is from the optimal contracting argument, which argues that firms use inside debt to alleviate agency cost of debt.

H_0: Deferred compensation and pension are both inside debt to firms. I expect that deferred compensation, as an instrument to alleviate the agency cost of debt, has the same determinants as pension.

H_{0a}: Because debt-based compensation reduces the agency costs of debt, I should observe a positive association between the CEO's inside debt and the firm's leverage.

H_{0b}: Equity compensation pays executives without the use of cash. However

pension or DCP need cash payout in the future. Therefore firms with lower future cash flow are less likely to compensate with inside debt. I expect a negative association between cash flow liquidity and CEOs inside debt.

H_{0c}: Equity pay is expected to be used when a firm has many valuable investment opportunities that are best understood by managers instead of outside shareholders or directors. Moreover, firms with growth opportunities are less likely to face agency costs of debt because they have opportunities to invest in projects that maximize both shareholder and debt holder value. Accordingly, I expect a negative association between measures of growth opportunities and the CEO's inside debt.

H_{0d}: Firms use inside debt as a tax saving instrument. When there is no tax saving needed, the firm will pay by inside debt, which will result in a tax savings for the future. I expect a positive association between inside debt and tax status, which is measured by an indicator of net operating loss-forwards.

H_{0e}: A CEO with more power over the board may use inside debt as a method of extracting additional rents. I expect that inside debt has a positive association with CEO power and a negative association with board efficiency.

5.1.2 The Determinants of the Contribution to DCP

Even though deferred compensation and pensions share some features of inside debt, deferred compensation decisions are mainly made by CEOs annually whereas most pension contracts are set when CEOs are first employed. This makes deferred determinants different from pensions. I develop the alternative hypotheses to exploit the factors may affect the deferred compensation differently from pensions.

H_1: Unlike a pension, which is set when CEO is hired, deferred compensation is in large degree determined by CEOs and varies every year. Therefore, I expect that deferred compensation has different determinants than those of pensions.

H_{1a}: High equity holding makes the CEO an owner-manager so that the CEO mainly retains equity interest in the firm. Therefore CEOs with high equity holdings are less interested in inside debt holdings. I expect a negative association between CEO equity value and their contributions to DCPs.

H_{1b}: DCP is an income taxation instrument for CEOs. CEOs with higher personal equity value tend to have higher income tax rate. So I expect that CEOs with higher equity values have higher contributions to DCPs. I further expect that CEOs will dynamically increase their contributions to DCPs if they have high equity value increases.

H_{1c}: CEOs assess firm default risk when they decide to contribute to DCPs. CEOs accept high DCPs when firms are far away from default. So I expect positive association between contribution to DCPs and firm risk.

H_{1d}: ROA is the main accounting measure of performance in determining executive bonus. High ROA typically results in high annual bonuses. Higher previous bonuses result in CEOs' higher personal income tax and lower need for cash. Therefore, I expect that lagged ROA has a positive association with contributions to DCP.

H_{1e}: Stock return can affect both CEOs' equity value and their annual bonuses. An increasing in equity value or annual bonus may increase CEOs' income tax rate

and decrease their cash need. Therefore, I expect that CEOs will increase their DCP contribution if the lagged firm stock return is higher.

H_{1e}: DCP is also an investment instrument, so I expect that CEOs with a higher expected DCP return will contribute more to their DCPs.

5.2 MODEL SPECIFICATIONS

I first examine the determinants of inside debt levels and their components. I apply Sundaram and Yermack's regression model as the base model to investigate the impact of firm leverage on CEO inside debt holdings. I estimate Tobit models to account for CEOs who do not receive pension benefits or deferred compensation packages.

First, I estimate the following specification to explain cross-sectional variation in inside debt levels and their components:

$$Y_{it} = Ln(ASSETS)_{it} + Ln(CEO\ TENURE)_it + LEVERAGE_{it} + LIQUIDITY_{it} + GROWTH_{it} + TAX_{it} + YEARS_{it} + OUTSIDE_{it} + X_{it}$$

Here Y_{it} represents inside debt and its components: pension value, deferred compensation balance, total inside debt, CEO leverage ratio and firm match rate. X_{it} represents all other control variables including board size, board independence, and other CEO characteristics. To avoid the clustering effect, I take the mean of each variable for each case across time and run regression on the collapsed dataset of means.

Next, I estimate the determinants of the CEO contribution to deferred compensation cross-sectional variation:

$$(CEO\ Contribution)_{it} = Ln(ASSETS)_{it} + Ln(CEO\ TENURE)_{it} + LEVERAGE_{it} + LIQUIDITY_{it} + GROWTH_{it} + TAX_{it} + YEARS_{it} + OUTSIDE_{it} + (Distance\ to\ Default)_{it} + (CEO\ Equity\ Holdings)_{it} + X_{it}$$

In this model, CEO contribution represents both contribution level and contribution rate. To avoid the clustering effect, I also use the collapsed dataset of means.

I also estimate the dynamic determinants of CEO contribution rate change. I add CEO equity value change to proxy the wealth change and the firm performance measures (ROA and RET) to proxy annual compensation change.

$$\Delta(CEO\ Contribution)_{it} = Ln(\Delta ASSETS)_{it} + \Delta LEVERAGE_{it} + \Delta LIQUIDITY_{it} + \Delta GROWTH_{it} + \Delta TAX_{it} + \Delta(CEO\ EQUITY)_{it} + \Delta\ RET_{it} + \Delta ROA_{it} + \Delta X_{it}$$

Since the change of contribution level is very sensitive to the change of salary and bonus, here only the change of contribution ratio is studied. The contribution rate is relatively stable and is merely CEO's personal decision that can convey CEO's attitude on deferred compensation. To avoid the noise, I normalize all the independent variables into indicator variables: one if the change is positive and zero if otherwise.

5.3 REGRESSION RESULTS AND ANALYSIS

5.3.1 Cross-sectional Determinants of Inside Debt and Its Components

The regression results on pension, deferred compensation, total inside debt, CEO leverage and firm match rate can be seen at Table 7.

A positive association exists between the CEO leverage and the firm leverage. However, pension, deferred compensation and total inside debt do not show any significant associations with the firm leverage. Since the univariate analysis in section

IV suggests an inverted U-shape relation between firm leverage and inside debt, I then include the quadratic term of firm leverage in the model. When the quadratic term of firm leverage is included, pension, inside debt total, CEO leverage and firm match rate all show an inverted U-shape relation with firm leverage. Deferred compensation still shows no relation with firm leverage. (See at Table 8).

To check whether the non-linear relation is driven by sample composition, I apply the model on SP 500 companies only and use pension only as the proxy of inside debt as Sundaram and Yermack did. The results are shown at Table 9. The non-linear relation consistently exists.

TABLE 7: Tobit Regression without Quadratic Term of Firm Leverage

Dependent variable:	Pension	DCP	Pension+DCP	(Pension+DCP)/ CEO equity value	Firm match rate
Intercept	-38.655***	-15.459***	-32.022***	-1.015***	-4.810***
	(-10.02)	(-9.81)	(-10.98)	(-8.22)	(-7.36)
CEO tenure with the firm	1.461***	0.713***	1.660***	0.010	0.103**
	(4.10)	(5.69)	(6.63)	(0.17)	(2.02)
CEO hired from outside indicator	-2.917***	-0.060	-1.825***	-0.041	-0.294*
	(-3.94)	(-0.94)	(-3.65)	(-1.49)	(-1.64)
Firm size	1.637***	0.781***	1.797***	0.022***	0.151***
	(8.45)	(9.89)	(12.02)	(4.56)	(4.39)
Leverage	0.063	0.347	0.615	0.129***	0.001
	(0.09)	(0.37)	(0.02)	(3.17)	(0.27)
Liquidity	-3.561***	-0.678***	-1.644***	-0.025	-0.370***
	(-2.83)	(-1.67)	(-1.95)	(-0.02)	(-2.24)
Growth	-14.911***	-2.623*	-6.553***	-0.389***	-1.774***
	(-3.71)	(-1.82)	(-2.63)	(-4.18)	(-2.71)
Tax status indicator	0.103	0.268	0.141	0.027	0.155*
	(0.50)	(0.18)	(0.15)	(1.42)	(1.74)
Years since founding of firms	0.134***	0.020***	0.111***	0.004***	-0.003
	(9.49)	(3.19)	(8.02)	(8.34)	(-0.87)
Pctg of top five institutional holdings	-0.005	0.004	0.011	0.004***	0.006
	(-0.31)	(0.62)	(0.60)	(4.27)	(1.09)
Founder CEO indicator	-2.936***	-1.845**	-1.882***	-0.070***	-0.601***
	(-2.77)	(-2.58)	(-3.39)	(-2.21)	(-3.37)
Board size	4.582***	2.690***	4.626***	0.220***	0.955***
	(3.21)	(3.46)	(3.42)	(3.87)	(4.08)
Pctg of outside directors	14.194***	2.362**	7.910***	0.313***	1.018**
	(4.58)	(2.24)	(3.50)	(3.14)	(1.88)
Leverage^2					
CEO–Chair duality					
Obs#	1388	1388	1388	1388	1388

TABLE 7: Tobit Regression without Quadratic Term of Firm Leverage (Continued)
Note:
Tobit regression estimates of inside debts and its components. To avoid the clustering effect, I take the mean of each variable for each case across time and running regression on the collapsed dataset of means. Pension is the aggregate actuarial present value of the executive's accumulated pension benefit. DCP is the aggregate balance in non-tax-qualified deferred compensation plans. CEO equity value equals the value of common stock plus stock options, calculated according to the estimated market value at fiscal year end. Firm match rate is the ratio of firm match contribution and executive contribution to deferred compensation account. Leverage equals total long-term dent divided by total debt plus the book value (or market value) of equity. Firm size is the natural logarithm of total assets. Liquidity is an indicator variable that equals one if the firm has negative operating cash flow. Growth is the ratio of the research and development expenditures to total sales. Tax status is an indicator variable equals one if the firm has net operating loss carry forwards on its balance sheet. T-statistics appear in parentheses below each estimate. Significant at 1% (***), 5% (**), and 10% (*) levels.

TABLE 8: Tobit Regression with Quadratic Term of Firm Leverage

Dependent variable:	Pension	DCP	Pension+DCP	(Pension+DCP)/ CEO equity value	Firm match rate
Intercept	-34.075***	-15.327***	-29.467***	-0.891***	-4.546***
	(-9.45)	(-9.59)	(-10.58)	(-7.80)	(-6.98)
CEO tenure with the firm	1.154***	0.698***	1.488***	0.008	0.081
	(2.95)	(5.36)	(5.85)	(0.24)	(1.50)
CEO hired from outside indicator	-2.808***	-0.068	-1.778***	-0.040	-0.276
	(-3.82)	(-0.91)	(-3.56)	(-1.42)	(-1.52)
Firm size	1.333***	0.769***	1.639***	0.015***	0.130***
	(7.36)	(9.52)	(11.28)	(3.93)	(3.81)
Leverage	9.908***	0.286	5.902*	0.361***	1.486**
	(2.82)	(0.95)	(1.69)	(3.47)	(2.31)
Liquidity	-3.249***	-0.680***	-1.571**	-0.023	-0.366**
	(-2.67)	(-1.66)	(-1.91)	(-0.08)	(-2.18)
Growth	-13.815***	-2.491	-6.126**	-0.373***	-1.545**
	(-3.31)	(-1.68)	(-2.30)	(-3.86)	(-2.35)
Tax status indicator	0.093	0.268	0.175	0.026	0.154*
	(0.55)	(0.16)	(0.09)	(1.42)	(1.75)
Years since founding of firms	0.120***	0.020***	0.102***	0.004**	-0.003
	(8.65)	(2.96)	(7.39)	(7.87)	(-1.31)
Pctg of top five institutional holdings	-0.003	0.004	0.008	0.003***	0.005
	(-0.40)	(0.61)	(0.63)	(4.22)	(1.01)
Founder CEO indicator	-3.074***	-0.503***	-2.009***	-0.068*	-0.604***
	(-2.93)	(-2.60)	(-3.59)	(-2.25)	(-3.41)
Board size	4.882***	2.671***	4.921***	0.230***	0.920***
	(3.03)	(3.37)	(3.32)	(3.69)	(3.90)
Pctg of outside directors	9.946***	2.273**	5.380***	0.209***	0.821*
	(4.00)	(2.10)	(3.15)	(2.84)	(1.83)
Leverage^2	-17.267***	-0.947	-12.466*	-0.328**	-2.502**
	(-2.99)	(-0.88)	(-1.65)	(-2.47)	(-2.35)
CEO–Chair duality	2.387***	0.091	1.509***	0.020**	0.124*
	(4.04)	(0.78)	(2.89)	(1.91)	(1.67)
Obs#	1388	1388	1388	1388	1388

TABLE 8: Tobit Regression with Quadratic Term of Firm Leverage (Continued)

Note:
Tobit regression estimates of inside debts and its components. To avoid the clustering effect, I take the mean of each variable for each case across time and running regression on the collapsed dataset of means. Pension is the aggregate actuarial present value of the executive's accumulated pension benefit. DCP is the aggregate balance in non-tax-qualified deferred compensation plans. CEO equity value equals the value of common stock plus stock options, calculated according to the estimated market value at fiscal year end. Firm match rate is the ratio of firm match contribution and executive contribution to deferred compensation account. Leverage equals total long-term dent divided by total debt plus the book value (or market value) of equity. Firm size is the natural logarithm of total assets. Liquidity is an indicator variable that equals one if the firm has negative operating cash flow. Growth is the ratio of the research and development expenditures to total sales. Tax status is an indicator variable equals one if the firm has net operating loss carry forwards on its balance sheet. T-statistics appear in parentheses below each estimate. Significant at 1% (***), 5% (**), and 10% (*) levels.

