Managerial Risk-Taking and CEO Excess Compensation

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Abstract:

This paper examines risk taking and CEO excess compensation problems in U.S firms to determine their impact on shareholders wealth. Literature suggests a positive effect of CEO incentive risk and strong corporate governance on CEO risk taking. Furthermore, the strong governance mitigates excess compensation problem. Controlling for governance quality and incentive risk, I provide empirical evidence of a significant association between risk taking and CEO excess compensation. When I also control for pay-performance sensitivity (delta) and feedback effects of incentive compensation on CEO risk taking, I find that higher use of incentive pay encourages risk taking, and due to a high exposure to risk CEOs draws excess compensation. Furthermore, I find that the excess compensation problem is more serious with CEOs taking high risk than with those taking low risk. Finally, I find that CEO risk taking also has structural impacts on CEO compensation.

Keywords: Excess Compensation; CEO risk taking; Incentive risk; Governance quality; Incentive compensation; Pay-performance sensitivity.

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1. Introduction

Equity-based compensation has almost doubled from the 1990s to present with an objective of encouraging CEO risk taking for the purpose of generating higher returns (Coles et al. 2006; Murphy, 1999; Perry and Zenner, 2000). This growth has substantially increased the sensitivity of CEO wealth to stock price (delta) and the sensitivity of CEO wealth to stock volatility (vega). The positive effect of delta and vega is that a higher delta encourages CEOs to work for shareholders because CEO share gains and losses that are aligned with shareholders' and the higher vega encourages CEOs to take risky and value creating investment decisions for the firm (Guay, 1999; Habib and Ljungqvist, 2005). The negative effect of higher delta and vega is that they expose CEOs to incentive risk. CEOs are less diversified with respect to firm-specific wealth than are diversified shareholders because stocks and options received by CEOs as part of their compensation are not liquid and are usually restricted for long term. Since the higher use of these restricted stocks and options in compensating an undiversified CEO encourages him to take risky investment decisions under the alignment hypothesis, these risky investment decisions increase volatility in earnings and stock returns of the firm and hence increases riskiness in CEO's compensation and his career with the firm he works for. This riskiness in performance prompts a greater desire to be compensated more for the riskiness. However, in fact CEOs are paid for their performance, but not for the riskiness in their compensation and career. Accordingly, one possibility is that CEOs manipulate the stock prices by such mechanisms as spring-loading and back-dating to gain excess compensation (Yermack, 1997; Aboody and Kaszinik, 2000; Bebchuk and Fried, 2010; Keith and Catherine, 2001). In other cases when CEOs are encouraged to take higher risk, they might protect themselves from the riskiness through the raising of the fixed proportion of their pay and by reducing the variable component of their pay (Garen, 1994; Aggarwal and Samwick, 1999). Finally, CEOs may not respond to the

incentives related to stock and options to protect their human capital and perquisite consumption associated with the firm (Amihud and Lev, 1981; Smith and stulz, 1985; Williams, 1987; Fama, 1980; Holmstrom, 1999). These evidences in association with agency theory suggest that when CEOs are encouraged to take excessive risks, they tend to protect themselves by obtaining excess compensation.

A natural question arises as "do risk taking CEOs generate excess compensation?" In practice, shareholders believe that they are compensating CEOs fairly for their performance and contribution. This is why resentment arises among shareholders when CEOs gain compensation at abnormally high levels. However, from the CEO's point of view the compensation package decided by shareholders may not be sufficient to remunerate the incentive risk that they face, resulting from taking on risky investment decisions. I find initial support for the conjecture that CEO risk taking results in CEO excess compensation by observing a simultaneous increase in popularity of both the excess executive compensation and excess risk taking issues during and after the recent financial crisis of 2008. As it is barely possible to explain this correlation without a theoretical background, I find three streams of literature related to CEO risk taking and excess compensation. One stream of literature analyzes the use of stocks and options to encourage CEOs pay-performance sensitivity and risk taking. (Jensen and Murphy; 1990, Baker, Jensen and Murphy, 1988; Coles et al., 2006; Bebchuk and Fried, 2010; Bolton, Mehran and Shapiro, 2011; Brisley, 2006; Carpenter, 2000). The second stream of literature identifies the determinants of executive pay and establishes the existence and reasons of CEO excess compensation. (Garen, 1994; Gao, Lemmon and Li, 2012; Aboody and Kasznik, 2000; Bebchuk and Fried, 2003; Walker, Bebchuk and Fried, 2002; Bebchuk and Fried, 2005; Bebchuk, Grinstein and Peyer, 2010; Conyon, Core and Guay, 2011; Core, Holthausen and Larcker, 1999; Bizjak, Lemmon and Naveen, 2008). The third stream of literature focuses on how CEOs react to risk taking and on

what is the impact of risk taking on their compensation structure (Aggarwal and Samwick, 1999; Amihud and Lev, 1981; Coles, Daniel and Naveen, 2006; Low, 2009). These three streams of extant literature explain three different but related concepts. However, no specific attempt has been made yet to explain excess compensation problems as a function of risk taking. The main reason is the complications of the simultaneous determination of risk taking and incentive pay. Furthermore, the continuous increase in the proportion of incentives in CEO pay and the resultant changes in CEO's behavior towards risk taking over last the two decades pose serious difficulties in analyzing this relationship. These endogeniety problems have lead Coles, Daniel and Naveen (2006) to develop a methodology to empirically disentangle the effect of firm risk taking from executive compensation. Consequently, with the seriousness of excess compensation problems and excessive risk taking as two critical corporate concerns, the theoretical connection between the two and the existing gap in the literature motivates this study that analyzes the relationship between excess compensation and risk taking.

It is well known that compensation committees encourage CEOs to take risk by including a combination of stocks and options in their compensation package. This equity based compensation encourages CEO to take risks, but in turn it also increases CEO's incentive risks for which CEO is not currently being remunerated. For example, CEO may receive a $1 million worth of stock and options which he cannot sell today. When CEO takes risky investment decisions for the firm later, he puts his firm specific wealth at risk. This uncertainty encourages CEO to remunerate himself more than expected levels. Thus, I expect that risk taking CEOs generate excess pay.

To test my hypotheses, I collect a sample of U.S CEOs and their respective firms for three distinct periods. I examine firm risk taking by using the proxies, the variance in stock returns and the variance of firm's income, as used by (Coles et al., 2006 and John, Litov and

Yeung 2008). I estimate excess compensation as the abnormal level of compensation above expected compensation. I control for the effects of other variables which have an established effect on executive compensation in the literature. These variables are the incentive risks borne by CEOs and the governance structure of the firm (Conyon et al, 2011; Core, Holthausen, and Larcker, 1999).

Overall results of this study provide empirical evidence of a significant association between two important corporate concerns, CEO risk taking and CEO excess compensation. In a causal chain, I first identify the impact of incentive risk on CEO's risk taking behavior and then the impact of CEO risk taking on excess compensation. After controlling for governance quality and pay-performance sensitivity, and by using simultaneous equation model as the econometric remedy for the endogenous feedback effects between risk taking and incentives, I find that incentive risk and vega positively affect risk taking and the risk taking positively affect CEO excess pay. This evidence provides support for the hypothesis that higher incentive risk and vega encourage CEOs to take risky investment decisions. A high risk load puts the CEO's job stability and wealth further at risk and to make up for that riskiness CEOs extract excess compensation. Such real implications are critical to find out the reasons for excess CEO pay which is a significant problem and one of the contributing factors to the 2008 financial crisis (Bebchuk and Fried, 2010; Mehran, Morrison and Shapiro, 2010).

This study contributes to the literature by introducing CEO risk taking as another determinant of excess compensation. Particularly this study adds to the second and the third stream of literature discussed above by identifying a new determinant of CEO excess compensation and by explaining the impacts of CEO risk taking on their compensation. To the best of my knowledge, this is the first study conducting an in-depth examination of CEO compensation in general and excess compensation problem in particular. The multi-period nature

of this research distinguishes it from previous studies on these topics. It analyzes CEO excess compensation problem over last two decades after controlling for reasonable economic determinants of CEO pay, causes of CEO excess pay, firm level fixed effects and the endogenous feedback loop between firm risk taking and CEO incentives. I believe that the results of this research are stronger because my model controls for a wide range of probable effects on primary research variables and complex interrelationships are handled in a simultaneous equation framework. These predictions can help practitioners, particularly the board and the compensation committees when they design compensation plans. Although this study does not gauge or define a threshold beyond which CEO risk taking should not be encouraged, the results suggest a strong relationship between risk taking and CEO excess compensation. Therefore, compensation committees should consider existing risk loads on CEOs before they grant more stocks and options in their compensation plan as the higher risk load encourage them to adopt unfair ways to gain excess compensation. Furthermore, this study finds the effects of varying risk taking on CEO compensation structure and attempts to justify the total pay differences between the low risk taking and the high risk taking CEOs.

The remainder of this paper is organized as follows. Section 2 provides a detailed overview of the literature. Section 3 presents the hypotheses development. In Section 4 construction of the sample variables and the descriptive statistics of the data are presented. Section 5 conducts an OLS estimation of the model to highlight the need for a simultaneous equation model. I specify, identify and estimate the model for the primary research hypotheses. Later subsections 5.2 and 5.3 include the correlation analysis for the effects of risk taking on CEO excess compensation and compensation structure. Section 6 presents conclusions and possible extensions.

2. Literature Review

2.1 CEO Risk Taking

Over the past two decades we have witnessed that executives are being incentivized more and more to take riskier investment decisions in order to increase short-term shareholders' value. This practice has increased the overall riskiness of corporations and the global economic system (Sharma, 2012). While both CEOs and shareholders are risk averse, only CEOs stay risk-averse with respect to the firm's performance because shareholders can become risk-neutral by diversifying away the idiosyncratic risk by investing in a portfolio of stocks. Hence, risk-neutral shareholders encourage CEOs to take risky investment decisions because these risky projects create value to the firm and gains to the shareholders. CEOs with no incentive packages are risk averse because their compensation, reputation, job security and future career are associated with the firm that they manage and this cannot be diversified. So a risk averse CEO prefers to run the firm in a stable and predictable way. For example, Amihud and Lev (1981), Hirshleifer and Thakor (1992), and Holmstrom and Costa (1986) argue that managers avoid taking risky projects, including those that enhance firm value, due to career concerns. However, due to the positive association between firm risk and stockholders' returns, according to agency theory, shareholders persuade CEOs to take on risky investments by tying their wealth to the firm's stock returns. This is usually done by granting stock options in CEO compensation. The higher level of stock options in CEO's wealth portfolio (higher vega), in theory, motivates CEO to pursue riskier investment strategies (Guay, 1999; Coles, Daniel and Naveen, 2006).

As discussed in the introduction, only a small proportion of research has been conducted with respect to firm risk as a determinant of executive compensation, but no researcher examines the relationship between risk taking and excess compensation. Most of the extant studies on risk

taking largely examine the effect of compensation structure on managerial risk taking. For example Bolton, Mehran and Shapiro (2011) assess the relationship between executive compensation and risk taking in financial institutions, which are supposed to maintain low risks in their operations. According to them, managerial risk taking can be reduced by linking executive compensation to default risk by using debt like compensation such as deferred pay and pension. Similarly, Carpenter (2000) addresses the issue of risk averse CEOs being compensated with stock options and finds that stock options do not always lead to greater risk seeking. Kempf, Ruenzi and Thiele (2009) study the influence of incentives on managerial risk taking. Their conclusion suggests that managerial risk taking depends upon the relative importance that incentives comprise in the overall compensation package. Low (2009) has worked on vega and the risk-taking relationship and found that the firm risk taking is low in firms with low vega and that vega is an efficient mechanism to encourage managerial risk taking. To sum up, the literature studies various characteristics of executive compensation that influence managerial risk taking.

There are a few studies that have examined the opposite direction of the relationship, but they have not used firm risk taking and excess compensation in their model. For instance, Coles et al. (2006) examine the relationship between vega and riskier policy choices. After controlling for delta they find that the higher prior vega encourages and the delta discourages managerial risk taking. As well, they find that riskier policy choices lead to compensation structures with higher vega and lower delta. Garen (1994), Aggarwal and Samwick (1999, 2002), Himmelberg et al. (1999), and Jin (2002) have found the inverse relationship between firm risk and pay-performance sensitivity (delta). According to these studies, the variance of firm performance is an extremely important determinant of compensation, as implied by the principal-agent model. Both streams of literature on risk taking; one which discusses incentives to encourage risk taking

and the other which discusses the impact of CEO risk taking on compensation structure serve as the foundation of my primary research hypotheses.

Garen (1994) and Aggarwal and Samwick (1999) point out that as the variability in output (risk) produced by executives increases, the insurance component (fixed pay) increases and the incentive component (performance pay) decreases. Garen (1994) further explains that executives with a higher share of their wealth in their firm's stock have high incentive risk and such executives prefer avoiding risky projects to protect their wealth associated to the firm. As there is a contradiction in the literature it requires further investigation which is part of this study. Finally John, Litov and Yeung (2008) discuss effects of governance quality on CEO risk taking. They find that in a weak governance environment CEOs are more likely to reap private benefits. That is, the value of private benefits is higher for them. Hence, managers are more likely to forego value enhancing risky investment projects to protect their private benefits. They have documented a positive relationship between strong governance and risk taking.

It is clear that CEOs are encouraged by the board, through incentives to take risky investment decisions. The literature is of two minds as to the success of this mechanism. Those CEOs who take risky investment decisions put their firm specific wealth and job at risk. Although shareholders hope to gain from the increased variance of the firm value, it is hard to confirm that CEOs are working in the best interest of shareholders. Due to the uncertainty in CEO's wealth there is an unmet demand for risk premium. In such cases CEOs demand more pay and a reduction in the incentive (risky) component of their pay to offset riskiness in their wealth. Moreover, they may use other potential means to fulfill the premium gap, and extract excess compensation. The literature discussed above covers the primary independent variable of this research. In next section I discuss excess compensation, which is a primary dependent variable.

2.2 Excess Compensation

In managing the firm's resources, CEOs are compensated for their efforts and hard work to create value for shareholders. While CEOs have different skills and level of experience, the environment, objectives and challenges faced by executives are different in different firms. Therefore, executive compensation is determined on the basis of a broad set of variables called the economic determinants of pay. These elements include firm size, firm's stock price and accounting performance, firm investment opportunity, CEO tenure and experience, CEO skills and abilities required by the firm, board understanding about CEO's abilities, and labor market situation (Core et al., 1999). Industry wide benchmarking is used to determine executive compensation in practice (Bizjak, Lemmon and Naveen, 2008), economic determinants are widely used in the literature to determine the expected level of CEO pay (Core, Guay and Larcker, 2008; Smith and Watts, 1992; Core et al., 1999; and Murphy, 1999). Although these economic determinants are used to determine the expected level of CEO pay, under the agency theory discussed by Jensen and Meckling (1976) managers are utility maximizers and have the tendency to shirk, divert, and use inside information to receive extra benefits over their normal pay at the cost of existing shareholders and bondholders. Core et al (1999); Core et al., (2008); and Iwasaki, Otomasa and Shiiba, (2012) describe excess CEO compensation as the level of compensation above expected pay. Excess compensation therefore is "an unearned proportion of pay received by executives" or "pay rewarded for an outcome which is beyond the manager's control". Excess compensation can be written as:

Excess Compensation = Total Compensation – Expected Compensation.

If executive compensation is retained at a normal level and serves its core functions of incentivizing and interest alignment, it creates positive effects on firm value and shareholders' wealth. Alternatively, if compensation exceeds the normal level, then it is counterproductive

with respect to intended objectives and suboptimal for shareholders. Thus, excess compensation in theory is considered bad and viewed as an agency problem (Bebchuk and Fried, 2003).

