CEO Risk Aversion, Firm Risk and Performance: Evidence from Deferred Compensation Returns around the 2008 Financial Crisis

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Abstract

Using a unique dataset from executive deferred compensation and the 2008 financial crisis, an exogenous event, we develop a novel approach to determine a CEO's risk-aversion, and examine whether CEO risk preferences influence firm risk and performance. We find robust evidence that there is a negative association between CEO risk-aversion and firm risk. We obtain similar results when deferred compensation return volatility is used as an alternative proxy of CEO risk-aversion. We also find that firms with CEO deferred compensation plans have lower firm risk. Our results contribute to the inside debt literature by showing that inside debt compensation is related to lower firm risk and firm market value.

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1. Introduction

How does CEO risk-aversion affect firm risk and performance? To this date, the answers to this important question are divergent. While traditional financial theory suggests that firms should simply pursue positive net present value projects to maximize shareholder wealth, some argue that heterogeneous objective functions are being maximized (e.g., Allen, 2005). More recent studies, stress the importance of managerial heterogeneity.[1] In this paper we address this question using a unique dataset from executive deferred compensation and the 2008 financial crisis, an exogenous event, that allow us to develop a novel approach of inferring CEOs' risk preferences. As far as we are aware, no other study attempts to measure CEO risk-attitudes directly through CEOs' personal deferred compensation investments to distinguish risk-averse from risk-seeking CEOs and examine how firm-risk and performance are affected by CEO risk preferences.

CEOs have different managerial styles and risk preferences. The prevailing perception in academic research is that CEOs' personal risk preferences tend to affect firm risk and performance by carrying out different firm policies. While CEOs risk preferences are not directly observable, the existing literature has considered two possible indirect measures of managerial risk preference: CEO compensation schemes and CEO personal characteristics. Smith and Stulz (1985) suggest that management's risk aversion can be affected by the design of compensation contracts. To proxy managerial risk aversion, the first research stream uses either the pay-for-performance

[1] For example, Bertrand and Schoar (2003) document managerial fixed effects, Malmendier and Tate (2005, 2008) find that managerial overconfidence proxies relating to firm behavior and Kaplan, Klebanov, and Sorensen (2012) report that Chief Executive Officer (CEO) characteristics in private equity firms being related to outcome success.

sensitivity (Garen (1994), Aggarwal and Samwick (1999), Coles, Daniel and Naveen (2006)) or the variance of compensation (Frank Moers and Erik Peek (2000)). Another stream uses managerial stock options (DeFusco et al. (1990); Tufano (1996); Guay (1997); Core and Guay (2000)) to gauge managerial risk aversion. Another strand of the literature has used CEOs portfolio characteristics (Carpenter (2000); Cohen, Hall and Viceira (2000); Rogers (2001); Abdel-khalik (2006); Brisley (2004)). In a recent study Cassell, Huang, Sanchez and Stuart (2012) use inside debt, a new component of CEO compensation structure (besides salary, bonus and options, so on), to proxy CEO risk seeking behavior. This stream is in a similar line to the literature concerning managerial stock options.

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

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

To avoid the risk-neutral assumption, endogeneity and irrelevance problems in previous literature, we focus on exogenous variables that allow us to quantify CEOs' current risk-aversion more accurately. The investment of CEOs' inside debt deferrals and the meltdown of financial markets in 2008, provide a unique opportunity that enables us to develop a novel approach to infer CEO risk-aversion and study its impact on firm risk and performance exogenously. Our empirical design, relies on an event that had its roots in housing mortgages instead of corporate finance (credit or equity markets), or on business or economic fundamentals (demand-side factors). And while the financial crisis ultimately spread to the corporate sphere, the original shock can be considered exogenous to the system (e.g., Campello, Graham, and Harvey (2010) and Campello, Giambona, Graham, and Harvey (2010)). We obtain similar results when we make use of an alternative CEO risk-aversion proxy deduced from CEOs' deferred compensation return volatility.

In firms that provide deferred compensation plans (DCPs thereafter) to their named executives, CEOs are allowed to select the investment options for their deferred compensation account. The investment options usually include various bonds, bond mutual funds and stock mutual funds. The portfolio allocation between bond mutual fund (riskless investment) and stock mutual fund (risky investment) should reflect CEO risk preferences (Schooley and Worden (1996)). But the 2006 new SEC disclosure rules do not require firms to report the portfolio allocation of CEOs' deferred compensation investment. Without further disclosure, there is no way to know CEOs' investment choices. However, while we do not know the exact DCP portfolio allocation into risky and riskless securities, the 2008 financial crisis allows us

to infer a CEO's risk preferences from his DCP investment performance. During the financial crisis in 2008, the financial markets melted down and nearly all stocks and stock related mutual funds realized negative returns. If a CEO had invested most of his compensation deferrals in risky securities, say stock mutual funds, we should observe a negative return on his/her deferred compensation account (DCP return hereafter) in 2008. In contrast, a risk-averse CEO who invested his/her deferrals mainly in riskless securities would enjoy a relatively higher or positive DCP return in 2008. Therefore, we use the low (high) return realizations of deferred compensation plans in 2008 as a measure of CEO relative risk aversion.

The 2008 natural experiment design, described above, allows us to generalize our unique approach of estimating CEO risk-aversion by introducing the volatility of CEO DCP return as an alternative CEO risk-aversion measure beyond the 2008 period. Specifically, even though we do not observe CEOs' investment choices on their deferred compensation account, we do observe their DCP investment returns. Hence, we conjecture that CEOs who allocate their DCP wealth into risky assets will have higher DCP return volatility than those investing in riskless (or less risky) assets. In another words, a risk-taking CEO would invest most of her compensation deferrals in risky securities, say stock mutual funds, we should observe a more volatile return to her deferred compensation account. In contrast, a risk-averse CEO who invested her deferrals mainly in riskless securities would have lower DCP return volatility. Therefore, the DCP return volatility, as a new proxy of CEO risk-aversion, allows us to confirm and generalize the results of our study. Interestingly, since DCP usually cannot be invested in own stock, DCP return is exogenous from own stock

performance and can be used to reflect CEO's investment talent on general financial assets. Consequently, we also use average DCP return to proxy CEO investment talent and study how it affects firm risk and performance.

Using this novel natural experiment dataset and new proxies of CEO risk-aversion, we provide new evidence on the relationship between CEO risk preferences and firm risk (i.e., stock return volatility, earnings and operating cash flows volatility). The results demonstrate that a negative association exists between CEO risk aversion and the volatility of stock price and earnings. Our results show that firms with CEOs who realized positive returns on their DCPs in year 2008 have relatively lower stock price and earnings volatility than firms run by CEOs who realized negative DCP returns. Furthermore, our evidence shows that CEO risk-taking behavior, gauged by CEOs' DCP return volatility, is positively associated with both high stock return and earnings (ROA) volatility. Interestingly, we also find that firms with CEOs earning high average returns on their DCP investments (i.e., CEOs with higher talent in personal DCP investing) experience lower stock price and earnings volatility. In addition, we also find that firms providing DCP plans to CEOs have lower stock price and earnings volatility. The result on providing DCP plan is consistent with Sundaram and Yermack(2006) in that they find firms with higher CEOs' inside debt have lower default risk. Furthermore, we find that stock-return volatility is significantly related to firm size, Tobin's Q, and institutional holdings. Nevertheless, firm size, industry segments, R&D investment, CEO pay-for-performance have significant power to explain firm risk in terms of ROA volatility.

We continue to find that firms with risk-averse CEOs perform better than other

firms in terms of stock return performance. Further, we show that this positive correlation is mainly driven by the year 2008. For the other years this correlation is either not significant or negative. This suggests that risk-averse CEOs are more likely to lead firms to perform better than others in a bad market year. However, in a good market year, it is more likely that risk-taking CEOs will outperform risk-averse CEOs.

We do not find evidence that firms with DCPs perform better than those without DCPs. Instead, we find that firms with DCPs have lower Tobin's Q than other firms. This result is consistent with the evidence of Wei and Yermack (2010) who use the announcement effect of DCP disclosure to study the market's response and find an overall reduction of enterprise value when a CEO's deferred compensation holdings are large.

Our study makes four main contributions. First, it is the first empirical study that uses the 2008 financial crisis as a natural experiment to measure CEO risk-aversion and examine the relation between CEO risk preferences and firm risk. Unlike previous studies, our approach in estimating CEO risk-aversion is free of limitations arising from the risk-neutrality assumption, endogeneity and irrelevance problems. Second, this paper is also the first empirical study that documents the returns of CEO deferred compensation investments after SEC's 2006 new disclosure rule. Third, it contributes to the managerial risk-taking literature by revealing a negative association between CEO risk-aversion and firm risk. Finally, it contributes to the executive compensation literature by providing evidence that firms with inside debt compensation plans have lower firm risk and firm market value.

The remaining sections of this paper are organized as follows. Section 2 briefly reviews the related literature. Section 3 describes the data and variables. Section 4 presents the results. Section 5 presents the conclusions.

2. Related Literature

Since CEO risk preferences are not an observable, the existing literature has considered two possible proxies: one stream uses the CEO compensation scheme (portfolio holdings) and the second stream relies on CEO personal characteristics (such as age, personal income, wealth, education and gender).

The first stream argues that managers with relatively low risk-aversion tend to accept larger proportions of their compensation contingent on performance (i.e., stocks and options) than in an assured pay (i.e., salary). Smith and Stulz (1985) suggest that managerial risk aversion can be affected by the design of compensation contracts. They argue that given that the utility function of a manager is concave in expected wealth or firm value, the manager could be exhibit less risk-averse, risk-neutral, or risk-taking behavior through the different extent of convexity in his compensation contract.

Pay-for-performance sensitivity is one of the major measures used in the previous literature to address the relation between risk and convexity in the compensation contract. Increasing pay-for-performance compensation induces managers to reduce the overall risk of the firm so as to reduce their own risk exposure. Garen (1994) examines the relation between CEO pay-for-performance sensitivity and different risk

measures and finds negative relations between proxies for risk and pay-for-performance sensitivity. However, the statistical significance of this relation in his study is quite weak. Aggarwal and Samwick (1999) test the relation between the variation of stock return volatility and pay-for-performance sensitivity and show that pay-for-performance sensitivity declines in the level of stock return variance. Coles, Daniel and Naveen (2006) consider the impact of higher pay-for-performance sensitivity on future firm volatility for a large sample and find that higher pay-for-performance sensitivity is associated with increases in firm volatility. The results from these studies suggest that equity-based compensation may not effectively reflect managerial risk aversion.

Similar to the pay-for-performance sensitivity measure, and building on the linear principal-agent model of Holmstrom and Milgrom (1987), Moers and Peek (2000) use two proxies for managerial risk, (i) the variance of compensation and (ii) mean compensation divided by variance of compensation, to empirically examine the effect of these two risk-aversion proxies on firm performance and find evidence in support of the principal-agent model. However, in Moers and Peek (2000), the assumption of using variance of compensation as the proxy for CEO risk-aversion is that there is a linear incentive contract based on performance when the principal designs the compensation structure. By this assumption, CEO's risk preference is actually determined by the linear incentive weight that is designed by the principal. In other words, CEO risk-aversion is an endogenous variable. This is obviously incorrect.