TABLE 9: Mimicking Sundaram and Yermack's Regression on S&P 500

Dependent variable:	Pension	Pension
CEO tenure with the firm	1.790**	1.687**
	(2.44)	(2.29)
CEO hired from outside indicator	-6.739***	-6.535***
	(-2.68)	(-2.59)
Firm size	2.508***	2.428***
	(4.30)	(4.15)
Leverage	4.011	33.154***
	(0.92)	(2.58)
Liquidity	-7.528*	-8.029*
	(-1.60)	(-1.73)
Growth	-21.916**	-17.882*
	(-2.41)	(-1.94)
Tax status indicator	1.008	1.099
	(0.85)	(0.92)
Years since founding of firms	0.163***	0.155***
	(5.61)	(5.36)
Leverage^2		-56.744**
		(-2.41)
Obs#	342	342

Note:
Tobit regression estimates of pension. This regression is used to check the comparability with Sundaram and Yermack(2006)'s sample with large firms. To avoid the clustering effect, I take the mean of each variable for each case across time and running regression on the collapsed dataset of means. Pension is the aggregate actuarial present value of the executive's accumulated pension benefit. Leverage equals total long-term dent divided by total debt plus the book value (or market value) of equity. Firm size is the natural logarithm of total assets. Liquidity is an indicator variable that equals one if the firm has negative operating cash flow. Growth is the ratio of the research and development expenditures to total sales. Tax status is an indicator variable equals one if the firm has net operating loss carry forwards on its balance sheet.
Coefficients of other explanatory variables (Percentage of top five institutional holdings, Founder CEO indicator, Board size, Percentage of outside directors, CEO duality) skipped for space saving. t-statistics appear in parentheses below each estimate. Significant at 1% (***), 5% (**), and 10% (*) levels.

The other explanatory variables show consistent results with Sundaram and Yermack: larger firms pay more inside debt, senior CEOs tend to have more inside debt and its components, and older firms pay larger inside debt than younger firms. I also find evidence that firms with less liquidity in cash flow (negative operating income) and more growth opportunities tend to pay less inside debt. I do not obtain a significant estimate for the variable measuring tax status except that firms with tax loss forwards tend to match more and encourage deferred compensation.

Unlike Sundaram and Yermack, I find that CEOs hired from outside tend to have less pension but more deferred compensation.

5.3.2 Determinants of CEO Contribution to DCP

This paper is the first empirical work to study the determinants of CEO deferred compensation. Even though deferred compensation and pension share some features of inside debt, regression analysis in the previous section shows that deferred compensation has quite different determinants from pension. I next demonstrate the differences and exploit the factors that may affect the deferred compensation. The deferred compensations have three basic components: CEO contribution, firm match contribution, and earnings from DCP investment. At the end of each fiscal year, CEOs decide how much percentage (contribution ratio) or amount (contribution level) they wish to contribute to their DCPs from their salary and bonus compensation during the next year. Firms simply match the CEO contribution with a contractual match rate (usually from zero to one).

Both regressions on level and ratio show consistent results.

TABLE 10: Tobit Regression on CEO Contribution to DCP

Dependent variable:	CEO contribution	CEO contribution rate	CEO contribution	CEO contribution rate
CEO tenure with the firm	0.065	0.007	0.106***	0.015*
	(1.58)	(0.82)	(2.54)	(1.75)
CEO hired from outside	0.014	0.022	0.027	0.023
	(0.10)	(0.78)	(0.20)	(0.82)
Firm size	0.207***	0.029***	0.191***	0.027***
	(7.49)	(4.99)	(6.56)	(4.37)
Leverage	-0.068	-0.027	-0.227	-0.055
	(-0.35)	(-0.67)	(-1.16)	(-1.33)
Liquidity	-0.393***	-0.079***	-0.235*	-0.053**
	(-2.97)	(-2.89)	(-1.77)	(-1.93)
Growth	-0.380	-0.139	-0.287	-0.117
	(-0.98)	(-1.64)	(-0.77)	(-1.40)
Tax status indicator	0.005	0.006	0.002	0.006
	(0.07)	(0.42)	(0.03)	(0.44)
Distance to default			0.142***	0.024***
			(4.69)	(3.72)
CEO equity value			-0.762***	-0.169***
			(-2.92)	(-2.94)
OBS#	1388	1388	1388	1388

Note:
Tobit regression estimates of CEO contribution to DCP. To avoid the clustering effect, I take the mean of each variable for each case across time and running regression on the collapsed dataset of means. CEO contribution is the annual executive contribution to deferred compensation account. CEO contribution rate is the ratio of the annual executive contribution to DCP and annual cash compensation. Leverage equals total long-term dent divided by total debt plus the book value (or market value) of equity. Firm size is the natural logarithm of total assets. Liquidity is an indicator variable that equals one if the firm has negative operating cash flow. Growth is the ratio of the research and development expenditures to total sales. Tax status is an indicator variable equals one if the firm has net operating loss carry forwards on its balance sheet.
Coefficients of other explanatory variables (Percentage of top five institutional holdings, Founder CEO indicator, Board size, Percentage of outside directors, Firm age) skipped for space saving. T-statistics appear in parentheses below each estimate. Significant at 1% (***), 5% (**), and 10% (*) levels.

No significant association is found between firm leverage and CEO contribution to DCP. CEOs in larger firms tend to contribute more. CEOs in firms with less cash (that is, with negative operating income) tend to contribute less. I also find that CEOs in firms with less likelihood of default tend to contribute more. This suggests that CEOs assess firm risk when making deferred compensation decisions. The result with regard to CEO wealth supports the owner-manager hypothesis, not support the income tax hypothesis. The potential reason for this result is that for the majority of CEOs with equity holdings, the income tax rates have already hit the maximum level so that there is no further income tax benefit that can be extracted from deferred compensation.

The dynamic regressions on contribution rate change find the evidence of that CEO equity value change has a positive effect on CEO contribution change.

Both ROA and stock returns have positive impacts on CEO contribution change. These results are consistent with the hypothesis that argues that the increase of wealth in current period will result in the increase in deferred compensation in next period for less cash need and lower the income tax rate.

In addition, I find a positive association between the firm leverage change and CEO contribution rate change. Since cross-sectional analysis does not find an association between firm leverage and CEO contribution rate, the dynamic association suggests a behavioral explanation: when CEOs intend to increase firm debt, they may increase the inside debt holdings to signal the debt holders in order to decrease the debt cost.

TABLE 11: Regression on Dynamic Change of CEO Contribution

Dependent variable	Change of contribution rate
Firm size	0.039***
	(3.36)
Leverage	0.054***
	(4.65)
Liquidity	-0.028
	(-1.06)
Growth	-0.003
	(-0.19)
Tax	0.049*
	(1.86)
Institutional holdings	0.069***
	(6.16)
CEO equity value	0.096***
	(5.85)
ROA	0.046***
	(3.87)
Stock return	0.034***
	(2.79)
Return on DCP	0.086***
	(5.03)
Obs#	4284
R^2	0.08

Note:
OLS regression estimates of CEO contribution rate to DCP. To study the dynamic decision of contribution rate, I take the dynamic change of each variable and normalize them into dummy variables: one if increase and zero otherwise. I run regression on the dataset of these dummies. CEO contribution rate is the ratio of the annual executive contribution to DCP and annual cash compensation. Leverage equals total long-term dent divided by total debt plus the book value (or market value) of equity. Firm size is the natural logarithm of total assets. Liquidity is an indicator variable that equals one if the firm has negative operating cash flow. Growth is the ratio of the research and development expenditures to total sales. Tax status is an indicator variable equals one if the firm has net operating loss carry forwards on its balance sheet. CEO equity value equals the market value of common stock plus stock options at fiscal year end. ROA is the ratio of net operating income to the book value of assets. Stock return is the annual return on common equity (monthly compounded). Return on DCP is estimated by dividing the earnings on DCP by deferred compensation balance in the beginning of that fiscal year. t-statistics appear in parentheses below each estimate. Significant at 1% (***), 5% (**), and 10% (*) levels.

5.3.3 Comparison of the Difference between DCP and Pension

One can see that deferred compensation and pension share some features of inside debt. But they also have substantial differences in terms of their contributors and decision makers.

The primary difference is that firm leverage has no economic impact on CEO deferred compensation level and its contribution decision. Cross sectional analysis shows that the absolute values of regression coefficients in the pension model are all larger than that in deferred compensation model. This suggests that deferred compensation is less sensitive than pension to firm characteristics and CEO characteristics.

I do not find evidence that firms pay CEOs hired outside more deferred compensation; instead I find that CEOs hired outside have lower pensions. This result is consistent with the impact of tenure because usually CEOs hired inside have longer tenure than new employed CEOs from outside.

The different impact from CEO duality shows that if managerial rent extraction problems exist for powerful CEOs, those CEOs' appetites are for pensions, not for deferred compensation.

Overall, these differences suggest that in terms of aligning the principal-agent interests, pension is a better instrument to play the role of inside debt than deferred compensation.

5.4 WHY INVERTED U-SHAPE

The regression results show a quadratic inverted U-shape relation between CEO personal leverage and firm leverage. This suggests that the associated agency problem in CEO inside debt compensation may be more complex than conventionally thought.

5.4.1 Potential Explanations of the Inverted U-shape

My result is not the only evidence of inverted U-shape relation in firm leverage and executive compensation literature. Gianluca and Speciale (2010) also find a similar relation between the firm leverage and the executive pay-to-performance sensitivity. The inverted U-shape relation between the firm leverage and the inside debt components consistently exists for pension, CEO debt-to-equity ratio and firm match rate. The potential reasons are unknown. I here attempt to exploit the explanation by suggesting two hypotheses: firm optimal selection and manager risk aversion selection.

Firm optimal selection suggests that the inverted U-shape is the firm's optimal policy based on its agency cost of debt concern. Therefore, firms with higher-than-average leverages may have other mechanisms other than inside debt compensation to reduce the agency cost of debt (Klock, Mansi and Maxwell (2005)). Or for these highly leveraged firms, creditors may require conservative financial reporting and stronger covenants to help creditors effectively monitor their investment. So the agency cost of debt may be reduced (Guay (2008)). Empirical works also suggest that firms with higher leverages may have fewer opportunities for risk-shifting and asset substitution—for example, firms in mature industries without growth opportunities (Talberg et al (2008)). It is also possible that, when firms have higher leverages, debt

holders may hold equity of that firm (called dual holder) or sit on the board so that CEOs in some degree may act in the interest of debt holder (Jiang, Li and Shao (2010)).

In other words, firm optimal selection argues that high leverage itself may be a result of lower agency cost of debt.

The manager risk aversion selection argument suggests that the inverted U-shape could also be driven by CEOs risk aversion decision. If the firm leverage exceeds the CEO's "optimal" level or a CEO foresees high risk of bankruptcy and financial distress, the CEO will be reluctant to leave his or her own wealth in the firm's inside debt. In this case, CEOs will be less interested in being compensated in inside debt and even will be withdrawing the inside debt to reduce their personal wealth loss risk.

5.4.2 Analysis on the Inverted U-shape

In order to test the above two arguments, I use univariate analysis to investigate the potential reasons. First, I explore the firm leverage level at which firms start to drop CEO leverage. Based on my regression analysis results in Table 8, I yield the following equation to express the relation between CEO leverage and firm leverage:

$$(CEO\ Leverage)_{it} = 0.36(LEVERAGE)_{it} - 0.33(LEVERAGE\hat{}2)_{it} + CX_{it}$$

X_{it} is a vector representing all other control variables and C is a vector of coefficients of these control variables. Using basic calculation, I yield that CEO leverage reaches the highest level when firm leverage ratio is around 0.54. Basic statistics show that, among 1480 sample firms in regression analysis, there are 55

firms with leverage higher than 0.54. These 55 firms account for 4% of the total sample firms. In another words, the negative association between CEO leverage and firm leverage only happens on 4% firms. This suggests that taken as a whole, inside debt basically is still positively associated with firm leverage. But unlike a linear pattern found by Sundaram and Yermack, this paper finds a non-linear pattern.

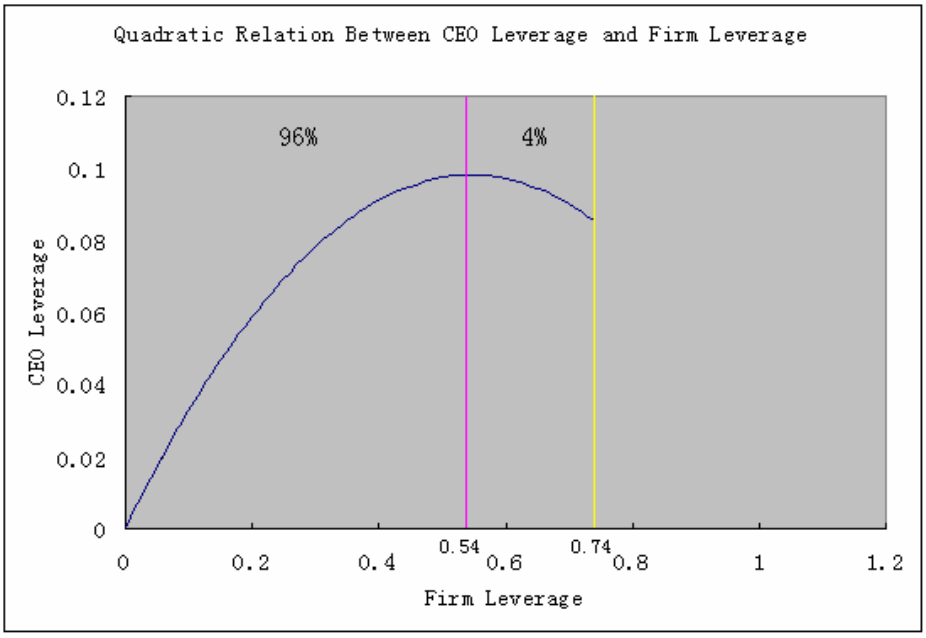

FIGURE 8: Non-Linear Relation between CEO Leverage and Firm Leverage

Figure 8: Non-Linear Relation between CEO Leverage and Firm Leverage. CEO leverage reaches the highest level when firm leverage ratio is around 0.54. 0.74 is the maximum of the firm leverage ratio in my sample universe. Basic statistics show that among 1480 sample firms in regression analysis, there are 55 firms with leverage higher than 0.54. These 55 firms account for 4% of the total sample firms in regression analysis.