2.2.1 Costs of Excess Compensation

Both practitioners and academics have shown strong concerns about excess compensation problems. Following the financial crises in 2008, large corporations were asked to reconsider their compensation practices because excess compensation was one of the contributing factors to the financial crisis. The problem of excess compensation is so severe that almost all known international business magazines, newspapers and journals have frequently discussed this issue at an increasing rate. For example, following the financial crisis the Financial Times reported that, "describing recent Wall Street bonuses as "shameful" and expressing "disgust" at chiefs who reward themselves for failure, Mr Obama said the curbs in pay were aimed at "taking the air out of the golden parachute." "This is America, We don't disparage wealth . . . but what gets people upset - and rightfully so - are executives being rewarded for failure especially when those rewards are subsidised by US taxpayers" (Beattie, 2009). Furthermore, a report from Financial Times highlights the magnitude of costs to shareholders and tax payers as a result of skyrocketing increases in executive pay, "Looking at the last 12 years, inflation has been about 40%, average wages are up about 50% and the stock market is down about 25%. The near 300% increase in senior executive pay is totally unjustified by performance" (Darrington, 2012). These are a few of thousands of practical evidence suggesting the seriousness of excess executive compensation problems.

According to the academic literature, there are two major costs of excess compensation (Fried and Shanlon, 2011). First is the *value diversion* from shareholders to the executives. Any excess payment received by CEO reduces shareholder value. If CEO does not extract rents, then

the shareholders may receive this value either directly in the form of dividends or indirectly through reinvestments in firm. In extreme cases this value diversion may drive net losses to the firm. For example, the CEO of Citigroup was rewarded $5 billion bonuses in 2008, the same year that Citigroup declared losses of $27 billion and received $45 billion support under the Troubled Asset Relief Program (TARP). Nortel executives received tens of millions of shareholders' dollars in bonus payment by manipulating accounts which badly affected the shareholders' wealth. Similarly, executives at Fannie Mae inflated earnings between 2001-2004 to receive higher earnings-based bonuses at the cost of shareholders' value (Bebchuk and Fried, 2005). The second major cost of excess compensation is *value destruction.* Value destruction is a possibility of excess pay that hurts shareholders by undermining the desirable effects of incentive pay. In other words, when executives gain excess pay, they destroy far more value than they actually receive. Recall that the purpose of incentive pay is to motivate executives to take risks and increase firm value. When CEOs receive excess pay without increasing performance, the payment differential between poor and good performance is reduced. The reduced differential weakens the pay-performance link originally intended to increase firm value. Thus, excess compensation reduces and ultimately removes the incentive effect. (Bebchuk and Fried, 2005). This evidence also suggests that; when CEOs are pressurized to take more risk, their willingness to gain excess compensation increases to counter act the incentive risks.

Furthermore, the ability to gain excess compensation can encourage executives to take steps that impose direct cost to firms and such actions can be at least value reducing if not value destroying (Jensen, 2005). For example, Enron lost $30 billion of firm value as a consequence of earnings manipulation by Enron's executives (Fried and Shanlon, 2011). Accounting manipulation by executives may not directly affect the firm value, but other costs to the firm can be significantly high. For example, firms involved in accounting fraud during the period 1996-

2002 collectively paid additional $320 million taxes for overstating their income by $3.36 billion (Erickson, Hanlon and Maydew, 2004). Similarly, Fannie Mae spent almost $1 billion cleaning up its book following a $10 billion earning manipulation by executives (Fried and Shilon, 2011). The evidence also shows that there are cases when excess payments are made to executives due to errors in performance measurements. Recovering these payments may require court judgement and thus can be costly (Fried and Shilon, 2011). Therefore, the excess compensation of any form is ultimately destroying the firm value. The overall cost of excess compensation to shareholders, taxpayers, and the global economy is so high that it becomes imperative to clearly identify the causes of excess pay in a way that excess pay can be monitored and controlled.

The literature presented above discusses excess compensation as a serious problem, on the other hand there is a wide range of literature which suggests corporate practices to curb excess executive compensation and discusses how executive's ability to gain excess pay can be hampered. A commonly accepted area to control excess compensation is corporate governance. The details on corporate governance literature are presented in sub-sections below.

2.3 Governance Structure

Corporate governance comprises a set of policies, procedures, and corporate laws to direct and control firms in a transparent and professional manner with the purpose of ensuring long-term success and sustainability. A primary objective of corporate governance is to protect shareholders from managerial expropriation. Thus, corporate governance increases investor confidence and in turn the liquidity of the firm's stock (La porta, Lopez-de-Silanes, 2000; Shleifer, and Vishny, 1997; Chung, Elder and Kim, 2010). A strong corporate governance structure puts strict controls on managerial actions and mitigates agency costs. Conversely, executives can override weak governance systems and receive excess compensation in several

ways (Core et al, 1999; Shleifer, and Vishny, 1997; Bebchuk, Grinstein, and Peyer, 2010; Bebchuk and Fried, 2004). Almost all corporations around the globe funded by shareholders are prone to agency problems. This is so because managers being controllers of the firm have access to special information about the firm, and have limited liability and limited tenure. In addition, their self-serving behaviors may give them enough reasons to betray shareholders and to receive excess compensation either by insider trading (Aboody and Kaszinik, 2000; Bebchuk and Fried, 2010; Keith and Catherine, 2001) or by manipulating financial performance (Watts, 2003; Lafond and Watts, 2008).

The first part on the governance literature examines the relationship between governance and excess compensation. The negative relationship between the two was initially discussed by Core et al (1999). They find that the firms with weaker governance structures are prone to more agency problems; and the CEOs in firms with greater agency problems achieve excess compensation. Such firms perform worse. This negative relationship between corporate governance and executive compensation has been confirmed by other researchers (Dicks, 2012; Basu, Hwang, Mitsudome and Weintrop, 2006)

The second part of governance literature examines the relationship between governance and firm risk taking. John, Litov, and Yeung (2008) explain that corporate governance puts more restrictions on management to better protect shareholders. CEOs have lesser opportunity to gain excess compensation and are compelled to take risky but value enhancing investment decisions. Similarly, the examination of board size and corporate risk performed by Nakano and Nguyen (2012) implies that strong corporate governance encourages valuable risk taking. Thus, the empirical work suggests a positive relationship between strong governance and firm risk taking.

The third part of the governance literature discusses the relationship between corporate governance and incentive risk. Core et al. (1999) find that the incentive pay is required to align

CEOs in those firms where governance and monitoring are weak. Harvey and Shrieves (2001) and Conyon and He (2011) further find that the incentive compensation is used higher in firms with weak governance structures. In line with the above findings, Dicks (2012) shows that incentive compensation becomes lower when firms increase their governance strengths. Therefore, studies on corporate governance generally suggest a negative relationship between governance and incentive compensation.

Furthermore, powerful CEOs can influence the board and compensation committees to obtain larger bonuses, windfalls, and "pay for luck" (Bebchuk and Fried, 2004; Bebchuk, Grinstein and Peyer, 2010). They can also use their influence to reduce risk taking as found by Pathan (2009). The CEO power in the literature is defined by tenure, background, being an insider or outsider, and duality. Moreover, in weakly governed firms compensation is weakly tied to CEOs' own performance and often based on easily achievable objective measures. For example, the imprecise criteria such as strategic decision and effective leadership allow managers to be almost always qualified for bonuses that they do not deserve (Bebchuk and Fried, 2004). Similarly, mergers and acquisition, even the value reducing ones, award bonuses to the executives of acquiring firms (Grinstein and Hribar, 2004).

Overall weak governance structures coupled with high CEO power implies greater CEO ability to extract rents, a higher likelihood of CEO shirking risk, and increased use of incentive compensation. The stronger governance structure suggests otherwise. The literature on corporate governance thereby establishes its importance in any debate on CEO compensation and firm risk taking. Therefore, I control for governance quality in my analysis. I use this literature to develop my measures for internal and external governance which are discussed in Section4.

2.4 Incentive Risk

Agency theory implies that in large corporations it is difficult for shareholders to closely observe and monitor CEO's actions. However, managerial shirking can be controlled by tying their pay to performance (Jensen and Meckling, 1976). In practice, this link is created by using either incentives or rewards. This incentive compensation is largely tied to quantifiable performance measures. For example, stock options given to CEOs are linked to company's annual earnings or changes in stock price (Bebchuk and Fried, 2004). As discussed above the principals (stockholders) of the firm are interested in maximizing their portion of ownership, so that they want CEOs to take risky investment decisions which can positively affect stock price. Hence, CEOs are granted with stocks and stock options to align CEOs' and stockholders' interests (Byrd et al., 1998). While the practice of incentivizing helps align both interests, it also increases incentive risks to risk averse CEOs (Conyon et al., 2011). Jensen and Murphy (1990) find that stock ownership provides the most direct connection between shareholder and CEO wealth. However, a higher proportion of incentive payment in compensation package results in increased variability in executive compensation. This variability increases uncertainty in an executive's wealth and thus is termed as incentive risk. While executives have no incentive risk when their compensation package is fixed, the higher use of incentive pay raises the incentive risk and drives executives to demand the higher pay for facing this risk.

The utility function developed by Pratt (1964) further explains the idea of incentive risk. He argues that for a risk averse manager, the utility from fixed pay is higher than utility from uncertain pay, which is provided via stock options. Hence, the compensation provided by stock options is risky. As a result, executives demand higher pay (certainty equivalence) to be compensated for the risk that they agree to take in the form of incentive compensation.

Considering the interest alignment benefit of incentive pay, regulators and institutional investors have strongly emphasized the need for incentive compensation over the past two decades. Since the 1990s, stock options have become the significant component of executive pay (Murphy, 1999; Fernandes, Ferreira, Matos and Murphy, 2012). Furthermore, the evidence shows that equity-based compensation and bonuses are also a significant portion of CEO compensation. For example, 73% of CEO compensation in all public firms and 55% of CEO compensation in private firms was comprised of stocks, stock options and bonuses during the period 1999–2008 (Gao, Lemmon and Lee, 2012).

Although the incentive compensation has its benefits and is widely used by corporations these days, the inherent cost of incentive compensation in terms of excessive risk load and excess compensation should not be ignored. The main consequence in the frequent use of incentive compensation is the overall increase in the level of executive compensation. For example, Yermack (1995) reports that the enormous growth in top executive compensation during 1984 – 1991 resulted mainly from stock option grants. Similarly, Conyon et al. (2011) attribute the overall high level of U.S CEO's compensation to incentive risk. They evaluate the reasons of high CEO pay in U.S. by comparing it with the risk adjusted compensation of CEOs in U.K. as a benchmark and conclude that executives in United States bear more equity based incentives, while their wealth is less diversified. Thus, the U.S. executives require more risk premium, which explains the major difference in CEO compensation between U.S. and U.K. These findings are important particularly for a study on executive compensation. Therefore, I include incentive risk as a control variable in the econometric model of this study.

The remainder of this section discusses other ways in which executives misuse incentive pay at a cost of shareholders. For instance, CEOs manipulate the incentive portion of their compensation to extract rent. Yermack (1997) suggests that managers can influence the extent

and timing of stock option grants, prior to good news or following bad news and receive excess compensation. Similarly, executives have been shown to be involved in insider trading, particularly backdating, spring-loading and or unwinding their stock options to receive excess compensation (Aboody and Kaszinik, 2000; Bebchuk and Fried, 2010; Keith and Catherine, 2001; Fried and Shilon, 2011; Dechow, 2006). Research by DeFusco, Johnson and Zorn (1990) show that managers take risky investment decisions to increase stock volatility following option grants as the increased volatility brings their options in the money. In addition, Lewellen et al. (1987) and Lambert et al. (1989) find that managers with stock options alter the firm's dividend policy to consume available slack.

Option re-pricing is found as another reason behind excess payment to executives. The idea of option re-pricing has been discussed by Bebchuk and Fried, (2004) and Dechow, (2006). They argue that stock price returns have positive expected values because the market is expected to grow overtime. A positive shock to stock price results in executives' abnormal gains, while in a negative shock CEO's options can become worthless. In the latter case, the board usually grants re-priced stock options. Since 70% of share price movements are driven by the general market or the sector conditions, managerial gains from stock options are not always the result of their own efforts. Thus, the higher use of conventional stock options opens more chances to managerial windfalls (Bebchuk and Fried, 2004). Following the prominent corporate governance scandals of last decade, several reduced-windfall options have been introduced including indexing, performance conditioned vesting, and performance accelerated options, but the widespread use of such options is not observed mainly because the reduced windfall options tightens the pay-performance sensitivity and thus imposes a high incentive risk to a risk averse managers. On the other hand, conventional stock options are widely used because these are relatively loosely linked to performance and allow managers to reap windfalls (Bebchuk and

Fried, 2003). A final reason for over-payment via stock options is the under-appreciation of the cost of stock options to the firm, thus shareholders, by the compensation committees of U.S firms (Hall and Murphy, 2002).

To sum up, the literature supports the use of incentive compensation as a device to increase managerial risk taking. At the same time, the incentive risk is strongly associated with high CEO compensation. Thus, I include incentive risk in my model. However, I do not expect incentives to relate positively to excess compensation in particular, because incentive compensation increases the overall level of CEO compensation, which is decided by shareholders and compensation committees on the basis of economic determinants of CEO pay as I discussed in Section 2.2. While the excess compensation is the residual of expected CEO compensation, it may relate positively to incentives if CEOs are misusing those incentives to their favor.

3. Hypothesis Development

The literature review indicates that in order to effectively assess the relationship between CEO risk taking and CEO excess compensation, the effects of incentive risk and corporate governance on excess compensation must be considered. According to literature the governance quality should negatively, and the incentive risk should positively relate to excess compensation. While all these variables are inter-connected, only incentive risk and CEO risk taking creates a feedback loop, because a higher incentive risk encourages CEOs to take risky investment decisions. On the other hand, CEOs of risky firms tend to reduce incentives from their compensation. Hence, these two variables are simultaneously determined and this simultaneous determination can be viewed as shown in Figure1.

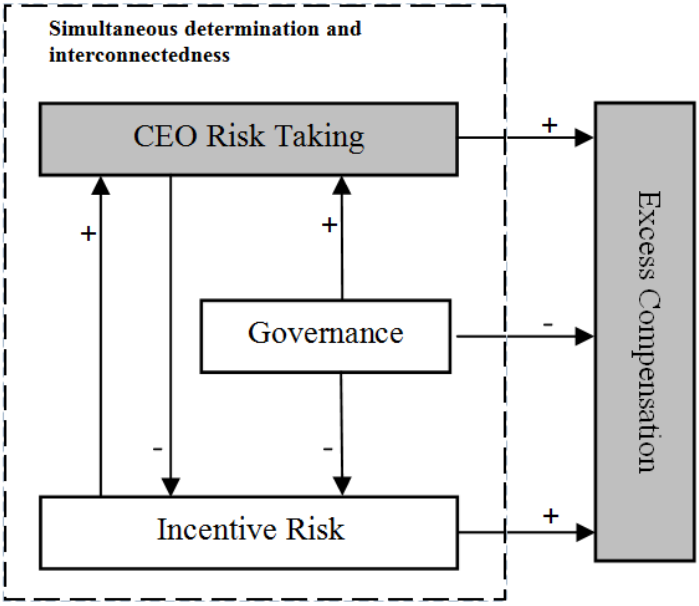

Figure – 1 Determinants of excess compensation.

This study explores relation between CEO risk taking and excess compensation after controlling the effects of governance quality and incentive risk. Figure above illustrates the endogeniety problem involved in estimation of this model; as firm risk taking and incentive risk are jointly determined.

3.1 H1 and H2: CEO Risk Taking and Excess Compensation

The goal of this research is to determine how executive compensation is affected by the risk taking behavior of executives. Particularly, I want to examine how the problem of CEO excess compensation is explained by CEO risk taking. Although, the extant research does not provide a clear explanation to this question, it provides enough evidence to develop this hypothesis.

The literature suggests that managers are encouraged to take risky investment decisions for shareholders' value (Byrd et al., 1998; Coles et al., 2006; Low, 2009). However, undiversified CEOs have their wealth and future prospects closely tied to the firm's performance. This gives them sufficient reasons to circumvent risk taking (Pratt, 1964; Fama, 1980; Holmstrom, 1999; Garen, 1994). Shareholders, on the other hand, can actively trade in the capital market to diversify their portfolio risk, and this diversification protects them from long-term negative effects of riskiness. Therefore, shareholders encourage CEO risk taking to attain larger short-term gains (Amihud and Lev, 1981; Smith and Stulz, 1985; Tufano, 1996; Sharma, 2012). These arguments show that CEOs and shareholders have different risk preferences because both are concerned about their personal gains.