Another stream of the literature argues that executive stock options create incentives for executives to manage firms in ways that maximize firm market value

(DeFusco et al. (1990)). Since options increase in value with the volatility of the underlying stock, executive stock options provide managers with incentives to take actions that increase firm risk. Therefore researchers in this stream simply use the value (or portion) of stock options or the characteristics of the stock option compensation as measures of managerial risk aversion.

Tufano (1996) finds that the value of executive stock holdings and the number of stock options held by managers significantly affect the hedging of gold mining firms. Guay (1999) finds that firms appear to grant options more frequently in companies with growth opportunities to increase risk-taking. Core and Guay (2002) propose a methodology for measuring the CEO risk-taking incentive effects arising from executive stock and option holdings. This methodology is widely used by recent empirical research to estimate CEO risk-taking preferences. Rogers (2002) uses observed characteristics of CEO portfolios of stock and option holdings, to measure CEO risk preferences/aversion, in order to study how CEO portfolio structure affects corporate derivatives usage. Abdel-khalik (2006) uses the extent to which compensation choice is made up of stock-based awards (such as stock options) as a measure of CEO risk aversion. His study shows a negative relationship between CEO risk aversion and the volatility of earnings and operating cash flows, supporting the argument that highly risk-averse CEOs act to reduce volatility. Brisley (2006) shows that vesting conditions of traditional executive stock option plans (ESOs) significantly affect managers to select profitable risky projects.

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

increases in firm risk. This evidence suggests that option grants lead to greater stock price volatility rather than the reverse. Carpenter (2000) presents simulations demonstrating that as firm size increases, option compensation induces managers to actually moderate asset risk. This actually questions the effect of option compensation on managerial risk-taking.

A more recent study by Cassell et al (2012) uses CEO inside debt holdings (pension benefits and deferred compensation) to proxy CEO risk seeking behavior and find that CEOs with large inside debt holdings are tend to adopt less risky investment and financial policies. However Cassell, et al (2012) actually raises a puzzling question on the causality between firm's financial leverage and CEO inside debt: which one causes the other? Sundaram and Yermack (2006), Liu and Edmas (2007) argue that it is firms' optimal selection to align CEO inside debt with firm's leverage to alleviate agency problem, which means firm leverage has a positive impact on CEOs inside debt. But Cassell, et al (2012) suggest, that CEOs with high levels of inside debt tend to be conservative and find that CEO inside debt has negative impact on firm leverage. The above evidence suggests that using inside debt holing as the proxy of CEO risk seeking behavior may suffer from the unclear causality relation between CEO inside debt and firm leverage.

Moreover, the methodology of using executive stock and option holdings or inside debt holdings as a measure of risk aversion is based on risk-neutral valuation. To the degree that the risk aversion of CEOs decreases their personal valuation of stock options, using executive stock and option holdings as a measure of risk aversion may yield inaccurate estimates (Lambert et al. (1991)). This might be the reason why

the relation between CEO risk-taking and firm risk is very weak and not widely supported in cross-sectional studies. The endogeneity among managerial incentives, risk, and performance makes the methodology of using executive stock and option holdings as a measure of risk aversion even noisier (Palia (2001); Low (2009)).

The second stream of research argues that the compensation component attributed to the individual's risk aversion is actually a latent variable and the underling drivers are the CEOs' characteristics such as age, gender, tenure, and wealth. Therefore this line of research uses these variables to predict CEO risk-aversion (e.g., Wang and Hanna (1997), Grable (2000), Donkers et al (2001); Bajtelsmit and Bernasek (2001)). Wang and Hanna (1997) examine the effect of age on risk tolerance and find that risk tolerance increases with age when other variables are controlled. Grable (2000) shows that personal risk tolerance is associated with being male, older, married, higher incomes, more education, more financial knowledge, and increased economic expectations. Bajtelsmit and Bernasek (2001) find that wealthier households, people with higher education, single women and African-Americans tend to form riskier portfolios. Donkers et al (2001) also find strong links between risk aversion and gender, education level, and income of the individual.

Although the above literature has merits, critics argue that CEO previous characteristics and employment histories might not be a good measure to predict CEO's talent and risk preference in his current employer firm. Wang (2009) finds no difference in long-run accounting performance for CEOs with different employment histories. Even though, Wang (2009) shows that CEOs with more frequently turn-over have a propensity to bear risk and implement riskier firm policies, he does not test for

endogeneity and causality between CEO turnover and risk taking. Bushman, Dai and Wang (2010) show, however, that the probability of CEO turnover is decreasing in performance risk, which suggests that risk-taking CEOs are more likely to have higher turnover rate.

Since CEO characteristics and compensation structures either show a weak relation with firm risk or suffer from endogeneity problems, it warrants to look for exogenous variables with the power to reflect CEO's current risk-aversion more accurately. The investment of CEO inside debt deferrals and the meltdown of financial market in 2008 provide a unique opportunity which enables us to use this novel natural experiment to study the link between managerial risk-aversion and firm risk.

Following Schooley and Worden (1996) who argue that personal portfolio allocations (measured as risky assets to wealth) are reliable indicators of attitudes toward risk, in this paper, we take advantage of the new disclosure rule of 2006 on CEO deferred compensation and the 2008 financial crisis to proxy CEOs' personal portfolio allocation and their attitudes towards risk. This exogenous proxy differentiates our study from the recent study of Cassell et al (2012), which contributes to the literature by revealing that inside debt, as a new component of CEO compensation structure, could induce less risky investment and policies. While this is an insightful study, it suffers from endogeneity that exists between firm policies and CEO compensation design. Although one could conduct sensitivity tests to determine the sensitivity of empirical results, endogeneity cannot be ruled out as a potential confounding factor. In addition, their evidence it is likely to be plagued with causality issues between CEO inside debt and firm leverage.

Using these new exogenous CEO risk-aversion proxies, we examine whether CEO personal risk preferences can explain both firm risk (i.e., measured by volatility in stock returns, earnings and operating cash flows and performance (i.e., measured by stock returns, ROA, and Tobin's Q).

Next, we present and discuss the testable hypotheses. The objective of this study is address two key research questions. First, whether CEO personal risk preferences can explain firm risk and performance. Specifically, we examine the following two hypotheses:

H1: CEO risk-aversion, assessed by the investment risk of deferred compensation funds, is inversely related to firm risk.

Much of the literature on innovation and general management assume that risk-taking has a positive influence on future performance. Aaker and Jocobson (1987) use business unit data and find that risk had a positive impact on performance. However, Kim and Zumwalt (1979) proposed that securities exhibit statistically significant return differences in up- markets and down-markets. In another words investors require a premium for taking downside risk and pay a premium for upside risk. This indicates that the risk-return relationship in bull and bear markets varies. So our second hypothesis is:

H2: Firms with risk-taking CEOs realize higher stock returns in up-markets, but experience lower returns in down markets.

However, since risk-taking CEOs may destroy debt value when increasing firm risk, the impact of risk-taking behavior on the overall firm value is unclear.

Second, we investigate whether CEO personal investment talent influences firm risk and performance. In a recent study, Bushman, Dai and Wang (2010) investigate how firm risk affects CEO turnover and find that it is increasing in idiosyncratic risk but decreasing in systematic risk. Edmans and Gabaix (2011) present a theoretical model studying CEO talent assignment under risk aversion and moral hazard. They predict that when moral hazard exists, "firms involving greater risk or disutility must pay particularly high premiums to hire talented managers, and so may prefer to appoint a poor-and-hungry CEO…". This suggests that firms with high risk will be inclined to hire CEOs with low talent. Based on this view of the literature, we argue that, high risk firms ask for greater managerial effort and exerting effort is more costly to a talented and thus wealthy manager. Therefore, under given incentive (compensation) structure, to avoid disutility of effort, a risk-averse CEO has incentives to forgo risky projects and keep firm risk at a low level. Consequently, this forms our next hypothesis:

H3: Firms with high CEO talent, measured by personal DCP investment performance (i.e., high average return on DCP investment), experience low risk.

To test whether our proxy for CEO talent is really a robust proxy, we also study how well it can explain firm performance. If our proxy for CEO talent is valid, we expect firms with CEOs possessing superior DCP investment returns to outperform firms with low talent CEOs. This leads to our final hypothesis:

H4: Firms with high CEO talent, measured by personal DCP investment performance (i.e., high average return on DCP investment), realize higher

performance (high stock return, high Tobin's Q and high ROA) than firms with low CEO talent.

In testing the above four hypotheses, we control for other economic determinants of the relationship between CEO risk-aversion and firm performance as in previous research (e.g., Abdel-khalik (2006); Brick, Palmon, and Wald (2008); Cohen, Hall and Viceira (2000)). Specifically, we control for firm size, leverage, business segments, growth opportunities, and Tobin's Q. Finally, we also control for other CEO characteristics (such as tenure, pay-for-performance sensitivity, cash compensation) and board characteristics (such as board size and percentage of independent directors).

3. Data and Variables

The research sample comes from COMPUSTAT Executive Compensation database from year 2006 to 2009. The database covers the S&P 1500 plus companies that were part of the S&P 1500 and are still trading. We exclude firms with CEO turnover during our study period. This results in a sample of 1744 firms and 6723 firm years. The number of observations in the regression may be less when firms without accounting data in COMPUSTAT or stock return data in CRSP are eliminated. About 32% of firms of the sample do not offer CEO deferred compensation plans (DCPs). Among the firms providing DCPs, there are about 26.5% firms whose CEOs realized positive return on their DCP investment in year 2008.

3.1 Measures of Firm Performance and Volatility

In our analysis we employ the following firm performance and firm risk measures.

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

Firm risk: ***VAR_ROA*** measures the volatility of accounting performance; ***VAR_RET*** measures the volatility of market performance and ***ASSET_VOL*** gauges the volatility of firm asset value. The volatility of firm's asset market value is estimated by Moody's KMV model (See Sundaram and Yermack (2006)). The KMV model gets firm's asset market values by using an options approach as proposed in Merton (1974). According to KMV model, we assume that the firm's capital structure is composed of equity, short-term debt which is considered equivalent to cash, long-term debt which is assumed to be a perpetuity, and convertible preferred shares. It is simple to get equity market value. But the estimation of debt market value is not easy since the liabilities of the firm were not market-to-market every day. The KMV model uses the option pricing model to valuate corporate liability market value. Higher volatility of asset market value in the context of the KMV model implies that the market has more uncertainty on the firm's business value.

3.2 Key Variables

CEO_Risk: *I*s a binary variable that proxies CEO risk-aversion. *CEO_Risk* takes the value of one if a CEO is risk-averse and zero if a CEO is risk-taking.

During the financial crisis in 2008, nearly all stocks and stock related mutual funds realized negative returns. If a CEO had invested most of his compensation deferrals in risky securities we should observe a negative return to his/her deferred compensation account in 2008. In contrast, a risk-averse CEO had invested his/her deferrals mainly in riskless securities would realize a relatively positive return in 2008. Therefore, we use the low (high) return realizations of deferred compensation plans in 2008 as a measure of CEO relative risk-aversion. Here it is how we build up *CEO_Risk*: First we estimate the return of DCP, RET_DCP. The RET_DCP is the ratio of the earnings of DCP (DEFER_EARNINGS_TOT) over the deferred compensation balance (DEFER_BALANCE_TOT) in the beginning of the fiscal year. Then we split the sample of firms into two groups based on their CEOs DCP returns in 2008. Specifically, Group 1 consists of firms whose CEOs realized a positive DCP return in 2008 and Group 0 stands for firms whose CEOs realized a negative DCP return in 2008. *CEO_Risk* takes one if a firm belongs to Group 1 and zero if it belongs to Group zero.