I further on check why these 55 firms have low CEO leverage and negative association between CEO leverage and firm leverage. By the firm optimal selection argument, the positive relation between firm leverage and CEO leverage should be more important in firms that are more likely to suffer from the asset substitution

problem. Therefore, for these 55 firms, I expect that they have less asset substitution problem. By the CEO risk aversion argument, CEOs reduce inside debt holdings when a firm is under high bankruptcy risk. Therefore I expect these 55 firms have higher financial distress than that of the other groups.

I compare the mean (median) firm fundamentals of these 55 firms with the sample mean (median) and that of the other five groups built on firm leverage quintiles.

In Table 12, group 6 represents these 55 firms that have negative association between CEO leverage and firm leverage. The univariate analysis does not find the evidence of the hypothesis arguing that low CEO leverage firms may have low agency cost of debt or less demand of new capital. No evidence shows that group 6 has significant low investment. The mean and median of capital expenditure of group 6 is about the same as the sample mean and median. Group 6 even has the highest mean value of R&D expense to total sales. When I use R&D expenditure plus capital expenditure over total assets to proxy the investment, the results show that the mean and median investment of these 55 firms is about the same or even a little bit higher than the average. This means these 55 firms are still active in investment.

TABLE 12: Univariate Analysis of Inverted U-Shape

Panel A: Mean Comparison, by Firm Leverage

	All	Group1	Group2	Group3	Group4	Group5	Group6
Firm Leverage	0.180	0.000	0.040	0.149	0.248	0.390	0.746
CEO Leverage	0.179	0.069	0.157	0.212	0.232	0.214	0.203
INVESTMENT	0.100	0.130	0.101	0.083	0.083	0.081	0.145
GROWTH	0.126	0.185	0.144	0.053	0.055	0.067	0.684
Tobins Q	1.814	2.475	1.856	1.617	1.602	1.511	2.099
Z-SCORE	235.36	2115.78	601.269	6.293	4.056	2.547	-0.724
Bond Rating	A	AAA	AA	A	A	BBB	BB+
DtD	2.811	2.338	2.831	2.983	3.006	2.691	2.080
Pi	4.633	4.663	2.804	3.221	3.184	7.343	18.867
EPS	4.846	0.915	8.492	11.973	1.458	0.395	-0.912
ROA	0.040	0.050	0.047	0.051	0.042	0.011	0.040
ROE	0.005	0.069	0.015	0.106	0.152	-0.277	-0.153
DCP withdraw	28.46	16.62	26.98	29.28	31.80	38.05	22.77
Cash-out rate %	2.08	1.957	2.595	2.07	1.69	2.18	0.52
DCP Contribute	3.72	1.64	6.08	3.74	3.81	2.83	1.85

Panel B: Median Comparison, by Firm Leverage

	All	Group1	Group2	Group3	Group4	Group5	Group6
Firm Leverage	0.145	0.000	0.036	0.149	0.248	0.377	0.644
CEO Leverage	0.060	0.000	0.037	0.131	0.153	0.085	0.056
INVESTMENT	0.079	0.110	0.082	0.070	0.070	0.062	0.080
GROWTH	0.025	0.090	0.028	0.020	0.017	0.018	0.011
Tobins Q	1.428	1.976	1.392	1.415	1.360	1.276	1.466
Z-SCORE	4.453	19.250	18.912	5.611	3.672	2.313	1.073
Bond Rating	AA	AAA	AAA	A	BBB	BBB	BB
DtD	2.643	2.306	2.634	2.799	2.842	2.515	2.011
Pi	0.000	0.000	0.000	0.000	0.000	0.017	2.319
EPS	1.380	0.850	1.605	1.750	1.770	1.225	0.170
ROA	0.048	0.075	0.048	0.055	0.050	0.032	0.005
ROE	0.120	0.113	0.129	0.132	0.120	0.104	0.007
DCP withdraw	0	0	0	0	0	0	0
Cash-out rate%	0	0	0	0	0	0	0
DCP Contribute	0	0	0	0	0	0	0

Note:
CEO leverage is (Pension+DCP) divided by (Pesion+DCP+CEO equity value). Leverage equals total long-term dent divided by total assets (book value). Investment the sum of R&D expenditure and capital expenditure divided by book value total assets. Growth is the ratio of the research and development expenditures to total sales. Tobins Q is estimated by market value of total assets over book value of total assets. Z-score is based on Altman (1968). Estimation of DTD (Distance-to-Default) see Sundaram and Yermack(2006). Estimation of Pi (Expected Default Frequency) in percent by KMV-Merton Model see Bharath and Shumway (2008). ROA= Net Income/Total Assets. ROE= Net Income/Book Value of Equity. DCP withdraw is the amount withdrawn from DCP during the year. Cash out rate is DCP withdraw over the DCP total balance. DCP contribute is executive contributions to DCP over executive annual total compensation.

The next paragraph show these 55 firms may be under financial distress. Aggressive investment and financial distress together is a strong sign of sever assets substitution/risk shifting problem. Therefore it is not the lower agency cost of debt drive the downward of the CEO leverage.

I observe strong evidence shows that firms in group 6 are under financial distress. Table 12 shows that group 6 has the lowest Altman Z-score (lower than 1.8) and lowest bond rating, which means the highest probability of going bankrupt. The distance-to-default and expected- default-frequency using the KMV-Merton model also show consistent conclusions. Group 6 furthermore consistently show low ROA and the lowest ROE and EPS. All these evidences point to one conclusion: Firms in group 6 are under serious financial distress.

High firm leverage, low CEO leverage, aggressive investment, low bond rating and financial distress, theses four aspects give us a big picture of these 55 firms: Managerial incentives are not aligned against asset substitution when the firm enters financial distress. This might suggest that the inside debt mechanism is not that effective and the non-positive relation is suboptimal.

5.5 ENDOGENEITY OF FIRM LEVERAGE

Endogeneity is perhaps the most considerable problem plaguing researchers in empirical corporate finance. Firm leverage is a typical endogenous variable in literature. In the analyses above, I follow the previous studies in inside debt and assume that CEO inside debt compensation is exogenously determined. However, it is possible that inside debt contracts/agreements and corporate debt contracts are

endogenously determined by some unobservable firm-specific factors. For example, firms in short of cash flow are more likely to compensate CEOs with inside debt (which requires less current cash) and less likely to refinance by corporate debt. On the other hand, CEOs with high inside debt have the potential to adjust firm leverage and firms' risk to maximize the value of inside debt. So that low-leveraged firms are associated with a higher CEO inside debt ratio. In such a case, the causation goes from high inside debt ratio to low leverage, and not vice versa.

Previous literature in inside debt research largely omitted the endogeneity of firm leverage and inside debt caused by joint determination and reverse causality. When endogeneity exists, the coefficient estimates from the Ordinary Least Squares (OLS) will be biased and inconsistent. Here I take the endogeneity bias into account and perform the following tests to alleviate the endogeneity concerns.

5.5.1 Effect of Changes in the CEO Inside Debt Ratio on Change in Leverage

To eliminate the concern of endogeneity bias, I first examine the effect of changes in the CEO inside debt ratio on the change in leverage. There are some advantages to using this approach. First, given that firm characteristics are constant over a certain period, I can control for the effect of unobserved firm characteristics on a firm's leverage. Second, as firms do not adjust their capital structure frequently, I am more likely to pick up the effects of changes in the CEO inside debt ratio on capital structure by examining the co-variation of these changes.

In order to test the effect of changes in the CEO inside debt ratio on change in leverage, I construct a model in which the dependent variable is the change of a firm's

debt ratio from year t-1 to t, and the independent variables are the changes in the explanatory variables from year t-2 to t-1. Among these independent variables, the primary explanatory variable is the year-to-year changes in the CEO inside debt ratio. Only one-year-lagged change is captured since the sample only has two year (2007, 2008) period.

$$\Delta Leverage_{i,t} = \Delta Log(Size)_{i,t-1} + \Delta Tangibility_{i,t-1} + \Delta MTB_{i,t-1} + \Delta Profitability_{i,t-1} + \Delta R\&D_{i,t-1} + \Delta SE_{i,t-1} + \Delta NDTS_{i,t-1} + \Delta(CEO\ inside\ debt\ ratio)_{i,t-1}$$

Leverage is measured by long-term debt plus short-term debt over total asset (book value).Size is measured by total sales. Tangibility is measured by net property, plant and equipment to total assets. MTB is market-to-book value. Profitability is ROA measured by EBITA to total assets. R&D is the research and development expense to total sales. SE is selling expenses over sales and NDTS is the Non-Debt Tax Shields. The detailed estimation of NDTS can be found at Titman and Wessels (1988). CEO inside debt ratio is CEO total inside debt divided by (inside debt + equity value).The results are reported in Table 13 Column one.

The result of significant negative coefficient on changes in CEO inside debt means that changes in CEO inside debt ratio have significant explaining power on future changes in firm leverage. This suggests endogeneity between inside debt ratio and firm leverage caused by reverse causality. The next section shows the treatment.

TABLE 13: Effect of Changes in Inside Debt Ratio on Firm Leverage

Dependent variable:	Leverage change (OLS)	Leverage change (IV)
Firm size change (Log(sales))	0.003**	0.0007***
	(2.12)	(2.85)
Asset tangibility (PPE/total asset)	0.030	0.182***
	(0.55)	(15.5)
Market-to-Book value	0.092***	0.002
	(2.97)	(0.19)
Profitability(ROA)	0.034	-0.081***
	(0.64)	(-7.01)
(R&D/sales)	-0.036	0.027***
	(-0.84)	(3.07)
Selling expenses over sales	0.009	-0.018***
	(0.43)	(-4.1)
Non-debt tax shield	-0.066	0.039***
	(-1.22)	(3.41)
CEO inside debt ratio	-0.032**	-0.0002
	(-2.05)	(-0.07)
R-Square	0.0146	0.202
Obs No.	1367	1256

Note:
Column one is the result of testing the reverse causality from CEO inside debt to firm leverage, using the actual firm leverage. Column two is the result of testing the efficiency of the instrumental variable regression, using the predicated leverage from the instrumental variable regression. Leverage is measured by long-term debt plus short-term debt over total asset (book value).Size is measured by total sales. Tangibility is measured by net property, plant and equipment to total assets. MTB is market-to-book value. Profitability is ROA measured by EBITA to total assets. R&D is the research and development expense to total sales. SE is selling expenses over sales and NDTS is the Non-Debt Tax Shields. The detailed estimation of NDTS can be found at Titman and Wessels (1988). CEO inside debt ratio is CEO total inside debt divided by (inside debt + equity value). T-statistics appear in parentheses below each estimate. Significant at 1% (***), 5% (**), and 10% (*) levels.

5.5.2 Efficiency of the Instrument Variable

I follow the literature and adopt instrumental variable regression approach to address the endogeneity. The instrument variable I selected is the asset tangibility, which is widely used by literature in firm leverage research. Asset tangibility is measured by Property, Plant and Equipment divided by Total assets.

To test the efficiency of the instrument variable in alleviating the endogeneity problem, I conduct a two stage least square test.

First stage: $Leverage_{it} = Tangibility_{it} + X_{it}$

Second stage: $\Delta Leverage_{i,t} = \Delta Log(Size)_{i,t-1} + \Delta Tangibility_{i,t-1} + \Delta MTB_{i,t-1} + \Delta Profitability_{i,t-1} + \Delta(R\&D\ dummy)_{i,t-1} + \Delta R\&D_{i,t-1} + \Delta SE_{i,t-1} + \Delta NDTS_{i,t-1} + \Delta(CEO\ inside\ debt\ ratio)_{i,t-1}$

In the first stage, I used tangibility as an instrument to predict firm leverage. X_{it} is a set of exogenous variables used to estimate the determinants of inside debt: Firm size, CEO tenure, Growth, Liquidity (cash flow status), Tax status, Firm age, board size, board independence, CEO duality. Industrial dummies (first SIC digit) and year dummies are also included to capture industry effect and time effect.

In the second stage, I re-visit the dynamic effect of lagged inside debt ratio change on firm leverage change in section 5.5.1. If the instrumental variable in the first stage can efficiently alleviate the endogeneity problem, I expect the impact of inside debt ratio on future firm leverage disappears. The results of the two-stage least square test are reported in Table 13 Column two. The results of the first stage regression are shown in Table 14.