Managing firms under the self-serving perspective, CEOs seek to maximize their own benefits. CEOs are controllers of the firms with superior expertise and special information. Therefore, CEOs can increase the overall risk by selecting projects with high cash flow volatility or by investing in assets that increase overall variance of earnings (Coles et al., 2006). However, as implied by agency theory, CEOs are likely to select those projects that first secure their personal interests and then consider shareholder's interests (Jensen and Meckling, 1976). This agency conflict implies that if CEOs are encouraged to take higher risks, then they would most

likely select those risky projects, which are beneficial for them and reject those risky projects whose costs are higher than the benefits they may generate (Low, 2009).

Finally, when CEOs respond to incentives by taking more risk, they expect to be awarded simultaneously for the riskiness they face. Although the value of stock options and restricted stock options in their portfolio increase with variance of firm performance, but these options cannot be vested before the scheduled dates. So, there is a risk-premium gap. That is, CEOs' need to be rewarded immediately for the risk taking remains unmet. Moreover, due to volatility in returns, the future value of the reward becomes shady. This creates further insecurity about the future value of rewards and urges CEOs to be compensated today. In explaining this phenomenon of "a bird in hand is better than two in bush", Pratt, (1946) maintains that assured immediate compensation is valued more than future uncertain pay. In fact, Huddart and Lang (1996) find that CEOs exercise their options as soon as they are vested. This implies the CEOs' desire for current and confirmed pay. Yermack (1995) and Conyon et al. (2011) have also confirmed the Pratt's prediction and find that CEOs are paid higher because they face incentive risk. But the higher pay they receive for facing incentive risk, if any, is again in form of stock options (Gao, Lemmon and Lee, 2012). Therefore, more stock options increase incentive risk and, at the same time, raise the willingness of CEOs to increase their current pay.

Recognizing the incentive effect, CEO's discretion to select projects, CEO's self-serving behavior, and CEO's desire to receive confirmed pay, I hypothesize that CEOs with high incentives are likely to take risky investment decisions. Also, due to the inherent self-serving behavior and more importantly due to the risk-premium gap, risk taking CEOs attempt to gain excess compensation in order to satisfy their need to be paid today. Therefore my main hypotheses are:

Hypothesis 1: The higher use of incentive compensation encourages risk taking.

Hypothesis 2: High risk taking CEOs derive excess compensation.

Following the predictions of Coles et al. (2006), I expect a positive relationship between incentive compensation and firm risk taking. For second hypothesis, I infer that risk taking is a crucial task. Hence, every CEO cannot take risky investment decisions unless they are rightly incentivized. However, riskiness in their wealth due to the risks they take frustrates CEOs and drives them to remove this frustration by getting more pay today. Specifically, their wish for immediate compensation coupled with their self-serving nature encourages them to gain excess pay. Thus, I expect that high risk taking CEOs will gain excess compensation.

3.2 H3: CEO Risk Taking and Compensation Structure

Risky investment decisions made by CEOs today have performance impacts in the future. That is why shareholders tie CEOs compensation to the future performance of the firm. However, CEOs have a myopic vision about the firm because they have a limited employment term with a particular firm. Hence, they meagrely discount the expected cash flows after their expected tenure with the firm (Byrd et al., 1998). They rather want a higher proportion of fixed pay which can be materialized in short term. Garen (1994) and Aggarwal and Samwick (1999) suggest that the variability in firm performance encourages executives to alter their pay structure such that they have higher proportion of fixed pay. These suggestions are useful in determining the effects of firm risk taking on compensation structure. Based on these suggestions, I hypothesize that high risk taking CEOs have a relatively higher proportion of fixed pay in comparison to that of the low risk taking CEOs. Conversely, I expect more incentive pay in compensation package of lower risk taking CEOs. Specifically, I hypothesize that:

Hypothesis 3a: CEOs taking higher risks have higher proportion of fixed pay and lower proportion of performance pay in their compensation package.

Hypothesis 3b: CEOs taking lower risks have higher proportion of performance pay and lower proportion of fixed pay in their compensation package.

Expecting higher incentive compensation for low risk taking CEOs also has intuitive appeals because these CEOs are at the lower side of risk taking, and from shareholders' perspective, more incentives should be given to these CEOs to encourage their risk taking (Amihud and Lev, 1982; Smith and Stulz, 1985; Rajgopal and Shevlin; 2002). Similarly, I expect an opposite pay structure for high risk taking CEOs because these people are considered active and hence not required to be incentivized further (Brisley, 2006).

3.3 H4: Severity of Excess Compensation Problem.

Having predicted the impact of CEO risk taking on CEO excess compensation and the structure of executive compensation, I continue to estimate the severity of excess compensation problem. The question that I address here is: "Does excess compensation have considerable adverse effects on shareholders wealth?" To estimate the adverse impact of excess compensation I create a ratio of excess compensation to net income and compare this ratio of high risk taking CEOs with that of the low risk taking CEOs. This analysis determines the seriousness of excess compensation problem and provides explanation to the difference of excess compensation among high risk taking and low risk taking CEOs. That is, when comparing high risk taking CEOs with their low risk taking counterparts, I expect the excess compensation problem to be more serious in low risk taking CEOs. This is because high risk taking CEOs are active and are able to

generate the higher value for the shareholders in the long run (Chen and Ma, 2011). Conversely, I expect that low risk taking CEOs should generate relatively lower value. As discussed above, regardless of the level of their risk taking, CEOs do not reduce their perquisites' consumption. Thus, excess compensation of low risk taking CEOs should have a relatively greater adverse impact on the firm's value compared to the impact created by excess compensation of a high risk taking CEO. To illustrate, a CEO earning $1 million excess pay after increasing $10 million worth to the firm is less harmful for shareholders in comparison to a CEO getting $1 million excess pay after increasing $5 million to the firm value. Conclusively, if the proportional damage to shareholders' wealth caused by CEO excess compensation is lower in high risk taking firms, then low risk taking which translates in to lower firm value should lead to proportionately larger damage to shareholders' wealth. Therefore, hypothesis for this analysis is stated as:

> *Hypothesis 4*: Excess compensation problem is more serious in low risk taking firms as compared to excess compensation problem in high risk taking firms.

4. Sample and Variable Construction

I obtain data on American firms from Compustat data base and used 16,767 CEO-year observations from 1996 to 2011. Data on executive compensation has been retrieved from Compustat Execucomp and data on corporate governance and board characteristics is obtained from Risk metrics governance and directors databases. I use Datastream to obtain treasury bills rates. The sample period includes two financial crises; the dotcom bubble burst in 2002 and the recent financial crisis in 2008. I expect to observe an unusual association among primary research variables during the second crisis period around 2008 because compensation practices and excessive risk taking were identified as major contributors to the crisis (Chesney, Stromberg,

and Wagner, 2012; DeYoung, Peng, and Yan, 2010; Gande and Kalpathy, 2012; Suntheim, 2011) and there was enormous pressure from governing authorities, politicians, shareholders, and the public to alter compensation practices, discouraging short-term excessive risk taking (Landkroner and Raviv, 2009; Sahlman, 2009; Bhatta, 2012). Therefore, to separate the effect of crisis on CEO risk taking behavior and compensation structures, and to keep my estimates comparable to previous research, (particularly Coles et al. 2006) I divide the data into three periods. I setup the first period of data for 1996-2002 as in the Coles et al. (2006) and denote it as sample-A. Coles et al. (2006) have used data from 1992-2002 in their risk and CEO incentive analysis and have reported a positive relation between risk and CEO incentives. The second period in my data is for 2002-2006. I refer it to the pre-crisis period and denote it as sample-B. The third and final period split 2007-2011 has been termed as the crisis period and denoted as sample-C. Sample-A has 5981, Sample-B has 5411, and Sample-C has 6358 observations. To further withhold from the crisis effect and to maintain consistency with the extant literature my sample does not include financial and regulated industries. The sample distribution based on 1-digit SIC codes is reported in the table below.

Table 1
Sample Distribution by 1-digit SIC industry

		Sample-A (1996-2002)		Sample-B (2002-2006)		Sample-C (2007-2011)	
SIC	Industry Division	Number	(%)	Number	(%)	Number	(%)
0	Agriculture	0	0.00	0	0.00	0	0.00
1	Mining and Exploration	393	6.57	367	6.78	461	7.25
2	Dairy, Livestock and chemicals	1161	19.41	975	18.02	1152	18.12
3	Industrial manufacturing	1753	29.31	1683	31.10	1982	31.17
4	Transportation, Communication and waste management	853	14.26	698	12.90	763	12.00
5	Wholesale and retail stores	791	13.23	699	12.92	814	12.80
6	Financial Services	0	0.00	0	0.00	0	0.00
7	Other services	788	13.18	721	13.32	850	13.37
8	Foreign services	220	3.68	240	4.44	302	4.75
9	International affairs	22	0.37	28	0.52	34	0.53
Total		5981	100	5411	100	6358	100

The Execucomp database provides data on CEO's salary, bonus, value of stock options and stock grants and other components of total pay. I select executives who are identified by Execucomp as CEOs. I compute tenure of CEOs by using the data on their joining and leaving dates. I include only those CEOs in my sample that have tenure greater than or equal to 5 years. Consistent with the prior literature, total compensation is taken from ExecuComp and represents the sum of salary, bonus, other annual pay, total value of restricted stock granted, total value of stock options granted (using Black-Scholes), long-term incentive payouts, and all other total.

As previously discussed, Hypothesis 3 states that the CEOs taking higher risks have higher proportion of fixed pay and lower portion of performance pay. To test this hypothesis I define two components of CEO pay. That is, CEO fixed pay and variable pay; the fixed pay includes only salary of CEO (as it remains relatively fixed), and the variable pay has performance based components such as bonuses, stock options, stock grants, long term investment plan payouts and others. For my primary research hypotheses I define excess CEO compensation as actual compensation minus expected compensation. My model for expected compensation follows prior research in this area (Core et al., 2008; Smith and watts, 1992; Core et al., 1999; and Murphy, 1999). Estimated compensation is obtained by regressing natural logarithm of total CEO compensation on the proxies of economic determinants of CEO pay such as firm performance, firm size, growth opportunities and industry controls.

$$Log(Total\ Pay)_{it} = \beta_1 + x_{it}\beta_2 + \varepsilon_{it} \quad (4.1)$$

The total pay is the sum of fix and variable pay and x_{it} includes economic determinants of pay; more specifically (1) Log (Tenure)$_{it}$: natural logarithm of tenure. According to Berger et al. (1997) as CEOs with longer tenure have higher pay, they are more likely to be entrenched and will seek to avoid risk; (2) Log(Sales)$_{it-1}$ to proxy for firm size, as larger firms pay higher pay to

their CEOs; (3) $S\&P500_{it-1}$ an indicator whether firm is a member of S&P index or not; (4) $Book\text{-}to\text{-}market_{it-1}$ to proxy for growth opportunities as (book value of assets)/(book value of liabilities + market value of equity); (5) RET_{it}, RET_{it-1}, ROA_{it}, and ROA_{it-1} are proxies for firm performance where RET is the firm's return for the year and ROA is income before extraordinary items divided by total assets. I estimate equation (4.1) using OLS and estimate expected compensation by exponentiating the estimated value of natural log of total pay from equation (4.1). Excess compensation is the residual ε_{it} from equation (4.1) which is the difference between actual compensation and estimated compensation. See Appendix-3 for actual estimates. I also estimate Fixed Excess Compensation and Variable Excess Compensation for further analysis. I follow the same procedure to estimate these two sub components of excess compensation. To test Hypothesis 3, I also measure the proportions of fixed to total pay and variable to total pay. Consistent with the prior literature, I use CEO cash compensation as proxy for CEO risk aversion where cash compensation is salary plus bonus. According to Core et al. (1999), CEOs with higher cash compensation are more diversified as they have more money to invest outside their own firm and, therefore, are less risk averse.

I create three proxies for governance strength of a firm. For the first measure, I use proportion of independent directors on board. Independent boards are better monitors of CEOs on behalf of shareholders. I use it as a primary measure of governance quality because this measure is widely used in the executive compensation and firm risk literature (Core et al. 1999; Shams Pathan, 2009). I obtain data on the number of total directors and their status (independent or dependent) from the RiskMetrics director database. I divide total number of independent directors by total directors to calculate this ratio. The second measure of governance strength is board size. There are problems like free-riding, low agility, low cohesiveness, and lack of communication and coordination in larger boards (Jensen, 1993). Since individual directors have

less incentive to acquire information and monitor managers in larger boards, CEOs may find larger boards less restrictive and easier to influence (Jensen, 1993). The board size is the total number of directors on board. Board independence and board size are both proxies for internal governance. As a measure of external governance, I use entrenchment index (E-index), to investigate the impact of external governance on CEO risk taking. External governance can encourage or discourage firm risk taking due the reasons discussed by John, et al. 2008. For example, Amihud and Lev (1981), Hirshleifer and Thakor (1992), and Holmstrom and Ricart I Costa (1986) argue that managers avoid risky decisions, including those that enhance firm value, due to career concerns. Better external governance mitigates such conservative approach and results in high corporate risk taking in value generating projects. In contrast, when external governance is strong, there is lesser requirement for monitoring by dominant shareholders (Burkart, Panuzi, and Shleifer, 2003). As a result, large shareholders become less prevalent, allowing greater CEO discretion to reduce risk taking. This can potentially increase a negative relationship between external governance and risk taking. E-index introduced by Bebchuk et al. (2008) is a representative of governance index which is based on IRRC anti-takeover provisions (Gomper, Ishii and Metrick, 2003). E-index is based on 6 provisions including staggered board, limits to amend bylaws, limits to amend charter, supermajority, golden parachutes, and poison pill. Each firm receives a score 1 if it has one of these 6 provisions. Firms with none of these provisions receive score 0 and firms with all the provision receive score 6. A higher score on E-index represents strong governance. Data on these 6 provisions are available in the RiskMetrics governance database. In addition to these three measures of governance strengths, I calculate CEO power, a proxy of CEO's influence on board and firm's operations. I define a CEO as powerful if he is chairing the board and has been a past employee of the firm before becoming

CEO. This measure is calculated from the data available in the RiskMetrics director database and is consistent with the prior literature (Bebchuk et al. 2010; Shams Pathan, 2009).

I use two measures as proxies for firm risk taking. One is an accounting measure based on firm's earnings and the other is a finance measure based on stock returns. I denote these measures as Risk1 and Risk2, respectively. My calculation for Risk1 follows John et al. (2008). These calculations are discussed below.

$$RISK1_{i,t} = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}\left(E_{i,t} - \frac{1}{T}\sum_{t=1}^{T}E_{i,t}\right)^2} \mid T \geq 5, \tag{4.2}$$

where

$$E_{i,t} = \frac{EBITDA_{i,t}}{A_{i,t}} - \frac{1}{N_t}\sum_{k=1}^{N_t}\frac{EBITDA_{k,t}}{A_{k,t}}. \tag{4.3}$$

N_t indexes total number firms within the sample for year *t*. All these firms must have available earnings and total assets data for at least 5 years. $EBITDA_{i,t}$ is earnings before interest, taxes, depreciation, and amortization. In other words it is sum of sales - net minus cost of goods sold minus selling, general and administrative expense. $A_{i,t}$ is contemporaneous total assets for firm *i* and year *t* from Compustat Global Industrial (Vantage) database. $E_{i,t}$ represents the deviation of firm *i*'s EBITDA/Assets from average EBITDA/Assets of the sample. $E_{i,t}$ is then used in computation of $RISK_{i,t}$ for firm *i* and year *t*.

Since RISK1 only accounts for volatility in firm's operations, I use RISK2, another more complete proxy, for risk taking which captures volatility of firm's operations and firm's information environment. RISK2 is my primary proxy for firm risk taking because it is used in major studies on executive compensation (Smith and Watts, 1992; Core et al., 1999; Coles et al., 2006). Based on this literature, I define Risk2 as the logarithm of the variance of daily stock returns over at least 60 months.