Avg_DCP_Ret: Average DCP return. We first estimate the return of DCP, RET_DCP. The RET_DCP is the ratio of the earnings of DCP (DEFER_EARNINGS_TOT) over the deferred compensation balance (DEFER_BALANCE_TOT) in the beginning of the fiscal year. We then take the average of RET_DCP for four years (from year 2006 to 2009) as the average DCP return. This variable is used to proxy CEO personal investment talent.

DCP_Ret_Vol: DCP return volatility is the variance of RET_DCP using four year spin (year 2006 to 2009). This variable is used to proxy CEO risk preference.

***DCP_Dummy*:** It is an indicator of DCP plan. It takes the value of one if a CEO has a deferred compensation account and zero if a CEO does not have a deferred compensation plan.

3.3 Other Explanatory Variables

3.3.1 Firm Characteristics

Firm leverage: Is measured as the ratio of long term debt to the book value of total assets, *LEVERAGE*. ***Firm Size***: Is the natural logarithm of total sales, *LOGSALE*, to control for size effects. ***Growth***: Is the ratio of the research and development expenditures to total sales, *GROWTH*, as a proxy for growth opportunities. ***Assets in Place***: Is measured as the sum of inventory and gross plan and equipment over total assets, *VALPORT*. ***Segments***: The number of industry segments, *SEG_NUM*.

3.3.2 CEO Characteristics

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

3.3.3 Other Control Variables

Following Sundaram and Yermack (2006), we also include control variables to

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

4. Empirical Analysis

4.1 Model Specifications

To address the two main issues of this study, first we estimate the following model which is designed to explain the cross-sectional variation in firm risk in response to *CEO_Risk*, our key measure of CEO risk-aversion:

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

The dependent variable $(Volatility)_{it}$ represents the volatility of performance measures (stock return (*VAR_RET*), return on assets (*VAR_ROA*), and return of asset market value (*ASSET_VOL*), X_{it} represents the vector of other control variables including

institutional holdings, firm segments, CEO tenure, CEO pay-for-performance sensitivity, CEO cash pay. If CEO risk aversion, captured by the investment risk of his deferred compensation funds, *CEO_Risk*, is linked with Volatility in stock returns, *VAR_RET*, return on assets, VAR_ROA, and return of asset market value (*ASSET_VOL*), we expect the CEO_Risk_{it} variable to have significant explanatory power for the cross-sectional variation in $Volatility_{it}$. In accord with our first hypothesis, we expect to see a negative relationship between *CEO_Risk* and *Volatility,* suggesting that risk-averse CEOs tend to pursue corporate policies that reduce volatility. The coefficient of the *DCP_Dummy* is expected to shed light on whether firms that provide deferred compensation plans experience lower firm risk. For this to be the case, we expect the *DCP_Dummy* should enter the regressions with a negative and statistically significant coefficient.

To test our second hypothesis, we include the *CEO_Risk* and *DCP_Dummy* into the following classic (such as Mehran(1995), Core, Holthausen and Larcker(1999),Anderson and Reeb(2003)) performance estimation model:

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

Here, the dependent variable $(\text{Performance})_{it}$ stands for the performance measures (Stock Return, ROA, and Tobin's Q), X_{it} represents the vector of other control variables including institutional holdings, firm business segments, board size, board independency, CEO tenure, CEO pay-for-performance sensitivity and CEO cash pay. This model specification allows us to examine whether the *CEO_Risk* and *DCP_Dummy* have explanatory power for the cross-sectional variation in firm

performance.

In line with the prediction of our second hypothesis, we expect a negative relationship between *CEO_Risk* and the performance measures in bull markets (relatively), but positive in bear market (year 2008). The *DCP_Dummy* is expected to enter the regression with a negative coefficient based on agency problems, arising from conflicts of interest between equity and debt holders, and inside debt arguments: inside debt mechanisms reduce equity value but enhance debt value.

Third, since *CEO_Risk* might reveal smart investing or risk aversion, to distinguish one from the other, we conduct a univariate analysis on CEOs' return on DCP by *CEO_Risk* groups. Using the 2008 return on DCP, we split CEOs into two groups: Group one if the CEO has realized positive returns in 2008, Group zero if the CEO has realized negative returns in 2008. Here firms without DCP plans are excluded. We then compare the other years' return on DCPs of these two groups. If CEOs in Group one, are smarter than CEOs in Group zero, we expect to see that group one consistently has higher return on compensation deferrals for the other years. Otherwise, if Group one is more risk-averse than Group zero, we should observe Group one consistently realizing lower return on deferrals in years when stock market is good. The variable definitions are listed in Table 1 and Table 2 reports their descriptive statistics.

[Tables 1 and 2 here]

To test the influence of CEO talent, on firm risk and performance, our last two hypotheses, we use the models from the first two hypotheses but replace *CEO_Risk*

with *DCP_Ret_Vol* as the new proxy for CEO risk preferences, and include *Avg_DCP_Ret* to measure CEO investment talent. *DCP_Ret_Vol* is the variance of return on DCP investment using four year spin.

CEOs are allowed to select the investment options for their DCP account. The investment options usually include various bonds, bond mutual funds and stock mutual funds. The portfolio allocation between bond mutual fund (riskless investment) and stock mutual fund (risky investment) should reflect CEO risk preferences (Schooley and Worden (1996)). CEOs' actual portfolio allocations are not observable due to limited SEC disclosure requirements. However, the return on their DCP account is observable and, hence, allows us to infer CEO risk preferences. We assume that the return on DCP of a risk-taking CEO who had invested most of his/her compensation deferrals in risky securities, say stock mutual funds, is more volatile than the DCP return of a risk-averse CEO who invested his/her deferrals mainly in riskless securities, such as bonds or bond related funds. Therefore, *DCP_Ret_Vol* can be used to proxy CEO risk preferences. Since DCP usually cannot be invested in own stock, DCP return is exogenous from a firm's own stock performance and can be used to reflect CEO's investment talent on general financial assets. Consequently, we also use average DCP return to proxy CEO investment talent. *Avg_DCP_Ret* is the average of DCP return from 2006 to 2009.

We estimate the following models to explain the cross-sectional variation in firm risk and performance:

$$(Volatility)_{it} = Ln(SALES)_{it} + LEVERAGE_{it} + GROWTH_{it} + TOBINSQ_{it} + DCP\_Ret\_Vol_{it} + Avg\_DCP\_Ret_{it} + DCP\_Dummy_{it} + X_{it}$$

$$(Performance)_{it} = Ln(SALES)_{it} + LEVERAGE_{it} + GROWTH_{it} + DCP\_Ret\_Vol_{it} + Avg\_DCP\_Ret_{it} + DCP\_Dummy_{it} + X_{it}$$

We first re-visit our first and second hypotheses with the new CEO risk preference proxy, *DCP_Ret_Vol* . Based on the prediction of our first hypothesis, we expect to see a positive relationship between *DCP_Ret_Vol* and *Volatility*, which suggests that risk-taking (risk-averse) CEOs tend to increase firm risk. Our second hypothesis, predicts a positive relationship between risk-taking (risk-averse) CEOs, *DCP_Ret_Vol*, and *Performance* in years other than year 2008. For year 2008, we expect to see negative relationship between *DCP_Ret_Vol* and *Performance*. *DCP_dummy* is included to control for sample selection problems since there are firms that do not offer DCP to CEOs so that both *DCP_Ret_VOl* and *Avg_DCP_Ret* will be zero for those CEOs.

In accord with our third hypothesis, the impact of the *Avg_DCP_Ret* on firm *Volatility* is expected to be negative, implying that firms whose CEOs possess high investment talent operate at low levels of risk. Our fourth hypothesis conjectures a positive relation between *Avg_DCP_Ret* and *Performance*.

4.2 Analysis and Results

4.2.1 Univariate Analysis

We first compare the yearly difference of the key variables. Table 3 clearly shows that both market performance and accounting performance reached the valley floor in 2008. The return of DCP in 2008 dropped almost 200% from year 2007's 6.3% to -16.28%. In year 2009, both the stock return and return of DCP recovered to a new

high, which are even better than year 2006 and 2007. However the recovery of operation earnings is relatively slower. The ROA of 2009 is even less than that of year 2008. And the volatility of ROA in 2009 is also larger than 2008. Interestingly, the stock return volatility in 2008 is less than the other years. This may be due to the stock market collapse and that most stocks reached the bottom or traded less. Nevertheless, all three firm risk indicators stay at high levels in 2009. This suggests that the post-crisis market becomes more sensitive and investors' expectations are widely dispersed.

The mean/median comparison by CEO_RISK groups (Risky vs Risk Averse) in Table 4 show that group one (Risk Averse CEOs) shows consistently lower firm risk than group zero for all three performance measures (*VAR_RET*, *VAR_ROA* and *ASSET_VOL*). The mean and median comparisons of performance measures (*RET*, *ROA*, and *TOBINSQ)*, show that there is weak difference between these two groups: Group one shows higher mean and median Tobin's Q and higher mean and median ROA. The difference in stock return is not statistically significant. We also find that group one has less investment, R&D/total assets, and lower institutional holdings, *TOP5_HLD*. The difference in firm leverage is not significantly big, as group one has a little bit lower mean leverage but higher median leverage. The difference in CEO compensation structure between the two groups is significant. The results in Table 4 show that group one has higher cash pay, CEO cash pay, and lower pay-for-performance sensitivity, *CEO PPS*. The above results indicate that CEOs in group one, which is defined as a risk-averse group, are more likely to adopt conservative corporate policies and subject to less risky compensation structures.

[Tables 3 and 4 here]

Next, we turn to firms with different DCP provisions. As discussed earlier, Group one represents firms providing DCPs and Group zero consists of firms without DCPs. Results in Table 5 show that firms with DCPs have lower mean and median Tobin's Q, lower stock return but higher ROA. This finding is consistent with Wei and Yermack (2010) in that, for firms with CEOs having sizable deferred compensation, experience lower equity prices when the deferred compensation information was disclosed. Based on both mean and median comparisons, we observe that firms with DCPs have significantly lower firm risk for all three volatility indicators. These results are consistent with our first hypothesis which predicts an inverse relation between CEO risk-aversion and firm risk and the results of Wei and Yermack (2010) illustrating that firms with CEOs with higher defined pension or deferred compensation have lower volatility in bond prices and stock prices. We also find that firms with DCPs have higher firm leverage, higher tangible assets (or assets in place) and lower R&D expense (or growth opportunity). These results in some degree support the arguments and findings in Sundaram and Yermack (2006). Sundaram and Yermack find that pension values (similar to DCPs in terms of its inside debt function) are higher when firm leverage is higher, and CEOs tend to take conservative investment policies when their personal debt-to-equity ratio is higher than the firm leverage ratio. Their interpretation is that the probability of the firm defaulting on its external debt is reduced when the managers hold large inside debt positions.