TABLE 14: Results of the First Stage Regression of the 2SLS Regression

Dependent variable:	Actual firm leverage
Asset tangibility	0.210***
	(18.78)
CEO tenure with the firm	-0.002
	(-0.72)
CEO hired from outside indicator	0.007
	(1.22)
Firm size	0.018***
	(9.67)
Liquidity	0.015*
	(1.77)
Growth	0.026***
	(7.05)
Tax status indicator	0.045***
	(8.8)
Years since founding of firms	-1.6E-05
	(-0.1)
Percentage of top5 institutional holdings	0.002***
	(6.99)
Founder CEO indicator	-0.002
	(-0.35)
Board size	-0.016
	(-1.25)
Percentage of outside directors	0.084***
	(2.7)
Obs NO.	4673
R-Square	0.1229

Note:
I perform a two-stage least squares (2SLS) regressions to address endogeneity of firm leverage. Asset tangibility is used as an instrumental variable for firm leverage. The other control variables are taken from the model estimating the impact of firm leverage on inside debt in Table 7 and Table 8.With the instrumental variable approach, the predicted firm leverage from the first-stage regression is no longer correlated with the error term of the second-stage regression, so the estimated coefficient will be consistent.T-statistics appear in parentheses below each estimate. Significant at 1% (***), 5% (**), and 10% (*) levels.

Results show that the coefficient of inside debt ratio change in the second stage becomes insignificant after the instrument variable is used. This suggests that the instrument statistically resolves reverse causality and it can be used to re-visit the determinants of inside debt problem.

5.5.3 Two-stage Least Squares Regression

The results in previous section show the evidence of endogeneity problem between inside debt and firm leverage. It also shows that asset tangibility is an efficient instrumental variable to alleviate the endogeneity. Here I perform another two-stage least squares (2SLS) regressions to re-visit the study questions of the determinant of inside debt in section 5.3.

In the first-stage regression, I still use an OLS model to predict the firm leverage using asset tangibility as the instrumental variable. In the second-stage regression, I regress the CEO inside debt and its components on the predicted firm leverage from the first-stage regression and the other control variables. Thus, with this approach, the predicted firm leverage from the first-stage regression is no longer correlated with the error term of the second-stage regression, so the estimated coefficient will be consistent.

I specify the two-stage model as follows:

First stage: $Leverage_{it} = Tangibility_{it} + Ln(ASSETS)_{it} + Ln(CEO\ TENURE)_{it} + LIQUIDITY_{it} + GROWTH_{it} + TAX_{it} + YEARS_{it} + OUTSIDE_{it} + X_{it}$

Second stage: $Y_{it} = Fitted\_LEV_{it} + Ln(ASSETS)_{it} + Ln(CEO\ TENURE)_{it} + LIQUIDITY_{it} + GROWTH_{it} + TAX_{it} + YEARS_{it} + OUTSIDE_{it} + X_{it}$

In the first stage, I use the asset tangibility as the instrument variable to predict

firm leverage (Fitted_LEV). X_{it} represents all other control variables including board size, board independence, and other CEO characteristics.

In the second stage, I use the predicted value of firm leverage from the first stage (Fitted_LEV) as a proxy of firm leverage and regress CEO inside debt on Fitted_LEV and other control variables. Here Y_{it} represents inside debt and its components: pension value, deferred compensation balance, total inside debt, CEO leverage ratio and firm match rate. X_{it} still represents all other control variables including board size, board independence, and other CEO characteristics. Regression results are reported in Table 15. Since the results of the first stage is the same as shown in Table 14. Here I only report the results of the second stage.

TABLE 15: Tobit Regression of CEO Inside Debt on Firm Leverage-Revisit

Panel A	**Basic Model Without Quadratic Term Of Predicted Firm Leverage**				
Dependent variable:	Pension	DCP	Pension+DCP	(Pension+DCP)/ CEO equity value	Firm match rate
Intercept	-53.418***	-31.766***	-52.296***	-1.015***	-4.364***
	(-10.63)	(-8.3)	(-10.95)	(-8.09)	(-6.58)
CEO tenure with the firm	1.439***	1.600***	2.467***	-0.004	0.078
	(3.85)	(5.2)	(6.46)	(-0.38)	(1.55)
CEO hired from outside indicator	-0.764	-0.951*	-1.662**	-0.029	-0.169*
	(-1.12)	(-1.7)	(-2.37)	(-1.54)	(-1.84)
Firm size	2.138***	1.844***	3.128***	0.029***	0.107***
	(7.11)	(7.4)	(10.06)	(3.44)	(2.6)
Leverage	-6.280	2.147	-3.984	0.206	1.621*
	(-0.89)	(0.38)	(-0.56)	(1.08)	(1.75)
Liquidity	-2.490*	-0.639	-1.145	0.027	-0.355**
	(-1.87)	(-0.64)	(-0.91)	(0.82)	(-2)
Growth	-12.768***	-6.081**	-11.282***	-0.361***	-1.413**
	(-3.23)	(-2.14)	(-3.1)	(-3.77)	(-2.37)
Tax status indicator	0.348	-0.273	-0.022	0.019	0.051
OBS#	1283	1283	1283	1283	1283

TABLE 15: Tobit Regression of CEO Inside Debt on Firm Leverage – Revisit (Continued)

Panel B	**Basic Model With Quadratic Term Of Predicted Firm Leverage**				
Dependent variable:	Pension	DCP	Pension+DCP	(Pension+DCP)/ CEO equity value	Firm match rate
Intercept	-57.744***	-32.664***	-53.695***	-1.151***	-4.644***
	(-10.5)	(-7.96)	(-10.53)	(-8.59)	(-6.4)
CEO tenure with the firm	1.125***	1.539***	2.216***	-0.007	0.060
	(2.95)	(4.85)	(5.66)	(-0.72)	(1.16)
CEO hired from outside indicator	-0.937	-0.989*	-1.782**	-0.033*	-0.179**
	(-1.39)	(-1.76)	(-2.55)	(-1.77)	(-1.96)
Firm size	1.916***	1.801***	3.000***	0.023***	0.096**
	(6.36)	(7.14)	(9.57)	(2.77)	(2.32)
Leverage	78.377**	21.321	35.718	2.906***	6.866*
	(2.42)	(0.85)	(1.15)	(3.54)	(1.63)
Liquidity	-2.372*	-0.632	-1.126	0.028	-0.349*
	(-1.79)	(-0.63)	(-0.9)	(0.87)	(-1.96)
Growth	-11.835***	-5.903**	-10.507***	-0.352***	-1.380**
	(-3.02)	(-2.07)	(-2.89)	(-3.69)	(-2.31)
Tax status indicator	0.016	-0.354	-0.142	0.005	0.032
	(0.02)	(-0.62)	(-0.2)	(0.26)	(0.34)
Liquidity^2	-197.112***	-44.710	-94.555	-6.267***	-12.128
	(-2.75)	(-0.8)	(-1.37)	(-3.42)	(-1.32)
CEO Duality	2.614***	0.495	1.972***	0.033*	0.147*
	(4.08)	(0.93)	(2.99)	(1.86)	(1.69)
OBS#	1283	1283	1283	1283	1283

TABLE 15: Tobit Regression of CEO Inside Debt on Firm Leverage-Revisit (Continued)

Note:

Tobit regression estimates of inside debts and its components- revisit with the predicted firm leverage from the instrument variable regression. Panel A is the model without quadratic term of firm leverage and Panel B is the model with quadratic term of firm leverage. To avoid the clustering effect, I take the mean of each variable for each case across time and running regression on the collapsed dataset of means. Pension is the aggregate actuarial present value of the executive's accumulated pension benefit. DCP is the aggregate balance in non-tax-qualified deferred compensation plans. CEO equity value equals the value of common stock plus stock options, calculated according to the estimated market value at fiscal year end. Firm match rate is the ratio of firm match contribution and executive contribution to deferred compensation account. Leverage equals total long-term dent divided by total debt plus the book value (or market value) of equity. Firm size is the natural logarithm of total assets. Liquidity is an indicator variable that equals one if the firm has negative operating cash flow. Growth is the ratio of the research and development expenditures to total sales. Tax status is an indicator variable equals one if the firm has net operating loss carry forwards on its balance sheet. Other control variables are skipped to save space, they are: firm age, institutional holdings, Founder CEO Indicator, Board size, Percentage of outside directors. The coefficients of these skipped variables are similar to those in Table 7 and Table 8.T-statistics appear in parentheses below each estimate. Significant at 1% (***), 5% (**), and 10% (*) levels.

Results in Table 15 show that after accounting for the endogeneity, the main findings are still consistent with the results from OLS estimation: the inverted U-shape still exists on CEO pension, CEO inside debt ratio and firm match rate. Firm leverage still show no impact on CEO deferred compensation and total inside debt after controlling for endogeneity. The new results have two substantial differences from the old results. First, new results suggest that firm leverage only show significant impact on inside debt in quadratic models. This is consistent with univariate results in section 4.1(Table 5 and Figure 5) and further confirms the finding of the non-linear inverted U-shape relation. Second, the new results show that, unlike 5% in old results, there are around 18% firms in the range of negative firm leverage-CEO inside debt relation. The turn point leverage goes down to 35% instead of 54%. This suggests that, as shown in Table 12, both group 5 and group 6 are under the range of declining CEO inside debt ratios. In Table 12, actually the CEO inside debt ratio does start to decline after group 4.

The impact of firm leverage on CEO Contribution to DCP still shows no significance. Unlike the insignificant negative coefficients in Table 10, the coefficients of the estimated firm leverage show insignificant positive. I skip the results to save space.

I also re-visit the dynamic change of CEO Contribution to DCP. Unlike the results in Table 11, the new results in Table 16 show that the firm leverage losses its dynamic impact on CEO contribution to DCP after the endogeneity is accounted for. This is consistent with the cross-sectional results in Table 15 or old results in Table 7.

TABLE 16: Regression on Dynamic Change of CEO Contribution - Revisit

Dependent Variable:	Change of contribution rate
Firm size	0.050***
	(4.37)
Leverage	-0.013
	(-1.35)
Liquidity	-0.014
	(-0.55)
Growth	-0.002
	(-0.18)
Tax	0.053**
	(2.02)
Institutional holdings	0.078***
	(7.09)
CEO equity value	0.103***
	(6.36)
ROA	0.048***
	(4.11)
Stock return	0.040***
	(3.32)
Return on DCP	0.085***
	(4.21)
Obs #	4330
R-Square	0.075

Note:
OLS regression estimates of CEO contribution rate to DCP-revisit with the predicted firm leverage from the instrument variable regression. To study the dynamic decision of contribution rate, I take the dynamic change of each variable and normalize them into dummy variables: one if increase and zero otherwise. I run regression on the dataset of these dummies. CEO contribution rate is the ratio of the annual executive contribution to DCP and annual cash compensation. Leverage equals total long-term dent divided by total debt plus the book value (or market value) of equity. Firm size is the natural logarithm of total assets. Liquidity is an indicator variable that equals one if the firm has negative operating cash flow. Growth is the ratio of the research and development expenditures to total sales. Tax status is an indicator variable equals one if the firm has net operating loss carry forwards on its balance sheet. CEO equity value equals the market value of common stock plus stock options at fiscal year end. ROA is the ratio of net operating income to the book value of assets. Stock return is the annual return on common equity (monthly compounded). Return on DCP is estimated by dividing the earnings on DCP by deferred compensation balance in the beginning of that fiscal year. T-statistics appear in parentheses below each estimate. Significant at 1% (***), 5% (**), and 10% (*) levels.

Over all, after accounting for the endogeneity of firm leverage, I find that the inverted U-shape relation between firm leverage and CEO inside debt ratio still exists. The new actual firm leverage turn point of this inverted U-shape goes down to 35% if the predicted firm leverage is mapped to the actual firm leverage. There are around 18% high leveraged firms are within the range of negative firm leverage-inside debt ratio relation. Firm leverage still does not show significant impact on CEO annual deferred compensation decisions.

6 CONCLUSION

Prior to now, empirical studies in CEO compensation have almost entirely overlooked the inside debt compensation due to data unavailability. Before 2006, CEO pension was the only proxy for inside debt compensation. The SEC's new disclosure rule in 2006 enabled researchers to look inside the black box of deferred compensation, which is another important part of inside debt. This paper documents the newly available information on inside debt disclosures and studies its determinants and implications in CEO compensation and agency problems.

Using the new disclosed deferred compensation data, I find that deferred compensation is as important as pensions in terms of its market values to CEOs' total compensation. Unlike that of Sundaram and Yermack, the univariate and regression analysis in this paper does not observe the linear positive association between firm leverage and CEO pension. Instead, I find an inverted U-shape relation: CEOs in the middle-leverage firms have higher inside debt holdings than both in low-leverage firms and high-leverage firms. Further univariate analysis suggests that the underlying reason is related to firm financial distress and CEO risk aversion.

I find that firm leverage has no impact on CEO deferred compensation decisions. The main factors that affect the amount or ratio of contribution to CEOs' deferred compensation account are firm size, liquidity status, default risk and CEO wealth. These results suggest that high equity holding makes the CEO an owner-manager so that the CEO mainly retains equity interest in the firm. Therefore CEOs with high equity holdings are less interested in inside debt holdings.

The above findings are still robust even after considering for the endogeneity of firm leverage.

The results of this paper also shed light on how CEO power and board monitoring efficiency affects inside debt compensation. I find a positive association between inside debt components and CEO power and a negative association with board efficiency. These results in some degree support the view that inside debt can be used by the managers to extract additional rents (Gerakos (2007)).

This study makes three main contributions. First, it is the first empirical study that documents the use of executive deferred compensation in large public U.S. firms. Second, it shows a non-linear relationship between firm leverage and executive inside debt holding. Third, it provides supportive evidence of the arguments that inside debt can be used to extract additional rents and an owner-manager favor equity interest rather than the income tax benefit of inside debt.