The prior literature uses various measures of CEO's incentive to increase firm volatility. I use two measures of CEO's incentives. First, the incentive risk which is used by Conyon et al. (2011) is defined as the value of options plus the value of stock grants divided by total compensation. Second, Vega which is most widely used measure of CEO incentives to increase firm volatility in the executive compensation literature (Core et al., 1999; Core and Guay, 2002; Coles et al., 2006; Hayes, Lemmon and Qiu, 2012; Core and Anderson, 2012). A simple definition of vega is number of stock options times the manager's per option sensitivity to firm volatility. See Appendix for details on vega calculations. Although vega is widely used measure of CEOs incentives, I use the incentive risk as a primary measure because vega has additional endogenous feedback loop with delta. Later in my analysis, I use vega in presence of delta for robustness of my estimation.

Descriptive statistics of research variables for sample A, B and C are displayed in Table 2. From 1996 till 2011 total CEO compensation has almost doubled. Fixed and variable compensation has equally contributed to this increase. Mean excess compensation $1,200,730 was at peak during the pre-crisis period and has slightly declined to 1,174,420 during the crisis period. Estimates of variable excess compensation are on average twenty times higher than fixed excess compensation, which confirms that the CEOs mainly extract rents via variable compensation. It is also interesting to see that the proportion of variable to total pay has almost 10% increase from 1996 to 2011, which confirms the increased use of variable pay in CEO's compensation packages. Followed by this increase in variable pay, the incentive risk is almost twice in 2007-2011 period as compared to 1996-2002 period. Vega and Delta also show an increase before the crisis period but both declined during the crisis period.

Table 2
Descriptive Statistics

Data on CEO compensation are obtained from Execucomp. The sample is selected for CEOs with tenure greater than 5 years. The sample is panel data on 1951 firms and 1936 CEOs with total 16,767 observations. Excess compensation is the difference between expected compensation and actual compensation. CEO liquidity is the ratio of cash to total compensation. CEO power is a dummy variable equal to 1 if CEO is chair and past employee of the firm and 0 otherwise. E-index (entrenchment index) assigns one point for each of the six provisions in the index that the firm has. These provisions include staggered board, limit to amend bylaws, limits to amend charter, supermajority, golden parachute and poison pills. Vega is the dollar change in the value of executive's option portfolio for a one percent change in standard deviation of stock returns. Delta is the sensitivity of dollar change in the value of executive's stock over one percent change in stock price. The details on variable construction are provided in the appendix#1 and discussed in the text. All variables are winsorized at 1st and 99th percentile for outliers.

	Sample-A (1996-2002)		**Sample-B (2002-2006)**		**Sample-C (2007-2011)**	
	Mean	**Standard Deviation**	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**
CEO Compensation and Characteristics						
Total Compensation ($000)	2839.40	4526.47	3727.97	4497.05	5023.99	5150.10
Fixed Compensation ($000)	440.30	245.74	579.77	297.98	758.47	341.67
Variable Compensation ($000)	2399.10	4435.86	3145.73	4327.64	4265.10	4931.24
Cash Compensation ($000)	815.85	696.58	1150.62	1033.98	914.38	676.85
Excess Compensation ($000)	994.09	4149.99	1200.73	3790.91	1174.42	3790.61
Fixed Excess Compensation ($000)	46.26	188.16	56.23	223.28	58.21	238.13
Variable Excess Compensation ($000)	1288.05	3964.35	1292.42	3698.45	1134.09	3607.48
Proportion of fixed to total pay (%)	35.66	25.14	31.00	23.09	27.31	21.04
Proportion of variable to total pay (%)	63.82	25.69	68.42	23.79	72.06	21.81
CEO Liquidity (%)	54.29	30.08	49.40	28.55	31.90	24.75
CEO Age (years)	51.48	7.57	52.82	7.18	54.55	7.20
CEO Tenure (years)	4.99	2.66	6.92	3.95	9.18	5.17
CEO Power (dummy)	0.53	0.50	0.63	0.48	0.65	0.48
Governance Characteristics						
E-index (index value)	2.08	1.24	2.26	1.22	2.82	1.34
Board size (individuals)	8.98	2.63	9.01	2.29	9.02	2.19
Ratio of independent to total directors (%)	22.04	12.07	18.68	9.78	16.70	8.67
Measures of Risk						
Standard deviation of EBITDA to Assets ratio (%)	5.22	4.87	5.06	5.11	4.70	4.82
Standard deviation of annual stock returns (%)	3.50	1.82	2.60	1.55	3.13	1.74
CEO's Sensitivities						
Incentive risk (%)	38.57	30.94	44.61	30.03	67.75	24.65
Vega ($000)	16.05	122.39	15.77	125.23	21.38	172.62
Delta ($000)	107.51	782.89	204.44	1488.16	151.61	1105.46
Firms Characteristics						
Firm Sales ($,000,000)	3217.13	7324.94	4635.79	9775.71	5347.93	11088.37
Return on Assets (%)	3.09	15.57	4.30	13.18	4.17	12.44
Book to market ratio	0.62	0.30	0.63	0.27	0.66	0.29
Surplus Cash (%)	7.60	11.39	8.66	9.89	9.37	9.87
Liquidity Constraint (%)	9.61	29.48	6.91	25.37	4.86	21.50
Number of observations	5981		5411		6358	

Table 3
Pearson Correlation Matrix

Pearson correlations of variables from the full sample (1996-2011) are reported. Relations are statistically significant at * which is 0.05 level under two-tailed test. Definition and description of variables is given in Appendix 1.

	Excess Compensation	Risk1	Risk2	Incentive Risk	Vega	Delta	Eindex	Board Size	Director Independence	CEO Power
Excess Compensation	1									
Risk1	0.0324*	1								
Risk2	-0.0006	0.3414*	1							
Incentive Risk	0.5886*	-0.0212*	-0.0209*	1						
Vega	0.4055*	-0.0705*	-0.2561*	0.2914*	1					
Delta	0.4020*	-0.001	-0.1618*	0.2801*	0.8588*	1				
Eindex	0.0633*	-0.1180*	-0.0332*	0.1556*	-0.0031	-0.0279*	1			
Board Size	0.0482*	-0.2870*	-0.3002*	0.0808*	0.2595*	0.1527*	0.0930*	1		
Director Independence	-0.1515*	0.1140*	0.1523*	-0.2233*	-0.1476*	-0.0707*	-0.2301*	-0.2419*	1	
CEO Power	0.0604*	-0.0501*	-0.1090*	0.0916*	0.1028*	0.0670*	0.0941*	0.0878*	-0.0112	1

5. Analysis and Results

5.1 Incentive Compensation and CEO Risk Taking

In this section I examine whether incentive compensation induces managers to take risky investment decisions. As I discussed earlier, I expect that a higher use of incentive compensation will result in higher risk taking, which is represented by high volatility of returns. Table 4 reports estimates from regressing Risk1 and Risk2 on incentive risk and contemporaneous control variables. Estimates from these regressions are for all sample periods i.e. from 1996 to 2011. Reported *t*-statistics and *p*-values are based on robust standard errors.

While I focus on incentive risk as the primary explanatory variable, I control for the effects of CEO tenure, CEO liquidity, proxies for governance quality, and firm and industry controls based on evidence in the literature. My specification controls for sales, book to market, stock return, ROA, surplus cash, cash compensation, CEO power, board independence, board size and E-index. To address the possibility of omitted variables, all specifications throughout include SIC industry controls and S&P500 (Core et al. 1999; Dechow, Hutton and Sloan, 1996; Core, Guay and Verrecchia, 2003).

In the last two columns of Table 4, the coefficients of incentive risk from the OLS regressions on Risk1 and Risk2 have shown different signs. The positive sign of incentive risk with Risk2 in the last column confirms that the higher use of incentives encourages CEO risk taking. However, unlike previous literature and my expectations, I observe a negative sign on coefficient of incentive risk with Risk1. There can be several reasons for observing this negative sign. First, OLS ignores the fact that risk taking and incentive risk are simultaneously determined and interdependent on each other. This causes OLS coefficients to be biased and inconsistent. Second, the association between incentive risk and risk taking is negative because I use full sample period from 1996 to 2011, which includes crisis period with 6,358 out of 16,767 on total

observations. Due to strong negative sentiment from the market and regulators against excessive risk taking during the crisis period it is therefore expected that managers have not responded to the risk taking incentives they received, or that they have responded negatively to those incentives in reaction to the outrage they face against excessive risk taking. Finally both measures capture the volatility of the firms, but Risk1 captures only internal volatility in earnings resulting directly from firm's operations, while Risk2 is a comprehensive measure and captures volatility from firm's operations as well as market expectations.

Table 4
Regressions of Risk1 and Risk2 on Incentive risk

The dependent variable is Risk1 (variance of ebitda/at) and Risk2 (variance of daily stock returns). Incentive Risk is the proportion of CEO's incentives to CEO's total pay. Control variables are described in Appendix. Intercepts are not reported. t-statistics are based on robust standard errors are within parentheses. ***, **, and * indicate statistical significance at 1%, 5% and 10% levels, respectively. Predicted signs are indicated in parentheses.

	Dependent Variables	**Risk1**	**Risk2**
Independent Variables	**Predicted Signs**	**Full Sample (1996-2011)**	
Incentive risk	(+)	-0.65***	0.32***
		(-6.7)	(4.9)
Tenure	(-)	0.32***	-0.07***
		(20.6)	(-6.3)
CEO Liquidity	(+)	-0.75***	0.01
		(-7.2)	(0.1)
Cash Compensation	(+)	0.06***	-0.06***
		(3.7)	(-5.6)
CEO power	(-)	-0.1***	-0.1***
		(-4.4)	(-6.1)
Director Independence	(+)	-0.03***	0.82***
		(-0.3)	(10.4)
Board Size	(-)	-0.07***	-0.05***
		(-12.8)	(-12.8)
Eindex	(+)	-0.1***	0.02***
		(-11)	(2.6)
$Ln(Sale)_{t-1}$		-0.29***	-0.16***
		(-29.8)	(-24)
Book to Market		-0.72***	0.34***
		(-17.7)	(12.3)
SIC1		-0.1***	0.01***
		(-17.2)	(2.7)
Firm Controls		Yes	Yes
Number of observations		16767	
R^2		23.7%	23.8%

5.1.1 Model Development

Although the estimated coefficient on incentive risk with Risk2 has a positive sign and is statistically significant at 1%, the presence of endogenous feedback effects of firm risk on CEOs incentives poses a limitation that the effect of risk taking on excess compensation should not be estimated without controlling for this endogenous feedback effect from risk taking, and that must be handled appropriately to achieve reliable results (Coles et al. 2006). Before adopting simultaneous equation model the test of simultaneity is essential to see whether (an endogenous) regressor is correlated with the error term. If simultaneity problem exists, then the simultaneous equation model is a correct alternative to OLS (Gujrati and Porter, 2009). I perform Durbin–Wu–Hausman test to see whether estimates from OLS are consistent. Specifically, I perform this test for measures of risk taking and incentive risk. The specifications I use for endogenous variables are

Risk Taking = function of {Incentive risk, Governance, CEO power, Controls}

$$RT_t = \Pi_0 + \Pi_1 IR_t + \Pi_2 Gov_t + \Pi_3 Pwr_t + \Pi_4 Ctrls_t + v_t$$

Incentive Risk = function of {Risk taking, Governance, Liquidity constraint, Controls}

$$IR_t = \Pi_0 + \Pi_1 RT_t + \Pi_2 LC_t + \Pi_3 Gov_t + \Pi_4 Ctrls_t + w_t$$

$$Vega_t = \Pi_0 + \Pi_1 RT_t + \Pi_2 Delta_t + \Pi_3 Gov_t + \Pi_4 Ctrls_t + w_t$$

In the first step I regress RT_t on IR_t, Gov_t, Pwr_t and $Ctrls_t$ to obtain $\hat{v}_t$. In the second step I regress IR on $\widehat{RT_t}$, $\widehat{Gov_t}$, $\widehat{Pwr_t}$, $\widehat{Ctrls_t}$ *and* $\hat{v}_t$ and perform an *F* test on the coefficient of $\hat{v}_t$ to determine if it is zero or not. I perform this test for all four combinations of endogenous variables; namely Risk1 and Incentive risk, Risk2 and incentive risk, Risk1 and Vega and Risk2 and Vega. In testing simultaneity for vega I use delta as a right hand side variable. In all four

tests I find coefficient of $\hat{v}_t$ significantly away from zero, which confirms simultaneous determination of Risk and Incentive Risk.

To resolve simultaneity of CEO incentives and risk taking effect I use three stages simultaneous equation model 3SLS. This method systematically creates instrumental variables to replace endogenous variables. The instrumental variable created in 3SLS is a linear combination formed by regressing a given endogenous variable on all predetermined variables such as governance, economic determinants and CEO characteristics in my case. To address the crisis effect I use 3 sample periods and estimate the same model in all three periods. This setup analyzes association between excess compensation and risk taking, while simultaneously analyzing two-way associations between managerial risk taking and incentive risk.

5.1.2 Model Specification

My model specifications follow the extant literature on excess compensation, managerial incentives and risk taking as in Core et al. (1999), Core et al. (2008), Conyon et al. (2011), and Coles et al. (2006), and the specification process discussed by Paxton, John, Pyatt (2011) and Gujrati and Porter (2009). My simultaneous equation model is nonrecursive because there is a reciprocal relationship and feedback loop in the system of equations. A causal path is tracing from risk to incentive risk and back to CEO risk taking. The path diagram of my model is displayed in Figure-1 below. This diagram pictorially represents how research variables are related to each other in empirical model. This diagram uses particular conventions: variables shown in rectangles are observed variables, single-headed arrows denote the direction of influence, and errors in the equations are placed in ovals. Rectangles on the left hand side are exogenous or pre-determined variables, and rectangles on the right are endogenous variables which are determined within the model. Excess compensation is my variable of interest, while governance quality, CEO risk taking, and incentive risks are independent variables with a direct

or indirect effect on excess compensation. Arrows from CEO risk taking to incentive risk and then from incentive risk to CEO risk taking represent the feedback loop which is the main reason to use the simultaneous equation model. Using the simultaneous equation model is also relevant here because it accounts for the effect of independent variables, which are indirectly affecting excess compensation. For example, in Figure-2 the governance quality is directly affecting excess compensation and also has indirect effects via incentive risk and CEO risk taking. Similarly, incentive risk affects excess compensation indirectly via CEO risk taking through risk encouragement process and directly through incentive manipulation by CEOs.

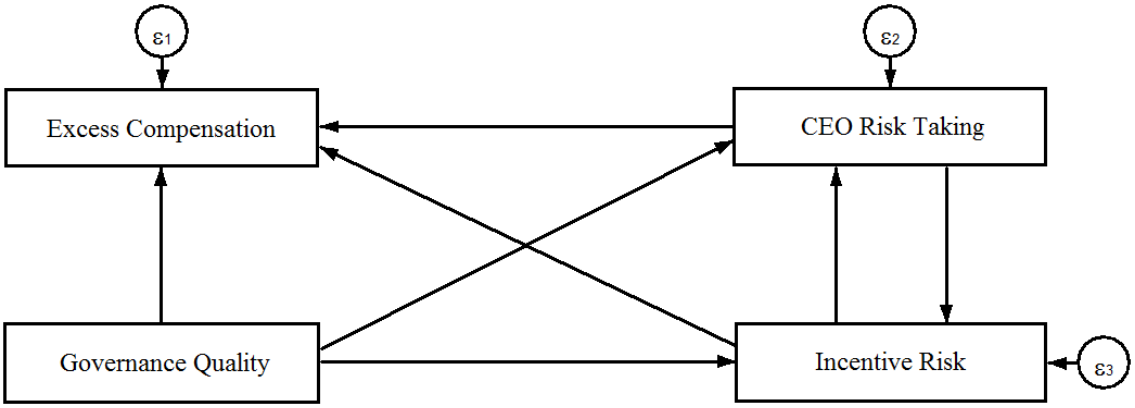

Figure – 2 Path Diagram.
This figure represents relationship among main research variables with their direct and indirect effect on excess compensation.