In brief, the univariate analysis yields results in support with our two hypotheses. First, the evidence shows that firms with risk-averse CEOs have lower firm risk (stock price and ROA) and performance (Tobins'Q and ROA). Second, it shows that our new

measure of CEO risk-aversion (*DCP_Risk Dummy*) is significantly associated with conservative corporate policies (less investment, and lower institutional holdings) and less risky compensation structures (higher cash pay and lower pay-for-performance sensitivity). This evidence reveals that *DCP_Risk Dummy*, as an alternative risk preference metric, adequately reflects CEO risk-aversion. In addition, our univariate analysis provides supportive evidence to inside debt literature by showing that firms with higher inside debt (with DCPs) have lower firm value, stock return and lower stock price volatility.

[Table 5 here]

4.2.2 Cross-sectional Impact on Firm risk

The cross-sectional regression results on firm risk, reported in Table 6, reveal a negative association between CEO risk aversion and firm risk (Stock return volatility , ROA volatility and asset market value volatility) after controlling for fundamentals and other volatility drivers. This result suggests that firms with CEOs that realized positive DCP returns in year 2008 have relatively lower market and accounting performance volatility. This is consistent with our first hypothesis which postulates that firms with risk-averse CEO exhibit lower performance volatility. It is interesting to note that the stand alone explanatory power of the *CEO_Risk* demonstrates that the DCP dummy, which has been used in previous studies to measure inside debt, captures a lower bound of risk aversion.

For all three volatility measures, we find that *DCP_Dummy* is negatively and significantly correlated to performance volatility after controlling for other volatility

drivers. This means that firms with DCP plans are subject to lower performance volatility than firms without DCP plans. This finding supports the view of the inside debt literature (such as Edmans and Liu(2010) that, since inside debt instrument is sensitive to the incidence of bankruptcy, debt-aligned managers reduce firm risk. This result is also consistent with Sundaram and Yermack (2006) who find that firms with higher CEO inside debt ratio have lower firm risk (measured by Distant-to-Default).

[Table 6 here]

The other control variables indicate that stock-return volatility is significantly related to firm size, Tobin's Q, and institutional holdings. Nevertheless, firm size, segments, R&D investment, CEO pay-for-performance sensitivity have significant power to explain firm risk in term of ROA volatility and asset value volatility. Here firm size (measured by log(sales)) shows positive association with market based volatility (stock return volatility) but negative association with accounting based volatility(ROA volatility). These results suggest that larger firms are more likely to have higher income volatility but lower stock return volatility. This is consistent with prior studies. Abdel-khalik(2006) find positive correlation between firm size and earnings volatility. Meanwhile, Coles, Daniel and Naveen (2006) find that log(sales) has negative impact on firms daily stock return volatility.

In sum, the cross-sectional regression results on performance volatility are in line with our first hypothesis and reveal a negative association between CEO risk-aversion and firm performance volatility. We then proceed to check how this CEO risk-aversion is related with firm performance.

4.2.3 Cross-sectional Impact on Performance

Table 7 reports the cross-sectional regression results on performance. The *CEO_Risk* enters the stock return regression with a coefficient of 0.0217 (t-value 2.79). This significant relation suggests that firms with risk-averse CEOs realize higher stock return performance than other firms. The coefficients of the *CEO_Risk* for the other two regressions are 0.0136 and 0.0978, respectively, but statistically insignificant. Suspecting the results are largely affected by averaging, we then run the return regression for 2007, 2008 and 2009 separately. The regression results on yearly data in Table 8 show that actually, the positive correlation is mainly driven by the year 2008. In contrast, we find the impact of CEO risk-aversion on stock returns to be negative in 2009. The sign of the *CEO_Risk* coefficient for the year 2007 is not significant. The ambiguous sign of the CEO risk aversion proxy suggests that risk-averse CEOs may lead firms to perform better than others during bad years or during rare catastrophic events (i.e., 2008 financial crisis). However, in good years firms with risk-averse CEOs may experience lower returns than other firms.

We do not find evidence that firms with DCPs perform better than firms without DCPs. Instead, as Table 7 shows, we observe a negative association between the DCP dummy and Tobin's Q, suggesting that firms with DCPs have lower Tobin's Q than firms without DCPs. This result actually is consistent with the evidence of Wei and Yermack (2010), who report an overall destruction of enterprise value when CEOs' deferred compensation holdings are large.

[Tables 7 and 8 here]

Overall, the cross-sectional regression results suggest that firms with risk-averse CEOs, on average, do not significantly outperform other firms in terms of stock returns. However, yearly regressions show that firms with risk-averse CEOs perform better during bad market years, but in good market year firms they experience lower stock returns. These results conditionally support our second hypothesis which predicts that CEO risk-aversion does affect firm performance; however the direction of the impact varies with the overall stock market performance.

4.2.4 Risk-Averse or Smart

As discussed earlier, one can argue that CEOs who enjoyed a positive return on their DCP investments in 2008 are likely to be smarter than their counterparts in the sense that they were able to predict the 2008 financial crisis or they had better investment skills. These views then may raise questions regarding the validity of our CEO risk-aversion proxy, *CEO_Risk*.

To address this concern, we conduct a univariate analysis on CEOs' DCP returns around the 2008 in order to determine if CEOs in group one (risk averse) are consistently smarter than CEOs in group zero (risk-taking). Here firms without DCP plans are excluded. We next compare the return on DCPs of these two groups for 2009, 2008, 2007 and 2006 and report the results in Table 9. Except for the year 2008, these results show that CEOs in group one consistently realize lower returns on their compensation deferrals for the other years. This suggests that CEOs in group one are at least not smarter than CEOs in group zero and, therefore, the concerns about the representativeness of our CEO risk-aversion measure, *CEO_RISK*, are not supported by the data.

[Table 9 here]

4.2.5 Selection Bias Adjusted Estimates

In our sample, about 32% of the firms do not offer CEO deferred compensation plans. We use the *DCP_dummy* to capture the effect of DCPs on firm performance. However, when we define the *CEO_Risk*, we set the *CEO_Risk* to zero as well when a firm does not have a DCP (*DCP_dummy*=0). This hypothetically "assumes" that managers without DCP plans are less risk averse. But this is just because we do not have any information on their portfolio returns. In other words, the DCP return is only observable when the CEO has a DCP. This then may bias our estimates and, as a result, it motivates additional testing to determine whether our main results are significantly affected by a firm's decision to offer its CEO a deferred compensation plan.

In order to examine if our previous results are sensitive to selection bias problems, we estimate a maximum-likelihood version of the Heckman (1979) sample selection model. The first stage regression models the decision whether or not to have a DCP. The second stage regression tests the effect of our CEO risk aversion proxy on performance conditional on having a DCP.

To model the firm's deferred compensation plan decision in a general statistical framework, we adopt important determinants of having deferred compensation plan from Table 5. These potential determinants lead to the following sample-selection model:

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

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

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

Tables 10 and 11 present the estimates of the Heckman selection model. To make sure the model is identified, we include CEO age, CEO-Chair duality, Founder CEO dummy and CEO hired outside dummy in the first stage of the Probit regression (columns (1), (3), and (5)). As indicated in the last row, the hypothesis of no correlation of the error terms (P value of Wald test of exogeneity is far larger than 10%) is not rejected in Table 10, suggesting that the sample selection is not a serious issue in estimating firm performance volatility. However, Table 11 suggests that the sample selection problem may be critical in estimating firm performance (P value of Wald test of exogeneity is less than 1%). From the results of the first stage, as shown in Table 10, we find that larger firms, larger size boards and higher percentage of independent directors are associated with higher likelihood of offering deferred compensation plans. Firms with lower Tobin's Q and larger tangible assets are also more likely to offer deferred compensation plans to their CEOs. In addition, we find that firms are less likely to offer deferred compensation plans to their founder CEOs. The evidence also shows that deferred compensation decisions are not associated with firm leverage. Overall, the results in the fist stage of the selection model suggest that firms with powerful CEOs and weak boards are associated with less likelihood of offering deferred compensation plans.

From columns (2), (4) and (6) of Table 10 and Table 11, we find that the main results do not change after controlling for selection bias. Comparing to Table 6, the only difference is that *the CEO_Risk* losses its impact on stock return volatility after adjusting the sample for selection bias, but it shows to have significant impact on ROA volatility and the volatility of asset value. Regarding the impact on performance, the results are even stronger after controlling for selection bias. Table 11 shows that the coefficients of *CEO_Risk* in all three models are significantly positive. This suggests that firms with risk-averse CEOs perform better around the financial crisis period than firms with risk-taking CEOs.

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

[Tables 10 and 11]

4.2.6 Generalization of CEO Risk Preference Proxy

The first part of this study basically contributes to the literature by introducing a novel way to proxy CEO risk preferences. That is, we used the 2008 financial crisis, an exogenous event, to estimate CEO risk preferences. However financial crises do not happen frequently. Therefore, our objective in this section we build on and extend our approach to generalize our study by developing an alternative CEO risk-aversion proxy that is as good as the measure used thus far. Specifically, we use CEOs' DCP return volatility to assess their risk-aversion. Specifically, this is measured as the

variance of a CEO's return on his DCP investment (RET_DCP) from 2006 to 2009. A low (high) *DCP_Ret_Vol* value signifies a risk-averse (risk-taking) CEO. Therefore, we replicate our analysis using CEOs' DCP personal investment return volatility, *DCP_Ret_Vol*.

To assess the power of *DCP_Ret_Vol*, as an alternative proxy of CEO risk-aversion, we put into testing our first two hypotheses using this new proxy. Our third and fourth hypotheses are simultaneously tested using the same econometric models used earlier. To avoid clustering effects, we first take the mean of each variable for each firm across time (from 2007 to 2010, we skip year 2006 since it is the first year that firms are required to disclose DCP earnings, therefore a lot of firms miss DCP return data for that year) and then run regressions on the collapsed dataset of means. To check if different market conditions affect our results, we also run the regression for each year to peel off the market effect. These regression results are summarized in Table 12. The individual regression results (i.e., Tables 12A to 12E) are reported in the Appendix.

[Table 12 here]

4.2.6 A. Re-visit how CEO risk preferences affect firm risk and performance

As shown in Table 10, the cross-sectional regression results on firm risk, reported in Models 1 and 2, reveal that firms with CEOs having high DCP return volatility have relatively higher stock return and earnings volatility. This suggests a positive association between CEO risk-taking and firm risk, which is consistent with our first hypothesis and our previous results based on our original measure of CEO risk-

aversion based on the 2008 financial crisis, *CEO_Risk*. In terms of our second hypothesis, in Models 3, 4 and 5, we find that the CEO DCP return volatility measure has a negative impact on Tobins'Q (Model 3) and ROA (Model 5), but a positive effect on stock returns (Model 4). If by definition, Tobin's Q represents firm total market value and stock return represent equity value, our results show that risk-taking CEOs tend to increase equity value, but hurt overall firm value. Using CEO deferred compensation holdings as a proxy of CEO risk preferences Wei and Yermack (2010) find a similar result pointing out an overall reduction of enterprise value when CEOs' deferred compensation holdings are large.

If we consider that the last financial crisis started at the end of 2007 and ended in the middle of 2009 (see NBER report at http://www.nber.org/cycles.html), consistent with our second hypothesis Model 4 shows that the DCP return volatility has a significant negative impact on stock returns in 2007 and 2008, but positive influence in 2009 and 2010. This pattern indicates that firms with risk-taking CEOs experience higher stock return performance in up markets, but lower returns in down markets. However, this market effect is not statistically significant on Tobin's Q (Model 3) and ROA (Model 4).