For the future research in this topic, the most important and interesting part will be testing and investigating possible reasons of inverted U-shape agent cost pattern. Based on the data sample, there are still 52% firms do not provide CEO defined pension and 33% firms do not provide deferred compensation plans to CEOs. There fore, a second question may deserve more attention is why firms provide or not provide inside debt. Last but not least, how CEO inside debt holdings relate to firm performance is also unknown. The main challenge in this problem may be the endogeneity between the compensation and firm performance.

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CHAPTER 2

MANAGERIAL RISK PREFERENCE AND FIRM PERFORMANCE VOLATILITY: NEW EVIDENCE FROM EXECUTIVE DEFERRED COMPENSATION

1 INTRODUCTION

How does managerial preference for risk affects risk characteristics of the firm? This chapter provides empirical evidence of a strong relation between managerial risk taking preference and firm performance volatility (stock return volatility, ROA volatility and asset value volatility).

CEOs have different managerial styles and risk preferences. The differences in CEOs' personal risk preferences affect their firm performance through different firm policies. This is a prevailing perception in academic research. While a CEO's risk preference is not directly observable, the existing literature has considered two possible indirect measures of managerial risk preference: CEO compensation scheme and CEO personal characteristics. Smith and Stulz (1985) suggest that management's risk aversion can be affected by the design of compensation contracts. To proxy the managerial risk preference, the first stream uses either the pay-for-performance sensitivity (Garen (1994), Aggarwal and Samwick (1999), Coles, Daniel and Naveen (2006)) or the variance of compensation (Frank Moers and Erik Peek (2000)) as the measures of managerial risk aversion. Another stream uses managerial stock options as the proxy of managerial risk measure (DeFusco et al. (1990); Tufano (1996); Guay (1997); Core and Guay (2000)). More recent literature turns to the characteristic of CEOs portfolios (Carpenter (2000); Cohen, Hall and Viceira (2000); Rogers (2001); Abdel-khalik (2006); Brisley (2004)).

However, the methodology of using executive compensation as a measure of risk aversion is based on risk-neutral valuation. To the degree that the risk aversion of CEOs decreases their personal valuation of stock options, the methodology may yield inaccurate estimates (Lambert et al. (1991)). This might be the reason why the relation between CEO risk-taking incentive and firm risk is very weak and not widely supported by cross-sectional studies. Moreover, the endogeneity among managerial incentives, risk, and performance makes this methodology even noisier (Palia (2001); Low (2009)).

Alternatively, prior literature also attempts to use managerial personal characteristics (such as age, personal income, wealth, education and gender) to estimate their risk aversion (e.g., Wang and Hanna (1997); Grable (2000); Donkers et al (2001); Bajtelsmit and Bernasek (2001)). However, critics argue that the history or previous characteristics of CEO are irrelevant and might not be a good measure to predict CEO's talent and risk preference in his current employer firm (Wang (2009)).

To avoid the weak relation, endogeneity and irrelevance problem in previous literature, I turn to look for exogenous variables that can reflect CEO's current risk aversion preference. The investment of CEO inside debt deferrals and the meltdown of financial markets in 2008 provide a unique opportunity which enables us to use this novel natural experiment to study the CEO risk aversion and firm risk exogenously.

In firms that provide deferred compensation plans (DCPs thereafter) to their named executives, CEOs are allowed to select the investment options for their deferred compensation account. The investment options usually include various bonds,

mutual funds and stock mutual funds. The portfolio allocation between bond mutual fund (riskless investment) and stock mutual fund (risky investment) should reflect CEOs risk preference (Schooley and Worden (1996)). But the 2006 new SEC disclosure rules do not require firms to report the CEO's portfolio allocation of their deferred compensation investment. Without further disclosure, there is no way to know CEOs' investment choices. However, the 2008 financial crisis allows us to estimate the CEOs' portfolio allocation into risky investment and riskless investment. During the financial crisis in 2008, the financial markets melted down and nearly all stocks and stock related mutual funds receive negative returns. If a CEO invested most of his deferrals in risky investment, say stock mutual funds, I should observe negative return to his/her deferred compensation account in 2008. In contrast, a risk-averse CEO who puts his/her deferrals mainly in riskless investment would enjoy relatively higher or positive return in 2008. I will therefore use low return realization to the compensation plan in 2008 as a measure for the relative risk aversion of the CEO.

Using this novel natural experiment data and new proxy of CEO risk aversion, I provide new evidence on the relationship between CEO risk preference and the volatility of firm performance measures (stock return, earnings and operating cash flows). My results show that a negative association exists between the CEO risk aversion and the volatility of firm market performance. This means that firms whose CEOs have positive return on DCP in year 2008 have relatively lower market performance volatility than firms whose CEOs have negative return on DCP. This result is robust even after controlling for sample selection bias. I also find that firms providing DCP plans to CEOs have lower performance volatility. This result is

consistent with Sundaram and Yermack(2006). For the other control variables, I find that stock-return volatility is significantly related to firm size, Tobin's Q, Institutional Holdings. Nevertheless, firm size, industry segments, R&D investment, CEO pay-for-performance sensitivity have significant power to explain firm risk in term of ROA volatility and asset value volatility.

After controlling for sample selection bias, I find that firms with risk-averse CEOs perform better than other firms in terms of stock return, ROA and Tobin's Q. Further, I show that this positive correlation is mainly driven by year 2008. This suggests that risk-averse CEO may lead firm to perform better than others in bad market year. However, in good years this correlation is not significant.

I do not find evidence of firms with DCPs perform better than those without DCPs. Instead, I find that firms with DCPs have lower Tobin's Q than other firms. This result is consistent with Wei and Yermack (2010)'s findings. Wei and Yermack (2010), find an overall reduction of enterprise value when a CEO's deferred compensation holdings are large.

This study makes four main contributions. First, it is the first empirical study that uses natural experiment data to examine the CEO risk preference and firm risk relation. Previous studies in this field largely omitted the natural experiment method and suffered from weak relation, endogeneity and irrelevance problems. Second, this paper is also the first empirical study that documents the return data of CEO deferred compensation investment after SEC's 2006 new disclosure rule. Third, it provides evidence that firms with inside debt compensation have lower firm risk and lower firm

market value. Four, it shows that firms with inside debt compensation have lower firm risk and lower firm market value.

The remaining sections of this chapter are organized as follows. Section 2 is the literature review. Section 3 describes the data and variables. Section 4 shows the results. Section 5 presents the conclusions.

2 LITERATURE REVIEW

Since the CEO risk preference is not an observable measure, the existing literature has considered two possible proxies of managerial risk preference. Ono stream use the CEO compensation scheme (portfolio holdings) and another stream looks at CEO personal characteristics (such as age, personal income, wealth, education and gender).

The first stream argues that managers with relatively low risk aversion are anticipated to accept larger proportions of their compensation be made contingent on performance (such as stocks and options) as compared to an assured pay (such as salary). Smith and Stulz (1985) suggest that management's risk aversion can be affected by the design of compensation contracts. They argue that given that a manager's utility function is concave in expected wealth or firm value, the manager could be induced into less risk-averse, risk-neutral, or risk-taking behavior through the different extent of convexity in the compensation contract.

Pay-for-performance sensitivity is one of the major measures used to address the relation between risk and convexity in the compensation contract. Increasing pay-for-performance sensitivity induces managers to reduce the overall risk of the firm so as to reduce their own risk exposure.

Garen (1994) examines the relation between CEO pay-for-performance sensitivity and different risk measures. He finds negative relations between proxies for risk and pay- for-performance sensitivity. However, the statistical significance of this relation in his study is quite weak.

Aggarwal and Samwick (1999) test the relation between the variation of stock

return volatility and pay-for-performance sensitivity. They find that pay-for-performance sensitivity declines in the level of stock return variance.

The results from these studies suggest that equity-based compensation may not effectively reflect managerial risk aversion.

Similar to the pay-for-performance sensitivity measure, and building on the linear principal-agent model of Holmstrom and Milgrom (1987), Moers and Peek (2000) use two proxies for managerial risk: (1) the variance of compensation and (2) mean compensation divided by variance of compensation. The first measure is based on the assumption that risk-averse managers prefer less risk to more risk. Therefore, the variance of compensation should be lower for more risk-averse managers. The assumption of the second measure is that risk-averse managers demand a risk premium. Therefore, the ratio of the mean compensation to the variance of compensation should be higher for more risk-averse managers. Moers and Peek's study finds that the use of performance measures in executive compensation contracts decreases as the level of risk aversion increases.

Coles, Daniel and Naveen (2006) consider the impact of higher pay-for-performance sensitivity on future firm volatility for a large sample and find (contrary to my primary results) that higher pay-for-performance sensitivity is associated with increases in firm volatility.

Another stream of literature argues that executive stock options create incentives for executives to manage firms in ways that maximize firm market value (DeFusco et al. (1990)). Since options increase in value with the volatility of the underlying stock,

executive stock options provide managers with incentives to take actions that increase firm risk. Therefore researches in this stream simply use the value (or portion) of stock options or the characteristics of the stock option compensation as measures of managerial risk aversion.

Tufano (1996) finds that the value of executive stock holdings and the number of stock options held by managers significantly affect the hedging by gold mining firms. Guay (1999) finds that firms appear to grant options more frequently in companies with growth opportunities to increase risk-taking. Core and Guay (2002) propose a methodology for measuring the CEO risk-taking incentive effects arising from executive stock and option holdings. This methodology is widely used by recent empirical research to estimate CEO risk-taking preference.

Rogers (2002) uses such a proxy variable measured with observed characteristics of CEO portfolios of stock and option holdings to study how CEO portfolio structure affects corporate derivatives usage. Abdel-khalik (2006) uses the extent to which compensation choice is made up of stock-based awards (such as stock options) as a measure of CEO risk aversion. His paper shows a negative relationship between CEO risk aversion and the volatility of performance measure. The results support the argument that high risk-averse CEOs act to reduce volatility. Brisley (2006) shows that vesting conditions of traditional Executive Stock Option plans (ESOs) significantly affect managers to select profitable risky projects.

Cohen, Hall and Viceira (2000) find that there is a statistically significant relationship between increases in option holdings by executives and subsequent

increases in firm risk. They find that CEOs with option holdings that are large relative to their wealth and whose value is sensitive to stock-price volatility tend to increase the volatility of the firms. This evidence suggests that option grants lead to greater stock price volatility rather than the reverse. Yet, the estimated effect on risk-taking is small, which means although options appear to increase firm risk, there is no evidence of that this effect is either large or damaging to shareholders. Carpenter (2000) presents simulations demonstrating that as the size of the firm increases, option compensation induces managers to actually moderate asset risk. This actually questions the effect of option compensation on managerial risk-taking.

Moreover, the methodology of using executive stock and option holdings as a measure of risk aversion is based on risk-neutral valuation. To the degree that the risk aversion of CEOs decreases their personal valuation of stock options, the methodology may yield inaccurate estimates (Lambert et al. (1991)). This might be the reason why the relation between CEO risk-taking incentive and firm risk is very weak and not widely supported by cross-sectional studies. The endogeneity among managerial incentives, risk, and performance makes this methodology even noisier (Palia (2001); Low (2009)).

The second stream argues that the compensation component attributed to the individual's risk aversion is actually a latent variable and the underling driver variables are those CEOs' demographic characteristics such as age, gender, tenure, and wealth. Therefore the second stream uses these variables to predict CEO risk aversion (e.g., Wang and Hanna (1997), Grable (2000) ,Donkers et al (2001); Bajtelsmit and Bernasek (2001)). Wang and Hanna (1997) examine the effect of age

on risk tolerance and find that risk tolerance increases with age when other variables are controlled. Grable (2000) shows that personal risk tolerance was associated with being male, older, married, higher incomes, more education, more financial knowledge, and increased economic expectations. Bajtelsmit and Bernasek (2001) find that wealthier households, people with higher education, single women and African-Americans tend to take riskier portfolios. Donkers et al (2001) also find strong links between risk aversion and gender, education level, and income of the individual.

Although the above literature has merits, critics argue that the history or previous characteristics of CEO might not be a good measure to predict CEO's talent and risk preference in his current employer firm. Wang (2009) finds no difference in long-run accounting performance for CEOs with different employment histories. Even though Wang's paper shows that CEOs with more frequently turn-over have a propensity to bear risk and implement riskier firm policies, it fails to test the endogeneity and causality between the CEO turnover and risk taking. It is showed by Bushman, Dai and Wang (2010) that the probability of CEO turnover is decreasing in performance risk, which suggests that risk-taking CEOs are more likely to have higher turnover rate.

Since CEO characteristics and compensation structure either show weak relation with firm risk or suffer from the endogeneity problem. I turn to look for exogenous variables that can reflect CEO's current risk aversion. The investment of CEO inside debt deferrals and the meltdown of financial market in 2008 provide a unique opportunity which enables us to use this novel natural experiment to study the managerial risk aversion and firm risk.

Schooley and Worden (1996) argue that personal portfolio allocations (measured as risky assets to wealth) are reliable indicators of attitudes toward risk.

Following Schooley and Worden (1996)'s argument, in this chapter, I take the advantage of the new disclosure rule of 2006 and the unique natural experiment by the 2008 financial crisis to proxy the CEOs' personal portfolio allocation and attitudes to risk.

3 DATA AND VARIABLES

My research sample comes from COMPUSTAT Executive Compensation database from year 2006 to 2009. The database covers the S&P 1500 plus companies that were part of the S&P 1500 and are still trading. This results in a sample of 1744 firms and 6723 firm years. The number of observations in the regression may be less when firms without accounting data in COMPUSTAT or stock return data in CRSP are eliminated. Within the sample firms, about 32% firms do not offer CEO deferred compensation plans so that I observe zero or missing return of deferred compensation investment in these firms. Among the firms providing DCPs, There are about 26.5% firms whose CEO receives positive return on DCP in year 2008.