The diagram depicts only main variables of concern. However, a complete system of equations for this model is presented below, further elaborating the specification.

$$Xcomp_t = \beta_0 + \beta_1 RT_t + \beta_2 IR_t + \beta_3 Gov_t + \beta_4 EDet_t + \beta_5 CEOChar_t + \beta_6 Ctrls_t + u_t \quad (1)$$

$$RT_t = \alpha_0 + \alpha_1 IR + \alpha_2 Gov_t + \alpha_3 CEOChar_t + \alpha_4 SC_t + \alpha_5 Ctrls_t + v_t \quad (2)$$

$$IR_t = \gamma_0 + \gamma_1 RT_t + \gamma_2 Gov_t + \gamma_3 LC_t + \gamma_4 Ctrls_t + w_t \quad (3)$$

While excess compensation is a dependent variable, I focus on risk taking (RT) as the primary explanatory variable. For this system and the subsequent system of equation with vega, I use board size and board independence for internal governance and e-index for external governance. I use the same economic determinants (EDet) of CEO pay, which I use to estimate

expected CEO compensation. In addition, I use different CEO characteristics (CEOChar) in different equations for identification purpose discussed later in this section. Accordingly, my specification controls (Ctrls) for book to market, sales growth, growth opportunities, surplus cash, stock return, and ROA (Core et al. 1999; Core et al. 2008; Coles et al. 2006). An important reason to include control variables is to represent forces that derive both dependent and independent variables of the system together. To address the possibility that there are other omitted variables, all specifications throughout the analysis include either firm fixed effects or SIC fixed effects. Furthermore, I use two measures of risk taking and create a separate system of equations with vega and delta to confirm robustness of my estimates. Risk2 is my primary measure for risk taking and incentive risk, defined as the proportion of CEO incentive to total pay, is the primary measure of CEO sensitivity. We know from the existing literature that when stocks and options are included in CEO's pay package they increase CEO delta and vega. Hence, recognizing that delta and vega are resultants of incentive risk and both are endogenous, I use both in my second model depicted in Figure-3. In this model delta is another endogenous and right hand side variable which has an endogenous feedback loop with vega. I confirm endogeneity between delta and vega via Hausman's test and find a significant correlation between delta and residual of vega. This second endogenous feedback loop adds another equation for delta to the existing system and vega replaces incentive risk. Determinants of vega and delta are followed as in Coles et al. (2006). They use endogenous policy decisions in their model. However, I do not include separate policy choices in my model because it is not the objective of my study. I only use CEO risk taking, which is derived from those policy decisions.

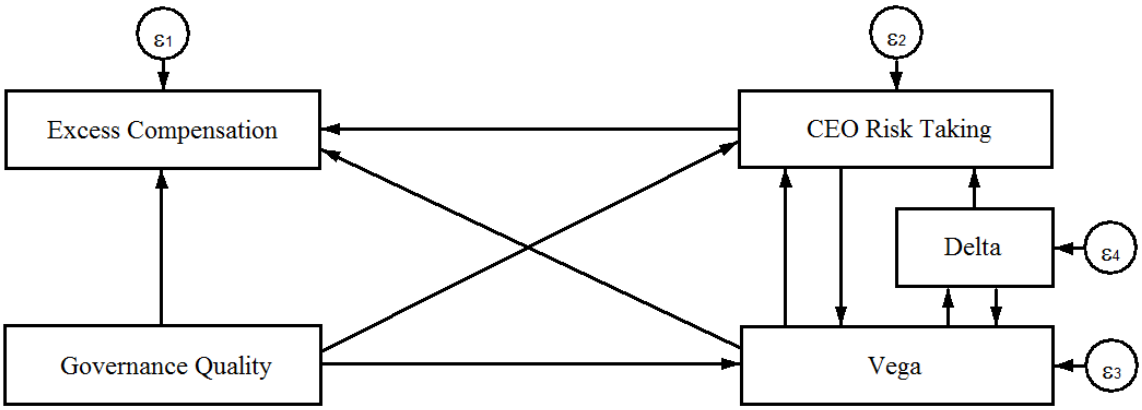

Figure – 3 Path Diagram.

This figure represents relationship among main research variables with their direct and indirect effect on excess compensation.

The system of equations for Figure-3 is displayed below where equation (4) and (5) are replicating equation (1) and (2) except that vega replaces incentive risk here. I introduce delta in both equations to control for its effect on book-to-market, tenure, and risk taking found in existing research (Core and Guay, 2002; Aggarwal and Samwick, 1999; Coles et al. 2006). I use the similar determinants of vega and delta used by Coles et al. (2006) and elsewhere in the literature.

$$Xcomp_t = \beta_0 + \beta_1 RT_t + \beta_2 Vega_t + \beta_3 Gov_t + \beta_4 EDet_t + \beta_5 CEOChar_t + \beta_6 Ctrls_t + u_t \quad (4)$$

$$RT_t = \alpha_0 + \alpha_1 Vega_t + \alpha_2 Delta_t + \alpha_3 Gov_t + \alpha_4 CEOChar_t + \alpha_5 SC_t + \alpha_6 Ctrls_t + v_t \quad (5)$$

$$Vega_t = \gamma_0 + \gamma_1 RT_t + \gamma_2 Delta_t + \gamma_3 Gov_t + \gamma_4 LC_t + \gamma_5 Ctrls_t + w_t \quad (6)$$

$$Delta_t = \eta_0 + \eta_1 Vega_t + \eta_2 CEOChar_t + \eta Ctrls_t + z_t \quad (7)$$

5.1.3 Model Identification and Estimation

Before estimating simultaneous equation models I take special care to identify the model by fulfilling order and rank conditions of identifiability. My model is over identified because it excludes more exogenous variables from each equation than the number of endogenous variables included, less one. Gujrati and Porter (2009) define condition of identification as follows:

If $K - k > m - 1$, equation is overidentified.

If $K - k = m - 1$, equation is exactly identified.

Simultaneous equation modeling requires researchers to exclude some exogenous variables from each equation to differentiate equations from each other. The main idea behind this exclusion is to make sure that I measure what I intend to measure. Therefore, considering the existing theory and established effects of each exogenous variable on dependent variables, I exclude some variables from each equation. To evaluate identification of all 7 equations in my model I create a list of all exogenous and endogenous variables of my research, which are tabulated in Table 5. There are 15 exogenous variables, excluding S&P500 and SIC fixed effects. I have 3 intercepts in the first system of equations from equation (1) to (3). In second system of equations I have 4 intercepts. For each equation of my model I perform identification test. Results for each test of identification for all 7 equations are displayed in Table 6. Accordingly, all equations for both systems of equations are over identified

Table – 5
List of Exogenous and Endogenous research variables

Endogenous	Proxy	Exogenous Variables	Proxy
Risk1	Risk Taking	Excess Compensation	CEO excess pay
Risk2		Board Independence	Governance
Incentive Risk	CEO Incentives	Board Size	
Vega		E-index	
Delta		CEO power	CEO Characteristics
		Cash Compensation	
		Tenure	
		Firm Sales	Controls for Firm Characteristics
		Book to market ratio	
		Return on Assets	
		Return on Assets t-1	
		Annual stock returns	
		Annual stock returns t-1	
		Surplus Cash	
		Liquidity Constraint	
		S&P500	
		SIC	

Table 6
Identification of system of simultaneous equations

Equation No.	(K-k)	(m-1)	Identification Condition (K-k)≥(m-1)	Identification status
1	4	2-1=1	>	Over Identified
2	6	2-1=1	>	Over Identified
3	8	2-1=1	>	Over Identified
4	4	3-1=2	>	Over Identified
5	6	3-1=2	>	Over Identified
6	8	3-1=2	>	Over Identified
7	10	3-1=2	>	Over Identified

K = number of exogenous variables in the model including intercepts
k = number of exogenous variables in a given equation
M = number of endogenous variables in the model
m = number of endogenous variables in a given equation
(K-k) = number of exogenous variables excluded
(m-1) = number of endogenous variables included, less 1

If all equations of a system are exactly identified, then it is possible to use indirect least square estimation (ILS). However, in this case all equations are over identified, and hence I use three-stage least square estimation (3SLS) using reg3 in STATA.

5.1.4 Model Assessment

Table 7A, 7B, and 7C present the estimates from first set of equations (1) – (3) I have developed above. The same set of equation is estimated via 3SLS for sample A, B, and C. The positive signs on coefficients of incentive risk in second column of both panels of Table 7A and 7B and on coefficients of RISK1 and RISK2 in third column of both panels of Table 7A and 7B confirm the existence of a positive feedback loop, which was identified by Coles et al. (2006) in their Table 7 and 9. This feedback loop has called my attention to use the simultaneous equation model here. These signs also confirm the presence of biased estimates or the crisis effect, which I mentioned for Table 4 above. Finally, these estimates support my first research hypothesis that the higher use of incentive compensation encourages risk taking.

Coefficients for Risk1 and Risk2 in the first column of Panel A and B present results on weather CEO's risk taking initiatives create a premium gap and build a desire to gain excess

compensation. My specification for excess compensation particularly controls for incentive risk, governance quality, and CEO characteristics to ascertain that CEO's desire to gain excess pay is explained only by the effect of CEO risk taking. These results are consistent with my predictions. The estimated coefficients on Risk1 and Risk2 are always positive and significant at the 1% level for all sample periods, which confirms that risk taking CEOs obtain excess compensation. The coefficient on incentive risk in second column of both panels of Table 7C is negative. Similarly, the coefficients of RISK1 and RISK2 in third column of both panels of Table 7C are negative, which clearly shows the presence of the crisis effect. A behavioral shift was expected due to the crisis effect. This shift is perhaps due to pressure on CEOs to curtail excess risk taking and pressure on boards to curb excess pay. Based on estimates from Table 7A and 7B effects of 1% increase in incentive risk are economically significant on Risk1 and Risk2. For instance, 1% increase in incentive risk increases Risk1 by 1.3 standard deviations, and Risk2 by 4.5 standard deviations. Also the effects of one standard deviation increase in Risk1 and Risk2 are economically significant on CEO excess compensation. For instance, the increase in one standard deviation of Risk1 increases CEO excess compensation by $250,000, which is similar to the effect from that of Risk2. Average CEO excess compensation in my full sample is $1,100,000 per year. Thus, according to the economic significance analysis almost 15% to 22% of total excess compensation is explained by CEO risk taking after controlling for other critical factors. Coefficients of the control variables are mostly significant, which confirms the reliability of main results.

Furthermore, I check for robustness of my estimates in several ways. Mainly, I use Risk1 and Risk2, the two measures of CEO risk taking, and observe consistent results for both estimates for all sample periods. I also include explanatory variables such as CEO gender because in Faccio, Marchica, and Mura (2012) female CEOs are more risk averse than male

CEOs. I include CEO age as an additional proxy for risk-aversion and excess compensation because older CEOs discount their future cash flows for shorter period and hence are less interested to take risky investment decision. In addition, older CEOs are generally more experienced and highly entrenched, and due to their short expected future with firm they are expected to extract more excess pay (Sundaram and Yermack, 2007). To control for other possible explanations for risk taking and CEO excess compensation I also include free cash flow to asset ratio, CEO inside ownership, which is ratio of CEO inside equity to total share outstanding, and the ratio of defer and pension pay to total pay. The data on defer and pension pay is available only after 2006. Due to this limitation, I add this variable for robustness check in Sample-C only. Overall, I find that the estimates of risk taking and incentives are similar after including these variables.

These robust estimates confirm the predictions and causal claims I have developed in my main hypotheses. Particularly, incentives in CEO pay serve as encouraging instrument for risk taking. And risk taking CEOs lose confidence about future of their wealth, which encourages them to gain excess pay.

In addition to the main findings, a positive coefficient of incentive risk on excess compensation supports findings of previous researchers that the higher use of stocks and options in CEO pay opens more avenues for excess compensation (Bebchuk and Fried, 2004; Aboody and Kaszinik, 2000; Bebchuk and Fried, 2010; Keith and Catherine, 2001; Yermack, 1997). A negative sign on the coefficient of incentive risk in the first column of panel B of Table 7A confirms this evidence further because incentive risk was only 38.5% in sample A in comparison to much higher incentive risk of 44.6% and 67.75% in sample B and C.

The negative association of governance strength with incentive risk confirms the argument of Harvey and Shrieves (2001), Dicks (2012), and Conyon and He (2011) in the sense

that firms with stronger governance do not need stock options as an alignment tool. Governance itself performs this alignment function, and hence there is lesser need to include incentives where governance is strong. In line with the findings of Pathan (2009) and Nakano and Nguyen (2012), I find that the strong internal governance represented by director independence and board size encourages risk taking. In addition to these findings on governance strength, my results support that internal governance strength helps curb CEO excess pay. However, I find that coefficients of external governance strength (E-index) are mostly insignificant. Similar to the findings in the extant literature, I find that CEOs use their power to gain advantages. In this setup they use their influence to avoid risk taking and to obtain excess pay.

Table 7A
Simultaneous equations (3SLS): Excess Compensation, Risk1 and Risk2 and Incentive Risk

Simultaneous regressions of excess compensation, risk taking and Incentive Risk are reported for Sample-A. The dependent variable is natural log of excess compensation. Risk1 is variance of EBITDA/at and Risk2 is variance of daily stock returns. Incentive risk is the proportion of CEO's incentives to CEO's total pay. E-index, director independence and board size are proxies for governance. Tenure and CEO power are proxies for CEO influence. Control variables not reported are Return on assets, Firm's return for the year, and an indicator for S&P index membership. All explanatory and control variables are described in Appendix 1. Intercepts are not reported. *t*-statistics based on robust standard errors are within parentheses. ***, **, and * indicate statistical significance at 1%, 5% and 10% levels, respectively. All variables are winsorized at 1st and 99th percentile to remove outlier effect without losing observations.

	Panel A			**Panel B**		
Dependent Variables	**Excess Comp**	**Risk1**	**Incentive Risk**	**Excess Comp**	**Risk2**	**Incentive Risk**
Independent Variables						
Risk1	3.99***		0.39***			
	(28.5)		(27.7)			
Risk2				14.41***		0.58***
				(33.4)		(43.3)
Incentive risk	3.95***	2.32***		-5.52***	1.64***	
	(18.4)	(46.3)		(-15.1)	(57.6)	
E-index		-0.09***	0.05***		0.01	0.01
		(-6.3)	(8.8)		(57.6)	(1.6)
Board Size	0.44***	-0.18***	0.05***	1.25***	-0.12***	0.06***
	(14.9)	(-22.3)	(16.9)	(24.3)	(-24.1)	(20.7)
Director Independence	-0.19	0.43**	-0.11**	-5.51***	0.62***	-0.32***
	(-0.4)	(2.5)	(-2)	(-6.4)	(5.6)	(-5.5)
Tenure	-0.81***	-0.08***		-0.03	-0.04***	
	(-9.1)	(-3.8)		(-0.2)	(-4)	
CEO Power	0.24**	-0.06**		0.52***	-0.02	
	(2)	(-2)		(3.3)	(-1.4)	
$Ln(Sale)_{t-1}$	0.37***		0.03***	0.87***		0.02***
	(7.1)		(6.6)	(11.5)		(4.5)
Book to Market	4.45***		0.01	4.49***		-0.04***
	(18.2)		(0.4)	(16.5)		(-2.9)
Surplus Cash		-0.44***			-0.46***	
		(-3.1)			(-7.1)	
Liquidity Constraint			-0.11***			-0.11***
			(-5.1)			(-6.5)
Cash Compensation		0.27***	-0.04***		0.14***	-0.03***
		(12.1)	(-4.6)		(12.2)	(-4.4)
SIC1	YES	YES	YES	YES	YES	YES
Firm Controls	YES		YES	YES		YES

Table 7B
Simultaneous equations (3SLS): Excess Compensation, Risk1 and Risk2 and Incentive risk

Simultaneous regressions of excess compensation, risk taking and incentive risk are reported for Sample-B. The dependent variable is natural log of excess compensation. Risk1 is variance of EBITDA/at and Risk2 is variance of daily stock returns. Incentive risk is the proportion of CEO's incentives to CEO's total pay. E-index, director independence and board size are proxies for governance. Tenure and CEO power are proxies for CEO influence. Control variables not reported are Return on assets, Firm's return for the year, and an indicator for S&P index membership. All explanatory and control variables are described in Appendix 1. Intercepts are not reported. *t*-statistics based on robust standard errors are within parentheses. ***, **, and * indicate statistical significance at 1%, 5% and 10% levels, respectively. All variables are winsorized at 1st and 99th percentile to remove outlier effect without losing observations.