4.2.6 B. The association between CEO investment talent and firm risk

The variable *Avg_DCP_Ret* in model 1 to model 2 in Table 10 is used to test our third hypothesis. For both volatility measures, we find that *Avg_DCP_Ret* is negatively and significantly correlated to ROA and Stock return volatility after controlling for other volatility effects. These results suggest that firms with higher

investment talent CEOs are subject to lower risk. This result supports our third hypothesis.

Next, we examine whether the *Avg_DCP_Ret* is a good proxy for CEO investment talent. In Models 3, 4 and 5 we can notice that the *Avg_DCP_Ret* is positively associated with Tobin's Q, and stock returns. Its relationship with ROA is insignificant but also positive. The results show that our CEO investment talent proxy, *Avg_DCP_Ret*, has considerable explanatory power for firm's stock market performance and, hence, should be considered as a valid proxy of CEO investment talent.

Overall, the new regression results not only confirm our previous findings based on our 2008 financial crisis and exogenous measure of CEO risk-aversion, *CEO_Risk*, but also suggest that the CEO DCP return volatility, *DCP_Ret_Vol*, is an adequate proxy of CEO risk-aversion that can be used in future studies. Furthermore, the negative association between the average DCP return metric, *Avg_DCP_Ret*, and firm risk suggests that this is a good proxy for CEO investment talent.

4.2.6 C. A Robustness Test

The stock return volatility we used in the previous section is the variance of monthly firm stock returns in year t to t-4, which Cassell et al (2012) refer to as Total Risk. One concern of this risk measure is that firm stock returns can also be affected by market fluctuations. This means the stock return volatility, as a risk measure, may not cleanly reflect how CEO risk preference can affect firm risk. Therefore, to test the robustness of our previous result, we adopt the argument of Cassell et al (2012) and

examine firm-specific risk (or idiosyncratic risk, a risk measure constructed after controlling for market fluctuations) as our alternative measure of firm risk.

Following Cassell et al (2012), we use daily firm return data 36 months prior to the beginning of fiscal year t to estimate the market model. Using the estimated parameters from the market model, we construct expected daily stock returns in fiscal year t for each firm and obtain the daily residual returns by subtracting the expected daily returns from the realized returns. We use the variance of daily residual returns in fiscal year t as the idiosyncratic risk (*Idio_Risk*).

We also examine another risk measure used in Cassell et al (2012) that is related to firm investment policies, *Diversification* (*Entropy*). *Diversification* is estimated using the entropy measure of diversification developed by Jacquemin and Berry (1979). As in Cassell et al (2012), we calculate *Diversification* (*Entropy*) as follows: Entropy = Σ P_s Ln $(1/P_s)$, where P_s is the proportion of the firm's total sales in industry segments. Here larger *Entropy* indicates greater firm diversification. To mitigate the effects of skewness, we use the natural logarithm of both measures.

The summary of results are shown in Table 12, Panel A (more detailed results are appended as Table 12F, 12G). We notice that the impact of inside debt on the above two risk measures is consistent with Cassell et al (2012): the DCP dummy has a negative impact on Idiosyncratic Risk and positive impact on Entropy. This suggests that inside debt exerts a negative influence on firm risk and firms with DCPs seem to pursue conservative investment policies.

In terms of the relation between CEO risk preference/investment talent and firm

risk. We find that Idiosyncratic Risk (*Idio_Risk*) is entirely consistent with our prior results. Moreover, the idiosyncratic risk shows an even stronger significant relation between CEO risk preference/investment talent and firm risk than that of using total risk (by comparing the results of Model 2 and Model 6): Model 6 reveals that firms with CEOs having high DCP return volatility have relatively higher Idiosyncratic Risk (coefficient estimates are significant at 1% level). This is consistent with our first hypothesis. We also find that *Avg_DCP_Ret* is negatively and significantly correlated to Idiosyncratic Risk (coefficient estimates are significant at 1% level). This result supports our third hypothesis which conjectures that firms with higher investment talent CEOs are subject to lower risk. However, the correlation between Diversification and CEO risk preference/investment talent (Model 7) does not appear to be significant.

Overall, the robustness check results confirm our previous findings based on our two measure of CEO risk-aversion (*CEO_Risk*, and *DCP_Ret_Vol)* and our proxy for CEO investment talent (*Avg_DCP_Ret)*.

5. Conclusions

Previous studies examine the effect of managerial risk aversion on firm risk and performance and allude to a weak influence of CEO risk-aversion on firm risk and performance. Critics of this literature argue that this may be attributed to limitations associated with identification of CEO risk-aversion and endogeneity problems. Following Schooley and Worden (1996) who argue that personal portfolio allocations (measured as risky assets to wealth) are reliable indicators of attitudes toward risk, this paper extends that work by using a novel approach in identifying CEO risk-aversion

based on the allocation of CEOs' deferred compensation portfolio into risky and non-risky investments and their return performance around the 2008 financial crisis, an exogenous event. This innovation of our study provides a unique opportunity to determine CEO risk-aversion and ultimately split CEOs into risk-averse and risk-taking CEOs.

Using this novel proxy of CEO risk-aversion, we find that CEO risk preferences influence firm risk. The results reveal a negative association between CEO risk-aversion, measured by the realized performance of inside debt, and stock price volatility. We then generalize our study by introducing DCP return volatility as a new proxy of CEO risk preferences. Using this new proxy, our findings show that the inverse relation between CEO risk-aversion and firm risk is robust. That is, CEO risk-taking attitudes increase firm risk. In addition, we find CEO investment talent has negative impact on firm risk. This result is consistent with the evidence of Dai and Wang (2010) which shows that to avoid turnover risk high talent CEOs tend to avoid risky investment. Furthermore, our results support the prediction of Edmans and Gabaix (2011) that, under the assumption of risk-averse CEO and moral hazard, firm risk is negatively associated with CEO talent.

We also find that firms with CEO deferred compensation plans have lower firm risk. The results of this study contribute to the inside debt literature by showing that inside debt compensation is related to lower firm risk and firm market value. Our results contribute to CEO risk preference literature by showing that risk-averse CEOs lead firms to perform better than others in a down market. However, in good years this correlation is not significant.

REFERENCES

Aaker,D.A., and Jacobson,R., 1987, The Role of Risk in Explaining Differences in Profitability, Academy of Management Journal,30,277-296.

Abdel-khalik, Ahmed Rashad, 2006, An Empirical Analysis of CEO Risk Aversion and the Propensity to Smooth Earnings Volatility, University of Illinois at Urbana-Champaign, unpublished manuscript.

Agrawal, Anup and Gershon N. Mandelker, 1987, Managerial Incentives and Corporate Investment and Financing Decisions, Journal of Finance 42, 823 – 837.

Aggarwal, Rajesh and Andrew A. Samwick, 1999, the Other Side of the Tradeoff: The Impact of Risk on Executive Compensation, Journal of Political Economy 107, 65-105.

Allen, F., 2005, Corporate Governance in Emerging Economics, Oxford Review of Economic Policy, 21(2), 164-177.

Anderson, Ronald and David Reeb,2003, Founding-Family Ownership and Firm Performance: Evidence from the S&P 500,The Journal of Finance,58(3), 1301–1327.

Baber, William R., Surya N. Janakiraman, and Sok-Hyon Kang, 1996, Investment Opportunities and the Structure of Executive Compensation, Journal of Accounting and Economics 21, 297-318.

Bajtelsmit, Vickie L. and Alexandra Bernasek, 2001, Risk Preferences and the Investment Decisions of Older Americans, Research Report No. 2001-11, American Association of Retired Persons Washington, D. C.

Bengt Holmstrom and Paul Milgrom, 1987, Aggregation and Linearity in the Provision of Intertemporal Incentives, Econometrica 55 (2): 303-328.

Bertrand, M., and A. Schoar, 2003, Managing with Style: The Effect of Managers on Firm Policies, Quarterly Journal of Economics, 118 (4), 1169-1208.

Brick, Ivan E., Oded Palmon and John K. Wald, 2010, Too Much Pay Performance Sensitivity? Unpublished manuscript.

Brisley, Neil, 2006, Executive Stock Options: Early Exercise Provisions and Risk-Taking Incentives, Journal of Finance 61(5), 2487-2509

Bushman, Robert, Zhonglan Dai and Xue Wang, 2010, Risk and CEO Turnover, Journal of Financial Economics 96(3), 381-398

Byrd, J., Hickman, K., 1992, Do Outside Directors Monitor Managers? Journal of

Financial Economics 32, 195–221.

Cassell, C., S. Huang, J. Sanchez and M. Stuart, 2012, Seeking safety: The relation between CEO inside debt holdings and the riskiness of firm investment and financial policies, Journal of Financial Economics,103,588-610.

Carpenter, J., 2000, Does Option Compensation Increase Managerial Risk Appetite? Journal of Finance 55, 2311-2331

Cohen, R. B., B. J. Hall, and L. M. Viceira, 2000, Do Executive Stock Options Encourage Risk-Taking? Working Paper, Harvard Business School.

Coles, Jeffrey, Naveen Daniel, and Lalitha Naveen, 2006, Managerial Incentives and Risk-taking, Journal of Financial Economics 79(2), 431-468.

Core, John, Robert W. Holthausen, and David F. Larcker, 1999, Corporate Governance, Chief Executive Officer Compensation, And Firm Performance, Journal of Financial Economics, 51(3), 371–406

Core, J., and Guay, W., 2002, Estimating The Value Of Employee Stock Option Portfolios and Their Sensitivities to Price and Volatility, Journal of Accounting Research 40, 613–630.

DeFusco, R., R.R. Johnson, and T.S. Zorn, 1990, The Effect of Executive Stock Option Plans on Stockholders and Bondholder, Journal of Finance 45, 617 – 627.

Donkers, Bas, Bertrand Melenberg and A. Van Söest, 2001, Estimating Risk Attitudes Using Lotteries: A Large Sample Approach, The Journal of Risk and Uncertainty 22, 165-195.

Edmans, Alex and Qi Liu, 2011, Inside Debt, Review of Finance, 15(1).75-102.

Edmans, A., and X. Gabaix, 2011, the Effect of Risk on the CEO Market, Review of Financial Studies, 24(8), 2822-2863

Garen, J.E., 1994, Executive Compensation and Principal-Agent Theory, Journal of Political Economy 102, 1175-1199.

Garvey, G.T., A. Mawani, 1999, Executive Stock Options as Home-Made Leverage: Why Financial Structure Does Not Affect the Incentive to Take Risk, unpublished working paper, University of British Columbia.

Gibbons, R., and K. Murphy, 1992, Does Executive Compensation Affect Investment? Journal of Applied Corporate Finance 5(2), 99-109.

Grable, John E. , 2000, Financial Risk Tolerance and Additional Factors that Affect Risk Taking in Everyday Money Matters, Journal of Business and Psychology,14(4), 625-630.

Guay, W.R., 1999, the Sensitivity of CEO Wealth to Equity Risk: An Analysis of the Magnitude and Determinants, Journal of Financial Economics 53, 43-71.

Hall B.J. and K. J. Murphy, 2002, Stock Options For Undiversified Executives, Journal of Accounting and Economics 33, 3 – 42.

Hartzell, Jay, and Starks, Laura, 2003, Institutional Investors and Executive Compensation, Journal of Finance 58, 2351–2374.

Haushalter, G.D., 2000, Financing Policy, Basis Risk, and Corporate Hedging: Evidence from Oil and Gas Producers, Journal of Finance 55, 107-152.