3.1 MEASURES OF FIRM PERFORMANCE AND VOLATILITY

Firm Performance: ***ROA*** is the ratio of net operating income to the book value of assets; ***RET*** is the annual stock return (monthly compounded), ***TOBINS' Q*** is measured by the ratio of market value of total assets to book value of total assets.

Performance Volatility: I use the volatility of accounting performance (**VAR_ROA**), volatility of market performance (**VAR_RET**) and the volatility of firm's asset value return (**ASSET_VOL**) that is used to estimate firms' distance to default in KMV model (See Sundaram and Yermack (2006)). KMV model gets market asset values for public companies by using an options approach. Higher volatility of asset value return in KMV model implies that the market has more uncertainty on the firm's business value.

3.2 KEY VARIABLES

DCP Return Dummy: first I estimate the return of DCP, RET_DCP. RET_DCP is the ratio of the earnings of DCP (DEFER_EARNINGS_TOT) over the deferred compensation balance (DEFER_BALANCE_TOT) in the beginning of the fiscal year. For firms missing fiscal year begining deferred compensation balance, I estimate them by subtracting the CEO contribution to DCP (DEFER_CONTRIB_EXEC_TOT), firm contribution to DCP (DEFER_CONTRIB_CO_TOT) and current year earnings in DCP (DEFER_EARNINGS_TOT) from the deferred compensation balance (DEFER_BALANCE_TOT) at year end. Then I separate all firms into two groups by their returns of DCP in 2008: Group 1 is firms whose CEOs have positive DCP return in 2008; Group 0 is firms whose CEOs have negative DCP return in 2008. DCP Return Dummy takes one if a firm belongs to Group one and zero if it belongs to Group zero.

DCP Dummy: It is an indicator of DCP plan. It takes one if a CEO has deferred compensation account, zero if a CEO does not have deferred compensation plan.

3.3 OTHER EXPLANATORY VARIABLES

3.3.1 Firm Characteristics

Firm leverage: the firm leverage ratio LEVERAGE is measured as the ratio of long term debt to the book value of total assets. ***Firm Size***: I use the natural logarithm of total sales LOGSALE to control for size effect. ***Growth***: To measure investment opportunities, I use the ratio of the research and development expenditures to total sales, GROWTH, as a proxy for growth opportunities. ***Assets in Place***: I include

VALPORT, Assets in place, which is measured by (inventory + gross plan and equipment)/total assets.

3.3.2 CEO Characteristics

Besides the return on deferred compensation investment, I include following variables to measure CEO's impact on firm performance and volatility used by Coles, Daniel and Naveen (2003). ***Tenure***: TENURE is the natural logarithm of CEO tenure. ***CEO Cash Pay***: I include CEO's cash compensation, which is the sum of salary, bonus and non equity incentive compensation. ***Pay for Performance Sensitivity*** (PPS): the ratio of CEO's total equity value change over 1% change in share price

3.3.3 Other Control Variables

I include the control variables used in Sundaram and Yermack (2006) such as board characteristics and institutional investors. They are used to proxy the corporate governance quality: ***BOARD SIZE*** is the natural logarithm of the number of directors. CEOs of firms with larger boards are assumed to have more power because of increased coordination costs (Yermack 1996). ***OUTSIDE DIRECTORS*** is the percentage of outsiders on the board, with a higher percentage of outsiders expected to decrease CEO power because CEOs have more influence over the careers of insiders (Byrd and Hickman 1992). To measure the level and quality of institutional investor influence, I use ***TOP5_HLD***, the percentage of top five institutional investors' equity holdings. The institutions may serve a monitoring role in mitigating the agency problem between shareholders and managers (Hartzell and Starks, 2003). Institutional ownership is taken from the CDA/Spectrum database of 13Fs.

4 EMPIRICAL ANALYSES

4.1 HYPOTHESIS AND MODEL SPECIFICATIONS

I desire to study two research questions. One is whether the CEOs' personal risk preference can explain the firm performance volatility. Second, I also want to ask whether CEO's personal risk preference affect firm performance. Therefore I have two hypotheses:

H1 Null: *CEOs' risk aversion that reflected by CEOs' personal investment risk preference has no association with firm performance volatility*

H1 Alternative: *CEOs' risk aversion reflected by CEOs' personal investment risk preference has association with firm performance volatility. Firms with strong risk-averse CEOs have lower performance volatility.*

H2 Null: *CEOs' risk aversion will not affect firm performance.*

H2 Alternative: *CEOs' risk aversion will affect firm performance. Risk-taking CEOs are more likely to take aggressive investment to increase equity value. Therefore Firms with risk-taking CEOs enjoy higher stock return. However, since risk-taking CEOs may increase firm risk and low down debt value, its impact on the overall firm value is unpredictable.*

In testing the above two hypotheses, I control for other economic determinants of CEO risk aversion and firm performance relationship used in previous research (e.g., Abdel-khalik (2006); Brick, Palmon, and Wald (2008); Cohen, Hall and Viceira (2000)). I control for the firm size, leverage, segments, growth opportunities, and

Tobin's Q. I also control for other CEO characteristics (such as tenure, pay-for-performance sensitivity, cash compensation) and board characteristics (such as board size and percentage of independent directors).

First, I estimate the following model to explain cross-sectional variation in performance volatility:

$$(Volatility)_{it} = Ln(SALES)_{it} + LEVERAGE_{it} + GROWTH_{it} + TOBINSQ_{it} + CEO\_Risk_{it} + DCP\_Dummy_{it} + X_{it}$$

Here $(Volatility)_{it}$ represents the volatility of performance measures (Stock Return, ROA, and return of asset value), X_{it} represents the vector of other control variables including institutional holdings, firm segments, CEO tenure, CEO pay-for-performance sensitivity, CEO cash pay.

Second, I include the CEO_Risk and DCP_Dummy into the following classic performance estimation model to see whether these two variables have explanatory power to cross-sectional variation in performance:

$$(Performance)_{it} = Ln(SALES)_{it} + LEVERAGE_{it} + GROWTH_{it} + CEO\_Risk_{it} + DCP\_Dummy_{it} + X_{it}$$

Here $(Performance)_{it}$ represents the performance measures (Stock Return, ROA, and Tobin's Q), X_{it} represents the vector of other control variables including institutional holdings, firm segments, board size, board independency, CEO tenure, CEO pay-for-performance sensitivity, CEO cash pay.

Third, since CEO_Risk might reveal smart or risk aversion, to distinguish one from the other, I conduct a univariate analysis on CEOs' return on DCP by CEO_Risk

groups. Using return on DCP in 2008, I separate CEOs into two groups: Group one if the CEO has positive return in 2008, Group zero if the CEO has negative return in 2008. Here I exclude the firms without DCP plans. I compare the other years' return on DCP of these two groups. If CEOs in Group one is smarter than CEOs in Group zero, I expect to see that group one consistently has higher return on deferrals for the other years. Otherwise, if Group one is more risk-averse than Group zero, I should observe Group one consistently has lower return on deferrals in years when stock market is good. The variable definitions are listed in Table 17 and Table 18 shows their description of statistics.

TABLE 17: Definition of Variables

Variable Name	Definition
Return on DCP:	The ratio of earnings on DCP over the DCP balance in the year beginning (in %).
ROA:	The ratio of net operating income to the book value of total assets.
RET:	The annual stock return (monthly compounded)=(1+ excess return)
RET_LAG:	Lagged annual stock return
Tobin's Q:	The ratio of market value of total assets to book value of total assets.
VAR_ROA:	The variance of annual ROA using previous five years ROA change.
VAR_RET:	The variance of annual stock return (five spanning years).
ASSET_VOL:	The volatility of firm's asset value returns that is used to estimate firms' distance to default in KMV model (See Sundaram and Yermack (2006) for the estimation method).
Leverage:	The ratio of long term debt to the book value of total assets.
SEG_NUM:	The number of industry segments.
Assets in place:	(inventory + gross plan and equipment)/total assets.
TOP5_HLD:	The percentage of top five institutional investors' equity holdings.
Board size:	The natural logarithm of the number of directors.
OUT_PCT:	The percentage of outsiders on the board.
CEO tenure:	The natural logarithm of CEO tenure.
CEO cash pay:	The sum of salary, bonus and non equity incentive compensation (in million).
CEO PPS:	Pay-for-Performance Sensitivity is the ratio of CEO's total equity value change (in million) over 1% change in share price.
DCP return dummy:	It takes one if the firm's CEO has positive DCP return in 2008, zero if negative, missing if no DCP.
DCP dummy:	It takes one if a CEO has deferred compensation account, zero if a CEO does not have deferred compensation plan.
CEO duality	It takes one if the CEO is also the chairman of board, zero if not
Founder CEO	It takes one if the CEO is one of the founders of the firm, zero if not
Outside	It takes one if the CEO is hired outside the firm, zero if the CEO is hired inside the firm

TABLE 18: Descriptive Statistics of all Variables

Variable	Obs#	Mean	Std Dev	1st Quartile	Median	3rd Quartile
Return on DCP	3275	3.658	24.105	-2.269	5.362	12.147
Tobin's Q	6723	1.822	2.425	1.092	1.408	2.030
ROA	5786	0.133	0.155	0.086	0.132	0.190
RET	6400	1.100	0.773	0.743	1.028	1.298
VAR_ROA	5472	0.475	3.760	0.021	0.076	0.254
VAR_RET	5952	0.263	1.869	0.020	0.054	0.145
ASSET_VOL	5200	39.83	18.457	28.700	36.690	47.120
Log(sales)	6708	7.373	1.653	6.277	7.302	8.430
R&D/total assets	6722	0.066	0.696	0.000	0.000	0.030
Leverage	6723	0.179	0.186	0.016	0.144	0.280
SEG_NUM	6320	3.598	2.130	2.000	3.000	5.000
Assets in place	6723	0.561	0.428	0.203	0.493	0.860
TOP5_HLD	6542	0.297	0.094	0.235	0.293	0.354
Board size	6417	2.198	0.260	2.079	2.197	2.398
OUT_PCT	6417	0.834	0.086	0.786	0.857	0.889
CEO tenure	6717	6.902	6.929	2.000	5.000	9.000
CEO cash pay	6717	1.986	2.654	0.799	1.301	2.386
CEO PPS	4608	-14.34	1270.14	0.011	0.122	0.520
DCP return dummy	3275	0.265				
DCP dummy	6723	0.679				

Note:
Descriptive statistics of variables related to CEO and firm characteristics for a sample of 1,744 firms from S&P 1500 companies over 2006 to 2009. See Table 17 for the definition of the variables.

4.2 ANALYSIS AND RESULTS

4.2.1 Univariate Analysis

I first compare the yearly difference of the key variables. Table 19 clearly shows that both the market performance and accounting performance reached the valley floor in 2008. The return of DCP in 2008 dropped almost 200% from year 2007's 6.3% to -16.28%. In year 2009, both the stock return and return of DCP recovered to a new high, which are even better than year 2006 and 2007. However the recovery of operation earnings is relatively slower. The ROA of 2009 is even less than that of year

2008. And the volatility of ROA in 2009 is also larger than 2008. Interestingly, the stock return volatility in 2008 is less than the other years. This may due to the stock market clash and most stocks reached the bottom or trade less. Nevertheless, all three performance volatility indicators keep high level in 2009. This suggests that the post-crisis market becomes more sensitive.

The mean/median comparison by CEO_RISK groups in Table 20 show that group one show consistently lower performance volatility than group zero for all three performance measures. The mean and median comparisons of the performance show that there is weak difference between these two groups: Group one shows higher mean and median Tobin's Q, higher mean and median ROA. The difference in stock return is not significant and the means and medians show opposite directions. I also find that group one has less investment (growth) and lower institutional holdings, the difference in firm leverage is not significantly big, group one has a little bit lower mean leverage but higher median leverage. I observe significant difference in CEO compensation structure. Table 20 shows that group one has higher cash pay and lower pay-for-performance sensitivity. The above results show that CEOs in group one, which is defined as a risk-averse group, are more likely to adopt conservative corporate policies and less risky compensation structure.

TABLE 19: Mean/median Comparison by Year

	2006			2007			2008			2009		
Variable	Obs#	Mean	Median	Obs#	Mean	Median	Obs#	Mean	Median	Obs#	Mean	Median
Return on DCP	698	9.649	8.937	867	6.314	5.817	860	-16.28	-15.63	850	16.209	11.178
Tobin's Q	1585	2.059	1.644	1733	1.977	1.537	1744	1.492	1.166	1661	1.782	1.364
ROA	1367	0.145	0.139	1481	0.142	0.139	1501	0.134	0.132	1437	0.114	0.116
RET	1549	1.177	1.134	1672	1.038	0.990	1632	0.641	0.616	1547	1.572	1.333
VAR_ROA	1305	0.393	0.078	1393	0.404	0.072	1408	0.427	0.070	1366	0.676	0.084
VAR_RET	1441	0.334	0.061	1534	0.243	0.052	1513	0.124	0.062	1464	0.360	0.044
ASSET_VOL	1292	37.522	34.255	1346	35.818	33.000	1335	38.840	36.340	1227	47.773	44.200
Log(sales)	1584	7.378	7.300	1727	7.371	7.285	1738	7.405	7.344	1659	7.339	7.279
R&D/total assets	1585	0.073	0.000	1732	0.053	0.000	1744	0.079	0.000	1661	0.060	0.000
Leverage	1585	0.166	0.130	1733	0.177	0.142	1744	0.194	0.157	1661	0.179	0.143
TOP5_HLD	1523	0.284	0.282	1688	0.294	0.292	1706	0.304	0.300	1625	0.305	0.300
SEG_NUM	1490	3.505	3.000	1627	3.557	3.000	1640	3.637	3.000	1563	3.691	3.000
Assets in place	1585	0.550	0.501	1733	0.538	0.479	1744	0.569	0.499	1661	0.586	0.501

Note:
Mean and median comparison for a sample of 1,744 firms from S&P 1500 companies over 2006 to 2009. See Table 17 for the definition of the variables.