	Panel A			**Panel B**		
Dependent Variables	**Excess Comp**	**Risk1**	**Incentive Risk**	**Excess Comp**	**Risk2**	**Incentive Risk**
Independent Variables						
Risk1	6.09***		0.2***			
	(38.9)		(18.2)			
Risk2				9.37***		0.1***
				(25.1)		(6.5)
Incentive risk	2.24***	1.92***		8.02***	0.3***	
	(8.1)	(29.5)		(29.4)	(6.4)	
E-index		-0.01	0.02***		0.01	0.01***
		(-0.5)	(4.5)		(6.4)	(2.7)
Board Size	0.78***	-0.21***	0.02***	0.73***	-0.14***	-0.02
	(19.6)	(-23.8)	(8.6)	(18)	(-23.5)	(-0.6)
Director Independence	-5.33***	1.73***	-0.53***	-9.17***	1.32***	-0.5***
	(-6.5)	(8.3)	(-10.2)	(-11)	(9.7)	(-10.5)
Tenure	-1.58***	0.11***		1.17***	-0.17***	
	(-13.9)	(4.5)		(11.3)	(-9.9)	
CEO Power	0.77***	-0.12***		0.66***	-0.07	
	(5)	(-3.3)		(4.3)	(-2.4)	
$Ln(Sale)_{t-1}$	0.64***		0.05***	0.86***		0.04***
	(10)		(10.9)	(10.7)		(9.2)
Book to Market	5.68***		-0.11***	1.04***		-0.26***
	(19.2)		(-5.4)	(3.8)		(-15)
Surplus Cash		0.09			-0.78***	
		(0.5)			(-6.3)	
Liquidity Constraint			-0.05**			-0.02
			(-2.3)			(-0.9)
Cash Compensation		0.4***	-0.08***		0.18***	-0.01
		(20.1)	(-11.6)		(13.1)	(-1.1)
SIC1	YES	YES	YES	YES	YES	YES
Firm Controls	YES		YES	YES		YES

Table 7C
Simultaneous equations (3SLS): Excess Compensation, Risk1 and Risk2 and Incentive risk

Simultaneous regressions of excess compensation, risk taking and incentive risk are reported for Sample-C. The dependent variable is natural log of excess compensation. Risk1 is variance of EBITDA/at and Risk2 is variance of daily stock returns. Incentive risk is the proportion of CEO's incentives to CEO's total pay. E-index, director independence and board size are proxies for governance. Tenure and CEO power are proxies for CEO influence. Control variables not reported are Return on assets, Firm's return for the year, and an indicator for S&P index membership. All explanatory and control variables are described in Appendix 1. Intercepts are not reported. *t*-statistics based on robust standard errors are within parentheses. ***, **, and * indicate statistical significance at 1%, 5% and 10% levels, respectively. All variables are winsorized at 1st and 99th percentile to remove outlier effect without losing observations.

	Panel A			**Panel B**		
Dependent Variables	**Excess Comp**	**Risk1**	**Incentive Risk**	**Excess Comp**	**Risk2**	**Incentive Risk**
Independent Variables						
Risk1	4.82***		-0.03***			
	(37.3)		(-5.5)			
Risk2				7.84***		-0.16***
				(10.1)		(-18.8)
Incentive risk	12.99***	-1.4***		15.19***	-1.72***	
	(44.4)	(-17.4)		(53.9)	(-35.6)	
E-index		-0.02	0.01***		0.02**	0.01***
		(-2)	(3.1)		(-35.6)	(5.7)
Board Size	0.71***	-0.19***	0	0.39***	-0.07***	-0.01***
	(19.5)	(-20.7)	(-1.8)	(9.2)	(-12.4)	(-4.2)
Director Independence	0.3	0.01	-0.48***	-2.26**	0.06	-0.36***
	(0.4)	(0.2)	(-13.8)	(-2.4)	(0.5)	(-9.9)
Tenure	-2.02***	0.33***		0.76***	-0.11***	
	(-17.6)	(12.2)		(6.7)	(-6.9)	
CEO Power	0.82***	-0.18***		0.92***	-0.11***	
	(5.9)	(-4.6)		(5.7)	(-4.7)	
$Ln(Sale)_{t-1}$	0.38***		0.04***	0.39***		0.03***
	(7.4)		(15.8)	(3.7)		(10.9)
Book to Market	2.23***		-0.14***	-2.56***		-0.06***
	(9.8)		(-13.1)	(-5.4)		(-5.2)
Surplus Cash		1.28			-0.49***	
		(7.4)			(-4.7)	
Liquidity Constraint			-0.06***			-0.02
			(-4.2)			(-1.5)
Cash Compensation		0.39***	0.01		0.22***	0.01**
		(17.1)	(1.3)		(14)	(2.4)
SIC1	YES	YES	YES	YES	YES	YES
Firm Controls	YES		YES	YES		YES

5.1.5 Further Robustness Checks

To determine that the results on CEO risk taking and excess compensation are reliable, I use another specification of the simultaneous equation model, which includes vega and delta in place of incentive risk. As model specification and identification have been discussed in Section 5.1.2 and 5.1.3 above, results of this estimation are presented in Table 8. These results are consistent with the previous results and with the predictions of Coles et al. (2006). Vega encourages CEOs to take risky investment decisions during 1996-2002, which is represented by the coefficients of vega in second column of both panels. Consistent with Table 7C the coefficients of vega here in Table 8C also suggest that incentives fail to encourage risk taking during the crisis period. Statistics, however, suggest that there was no significant reduction in the proportion of stocks and options in executive pay during the crisis period. For instance, incentive risk was on average 65% from 2007 to 2009 and increased to 70.7% and 71.5% in 2010 and 2011, respectively. Note that the underlying encouraging mechanism of vega for CEO risk taking was inactive. This is partly because of external pressure on CEOs to reduce risk and some CEOs might have avoided risk taking due to reputational concerns, professional integrity or fiduciary duty norms. Moreover, I use the lagged and logarithmic values of vega and delta and find similar results.

Coefficients of risk taking in column one in both panels of Table 8 are quite consistent with the estimates of previous setup. Risk1 is always positive and significant at 1%, and Risk2 is also positive for non-crisis period. However, a negative sign in RISK2 during the crisis period can be attributed to the crisis effect. The negative relationship between Risk2 and excess compensation during the crisis period can be associated to the financial losses that CEOs incurred on their stock holdings. In addition, Risk2 is based on market expectations in contrast to Risk1, which is earnings-based. This different behavior of RISK1 and Risk2 in conjunction with

Table 8A
Simultaneous equations (3SLS): Excess Compensation, Risk1 and Risk2 , Vega and Delta

Simultaneous regressions of excess compensation, risk taking, vega and delta are reported for Sample-A. The dependent variable is natural log of excess compensation. Risk1 is variance of EBITDA/at and Risk2 is variance of daily stock returns. Vega is the dollar change in the value of executive's stock and option portfolio for a 0.01 change in standard deviation of stock returns. Delta is the dollar change in the value of executive's stock and option portfolio for a 1% change in stock price. E-index, director independence and board size are proxies for governance. Tenure and CEO power are proxies for CEO influence. Control variables not reported are Return on assets, Firm's return for the year, an indicator for S&P index membership. All explanatory and control variables are described in Appendix 1. Intercepts are not reported. *t*-statistics based on robust standard errors are within parentheses. ***, **, and * indicate statistical significance at 1%, 5% and 10% levels, respectively. All variables are winsorized at 1st and 99th percentile to remove outlier effect without losing observations.

	Panel A				**Panel B**			
Dependent Variables	**Excess Comp**	**Risk1**	**Vega**	**Delta**	**Excess Comp**	**Risk2**	**Vega**	**Delta**
Independent Variables								
Risk1	10.942***		0.212***	0.677***				
	(35.95)		(3.43)	(2.16)				
Risk2					22.239***		1.028***	-3.192***
					(38.41)		(15.99)	(-8.84)
Vega	-0.546***	0.068***		5.551***	-4.889***	0.311***		5.377***
	(-3.16)	(2.74)		(50.6)	(-23.68)	(21.35)		(48.78)
Delta	0.023	-0.01	0.14***		0.615***	-0.04***	0.147***	
	(0.85)	(-0.16)	(51.04)		(18.66)	(-15.43)	(50.77)	
Director Independence	5.241***	-0.576***	0.152		-4.765***	0.034	0.002	
	(3.54)	(-2.38)	(0.87)		(-2.66)	(0.22)	(0.01)	
Board Size	0.86***	-0.097***	0.031***		1.656***	-0.08***	0.062***	
	(10.56)	(-7.63)	(2.98)		(15.8)	(-9.88)	(5.89)	
E-Index	1.47***	-0.149***	0.056***		1.146***	-0.059***	0.054***	
	(10.66)	(-6.86)	(3.24)		(7.04)	(-4.29)	(3.27)	
Tenure	-0.511***	0.031***		-0.089**	0.308***	-0.015**		-0.004
	(-7.4)	(2.75)		(-1.73)	(3.94)	(-2.26)		(-0.08)
CEO Power	-0.008	0.017			0.728**	-0.015		
	(-0.02)	(0.32)			(1.93)	(-0.48)		
$Ln(Sale)_{t-1}$	2.513***	-0.283***	0.034*	0.222**	2.596***	-0.154***	0.154***	-0.635***
	(17.91)	(-13.28)	(-8.23)	(1.69)	(15.79)	(-11.26)	(4.9)	(-5.41)
Book to Market	13.497***	-1.291***	0.215**	0.65	10.16***	-0.486***	0.455***	-1.709***
	(18.12)	(-13.22)	(1.92)	(1)	(12.81)	(-7.75)	(4.85)	(-2.94)
Surplus Cash		-1.029**	0.212***	-2.15*		-0.507***	1.028***	-1.423
		(-5.76)	(3.43)	(-1.57)		(-4.97)	(15.99)	(-1.18)
Liquidity Constraint			-0.142*				-0.154**	
			(-1.58)				(-2.04)	
Cash Compensation		0.368***	-0.083***			0.186***	-0.1***	
		(14.72)	(-2.67)			(11.62)	(-3.3)	
Firm Controls	YES		YES	YES	YES		YES	YES
SIC Control	YES	YES	YES	YES	YES	YES	YES	YES

Table 8B
Simultaneous equations (3SLS): Excess Compensation, Risk1 and Risk2 , Vega and Delta

Simultaneous regressions of excess compensation, risk taking, vega and delta are reported for Sample-B. The dependent variable is natural log of excess compensation. Risk1 is variance of EBITDA/at and Risk2 is variance of daily stock returns. Vega is the dollar change in the value of executive's stock and option portfolio for a 0.01 change in standard deviation of stock returns. Delta is the dollar change in the value of executive's stock and option portfolio for a 1% change in stock price. E-index, director independence and board size are proxies for governance. Tenure and CEO power are proxies for CEO influence. Control variables not reported are Return on assets, Firm's return for the year, an indicator for S&P index membership. All explanatory and control variables are described in Appendix 1. Intercepts are not reported. *t*-statistics based on robust standard errors are within parentheses. ***, **, and * indicate statistical significance at 1%, 5% and 10% levels, respectively. All variables are winsorized at 1st and 99th percentile to remove outlier effect without losing observations.

	Panel A				**Panel B**			
Dependent Variables	**Excess Comp**	**Risk1**	**Vega**	**Delta**	**Excess Comp**	**Risk2**	**Vega**	**Delta**
Independent Variables								
Risk1	10.795***		-0.361***	2.94***				
	(42.75)		(-6.26)	(5.46)				
Risk2					23.747***		0.531***	3.899***
					(30.57)		(4.67)	(4.1)
Vega	2.468***	-0.401***		8.499***	-1.902***	0.121***		7.779***
	(14.12)	(-14.73)		(44.09)	(-8.82)	(7.31)		(38.17)
Delta	-0.205***	0.036***	0.08***		-0.061***	0.006***	0.073***	
	(-12.16)	(13.61)	(44.09)		(-2.95)	(3.72)	(38.01)	
Director Independence	-8.532***	0.495	0.394		-16.185***	0.512***	-0.111	
	(-4.2)	(1.58)	(1.64)		(-6.35)	(2.67)	(-0.43)	
Board Size	0.446***	-0.049***	0.007		1.389***	-0.065***	0.064***	
	(4.56)	(-3.27)	(0.62)		(10.85)	(-7.07)	(4.74)	
E-Index	1.248***	-0.125***	-0.017		0.301**	-0.019	0.023	
	(8.34)	(-5.49)	(-0.93)		(1.68)	(-1.36)	(1.27)	
Tenure	-0.667***	0.057***		-0.187***	0.265***	-0.008*		-0.069
	(-13.04)	(7.77)		(-2.71)	(4.52)	(-1.75)		(-1.13)
CEO Power	1.568***	-0.106**			0.567	-0.013		
	(4.27)	(-1.88)			(1.33)	(-0.42)		
$Ln(Sale)_{t-1}$	3.463***	-0.409***	-0.178***	1.38***	4.647***	-0.237***	0.067**	1.339***
	(22.47)	(-18.42)	(-6.99)	(5.7)	(21.23)	(-17.69)	(1.06)	(4.71)
Book to Market	12.177***	-0.943***	-0.481***	4.482***	-6.028***	0.241***	-0.305***	0.941
	(13.8)	(-7.51)	(-3.85)	(3.5)	(-6.16)	(3.17)	(-2.85)	(0.76)
Surplus Cash		-0.459**	-0.361***	1.611		-0.406***	0.531***	3.045
		(-2.41)	(-6.26)	(0.55)		(-3.48)	(4.67)	(1.09)
Liquidity Constraint			0.206*				0.089	
			(1.85)				(0.86)	
Cash Compensation		0.396***	0.061*			0.202***	-0.138***	
		(17.91)	(1.75)			(16.31)	(-4.12)	
Firm Controls	YES		YES	YES	YES		YES	YES
SIC Control	YES	YES	YES	YES	YES	YES	YES	YES

Table 8C
Simultaneous equations (3SLS): Excess Compensation, Risk1 and Risk2 , Vega and Delta

Simultaneous regressions of excess compensation, risk taking, vega and delta are reported for Sample-C. The dependent variable is natural log of excess compensation. Risk1is variance of EBITDA/at and Risk2 is variance of daily stock returns. Vega is the dollar change in the value of executive's stock and option portfolio for a 0.01 change in standard deviation of stock returns. Delta is the dollar change in the value of executive's stock and option portfolio for a 1% change in stock price. E-index, director independence and board size are proxies for governance. Tenure and CEO power are proxies for CEO influence. Control variables not reported are Return on assets, Firm's return for the year, an indicator for S&P index membership. All explanatory and control variables are described in Appendix 1. Intercepts are not reported. *t*-statistics based on robust standard errors are within parentheses. ***, **, and * indicate statistical significance at 1%, 5% and 10% levels, respectively. All variables are winsorized at 1st and 99th percentile to remove outlier effect without losing observations.