Holmstrom, B. and P. Milgrom, 1987, Aggregation and Linearity in the Principal-Agent Relationship, Econometrica, 55, 303-328.

Jacquemin, A., Berry, C., 1979, Entropy Measure of Diversification and Corporate Growth, Journal of Industrial Economics 4, 359-369.

Jensen, M., Murphy, K., 1990, Performance Pay and Top-Management Incentives, Journal of Political Economy 98, 225-264.

Jin, L., 2002, CEO Compensation, Diversification and Incentives, Journal of Financial Economics 66, 29-63.

Ju, N., H. Leland, and L. Senbet, 2002, Options, Option Repricing and Severance Packages in Managerial Compensation: Their Effects On Corporate Risk, Working paper, University of Maryland and University of California, Berkeley.

Kaplan, S. N., M. M. Klebanov, and M. Sorensen (2012), Which CEO Characteristics and Abilities Matter? Journal of Finance 67, 973-1007.

Kim, Moon K. and J. Kenton Zumwalt, 1979, An Analysis Of Risk In Bull And Bear Markets, Journal of Financial and Quantitative Analysis, 14(5), 1015-1025.

Knopf, J. D., J. Nam, and J. H. Thornton, Jr., 2002, The Volatility and Price Sensitivities Of Managerial Stock Option Portfolios and Corporate Hedging, Journal of Finance 57, 801 – 813.

Lambert R.A., D.F. Larcker, and R.E. Verrecchia, 1991, Portfolio Considerations in Valuing Executive Compensation, Journal of Accounting Research 29, 129 – 149.

Lewellen, Katharina, 2006, Financing Decisions When Managers Are Risk Averse, Journal of Financial Economics 82(3), 551-589,

Low, Angie, 2009, Managerial Risk-Taking Behavior and Equity-Based Compensation, Journal of Financial Economics, 92(3), 470-490

Malmendier, U. and G. Tate, 2005, CEO overconfidence and corporate investment', Journal of Finance 60, 2661–2700.

Malmendier, U. and G. Tate, 2008, Who Makes Acquisitions? CEO Overconfidence and the Market's Reaction, Journal of Financial Economics, 89(1), 20-43.

May, D. O., 1995, Do Managerial Motives Influence Firm Risk Reduction Strategies? Journal of Finance, 50, 1291-1308.

Mehran, Mamid, 1995, Executive compensation structure, ownership, and firmperformance, , Journal of Financial Economics, 38(2), 163-184

Merton, R., 1974, On the Pricing of Corporate Debt: The Risk Structure of Interest Rates, Journal of Finance, 28, 449-470.

Moers, Frank and Erik Peek, 2000, an Empirical Analysis of the Role of Risk Aversion in Executive Contracts, Working Paper, Maastricht University.

Palia, Darius, 2001, the Endogeneity of Managerial Compensation in Firm Valuation: A Solution, Review of Financial Studies 14 (3), 735-764.

Parrino, R., A. M. Poteshman, and M. S. Weisbach., 2002, Measuring Investment Distortions When Risk-Averse Managers Decide Whether to Undertake Risky Projects, Working Paper.

Rajgopal, S. and T. Shevlin, 2002, Empirical Evidence on the Relation between Stock Option Compensation and Risk Taking, Journal of Accounting and Economics 33, 145 – 171.

Rogers, Daniel A., 2002, Does Executive Portfolio Structure Affect Risk Management? CEO Risk Taking Incentives and Corporate Derivatives Usage, Journal of Banking and Finance 26, 271-295.

Ross, Stephen. A., 2004, Compensation, Incentives, and the Duality of Risk Aversion and Riskiness, Journal of Finance 59(1), 207-225.

Schooley, Diane K. and Debra D.Worden, 1996, Risk Aversion Measures: Comparing Attitudes and Asset Allocation, Financial Services Review S(2), 87-99.

Smith, C. W. and R. M. Stulz, 1985, The Determinants Of Firms' Hedging Policies, Journal of Financial and Quantitative Analysis, 20, 391-405.

Stulz, R.M., 1996, Rethinking Risk Management, Journal of Applied Corporate Finance 9(3), 8-24.

Sundaram, Rangarajam, and David Yermack, 2007, Pay Me Later: Inside Debt and Its Role In Managerial Compensation, Journal of Finance 62, 1551-1588.

Tufano, P., 1996, Who Manages Risk? An Empirical Examination of Risk Management Practices in the Gold Mining Industry, Journal of Finance 51, 1097-1137.

Wang, Hui and Sherman Hanna, 1997, Does Risk Tolerance Decrease with Age, Financial Counseling and Planning 8(2), 1997.

Wang, Lingling, 2009, CEO Risk Taking and Firm Policies: Evidence from CEO Employment History, Finance Dissertation, Georgia State University.

Wei, Chenyang and David Yermack, 2010, Deferred Compensation, Risk, and Company Value: Investor Reactions to CEO Incentives, Working Paper, New York University

White, Halbert, 1980, A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test of Heteroskedasticity, Econometrica 48, 817-838.

Yermack, David, 1996, Higher Market Valuation of Companies with A Small Board of Directors, Journal of Financial Economics 40, 185–211.

TABLE 1: Definition of Variables

This table reports the definition of all variables used in this study.

Variables	Definition
Return on DCP:	The ratio of earnings on DCP over the DCP balance in the year beginning (in %).
ROA:	The ratio of net operating income to the book value of total assets.
RET:	The annual stock return (monthly compounded)=(1+ excess return)
TOBINSQ:	The ratio of market value of total assets to book value of total assets.
VAR_ROA:	The variance of annual ROA using previous five years ROA change.
VAR_RET:	The variance of annual stock return (five spanning years).
ASSET_VOL:	The volatility of firm's asset value returns (it is used to estimate firms' distance to default in KMV model, See Sundaram and Yermack (2006) for the estimation method).
Leverage:	The ratio of long term debt to the book value of total assets.
SEG_NUM:	The number of industry segments.
Assets in place:	(inventory + gross plan and equipment)/total assets.
TOP5_HLD:	The percentage of top five institutional investors' equity holdings.
Board size:	The natural logarithm of the number of directors.
OUT_PCT:	The percentage of outsiders on the board.
CEO tenure:	The natural logarithm of CEO tenure.
CEO cash pay:	The sum of salary, bonus and non equity incentive compensation (in million).
CEO PPS:	Pay-for-Performance Sensitivity is the ratio of CEO's total equity value change (in million) over 1% change in share price.
CEO duality	It takes one if the CEO is also the chairman of board, zero if not
Founder CEO	It takes one if the CEO is one of the founders of the firm, zero if not
Outside	It takes one if the CEO is hired outside the firm, zero if the CEO is hired inside the firm
CEO_Risk:	Is a dummy that takes the value of one if the firm's CEO has positive DCP return in 2008, zero if negative. It is set to be zero as well if no DCP.
DCP dummy:	Is a binary variable that takes the value of one if a CEO has deferred compensation account, zero if a CEO does not have deferred compensation plan.
DCP_Ret_Vol:	DCP return volatility is the variance of RET_DCP using four year spin (year 2006 to 2009). This variable is used to proxy CEO risk preference.
Avg_DCP_Ret:	It is the average of RET_DCP for four years (from year 2006 to 2009). This variable is used to proxy CEO personal investment talent.

TABLE 2: Descriptive Statistics of all Variables

This table presents descriptive statistics for sample observations of 1,744 firms from S&P 1500 companies over 2006 to 2009. See Table 1 for the variable definitions.

Variable	Obs#	Mean	Std Dev	1st Quartile	Median	3rd Quartile
Return on DCP	3275	3.658	24.105	-2.269	5.362	12.147
TOBINSQ	6723	1.822	2.425	1.092	1.408	2.030
ROA	5786	0.133	0.155	0.086	0.132	0.190
RET	6400	1.100	0.773	0.743	1.028	1.298
VAR_ROA	5472	0.475	3.760	0.021	0.076	0.254
VAR_RET	5952	0.263	1.869	0.020	0.054	0.145
ASSET_VOL	5200	39.83	18.457	28.700	36.690	47.120
Log(sales)	6708	7.373	1.653	6.277	7.302	8.430
R&D/total assets	6722	0.066	0.696	0.000	0.000	0.030
Leverage	6723	0.179	0.186	0.016	0.144	0.280
SEG_NUM	6320	3.598	2.130	2.000	3.000	5.000
Assets in place	6723	0.561	0.428	0.203	0.493	0.860
TOP5_HLD	6542	0.297	0.094	0.235	0.293	0.354
Board size	6417	2.198	0.260	2.079	2.197	2.398
OUT_PCT	6417	0.834	0.086	0.786	0.857	0.889
CEO tenure	6717	6.902	6.929	2.000	5.000	9.000
CEO cash pay	6717	1.986	2.654	0.799	1.301	2.386
CEO PPS	5248	505.38	720.24	81.10	220.62	577.95
DCP_Ret_Vol	2185	8.221	13.429	0	1.494	13.512
Avg_DCP_Ret	2185	2.378	5.536	0	0	4.323
CEO_Risk	3275	0.265				
DCP dummy	6723	0.679				

TABLE 3: Variation of Firm Performance, Performance Volatility and other Main Variables by Year

This table reports the yearly mean and median variation of firm performance, performance volatility and other main variables for a sample of 1,744 firms from S&P 1500 companies over 2006 to 2009. See Table 1 for variable definitions.

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

TABLE 4: Comparison of Firm Performance, Performance Volatility and other main variables between two CEO_RISK Groups

This table reports mean/median comparison of firm performance, performance volatility and other main variables between risk-averse CEO group and risk-taking CEO group of the 889 firms that have DCPs over 2006 to 2009. See Table 1 for variable definitions. We use CEO_RISK dummy to proxy CEO risk-aversion. While the whole stock market experienced a dramatic valuation decline in year 2008, CEOs in CEO_risk dummy=1 group are CEOs who realized positive DCP return in year 2008. CEOs in CEO_risk dummy=0 group are CEOs with negative DCP return in year 2008. We use this dummy to proxy that CEOs in CEO_RISK dummy=0 group are more risk-taking than CEOs in CEO_RISK dummy=0 group.

	Risk-taking CEOs (CEO_RISK Dummy=0)				Risk-averse CEOs (CEO_RISK Dummy=1)			
Variable	Obs#	Mean	Std Dev	Median	Obs#	Mean	Std Dev	Median
TOBINSQ	2406	1.573	0.750	1.339	869	1.671	0.947	1.341
ROA	2027	0.140	0.086	0.135	692	0.151	0.097	0.138
RET	2327	1.092	0.864	1.035	816	1.053	0.444	1.046
VAR_ROA	1960	0.190	0.583	0.049	662	0.173	0.603	0.039
VAR_RET	2223	0.194	2.412	0.044	784	0.102	0.268	0.039
ASSET_VOL	1903	35.131	13.147	32.200	632	34.084	12.526	31.850
Log(sales)	2404	8.076	1.470	7.975	867	7.890	1.426	7.770
R&D/total assets	2406	0.025	0.062	0	869	0.016	0.057	0
Leverage	2406	0.200	0.165	0.176	869	0.199	0.168	0.181
TOP5_HLD	2368	0.293	0.087	0.285	846	0.286	0.096	0.279
SEG_NUM	2259	3.843	2.185	3	776	3.666	1.770	3
Board size	2362	2.278	0.242	2.302	839	2.285	0.221	2.302
OUT_PCT	2362	0.850	0.078	0.875	839	0.848	0.073	0.875
Assets in place	2406	0.601	0.426	0.567	869	0.606	0.441	0.610
CEO tenure	2405	6.616	6.138	5	867	6.491	6.382	5
CEO cash pay	2405	2.452	3.228	1.733	867	2.644	2.748	1.875
CEO PPS	2071	568.49	725.92	279.91	708	560.51	752.21	286.96

TABLE 5: Comparison of firm Performance, performance volatility and other variables between firms with and without DCPs

This table shows mean/median comparison of firm performance, performance volatility and other main variables between firms with DCP plan and Firms without DCP plan. It covers 1774 firms that have DCPs over 2006 to 2009. See Table 1 for the definition of the variables. DCP dummy=0 represents firm group that has no DCP. DCP dummy=1 is the group of firms having DCP plans. See Table 1 for variable definitions.