TABLE 20: Mean/median Comparison by CEO_RISK Group

	DCP_Return_Dummy=0				DCP_Return_Dummy=1			
Variable	Obs#	Mean	Std Dev	Median	Obs#	Mean	Std Dev	Median
Tobin's Q	2406	1.573	0.750	1.339	869	1.671	0.947	1.341
ROA	2027	0.140	0.086	0.135	692	0.151	0.097	0.138
RET	2327	1.092	0.864	1.035	816	1.053	0.444	1.046
VAR_ROA	1960	0.190	0.583	0.049	662	0.173	0.603	0.039
VAR_RET	2223	0.194	2.412	0.044	784	0.102	0.268	0.039
ASSET_VOL	1903	35.131	13.147	32.200	632	34.084	12.526	31.850
Log(sales)	2404	8.076	1.470	7.975	867	7.890	1.426	7.770
R&D/total assets	2406	0.025	0.062	0	869	0.016	0.057	0
Leverage	2406	0.200	0.165	0.176	869	0.199	0.168	0.181
TOP5_HLD	2368	0.293	0.087	0.285	846	0.286	0.096	0.279
SEG_NUM	2259	3.843	2.185	3	776	3.666	1.770	3
Board size	2362	2.278	0.242	2.302	839	2.285	0.221	2.302
OUT_PCT	2362	0.850	0.078	0.875	839	0.848	0.073	0.875
Assets in place	2406	0.601	0.426	0.567	869	0.606	0.441	0.610
CEO tenure	2405	6.616	6.138	5	867	6.491	6.382	5
CEO cash pay	2405	2.452	3.228	1.733	867	2.644	2.748	1.875
CEO PPS	1741	0.367	21.239	0.158	631	-5.325	111.247	0.144

Note:
Mean/median comparison of the 889 firms that have DCPs over 2006 to 2009. See Table 17 for the definition of the variables.

I then turn to look at the firms with different DCP provisions. Group one is firms providing DCPs and Group zero is firms without DCPs. Results in Table 21 show that firms with DCPs have lower Tobin's Q, lower stock return but higher ROA. This finding is consistent with Wei and Yermack (2010).I observe that based on both mean and median comparison, firms with DCPs have significant lower performance volatility for all three indicators. I also find that firms with DCPs have higher firm leverage, higher tangible assets (or assets in place) and lower R&D expense (or growth opportunity). These results in some degree support the arguments and findings in Sundaram and Yermack (2006).

TABLE 21: Mean/median Comparison by DCP_DUMMY Group

	DCP_Dummy=0				DCP_Dummy=1			
Variable	Obs#	Mean	Std Dev	Median	Obs#	Mean	Std Dev	Median
Tobin's Q	2156	2.213	4.034	1.578	4567	1.637	0.933	1.354
ROA	1947	0.115	0.232	0.126	3839	0.142	0.093	0.1343
RET	2018	1.118	0.742	1.005	4382	1.091	0.787	1.037
VAR_ROA	1792	1.038	6.474	0.164	3680	0.201	0.623	0.052
VAR_RET	1810	0.412	1.677	0.087	4142	0.199	1.944	0.045
ASSET_VOL	1639	47.281	21.131	44.750	3561	36.412	15.963	33.700
Log(sales)	2145	6.250	1.461	6.242	4563	7.901	1.463	7.813
Growth	2155	0.151	1.220	0.002	4567	0.025	0.066	0
Leverage	2156	0.145	0.215	0.050	4567	0.195	0.168	0.171
TOP5_HLD	2083	0.300	0.097	0.300	4459	0.295	0.091	0.288
SEG_NUM	2071	3.269	2.177	3	4249	3.758	2.087	3
Board size	1975	2.051	0.238	2.079	4442	2.263	0.242	2.302
OUT_PCT	1975	0.810	0.092	0.833	4442	0.844	0.080	0.875
Assets in place	2156	0.496	0.426	0.390	4567	0.590	0.425	0.558
CEO tenure	2155	7.485	7.376	5	4562	6.627	6.691	5
CEO cash pay	2155	1.221	1.736	0.854	4562	2.347	2.923	1.644
CEO PPS	1461	-44.796	2254	0.088	3147	-0.211	56.901	0.144

Note:
Mean/median comparison of the 1,744 firms in S&P 1500 over 2006 to 2009. See Table 17 for the definition of the variables.

4.2.2 Cross-sectional Impact on Performance Volatility

The cross-sectional regression results on performance volatility can be seen at Table 22. A negative association exists between the CEO risk aversion and the firm market performance volatility (Stock return volatility and asset value volatility) after controlling for the fundamentals and other volatility drivers. This means that firms with CEOs that have positive return on DCP in year 2008 have relatively lower market performance volatility. I do not find significant association with accounting performance (ROA) volatility. The insignificant impact on ROA may due to earnings management or manipulation. But the negative coefficient is consistent with the market based performance volatility.

For all three volatility measures, I find that DCP_Dummy is negatively and significantly correlated to performance volatility after controlling for the other volatility drivers. This means that firms with DCP plans have lower performance volatility than that of firms without DCP plans. This result is consistent with Sundaram and Yermack (2006). Sundaram and Yermack find that firms with higher CEO inside debt ratio have lower firm risk (measured by Distant-to-Default).

TABLE 22: Regression Results of Performance Volatility

	VAR_RET	VAR_ROA	ASSET_VOL
Log(sales)	-0.1812***	-0.3722***	-0.0893***
	(-6.56)	(-10.82)	(-13.84)
Tobin's Q	0.0772**	0.2283***	0.0045
	(2.18)	(5.12)	(0.71)
Leverage	0.0383	-0.4170*	-0.1583***
	(0.2)	(-1.73)	(-3.55)
TOP5_HLD	0.0114***	0.0258***	0.0025***
	(2.71)	(4.79)	(2.61)
SEG_NUM	0.0212	0.0579***	0.0114***
	(1.29)	(2.85)	(3.07)
R&D/total assets	0.0321	0.1133	0.0434***
	(0.52)	(1.52)	(2.92)
Assets in place	-0.1213	0.0012	0.0455**
	(-1.36)	(0.19)	(2.09)
CEO tenure	0.0041	0.1829	-0.0003
	(0.74)	(1.57)	(-0.21)
CEO PPS	-0.0412	0.9568**	0.0196**
	(-1.02)	(2.24)	(2.02)
CEO cash pay	7.0734	43.1134**	-1.4315
	(0.48)	(2.28)	(-0.43)
DCP return dummy	-0.1592*	-0.3163**	-0.0579**
	(-1.68)	(-2.5)	(-2.34)
DCP dummy	-0.4181***	-0.5067***	-0.0674***
	(-4.84)	(-4.75)	(-3.38)
Obs#	1363	1255	1363
R-Squared	0.1279	0.2535	0.2716

Note:
OLS regression estimates of performance volatility for a sample of S&P 1500 companies over 2006 to 2009. To avoid the clustering effect, I take the mean of each variable for each case across time and running regression on the collapsed dataset of means. See Table 17 for the definition of the variables.T-statistics appear in parentheses below each estimate. Significant at 1% (***), 5% (**), and 10% (*) levels.

For the other control variables, I find that stock-return volatility is significantly related to firm size, Tobin's Q, and institutional holdings. Nevertheless, firm size, segments, R&D investment, CEO pay-for-performance sensitivity have significant power to explain firm risk in term of ROA volatility and asset value volatility. Here firm size (measured by Ln(sales)) shows positive association with market based volatility (stock return volatility and asset market value volatility) but negative association with accounting based volatility(ROA volatility). These results suggest

that larger firms are more likely to have higher income volatility but lower stock return volatility. It is consistent with prior studies. Abdel-khalik(2006) find positive correlation between firm size and earnings volatility; Meanwhile, Coles, Daniel and Naveen (2006) find that log(sales) has negative impact on firms daily stock return volatility.

4.2.3 Cross-sectional Impact on Performance

Table 23 shows the cross-sectional regression results on performance. I find weak evidence of firms with risk-averse CEOs performing better than other firms in terms of stock return. Suspecting the results are largely affected by averaging, I then run regression for each year from 2007 to 2009. The regression results on yearly data in Table 24 show that actually, the positive correlation is mainly driven by year 2008. In contrast, I find negative impact of CEO risk aversion on stock return in year 2009. The sign for year 2007 is not significant. The ambiguous sign of CEO risk aversion proxy suggests that risk-averse CEOs may lead firms perform better than others in bad year or during financial crisis. However, in good years firms with conservative CEOs may suffer from less return than the other firms.

I do not find evidence of firms with DCPs perform better than those without DCPs. Instead, I find that firms with DCPs have lower Tobin's Q than other firms. The result on Tobin's Q actually is consistent with Wei and Yermack (2010)'s find. In Wei and Yermack(2010), they find an overall destruction of enterprise value when a CEO's deferred compensation holdings are large.

TABLE 23: Regression Results of Firm Performance

	RET	ROA	Tobin's Q
Log(sales)	-0.0052	0.0232***	-0.1160***
	(-0.84)	(7.74)	(-3.87)
Leverage	-0.2405***	-0.0127	-0.4960***
	(-6.37)	(-0.69)	(-2.68)
TOP5_HLD	-0.0043***	0.0005	-0.0304***
	(-5.37)	(1.33)	(-7.68)
SEG_NUM	-0.0002	-0.0021	-0.0016
	(-0.07)	(-1.39)	(-0.11)
R&D/total assets	0.0114	-0.1096***	0.7727***
	(0.83)	(-16.37)	(11.51)
Assets in place	0.039***	0.0373***	-0.2336***
	(2.28)	(5.36)	(-3.42)
Board size	0.0178	-0.0495***	-0.2403
	(0.5)	(-2.87)	(-1.39)
OUT_PCT	-0.1634**	-0.0369	-0.0220
	(-2.14)	(-0.99)	(-0.06)
CEO tenure	0.0012	0.0006	0.0055
	(1.13)	(1.12)	(1.09)
CEO PPS	0.0024	-0.0046	-0.0303
	(0.29)	(-1.17)	(-0.77)
CEO cash pay	6.1742**	-2.1725	7.5659
	(2.2)	(-1.58)	(0.55)
DCP return dummy	0.0217**	0.0136	0.0978
	(2.79)	(1.59)	(1.35)
DCP dummy	-0.002	-0.0080	-0.1752**
	(-0.11)	(-0.97)	(-2.12)
Obs#	1333	1333	1333
R-Squared	0.0656	0.2339	0.1797

Note:
OLS regression estimates of performance for a sample of S&P 1500 companies over 2006 to 2009. To avoid the clustering effect, I take the mean of each variable for each case across time and running regression on the collapsed dataset of means. See Table 17 for the definition of the variables. T-statistics appear in parentheses below each estimate. Significant at 1% (***), 5% (**), and 10% (*) levels.

TABLE 24: Regression Results of Stock Performance, by Year

	2007	2008	2009
Log(sales)	0.014	-0.016**	-0.067***
	(1.63)	(-2.39)	(-2.75)
R&D/total assets	0.079	-0.002	0.026
	(1.58)	(-0.27)	(0.5)
Leverage	-0.237***	-0.179***	0.248
	(-3.88)	(-4.12)	(1.37)
TOP5_HLD	-0.650***	-0.568***	0.550
	(-4.92)	(-5.87)	(1.55)
SEG_NUM	0.015***	-0.014***	-0.025**
	(2.94)	(-3.6)	(-1.81)
Board size	-0.074	0.043	0.245
	(-1.32)	(1.00)	(1.51)
OUT_PCT	0.382***	-0.027	-1.027***
	(2.95)	(-0.26)	(-2.67)
Assets in place	0.031	-0.054***	0.079
	(1.08)	(-2.59)	(1.09)
CEO PPS	0.0022	0.0076	-0.0033
	(0.07)	(0.14)	(-0.24)
CEO cash pay	15.09***	3.451	46.62***
	(3.16)	(1.35)	(2.64)
RET_LAG	0.046	-0.072***	-1.284***
	(1.51)	(-3.97)	(-13.37)
DCP return dummy	0.045	0.046**	-0.182**
	(1.42)	(1.92)	(-1.95)
DCP dummy	-0.049*	0.020	0.081
	(-1.8)	(0.95)	(1.07)
Obs#	1454	1460	1413
R-Squared	0.0532	0.0643	0.1414

Note:
OLS regression estimates of performance for a sample of S&P 1500 companies over 2007 to 2009. See Table 17 for the definition of the variables. RET_LAG is one year lagged stock return. T-statistics appear in parentheses below each estimate. Significant at 1% (***), 5% (**), and 10% (*) levels.

4.2.4 Risk-Averse or Smart

Questions may be raised regarding the validity of my proxy of risk-averse CEOs. Because it is very possible that CEOs who enjoy positive return on DCPs are smarter than others in ways such as they predicted the financial crisis or they are better in picking up mutual funds. To distinguish one from the other, I conduct a univariate analysis on CEOs' return on DCPs. Here I exclude the firms without DCP plans. I compare the return on DCP of these two groups in different years. Table 25 shows that, except for year 2008, CEOs in group one consistently have lower return on deferrals for the other years. This suggests that CEOs in group one are at least not smarter than CEOs in group zero and therefore the representativeness of CEO_RISK for risk aversion is valid.