Dependent Variables	**Excess Comp**	**Risk1**	**Vega**	**Delta**	**Excess Comp**	**Risk2**	**Vega**	**Delta**
Independent Variables								
Risk1	5.248***		0.026	5.519***				
	(21.82)		(0.4)	(9.83)				
Risk2					-22.034***		-0.094	0.471
					(-19.84)		(-1.17)	(1.02)
Vega	0.395***	-0.106***		4.406***	0.109	-0.005		4.498***
	(4.82)	(-5.88)		(29.4)	(0.77)	(-0.44)		(35.28)
Delta	-0.162***	0.046***	0.096***		0.036	0.004	0.11***	
	(-13.05)	(19.12)	(29.69)		(1.58)	(2.14)	(35.15)	
Director Independence	-5.539***	0.197	0.127		27.339***	1.68***	0.35	
	(-4.11)	(0.65)	(0.33)		(9.72)	(7.79)	(0.92)	
Board Size	0.434***	-0.056***	0.041**		-0.727***	-0.034***	0.013	
	(6.7)	(-3.95)	(2.28)		(-6.01)	(-3.39)	(0.76)	
E-Index	0.061	0.001	-0.005		2.404***	0.139***	0.002	
	(0.78)	(0.03)	(-0.22)		(13.99)	(11.39)	(0.1)	
Tenure	-0.381***	0.071***		-0.475***	-0.388***	-0.021***		-0.082**
	(-13.43)	(13.13)		(-8.26)	(-9.42)	(-6.29)		(-2.21)
CEO Power	0.467**	-0.129***			-4.299***	-0.177***		
	(2.09)	(-2.65)			(-9.64)	(-5.03)		
$Ln(Sale)_{t-1}$	1.804***	-0.37***	-0.005	1.844***	-1.896***	-0.057***	-0.029	0.151
	(16.82)	(-16.54)	(-7.17)	(8.14)	(-9.77)	(-4.05)	(-2.53)	(1.01)
Book to Market	0.532	-0.019	0.186*	-0.403	14.412***	0.707***	0.244**	-0.725
	(1.13)	(-0.18)	(1.65)	(-0.45)	(14.5)	(11.51)	(1.92)	(-0.83)
Surplus Cash		1.189***	0.026	-7.262**		-0.728***	-0.094	1.305
		(4.41)	(0.4)	(-2.44)		(-6.17)	(-1.17)	(0.59)
Liquidity Constraint			-0.016				0.132	
			(-0.1)				(0.89)	
Cash Compensation		0.509***	-0.213***			-0.253***	-0.053	
		(11.9)	(-2.99)			(-11.12)	(-0.77)	
Firm Controls	YES		YES	YES			YES	YES
SIC Control	YES	YES	YES	YES	YES	YES	YES	YES

the prior literature also indicates that a major portion of CEO excess compensation comes from stocks and options. A crash in stock market should have negative effects on Risk2 and CEO excess pay, and this negative effect comes from variable sources of pay. This argument receive additional support from the fact that variable excess compensation declined by 12.3% from the pre-crisis to the crisis period in Table 2.

To conclude, main hypotheses of my research are well supported by these results. The higher vega in CEO pay encourages CEO to take on risky investment decisions, and high risk taking by CEO leads to higher excess compensation. These results are consistent with the main analysis and robustness checks. Although I indicate the crisis effect as a reason for observing unusual signs on coefficients of incentives and risk taking during the crisis period, a further empirical research can explore the underlying details.

Finding substantial economic effects of CEO risk taking on CEO excess compensation, I regress CEO excess compensation again on Risk1 and Risk2 in an OLS setup and find both measures of risk taking to be positive and statistically significant at 1%. I also estimate CEO total pay using Risk1 and Risk2 in combination of other economic determinants and find Risk1 to be statistically significant at 1% in all sample periods. Coefficients of Risk2 are also significant during non-crisis period, but insignificant during the crisis period.

5.2 Effects of Firm Risk Taking on CEO Compensation Structure

The premise is that the CEOs taking lower risk should have high a proportion of incentives in their pay structure, while CEOs already taking high risk should not. It logically makes sense because the purpose behind incentivizing CEOs is to encourage risk taking. Thus, a risk averse CEO should be incentivized more to encourage risk taking. On the other hand, a CEO who is already taking risky investment decisions should not be incentivized further to avoid excess risk taking. I want to analyze how these two goals work for corporate finance in practice.

To estimate these relationships I use the ratio of the CEO fixed to total pay and the variable to total pay in a correlation analysis.

Table 9
Pearson Correlations matrices of Risk Taking and CEO Compensation Structure

Pearson correlations of Risk taking and compensation structure are reported. Risk1 is standard deviation of Ebitda/Total Assets. Risk 2 is standard deviation of daily stock returns. Fix to Total Pay is the ratio of CEO's salary to total pay. Variable to total pay is the ratio of CEO's variable pay to total pay as defined in Appendix. High risk taking CEOs are defined as CEOs with Risk1/Risk2 above mean volatility and respectively low risk taking CEOs are below mean volatility. Relations are statistically significant *,** and *** which is at 0.1, 0.05 and 0.01 level respectively under two-tailed test. Upper diagonal reports correlations with Risk2 and lower diagonal reports correlations with Risk1

Correlations of High Risk Taking and CEO Compensation Structure (For Sample-A 1996-2002)

	Risk1	Fix to Total Pay	Variable to Total Pay
Risk2		**0.01**	**-0.02**
Fix to Total Pay	**0.07****	1	-0.61****
Variable to Total Pay	**-0.05****	-0.61***	1

Correlations of Low Risk Taking and CEO Compensation Structure (For Sample-A 1996-2002)

	Risk1	Fix to Total Pay	Variable to Total Pay
Risk2		**-0.10*****	**0.03****
Fix to Total Pay	**-0.06*****	1	-0.61***
Variable to Total Pay	**0.01**	-0.61****	1

Correlations of High Risk Taking and CEO Compensation Structure (For Sample-B 2002-2006)

	Risk1	Fix to Total Pay	Variable to Total Pay
Risk2		**0.04**	**-0.04***
Fix to Total Pay	**0.05***	1	-0.62***
Variable to Total Pay	**-0.06***	-0.62***	1

Correlations of Low Risk Taking and CEO Compensation Structure (For Sample-B 2002-2006)

	Risk1	Fix to Total Pay	Variable to Total Pay
Risk2		**-0.01*****	**-0.09*****
Fix to Total Pay	**-0.05*****	1	-0.62***
Variable to Total Pay	**-0.01**	-0.62***	1

Correlations of High Risk Taking and CEO Compensation Structure (For Sample-C 2007-2011)

	Risk1	Fix to Total Pay	Variable to Total Pay
Risk2		**0.09*****	**-0.14*****
Fix to Total Pay	**0.09*****	1	-0.65***
Variable to Total Pay	**-0.15*****	-0.65***	1

Correlations of Low Risk Taking and CEO Compensation Structure (For Sample-C 2007-2011)

	Risk1	Fix to Total Pay	Variable to Total Pay
Risk2		**0.18*****	**-0.10*****
Fix to Total Pay	**0.04*****	1	-0.65***
Variable to Total Pay	**-0.07*****	-0.65***	1

I define high risk taking CEOs as those who have standard deviation of Risk1 and Risk2 above mean of Risk1 and Risk2, respectively. Table 9 presents the results of this analysis. I repeat this analysis for the three sample periods A, B, and C. The two matrices on the top of Table 9 pertains to Sample-A, where the first matrix is for high risk taking CEOs, and the second is for low risk taking CEOs. The format follows for the other two sample periods. The correlation analysis supports this hypothesis. Note that all of the cases in high risk taking are shown in the first matrix for all sample periods. The correlation between both measures of risk and proportion of fix pay is positive and mostly significant, while the correlation between risk and proportion of variable pay is always negative and significant. This implies that higher risk taking CEOs have high fixed income and low variable pay. Observing the low risk taking cases which is the second matrix for all sample periods, I receive support for this hypothesis from sample-A only, because the risk taking positively correlates with incentives and negatively with fix pay. However, these signs do not hold in the pre-crisis and the crisis period. In fact, these signs are opposite during the crisis period, which confirms the finding of Garen (1994) and Aggarwal and Samwick (1999) in the sense that CEOs either taking high risk or low risk tend to increase fixed proportion of their pay and decrease a variable component of their pay. An alternative explanation for low risk taking CEOs earning higher fixed pay and lower variable pay follows Chen and Ma (2011), where a high level of stock options can have negative effects on risk taking. In Table 2 the variable to total pay ratio is 68.42% in the pre-crisis period and 72.06% in the crisis period, which is significantly higher than 63.82% observed during 1996-2002. If I focus particularly on incentive risk which is the ratio of stock and options to total pay, it is just 38.57% during 1996-2002 and increases to 44.61% in the pre-crisis period and to 67.75% during the crisis period. Consistent with the notion that the significant increase in stocks and options in CEO pay can

have negative effects on risk taking, I observe a negative relation between the measure of risks and the variable to total pay ratio for low risk taking CEOs only for Sample B and C, where the proportion of stock and options in CEO compensation package is too high. Finally, these negative signs may also indicate the failure of compensation committees to properly identify and incentivize low risk taking CEOs.

Furthermore, to support these results I regress the ratios of CEO pay on both measures of risk, while controlling for firm size, growth, growth opportunities, liquidity constraints, and industry effects. Based on findings by Ittner, Lambert and Larcker (2003) I include new economy SIC dummy as well. Results from the regression analysis are in line with Table 9. To sum up, these analyses support the premise that CEO risk taking has structural impacts on his compensation. Particularly, high risk taking CEOs have high proportion of fixed pay and low proportion of incentive pay in their pay plan in comparison to the low risk taking CEOs.

5.3 Severity of Excess Compensation Problem and Risk Taking

This section analyzes the last question of this study, which aims to identify the group of CEOs who are plagued with excess compensation problem. Particularly, the question is whether high risk taking CEOs are more costly for the shareholders or for low risk taking CEOs. I analyze this question by performing a classical T-test on a severity measure. The definition of high risk taking CEOs, low risk taking CEOs, and the structure of table stays the same as in the previous analysis. Under the fourth hypothesis, I expect excess compensation problems to be more serious in low risk taking CEOs because low risk taking CEOs are considered inactive. I expect that low risk taking CEOs do not create much value to the firm in proportion to what they are paid. In line with this argument I measure the severity of excess compensation problem as a ratio of CEO excess compensation divided by net income each year. The higher value of this ratio indicates severity of excess compensation problems. The mean value of this ratio is 0.5%

for the full sample, and the maximum of 3.67% is a value for the most problematic CEO. Results of T-test are presented in Table 10. I find two points from this. First, the severity of excess compensation is significantly different between high risk taking and low risk taking CEOs. Second, in contrast to my expectation the excess compensation problem is severe in high risk taking CEOs instead of low risk taking CEOs. The negative mean severity during the crisis period is due to the net losses firms faced. The results of this analysis do not support the fourth hypothesis. In fact, the results of this analysis are opposite to my expectations. There can be several reasons why high risk taking CEOs are more costly for shareholders. First, based on the results from the second hypothesis, high risk taking CEOs generate higher excess pay and thus more costly for shareholders. Second, these CEOs may take value reducing risky investment decisions, which can put a negative pressure on net income, the denominator of severity ratio. Finally, since high risk taking CEOs are considered active, they might have more ways to obtain excess pay than their low risk taking counterparts. These interpretations are based on possibilities discussed in extant literature, however, a separate analysis can be conducted to precisely know why excess compensation problem is more serious in high risk taking CEOs.

Table 10
Mean comparison test between severity of excess compensation among high risk taking and low risk taking CEOs

Mean comparison T-tests are reported for all sample periods. High risk taking CEOs are defined as CEOs with Risk1/Risk2 above mean volatility and respectively low risk taking CEOs are below mean volatility. Severity of excess pay is the ratio of CEO excess pay to net income for that sample year. Null hypothesis for analysis is "Mean severity of excess pay is same for high risk taking and low risk taking CEOs". Final decision is based on 95% confidence interval reported.

	Sample-A	Sample-B	Sample-C
	Mean Severity of Excess Pay		
High Risk	0.87%	0.81%	-0.093%
Low Risk	0.28%	0.29%	0.28%
95% Confidence Interval	(0.17% to 0.77%)	(0.22% to 0.65%)	(-0.012% to 0.36%)
H_0 ($\mu_{HighRisk} = \mu_{LowRisk}$)	**Rejected**	**Rejected**	**Rejected**

Results from Table 10 also support my argument that high risk taking CEOs have their wealth at risk. For example, I find that the severity of excess pay remains consistent at 0.28% during all of

the sample periods, explaining that CEOs in low risk state are insulated from external risks and hence are able to maintain the desired level of excess pay in any economic state. However, for high risk taking CEOs this ratio drops from 0.8% to -0.093% during the crisis period, which confirms that CEOs in high risk state are exposed to high risk and lose fortunes during the recent financial crisis. It can be concluded that CEOs are better off when taking low risks. Being in low risk state, they have low risk load which creates relatively a lesser desire to gain excess pay, CEOs gaining less excess pay are not blamed for being costly on shareholders. On the other hand, they are capable of generating more net income for the firm because they might be taking value creating investment decisions. Finally, my results suggest that CEOs in low risk states always have a paycheck larger than those in high risk state.

I further conduct an analysis similar to Table 9 for the severity hypothesis. For further insight I also compute fixed and variable excess compensation. Fixed excess or variables excess compensation is estimated in a way similar to total excess compensation. For instance, I regress CEO's salary on economic determinants of pay to estimate expected fix pay and regress CEO's variable pay on economic determinants for expected variable compensation. Variable or fixed excess pay is the residual from both regressions. Moreover, I compute the ratios of variable excess pay to net income and of fixed excess pay to net income for each sample year. Earnings based measure, Risk1, is intentionally omitted from t-test and from this analysis because EBITDA and 1 divided by net income are essentially negatively correlated and hence create bias in the analysis. Obtaining these three ratios of severity, I perform correlation analysis which is displayed in Table 11. Correlations reported in the first column for all sample periods are almost always positive and significant for the severity of variable excess pay, which suggests that CEOs in a low risk state are capable of achieving desired excess compensation mainly from variable sources. However, the estimates in the first row for all samples have mixed signs and are mostly

insignificant. This suggests that CEOs in high risk state fail to achieve desired excess pay because the risk load they face is too high to be compensated concurrently.

Table 11 Pearson Correlations of Risk Taking and CEO Excess Compensation

Pearson correlations of Risk taking and severity of CEO excess compensations are reported. Risk 2 is standard deviation of daily stock returns. Severity of excess compensation is the ratio of CEO excess compensation to net income. Severity of fixed excess compensation is the ratio of CEO fixed excess pay to net income and severity of variable excess compensation is the ratio of variable excess pay to net income for each sample year. All measures of excess compensation are residual of expected compensation. Expected compensations are estimated by regressing total, fixed and variable compensation on economic determinants of CEO pay. High risk taking CEOs are defined as CEOs with Risk2 above mean volatility and respectively low risk taking CEOs are below mean volatility. Correlations with high risk taking are reported in upper diagonal and correlations with low risk taking are reported in lower diagonal of each matrix. Relations are statistically significant *,** and *** which is at 0.1, 0.05 and 0.01 level respectively under two-tailed test.

Correlations of Risk Taking and Severity of CEO Excess Compensation (Sample-A 1996-2002)

	Risk2 (Low)	Severity of Excess Compensation	Severity of Fixed Excess Compensation	Severity of Variable Excess Compensation
Risk2 (High)		0.0066	-0.0039	0.0265
Severity of Excess Compensation	0.0450***	1	0.3311***	0.8847***
Severity of Fixed Excess Compensation	0.0068	0.4138***	1	0.2642***
Severity of Variable Excess Compensation	0.0652***	0.9073***	0.3373***	1

Correlations of Risk Taking and Severity of CEO Excess Compensation (Sample-B 2002-2006)

	Risk2 (Low)	Severity of Excess Compensation	Severity of Fixed Excess Compensation	Severity of Variable Excess Compensation
Risk2 (High)		-0.0819***	-0.0676	-0.0897***
Severity of Excess Compensation	0.0263	1	0.3165***	0.9754***
Severity of Fixed Excess Compensation	0.0015	0.4836***	1	0.2102***
Severity of Variable Excess Compensation	0.0442***	0.9598***	0.3772***	1

Correlations of Risk Taking and Severity of CEO Excess Compensation (Sample-C 2007-2011)

	Risk2 (Low)	Severity of Excess Compensation	Severity of Fixed Excess Compensation	Severity of Variable Excess Compensation
Risk2 (High)		0.0311	0.0659***	0.0004
Severity of Excess Compensation	-0.005	1	0.5266***	0.9304***
Severity of Fixed Excess Compensation	0.0182	0.4558***	1	0.4360***
Severity of Variable Excess Compensation	0.0099***	0.9753***	0.3744***	1

These findings are also in line with the classical risk aversion hypothesis and provide a rather precise example of CEO risk aversion. When CEOs take undue risks, then they find that their wealth is at risk. When they fail to create value for shareholders, they also fail to obtain excess

pay that they want from taking riskiness in their wealth and ultimately receive total salary less than those who take low risks. While I close my analysis here to conclude the scope of this paper, I leave opportunities to future studies in which CEOs are gaining excess compensation. Specifically, I find that CEOs are capable of manipulating their variable portion of pay to obtain excess compensation, and the extant literature frequently suggests that stocks and options are those components from variable pay which are mostly manipulated by CEOs. However, we are not confident whether that manipulation generally results in the higher level of total pay or of undue excess pay.