	Firms without DCPs				Firms with DCPs			
Variable	Obs#	Mean	Std Dev	Median	Obs#	Mean	Std Dev	Median
TOBINSQ	2156	2.213	4.034	1.578	4567	1.637	0.933	1.354
ROA	1947	0.115	0.232	0.126	3839	0.142	0.093	0.1343
RET	2018	1.118	0.742	1.005	4382	1.091	0.787	1.037
VAR_ROA	1792	1.038	6.474	0.164	3680	0.201	0.623	0.052
VAR_RET	1810	0.412	1.677	0.087	4142	0.199	1.944	0.045
ASSET_VOL	1639	47.281	21.131	44.750	3561	36.412	15.963	33.700
Log(sales)	2145	6.250	1.461	6.242	4563	7.901	1.463	7.813
Growth	2155	0.151	1.220	0.002	4567	0.025	0.066	0
Leverage	2156	0.145	0.215	0.050	4567	0.195	0.168	0.171
TOP5_HLD	2083	0.300	0.097	0.300	4459	0.295	0.091	0.288
SEG_NUM	2071	3.269	2.177	3	4249	3.758	2.087	3
Board size	1975	2.051	0.238	2.079	4442	2.263	0.242	2.302
OUT_PCT	1975	0.810	0.092	0.833	4442	0.844	0.080	0.875
Assets in place	2156	0.496	0.426	0.390	4567	0.590	0.425	0.558
CEO tenure	2155	7.485	7.376	5	4562	6.627	6.691	5
CEO cash pay	2155	1.221	1.736	0.854	4562	2.347	2.923	1.644
CEO PPS	1561	399.52	647.05	156.92	3687	550.03	745.27	259.95

TABLE 6: CEO risk aversion and firm performance volatility

This table reports OLS regression estimates of performance volatility for a sample of S&P 1500 companies over 2006 to 2009. The dependent variable VAR_RET is the variance of annual stock return (five spanning years). VAR_ROA is the variance of annual ROA using previous five years ROA change. ASSET_VOL is the volatility of firm's asset value returns (it is used to estimate firms' distance to default in KMV model, See Sundaram and Yermack (2006) for the estimation method).To avoid the clustering effect, we take the mean of each variable for each firm across time and run regression on the collapsed dataset of means. See Table 1 for the definition of the other variables. T-statistics appear in parentheses below each estimate. Significant at 1% (***), 5% (**), and 10% (*) levels.

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

TABLE 7: CEO risk aversion and firm performance

This table reports OLS regression estimates of performance for a sample of S&P 1500 companies over 2006 to 2009. The dependent variable ROA is the ratio of net operating income to the book value of total assets. RET is the annual stock return (monthly compounded). TOBINSQ is the ratio of market value of total assets to book value of total assets. To avoid the clustering effect, we take the mean of each variable for each case across time and run regression on the collapsed dataset of means. See Table 1 for the definition of the other variables. T-statistics appear in parentheses below each estimate. Significant at 1% (***), 5% (**), and 10% (*) levels.

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

TABLE 8: Stock return and CEO risk aversion in different years

This table reports OLS regression estimates of stock performance for a sample of S&P 1500 companies over 2007 to 2009. The dependent variable is RET (the annual stock return with monthly compounded). CEO_Risk is a dummy that takes the value of one if a firm's CEO realized positive DCP return in 2008, zero if negative. We use CEO_Risk =1 to proxy risk-averse CEOs and CEO_Risk =0 to proxy risk-taking CEOs. See Table 1 for the definition of the other variables. T-statistics appear in parentheses below each estimate. Significant at 1% (***), 5% (**), and 10% (*) levels.

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

TABLE 9: DCP investment returns for CEOs with different risk preferences around the 2008 financial crisis

This table shows the difference in DCP returns between risk-averse and risk-taking CEOs. Group0 represents firms with CEOs that realized negative returns on their DCP investment in 2008 (*CEO_RISK dummy*=0, represents risk-taking CEOs) and Group1 consists of firms with CEOs that realized positive returns on their DCP investment in 2008 (*CEO_RISK dummy*=1, represents risk-averse CEOs).

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

TABLE 10: CEO risk-aversion and firm performance volatility (using Heckman Selection Model)

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

	Selection	VarRET	Selection	VarROA	Selection	AssetVol
Intercept	-1.024***	-0.512	-1.031***	-5.690	-1.006***	3.941***
	(-6.68)	(-0.2)	(-6.13)	(-1.57)	(-6.7)	(6.18)
TOBINSQ	-0.029***	-0.029	-0.023**	0.154**	-0.031***	-0.041***
	(-2.58)	(-0.6)	(-1.96)	(2.38)	(-2.62)	(-3.19)
Log(sales)	0.091***	-0.043	0.095***	-0.201	0.091***	-0.025
	(9.91)	(-0.36)	(9.59)	(-1.18)	(9.94)	(-0.84)
Leverage	0.077	0.221	0.089	-0.673*	0.077	-0.234***
	(1.22)	(0.83)	(1.35)	(-1.87)	(1.22)	(-3.18)
TOP5_HLD	0.002	0.014***	0.002*	0.031***	0.002*	0.004***
	(1.56)	(2.7)	(1.59)	(4.35)	(1.63)	(2.58)
SEG_NUM	0.002	0.011	0.004	0.080***	0.002	0.007
	(0.43)	(0.62)	(0.82)	(3.06)	(0.46)	(1.45)
R&D/total assets	-0.031	1.493**	-0.021	3.316***	-0.029	0.527***
	(-1.29)	(2.3)	(-0.89)	(3.98)	(-1.28)	(3.06)
Board size	0.298***	-0.605	0.266***	-1.029**	0.298***	-0.126
	(5.11)	(-1.4)	(4.24)	(-1.89)	(5.1)	(-1.14)
OUT_PCT	0.214*	-1.321**	0.265*	0.234	0.214*	-0.166
	(1.61)	(-2.08)	(1.89)	(0.26)	(1.61)	(-0.98)
CEO tenure	0.001	-0.003	0.002	0.009	0.001	-0.001
	(0.47)	(-0.6)	(0.91)	(1.2)	(0.49)	(-0.51)
Assets in place	0.078***	-0.082	0.127***	0.397	0.077***	0.113***
	(2.72)	(-0.56)	(4.06)	(1.48)	(2.71)	(2.9)
CEO AGE	0.001		0.001		0.001	
	(0.74)		(0.71)		(0.69)	
CEO Duality	0.034		0.031		0.038*	
	(1.43)		(0.92)		(1.73)	
FOUNDER	-0.108***		-0.112***		-0.111***	
	(-3.29)		(-3.26)		(-3.38)	
OUTSIDE	-0.006		0.004		-0.015	
	(-0.22)		(0.15)		(-0.62)	
CEO PPS		0.575		-2.241		-0.347

	(0.19)	(-0.59)	(-0.44)
CEO cash pay	10.953	30.738	-1.209
	(0.7)	(1.49)	(-0.29)
CEO_Risk	-0.088	-0.251**	-0.041*
	(-0.94)	(-2.04)	(-1.62)
Obs. No.	1330	1248	1330
Log pseudo-likelihood	-2085	-2121	-862.5
P value of Wald test of exogeneity	0.698	0.999	0.136

TABLE 11: CEO risk-aversion and firm performance (using Heckman Selection Model)

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

	Selection	RET	Selection	ROA	Selection	TOBINSQ
Intercept	-0.960***	1.921***	-1.145***	-0.282	-1.128***	-1.128
	(-6.63)	(3.98)	(-8.14)	(-1.04)	(-7.96)	(-0.4)
Log(sales)	0.091***	-0.052**	0.093***	0.029**	0.095***	0.201
	(10.01)	(-2.29)	(10.24)	(2.27)	(10.36)	(1.49)
Leverage	0.076	-0.27***	0.078	-0.021	0.079	-0.236
	(1.2)	(-4.68)	(1.23)	(-0.82)	(1.24)	(-1)
TOP5_HLD	0.002*	-0.007**	0.002*	-0.001*	0.002*	-0.011**
	(1.61)	(-2.35)	(1.66)	(-1.63)	(1.62)	(-2.33)
SEG_NUM	0.002	0.001	0.001	-0.002	0.002	-0.007
	(0.48)	(0.14)	(0.36)	(-0.88)	(0.31)	(-0.42)
R&D/total assets	-0.029	-0.132	-0.031	0.015	-0.031	2.556***
	(-1.26)	(-1.12)	(-1.3)	(0.35)	(-1.3)	(5.96)
Board size	0.298***	-0.127	0.302***	0.024	0.301***	0.305
	(5.11)	(-1.5)	(5.17)	(0.55)	(5.13)	(0.66)
OUT_PCT	0.214*	0.074	0.229*	0.078	0.235*	0.390
	(1.61)	(0.56)	(1.72)	(1.3)	(1.76)	(0.67)
CEO tenure	0.0003	0.0007	-0.0003	0.0001	0.0003	-0.007
	(0.74)	(0.51)	(-0.17)	(0.04)	(0.15)	(-1.37)
Assets in place	0.078***	0.019	0.083***	0.063***	0.085***	0.106
	(2.74)	(0.62)	(2.89)	(4.11)	(2.95)	(0.69)
CEO AGE	0.0002		0.002*	0.064	0.002*	
	(0.15)		(1.93)	(0.31)	(1.61)	
CEO Duality	0.038**		0.013	0.879	-0.003	
	(1.94)		(0.7)	(0.8)	(-0.15)	
FOUNDER	-0.113***		-0.055	0.011*	-0.061	
	(-3.59)		(-1.48)	(1.61)	(-1.49)	
OUTSIDE	-0.018		0.035**		0.033*	
	(-0.88)		(2)		(1.79)	
CEO PPS		-0.192		0.064		1.961

	(-0.35)	(0.31)	(0.98)
CEO cash pay	5.823**	0.879	7.323
	(2.01)	(0.80)	(0.7)
CEO_Risk	0.049***	0.011*	0.132**
	(2.85)	(1.61)	(2.12)
Obs. No.	1330	1330	1330
Log pseudo-likelihood	-539.59	354.4	-1717
P value of Wald test of exogeneity	0.0003	<.0001	0.0007

Table 12: Summary of the association between CEO risk preferences and firm risk

This table summarizes the regression results on firm risk and firm performance. Panel A shows the association between firm risk and other independent variables. The dependent variables are ROA volatility (Model 1) and stock return volatility (Model 2). The main independent variables of interest are: DCP_Ret_Vol, is the DCP return volatility; Avg_DCP_Ret, is the average DCP return; DCP dummy, is an indicator variable, that takes the value of one if a CEO has a deferred compensation account and zero if a CEO does not have a deferred compensation plan.
Panel B shows the relationship between firm performance and our main independent variables of interest. The dependent variables are: Tobin's Q (Model 3), Stock return (Model 4) and ROA (Model 5). The main independent variables of interest are still DCP_Ret_Vol, Avg_DCP_Ret, and DCP dummy.
Column "Average" denotes all variables used here are variable means from year 2007 and 2010. Column "200x" means the regression uses data of year 200x.
'+' /'-'denotes positive/negative coefficients. And '*','**','***' denote significant level at 10%, 5% and 1% respectively. No star means the association is not statistically significant.