TABLE 25: Comparison of Groups with Different CEO Risk Preference

	Group0			Group1		
	Mean	Std	Median	Mean	Std	Median
2009	20.37	31.46	18.70	4.69	14.31	3.86
2008	-25.78	15.65	-25.76	6.89	9.28	4.80
2007	6.41	18.58	5.82	5.51	9.45	5.58
2006	10.73	9.62	10.46	7.12	5.39	6.71
Obs#	662			227		

Note:
Group0 is a set of firms having negative return on DCP in 2008 and group one is a set of firms having positive return of DCP in 2008

4.2.5 Selection Bias Adjusted Estimates

In my sample, about 32% of the firms do not offer CEO deferred compensation plans. As Table 21 shows, a majority of the sample characteristics is significantly different between firms with deferred compensation plan and firms without it. In particular, firms with deferred compensation plan are likely to be larger in total assets, more business segments, more tangible assets, higher leverage ratios and larger board size compared to firms without deferred compensation plans. In addition, CEOs with deferred compensation plans seem more paid in cash and higher pay-for-performance sensitivity. These observations motivate additional tests of whether my main results are significantly affected by a firm's decision to require a CEO's deferred compensation plan.

In order to avoid sample selection problem, I estimate a maximum-likelihood version of the Heckman (1979) selection model. To model the firm's deferred compensation plan decision in a general statistical framework, I adopt important determinants of having deferred compensation plan from Chapter one and Table 21 in this Chapter. These potential determinants lead to the following sample-selection model:

Stage One: $(DCP\_Dummy)_{it} = Ln(SALES)_{it} + LEVERAGE_{it} + GROWTH_{it} + TOBINSQ_{it} + Z_{it}$

Stage Two: $(Volatility\ or\ Performance)_{it} = Ln(SALES)_{it} + LEVERAGE_{it} + GROWTH_{it} + TOBINSQ_{it} + CEO\_Risk_{it} + X_{it}$

In stage one, I include some CEO characteristics such as CEO age, CEO-Chairman duality, Founder CEO dummy and Outside CEO dummy. Stage two is similar to the model in section 4.2.2 and 4.2.3 but excludes the DCP dummy.

Table 26 and Table 27 present the estimates of the Heckman selection model. To make sure the model is identified, I include CEO age, CEO-Chair duality, Founder CEO dummy and CEO hired outside dummy in the first stage of the Probit regression (see column (1), (3), and (5)). As indicated in the last row, the hypothesis of no correlation of the error terms ($\rho = 0$) is not rejected in Table 26, suggesting that the sample selection is not a serious issue. However Table 27 suggests that the sample selection problem may be critical in estimating the firm performance. From the results of first stage, I find that larger firm, larger board size, higher percentage of independent directors are associated with higher likelihood of offering deferred compensation plans. Firms with lower Tobin's Q and larger tangible assets are also more likely to offer deferred compensation plans to their CEOs. In addition, I find that firms are less likely to offer deferred compensation plans to their founder CEOs. Consistent with the results in Chapter one, I still do not find evidence of that deferred compensation decision is associated with firm leverage level. Overall, the results in the fist stage of selection model suggest that powerful CEOs, weak board are associated with less likelihood of offering deferred compensation plans.

From column (2), (4) and (6) of Table 26 and Table 27, I find that the main results do not change after controlling for selection bias. Comparing to Table 16, the only difference is that CEO_risk dummy losses its impact on stock return volatility after adjusting the sample selection bias, but it still show significant impact on ROA volatility and the volatility of asset value. Regarding the impact on performance, the results show even stronger significance after controlling for selection bias. Table 27 shows that the coefficients of CEO_risk dummy for all three models are significantly

positive. This suggests that firms with risk-averse CEOs perform better during my research period (which is around the financial crisis) than firms with risk-taking CEOs.

Overall, the results of Heckman selection model indicate that the evidence of risk aversion CEOs resulting in less firm performance volatility is robust to sample selection bias. Moreover, the results provide strong evidence of that firms with risk-averse CEOs perform better in bad market than their counterparts.

TABLE 26: Heckman Selection Model Estimates for Performance Volatility

	Selection	VarRET	Selection	VarROA	Selection	AssetVol
Intercept	-1.024***	-0.512	-1.031***	-5.690	-1.006***	3.941***
	(-6.68)	(-0.2)	(-6.13)	(-1.57)	(-6.7)	(6.18)
Tobin's Q	-0.029***	-0.029	-0.023**	0.154**	-0.031***	-0.041***
	(-2.58)	(-0.6)	(-1.96)	(2.38)	(-2.62)	(-3.19)
Log(sales)	0.091***	-0.043	0.095***	-0.201	0.091***	-0.025
	(9.91)	(-0.36)	(9.59)	(-1.18)	(9.94)	(-0.84)
Leverage	0.077	0.221	0.089	-0.673*	0.077	-0.234***
	(1.22)	(0.83)	(1.35)	(-1.87)	(1.22)	(-3.18)
TOP5_HLD	0.002	0.014***	0.002*	0.031***	0.002*	0.004***
	(1.56)	(2.7)	(1.59)	(4.35)	(1.63)	(2.58)
SEG_NUM	0.002	0.011	0.004	0.080***	0.002	0.007
	(0.43)	(0.62)	(0.82)	(3.06)	(0.46)	(1.45)
R&D/total assets	-0.031	1.493**	-0.021	3.316***	-0.029	0.527***
	(-1.29)	(2.3)	(-0.89)	(3.98)	(-1.28)	(3.06)
Board size	0.298***	-0.605	0.266***	-1.029**	0.298***	-0.126
	(5.11)	(-1.4)	(4.24)	(-1.89)	(5.1)	(-1.14)
OUT_PCT	0.214*	-1.321**	0.265*	0.234	0.214*	-0.166
	(1.61)	(-2.08)	(1.89)	(0.26)	(1.61)	(-0.98)
CEO tenure	0.001	-0.003	0.002	0.009	0.001	-0.001
	(0.47)	(-0.6)	(0.91)	(1.2)	(0.49)	(-0.51)
Assets in place	0.078***	-0.082	0.127***	0.397	0.077***	0.113***
	(2.72)	(-0.56)	(4.06)	(1.48)	(2.71)	(2.9)
CEO AGE	0.001		0.001		0.001	
	(0.74)		(0.71)		(0.69)	
CEO Duality	0.034		0.031		0.038*	
	(1.43)		(0.92)		(1.73)	
FOUNDER	-0.108***		-0.112***		-0.111***	
	(-3.29)		(-3.26)		(-3.38)	
OUTSIDE	-0.006		0.004		-0.015	
	(-0.22)		(0.15)		(-0.62)	
CEO PPS		0.575		-2.241		-0.347
		(0.19)		(-0.59)		(-0.44)
CEO cash pay		10.953		30.738		-1.209
		(0.7)		(1.49)		(-0.29)
DCP return dum		-0.088		-0.251**		-0.041*
		(-0.94)		(-2.04)		(-1.62)
Obs. No.		1330		1248		1330
Log pseudo-likelihood		-2085		-2121		-862.5
P value of Wald test of exogeneity		0.698		0.999		0.136

TABLE 26: Heckman Selection Model Estimates for Performance Volatility (continue)

Note: This table presents the selection adjusted estimates using an MLE version of the Heckman (1979) selection model to examine the impact of CEO risk aversion on firm performance volatility. The dependent variables of the second stage regressions are Variance of Stock Return (column (2)), Variance of ROA (column (4)) and Asset Value Volatility (column (6)). Corresponding first stage of selection regression estimates are shown in column (1), (3) and (5) respectively. All other variables are defined in the Table 17. All results are adjusted for heteroskedasticity using the test of White (1980). T-statistics are shown in the square brackets. ***, **, * represent 1%, 5%, and 10% significance levels, respectively, based on a two-tailed test.

TABLE 27: Heckman Selection Model Estimates for Firm Performance

	Selection	RET	Selection	ROA	Selection	Tobin's Q
Intercept	-0.960***	1.921***	-1.145***	-0.282	-1.128***	-1.128
	(-6.63)	(3.98)	(-8.14)	(-1.04)	(-7.96)	(-0.4)
Log(sales)	0.091***	-0.052**	0.093***	0.029**	0.095***	0.201
	(10.01)	(-2.29)	(10.24)	(2.27)	(10.36)	(1.49)
Leverage	0.076	-0.27***	0.078	-0.021	0.079	-0.236
	(1.2)	(-4.68)	(1.23)	(-0.82)	(1.24)	(-1)
TOP5_HLD	0.002*	-0.007**	0.002*	-0.001*	0.002*	-0.011**
	(1.61)	(-2.35)	(1.66)	(-1.63)	(1.62)	(-2.33)
SEG_NUM	0.002	0.001	0.001	-0.002	0.002	-0.007
	(0.48)	(0.14)	(0.36)	(-0.88)	(0.31)	(-0.42)
R&D/total assets	-0.029	-0.132	-0.031	0.015	-0.031	2.556***
	(-1.26)	(-1.12)	(-1.3)	(0.35)	(-1.3)	(5.96)
Board size	0.298***	-0.127	0.302***	0.024	0.301***	0.305
	(5.11)	(-1.5)	(5.17)	(0.55)	(5.13)	(0.66)
OUT_PCT	0.214*	0.074	0.229*	0.078	0.235*	0.390
	(1.61)	(0.56)	(1.72)	(1.3)	(1.76)	(0.67)
CEO tenure	0.0003	0.0007	-0.0003	0.0001	0.0003	-0.007
	(0.74)	(0.51)	(-0.17)	(0.04)	(0.15)	(-1.37)
Assets in place	0.078***	0.019	0.083***	0.063***	0.085***	0.106
	(2.74)	(0.62)	(2.89)	(4.11)	(2.95)	(0.69)
CEO AGE	0.0002		0.002*	0.064	0.002*	
	(0.15)		(1.93)	(0.31)	(1.61)	
CEO Duality	0.038**		0.013	0.879	-0.003	
	(1.94)		(0.7)	(0.8)	(-0.15)	
FOUNDER	-0.113***		-0.055	0.011*	-0.061	
	(-3.59)		(-1.48)	(1.61)	(-1.49)	
OUTSIDE	-0.018		0.035**		0.033*	
	(-0.88)		(2)		(1.79)	
CEO PPS		-0.192		0.064		1.961
		(-0.35)		(0.31)		(0.98)
CEO cash pay		5.823**		0.879		7.323
		(2.01)		(0.80)		(0.7)
DCP return dum		0.049***		0.011*		0.132**
		(2.85)		(1.61)		(2.12)
Obs. No.		1330		1330		1330
Log pseudo-likelihood		-539.59		354.4		-1717
P value of Wald test of exogeneity		0.0003		<.0001		0.0007

TABLE 27: Heckman Selection Model Estimates for Firm Performance (continue)

Note: This table presents the selection adjusted estimates using an MLE version of the Heckman (1979) selection model to examine the impact of CEO risk aversion on firm performance. The dependent variables of the second stage regressions are Stock Return (column (2)), ROA (column (4)) and Tobin's Q (column (6)). Corresponding first stage of selection regression estimates are shown in column (1), (3) and (5) respectively. All other variables are defined in the Table 17. All results are adjusted for heteroskedasticity using the test of White (1980). T-statistics are shown in the square brackets. ***, **, * represent 1%, 5%, and 10% significance levels, respectively, based on a two-tailed test.

5 CONCLUSION

Schooley and Worden (1996) argue that personal portfolio allocations (measured as risky assets to wealth) are reliable indicators of attitudes toward risk. In response to critics of weak relation, endogeneity and identification problems in previous literature in the study of managerial risk aversion and firm risk/performance, I turn to look for exogenous variables that can reflect CEO's current risk aversion. The 2008 financial crisis provides a unique opportunity to boil down the portfolio allocation of CEO personal investment in DCPs into risky investment and riskless investment. By looking at the return of DCP in 2008, I will be able to separate the CEOs into two groups: risk-averse CEOs and risk-taking CEOs.

Using this novel proxy of CEO risk aversion, I provide new evidence on the relationship between CEO risk preference and the volatility of firm performance. I also find that firms providing DCP plans to CEOs have lower performance volatility. After controlling for sample selection bias, I find that firms with risk-averse CEOs have relatively lower market performance volatility. My results show firms with risk-averse CEOs perform better than other firms in terms of stock return, ROA and Tobin's Q after selection bias adjustment. Further examination of stock return shows that the positive correlation is mainly driven by year 2008. This suggests that risk-averse CEOs may lead firms to perform better than others in a down market. However, in good years this correlation is not significant. I do not find evidence of firms with DCPs performing better than those without DCPs. Instead, I find that firms with DCPs have lower Tobin's Q than other firms. This result is consistent with Wei and Yermack (2010)'s findings. Wei and Yermack(2010) find an overall destruction of

enterprise value when a CEO's deferred compensation holdings are large.

This study makes four main contributions. First, it is the first empirical study that uses natural experiment data to examine the CEO risk preference and firm risk relation. Previous studies in this field largely omitted the natural experiment method. Second, it is also the first empirical study that documents the return data of CEO deferred compensation investment. Third, it provides supportive evidence of firms with risk-averse CEOs have lower firm risk and higher firm performance in bad market. Four, it shows that firms with inside debt compensation have lower firm risk and lower firm market value.

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