6. Conclusion

The purpose of this paper is to examine CEO risk taking as a determinant of CEO excess pay in the presence of many control variables. I provide strong empirical evidence that incentives in pay package encourage risk taking, and CEOs taking risky investment decisions tend to gain excess pay. The primary measure I use for CEO incentives is incentive risk, and that for risk taking is standard deviation of daily stock returns. Consistent with the prior literature I use the residual of expected compensation as excess pay. I also examine the role of the sensitivity of CEO wealth to stock volatility (vega) and find that the impact of vega is consistent with the impact of incentive risk on CEO risk taking and excess compensation.

Controlling for CEO delta, and utilizing three stage least squares as the econometric methodology to control for endogeniety between delta and vega, and for endogeniety between CEO incentives and risk taking, I find that incentive risk and vega encourage CEOs to take risky investment decisions, which are then translated into high volatility in earnings and stock returns. The CEOs taking risky investment decisions find their wealth tied to stocks and options, and their career at risk. Moreover, they receive no short-term benefits from the employer to be compensated for this riskiness. Hence, such CEOs pay themselves by extracting rents. The

primary source of these rents is the variable component of their pay. I find that a higher use of incentive pay has also resulted in increased CEO excess compensation during the last two decades. In addition, I find that the incentivizing mechanism of stock and options was temporarily deactivated during the crisis period, and the CEOs with low risk load gained high excess pay during the crisis period. In contrast, high risk taking CEOs faced losses in their compensation.

From the compensation structure analysis I find that high risk taking CEOs have a higher proportion of fixed pay and lower proportion of incentive pay in their compensation package compared to their low risk taking counterparts. I find further evidence that even low risk taking CEOs have a higher proportion of fixed pay during the crisis period, which is consistent with the extant literature. Finally, in my severity analysis I find that the excess compensation problem prevails among both groups of CEOs. However, it is economically more serious in high risk taking CEOs. Due to their excessive risk taking these CEOs fail to create high value for their firms and due to high risk loads they gain proportionally higher excess pay in comparison to their low risk taking counterparts. Despite the fact that high risk taking CEOs are costlier for shareholders, their total paycheck is significantly lower than that of low risk taking CEOs.

These findings suggest a number of implications for the practitioners. The main finding of this research requires board of directors, particularly compensation committees, compensation consultants and anyone else involved in designing CEO compensation plans to consider the CEO risk load as a determining factor of CEO compensation. That is, CEOs should be compensated according to their risk load. I develop no specific formula to precisely determine how much more pay should be provided to high risk taking CEOs. However, it is clear that the absence of this consideration would lead CEOs to gain excess pay and to adopt counterproductive behaviors which are costly to shareholders. My second recommendation is to reduce the excessive use of

incentive pay because the higher use of incentive pay increases CEO's incentive risk and risk load, and opens further avenues for them to gain excess pay. I find that high risk taking CEOs are less productive, gain high excess compensation, and hence are costly for shareholders.

In the end, I leave opportunities open for future research to develop a gauge for CEO risk load, which can help compensation committees decide the level of CEO pay according to their risk load. I also leave the door open in identifying the component of CEO's variable pay which is most critical in their ability to obtain excess pay. This identification will enable us to control excess pay by reducing that particular component and to take an appropriate balance in executive compensation.

Appendix 1: Description of Variables

Variables	Description/Formula with database (*symbol*)	Proxy for	Data Source	Reference
Fixpay	Executive's basic salary *(salary)*	Reservation wage	ExecuComp	Core et al. 1999
Varpay	Bonus+Stock_awards+Option_awards+Non_equity_incentives+Pension_change+other_Compensation *(tdc1-salary)*	CEO incentives	ExecuComp	Core et al. 1999
Totpay	Total executive's compensation is the sum of fixpay and varpay *(tdc1)*.	Total pay	ExecuComp	Core et al. 2008
Fix to Totpay	Ratio of CEO's fix pay to total pay. Fix pay is defined above.	Compensation Structure		
Var to Totpay	Ratio of CEO's variable pay to total pay. Variable pay is defined above.	Compensation Structure		
Expcomp	Expected compensation obtained by regressing Log (Totpay) on economic determinants such as firm size, tenure, stock and accounting returns and firm controls.	Expected Pay	ExecuComp	Core et al. 2008
Xcomp	Excess compensation is the positive difference between expected and actual compensation.	Excess Pay	Execucomp	Core et al. 2008
RISK1	Standard deviation of EBITDA/Total Assets *(ebitda/at)*	CEO Risk taking	CRSP/Compustat	John et al,2008.
RISK2	Natural log of variance of daily stock returns per year per firm $Ln(prccd/prccd_{t-1})$	CEO Risk taking		Coles et al. 2006
IncntvRisk	Incentive Risk is the ratio of CEO's incentive pay to CEO's total pay. CEO incentive pay is the sum of stock options and restricted stock grants. In Execucomp Total compensation is *tdc1=salary+bonus+rstkgrnt+option_awards_blk_value+ltip+othann+allothtot* Data on tdc1 is available for all observations however separate values of restricted stock grants *(rstkgrnt)* and Black scholes value of stock option awards *(option_awards_blk_value)* are missing after 2006. To handle missing values I define incentive pay as *Ipay=tdc1-salary-bonus-ltip-othann-allothtot* and *IncntvRisk=ipay/tdc1*	CEO incentives	Execucomp	Coyon et al. 2011
Vega	Sensitivity of CEO's wealth to variance of stock returns (Calculated in Appendix 2)	CEO incentives	ExecuComp + CRSP/Compustat	Guay. 1999
Delta	Sensitivity of CEO's stock/option portfolio to a 1% increase in stock price. (Calculated in Appendix 2)	CEO incentives	CRSP/Compustat	Guay. 1999
E-index	Eindex: Entrenchment index indicating values 0 to 6 based on 6 provisions including staggered board, limits to amend bylaws, limits to amend charter, supermajority, golden parachutes and poison pill.	Governance	Riskmetrics Governance	Bebchuk et al. 2008
Board Size	Number of members in board. Strong boards (small and less restrictive) positively affect risk taking and negatively effects excess pay.	Governance	Riskmetrics Governance	Core et al. 1999and Shams Pathan. 2009

Board Independence	Percentage of independent directors on board. Measured as a ratio of independent directors to total directors. Risk metrics director database provides indication for independence in *(classification)* variable.	Governance	Riskmetrics Governance	Core et al. 1999 and Shams Pathan. 2009
CEO Power	CEO power is an indicator variable equal to 1 if CEO is chair and a past employee and 0 otherwise. Risk metrics director database provides indication for CEO in *employement_ceo* and past employee in *classification* variable.	CEO power	Riskmetrics Governance	Shams Pathan. 2009; Walker et al. 2002
$Log(tenure)_t$	Log of CEO tenure in years at the end of year *t*. CEO tenure is calculated using *(becameceo)* date available in the database.	CEO power	Execucomp	Core et al. 2008
CEO age	CEO age is the number of years since CEO's birth *(page)*	CEO risk aversion and entrenchment	ExecuComp	
$Log(sales)_{t-1}$	Log of firms sales for year t-1. $Ln(sale_{t-1})$	Firm size	CRSP/Compustat	Core et al. 2008
$S\&P500_t$	Indicator variable is one if the firm is in S&P500 at the end of year t and zero otherwise. *(spcode)*	Firm size	Execucomp	Core et al. 2008
ROA_t	Return on assets = $(ni \div at)$	Acct performance	CRSP/Compustat	Core et al. 2008
ROA_{t-1}	Lagged return on assets =$(ni_{t-1} \div at_{t-1})$	Acct performance	CRSP/Compustat	Core et al. 2008
RET_t	Continuously compounded rate of returns. Ln($prcc\_c/prcc\_c_{t-1}$)	Firm performance	CRSP/Compustat	Core et al. 2008
RET_{t-1}	Continuously compounded rate of return from previous period ln($prcc\_c_{t-1}/prcc\_c_{t-2}$)	Firm performance	CRSP/Compustat	Core et al. 2008
$BK2MKT_{t-1}$	Book to market ratio. bkmkt1= $(at_{t-1}/(lt_{t-1}+csho_{t-1}\times prcc\_c_{t-1}))$	Firm Investment opportunities	CRSP/Compustat	Core et al. 2008
Cash Compensation	Cash compensation = $\underline{ln}(salary + bonus)$	CEO's ability to diversify.	ExecuComp	Coles et al. 2006
CEO Liquidity	CEO liquidity is the proportion of CEO's cash compensation to non- cash compensation. Calculated as *((salary+bonus)/tdc1)*	CEO's liquidity	ExecuComp	Core and Anderson. 2012
Liquidity Constraint	An indicator variable set to one if the firm generates negative cash flow from operations *(oancf<0)* and zero otherwise	Firm's Liquidity Constraint		Core and Anderson. 2012
Surplus cash	The ratio of net cash flow from operations (*oancf*) less depreciation (*dpc*) plus R&D expense (*xrd*) to total assets (*at*). If depreciation expense is missing (*dpc*), and if PPE is less than 1% of total assets, I set depreciation expense to zero.	Firm's Liquidity	CRSP/Compustat	Cole et al. 2006
New economy firm indicator	An indicator variable equal to 1 if firm is competing in the computer, software, internet, telecommunication or networking fields and 0 otherwise. SIC Codes identifying these firms are 3570, 3571, 3572, 3576, 3577, 3661, 3674, 4812, 4813, 5045, 5961, 7370, 7371, 7372, and 7373.	Technology Firm	CRSP/Compustat	Ittner et al. 2003

Appendix 2: Vega and Delta Calculations

This appendix explains how vega and delta used in this paper are calculated. I follow the methodology used by Guay (1999), Core and Guay (2002), Coles et al. (2006) and Core and Anderson (2012).

My estimates of stock option value, sensitivity to stock price, and stock return volatility are calculated based on Black-Scholes (1973) modified to account for dividend payouts by Merton (1973).

$$Option\ value = [Se^{-dT}N(Z) - Xe^{-rT}N(Z - \sigma T^{(\frac{1}{2})})]$$

Where

$$Z = \frac{\left[\ln\left(\frac{S}{X}\right) + T\left(r - d + \frac{\sigma^2}{2}\right)\right]}{\sigma \times \sqrt{T}}$$

S = Price of underlying stock at the end of financial year *(prcc_f)*

X = Exercise price of option *(optprcey)*. The exercise price of options is missing from the database for almost 2% observations. For the missing values exercise price is set equal to the simple average of stock prices at the beginning and the end of the year in which the option was granted

d = Natural log of dividend yield *[ln{1+(dvpsx_f/prcc_f)}]*. Where *dvpsx_f* is the dividend paid during the year and *prcc_f* is the year end stock price.

T = Time to maturity of option in years. In general, unexercisable options have a maturity of 9 years and exerciseable options have a maturity of 6 years. Thus, I calculate estimated time to maturity of options using the formula below:

$$T = \left(\frac{Nex}{Nex + Nux} \times 6\right) + \left(\frac{Nux}{Nux + Nex} \times 9\right)$$

where

Nex is number of exerciseable unexercised options *(opt_unex_exer_num)*

Nux is number of unexerciseable unexercised options *(opt_unex_unexer_num)*

r = ln(risk free interest rate), where the risk-free interest rate is the yield as of December 31 of grant year on a U.S. Treasury with 7 year maturity. I have selected 7 years maturity because the mean time to maturity of the data is 7.5 years on the basis of assumptions stated above.

σ = Annualized standard deviation of daily logarithmic stock returns.

N( ) = Cumulative probability function for the normal distribution

N'( ) = Normal density function

Delta is defined as the sensitivity of CEO's option value with respect to 1% change in stock price. In other words, delta is the change in dollar value of the executive's stock options for a one percentage point change in stock price.

$$\text{Delta} = N_M * e^{-dT} * N(Z) * P \times 0.01$$

Vega is defined as the sensitivity of CEO's option value with respect to 1% change in stock volatility.

$$Vega = N_M \times e^{-dT} N'(Z) \times ST^{(\frac{1}{2})} \times 0.01$$

N_M = the number of options in CEO portfolio. I multiply vega and delta by N_M to determine the change in dollar value of CEO wealth for a 1% change in stock price, or volatility. N_M is the sum of number of CEO's unexercised exercisable and unexerciseable options.

N_M = *(opt_unex_exer_num+ opt_unex_unexer_num).*

Appendix 3: Estimates of Excess Compensation

I report my model and steps in estimating excess compensation. I first regress the natural log of CEO's total compensation on the economic determinants of pay. The model and results of OLS regressions are reported below.

In the second step I generate log of expected compensation, which I display below for Sample A.

$$Log\ (Expected\ Compensation) = 5.52 + 0.47 \times Ln(Tenure)_t + 0.31 \times Ln(Sales)_{t-1} - 0.32 \times S\&P - 1.2 \times Bkmkt$$
$$+0.19 \times RET_t + 0.07 \times RET_{t-1} - 0.44 \times ROA_t - 0.18 \times ROA_{t-1}$$

Regressions of Total pay on economic determinants

This table presents results of OLS regressions for the logarithm of CEO total compensation and the economic determinants of compensation for all samples A, B and C. Total compensation is the sum of salary, bonus, long-term incentive plan, the value of stock grants, the value of options granted during the year, and any other annual pay for the CEO in year *t*. Log(Tenure)$_t$ is the logarithm of CEO's tenure in years at the end of year *t*. Log(Sales)$_{t-1}$ is the logarithm of firm sales for year *t-1*. S&P500$_t$ is one if the firm is in the S&P500 at the end of year *t*, and zero otherwise. Book to Market$_{t-1}$ is the (book value of assets)/(book value of liabilities + market value of equity) at the end of year *t-1*. RET$_t$ is the firm's return for year t. RET$_{t-1}$ is the firm's return for year *t-1*. ROA$_t$ is the income before extraordinary items divided by average total assets for year *t*. ROA$_{t-1}$ is income before extraordinary items divided by average total assets for year *t-1*. Fixed effects for SIC codes are included. *t*-statistics using robust standard errors are presented in parentheses below coefficients. *, **, and *** indicate two-tailed statistical significance ate 0.1, 0.05 and 0.01 levels respectively.

Dependent Variable	**Ln(Totpay)**		
Independent Variables	**Sample-A (1996-2002)**	**Sample-B (2002-2006)**	**Sample-C (2006-2011)**
Log(tenure)$_t$	0.47***	0.19***	0.05***
	(20.7)	(9.1)	(2.6)
Log(sales)$_{t-1}$	0.31***	0.36***	0.37***
	(30.4)	(34.5)	(40.2)
S&P500 $_t$	-0.32***	-0.26***	0.01
	(-10.3)	(-7.7)	(0.2)
Book to Market $_{t-1}$	-1.2***	-1.04***	-0.49***
	(-21.8)	(-16.1)	(-8.5)
RET $_t$	0.19***	0.25***	0.03
	(6.3)	(6.6)	(0.9)
RET $_{t-1}$	0.07**	0.06*	0.2***
	(2.1)	(1.7)	(7.4)
ROA $_t$	-0.44***	-0.46***	0.1
	(-3.8)	(-2.9)	(0.7)
ROA $_{t-1}$	-0.18*	0.01	-0.39***
	(-1.6)	(0.1)	(-2.8)
SIC	YES	YES	YES

In the next step I calculate expected compensation by exponentiating natural log of expected compensation from step 2.

$$Expected\ Compensation = e^{Ln(Expected\ Compensation)}$$

Finally, excess compensation is the difference between CEO's actual pay and expected compensation.

$$Excess\ Compensation = Total\ Compensation - Expected\ Compensation$$

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