Panel A	CEO risk preferences /investment talent and firm risk						
	Dependent Variable	Independent Variable	Average	2007	2008	2009	2010
Model1	ROA volatility	DCP_ret_vol	$+^{*}$	+	$+^{*}$	$+^{*}$	$+^{**}$
		Avg_DCP_ret	$-^{*}$	$-^{***}$	$-^{***}$	$-^{***}$	$-^{***}$
		DCP dummy	$-^{***}$	$-^{***}$	$-^{***}$	$-^{***}$	$-^{***}$
Model2	Stock volatility	DCP_ret_vol	$+^{**}$	+	$+^{**}$	$+^{***}$	$+^{***}$
		Avg_DCP_ret	$-^{**}$	$-^{**}$	$-^{**}$	$-^{**}$	$-^{**}$
		DCP dummy	$-^{**}$	$-^{**}$	$-^{**}$	$-^{**}$	$-^{**}$
Model6	Idio_Risk	DCP_ret_vol	$+^{***}$	$+^{***}$	$+^{***}$	$+^{***}$	$+^{**}$
		Avg_DCP_ret	$-^{***}$	$-^{***}$	$-^{***}$	$-^{***}$	$-^{***}$
		DCP dummy	$-^{***}$	$-^{**}$	$-^{**}$	$-^{**}$	$-^{**}$
Model7	Diversification (Entropy)	DCP_ret_vol	$+^{*}$	+	+	+	+
		Avg_DCP_ret	+	+	+	+	+
		DCP dummy	$+^{**}$	$+^{**}$	$+^{***}$	$+^{**}$	$+^{**}$
Panel B	CEO risk preferences /investment talent and firm performance						
	Dependent Variable	Independent Variable	Average	2007	2008	2009	2010
Model3	Tobin's Q	DCP_ret_vol	$-^{*}$	$-^{**}$	$-^{***}$	$-^{**}$	$-^{*}$
		Avg_DCP_ret	$+^{*}$	+	$+^{*}$	$+^{*}$	+
		DCP dummy	−	−	−	$-^{*}$	$-^{*}$
Model4	Stock return	DCP_ret_vol	$+^{**}$	−	$-^{***}$	$+^{***}$	+
		Avg_DCP_ret	$+^{***}$	$+^{***}$	$+^{**}$	$+^{***}$	+
		DCP dummy	−	$-^{*}$	$+^{***}$	$-^{*}$	−
Model5	ROA	DCP_ret_vol	$-^{*}$	−	$-^{**}$	$-^{***}$	−
		Avg_DCP_ret	+	+	+	+	+
		DCP dummy	+	+	+	+	+

APPENDIX

Table 12A: CEO risk preferences (investment talent) and ROA volatility
(Model 1)

This table reports OLS regression estimates of ROA volatility for a sample of S&P 1500 companies over 2007 to 2010. The dependent variable is ROA volatility (five spanning years). Column 'Average' takes the mean of each variable for each case across time and run regression on the collapsed dataset of means. Column "200x" means the regression uses data of year 200x. See Table 1 for the definition of all other variables. T-statistics appear in parentheses below each estimate. Significant at 1% (***), 5% (**), and 10% (*) levels.

Variable	Average	2007	2008	2009	2010
Log(sales)	0.657***	-0.231***	-0.243***	-0.335***	-0.313***
	(24.19)	(-3.82)	(-4.35)	(-6.07)	(-5.16)
TOBINSQ	0.004	0.144***	0.115*	0.198***	0.126**
	(0.14)	(2.87)	(1.63)	(3.11)	(2.21)
Leverage	0.252*	-0.329	0.088	-0.335	-0.694**
	(1.63)	(-1.09)	(0.32)	(-1.08)	(-1.99)
TOP5_HLD	-0.0009	0.017**	0.006	0.004	-0.013
	(-0.26)	(2.23)	(0.88)	(0.64)	(-1.62)
SEG_NUM	0.027**	0.065**	0.077***	0.045**	0.064***
	(2.04)	(2.33)	(2.79)	(2.02)	(2.78)
Board size	0.122	-0.73**	-1.025***	-0.337	-0.651**
	(0.83)	(-2.44)	(-3.3)	(-1.1)	(-2.04)
R&D/total assets	0.268***	0.683**	0.059	0.091	0.026
	(4.92)	(2.16)	(1.44)	(1.25)	(1.35)
Assets in place	0.154**	0.192	0.453***	0.7***	0.625***
	(2.18)	(1.22)	(3.09)	(5.49)	(4.39)
CEO tenure	-0.011**	-0.004	-0.008	-0.013	-0.008
	(-2.5)	(-0.41)	(-0.91)	(-1.38)	(-0.83)
CEO PPS	0.098***	-0.087	-0.097**	0.039	-0.015
	(4.2)	(-1.5)	(-2.14)	(0.7)	(-0.26)
CEO cash pay	76.738***	17.643	3.452	3.247	34.666
	(6.67)	(0.63)	(0.12)	(0.11)	(1.19)
DCP return volatility	0.009*	0.009	0.008*	0.009*	0.013**
	(1.73)	(1.45)	(1.69)	(1.79)	(2.38)
Average DCP return	-0.003*	-0.047***	-0.044***	-0.036***	-0.039***
	(-1.8)	(-3.22)	(-3.05)	(-2.81)	(-2.9)
DCP Dummy	-0.186**	-0.539***	-0.57***	-0.433***	-0.435***
	(-2.58)	(-3.4)	(-3.73)	(-2.95)	(-2.83)
Obs#	1227	770	823	815	794
R-Square	0.6468	0.2452	0.2434	0.2306	0.20

Table 12B: CEO risk preferences (investment talent) and Stock return volatility (Model 2)

This table reports OLS regression estimates of Stock return volatility for a sample of S&P 1500 companies over 2007 to 2010. The dependent variable is Stock return volatility (five spanning years). Column 'Average' takes the mean of each variable for each case across time and run regression on the collapsed dataset of means. Column "200x" means the regression uses data of year 200x. See Table 1 for the definition of all other variables. T-statistics appear in parentheses below each estimate. Significant at 1% (***), 5% (**), and 10% (*) levels.

Variable	Average	2007	2008	2009	2010
Log(sales)	-0.057***	-0.063***	-0.045***	-0.042***	-0.077***
	(-6.7)	(-6.76)	(-4.99)	(-4.11)	(-7.6)
TOBINSQ	0.004	0.007	-0.005	-0.017	-0.025***
	(0.49)	(0.87)	(-0.43)	(-1.41)	(-2.6)
Leverage	-0.176***	-0.069	-0.089*	0.1*	0.128**
	(-3.61)	(-1.45)	(-1.96)	(1.71)	(2.19)
TOP5_HLD	0.002*	0.004***	0.0005	0.004***	-0.002*
	(1.89)	(3.48)	(0.48)	(2.94)	(-1.8)
SEG_NUM	0.003	0.01**	0.009**	0.009**	0.001
	(0.63)	(2.36)	(2.12)	(2.06)	(0.34)
Board size	-0.237***	-0.222***	-0.262***	-0.121**	-0.13**
	(-5.19)	(-4.92)	(-5.36)	(-2.16)	(-2.54)
R&D/total assets	0.051***	0.157***	0.013*	0.022	-0.0009
	(2.96)	(3.1)	(1.95)	(1.59)	(-0.25)
Assets in place	0.022	0.056**	0.041*	0.068***	0.074***
	(0.97)	(2.37)	(1.8)	(2.92)	(3.17)
CEO tenure	0.001	0.002*	0.003**	0.003*	0.003**
	(0.95)	(1.75)	(2.35)	(1.85)	(1.99)
CEO PPS	-0.043***	-0.032***	-0.051***	-0.066***	-0.076***
	(-5.83)	(-3.54)	(-6.96)	(-6.34)	(-7.6)
CEO cash pay	2.347	6.011	1.647	6.909	11.918**
	(0.65)	(1.51)	(0.36)	(1.28)	(2.38)
DCP return volatility	0.001**	0.0009	0.002**	0.004***	0.004***
	(1.99)	(1.04)	(2.05)	(4.18)	(4.42)
Average DCP return	-0.004***	-0.006***	-0.009***	-0.01***	-0.008***
	(-3.6)	(-2.82)	(-3.86)	(-4.25)	(-3.81)
DCP_DUMMY	-0.054**	-0.072***	-0.072***	-0.076***	-0.05*
	(-2.37)	(-2.86)	(-2.85)	(-2.74)	(-1.94)
Obs#	1227	830	886	874	898
R-Square	0.3326	0.4074	0.3746	0.2972	0.3446

Table 12C: CEO risk preferences (investment talent) and Tobin's Q
(Model 3)

This table reports OLS regression estimates of ROA for a sample of S&P 1500 companies over 2007 to 2010. The dependent variable is annual Tobin's Q. Column 'Average' takes the mean of each variable for each case across time and run regression on the collapsed dataset of means. Column "200x" means the regression uses data of year 200x. See Table 1 for the definition of all other variables. T-statistics appear in parentheses below each estimate. Significant at 1% (***), 5% (**), and 10% (*) levels.

Variable	Average	2007	2008	2009	2010
Log(sales)	-0.172***	-0.274***	-0.133***	-0.136***	-0.256***
	(-6.47)	(-6.74)	(-5.11)	(-4.68)	(-7.29)
Leverage	0.248*	0.199	0.832***	0.127	-0.625***
	(1.61)	(0.94)	(6.47)	(0.76)	(-3.02)
TOP5_HLD	-0.021***	-0.027***	-0.011***	-0.011***	-0.013***
	(-6.07)	(-5.46)	(-3.41)	(-3.16)	(-2.85)
SEG_NUM	0.016	0.024	-0.007	-0.003	-0.014
	(1.2)	(1.26)	(-0.55)	(-0.29)	(-1.01)
Board size	-0.416***	-0.534***	-0.238*	-0.481***	-0.229
	(-2.86)	(-2.65)	(-1.68)	(-3.01)	(-1.26)
R&D/total assets	0.148***	1.165***	0.021	0.237***	0.006
	(2.74)	(5.22)	(1.07)	(5.98)	(0.48)
Assets in place	-0.072	-0.093	-0.148**	-0.065	-0.040
	(-1.02)	(-0.89)	(-2.21)	(-0.97)	(-0.48)
CEO tenure	-0.021***	-0.034***	-0.024***	-0.03***	-0.03***
	(-4.92)	(-5.62)	(-5.77)	(-6.26)	(-5.42)
CEO PPS	0.266***	0.41***	0.195***	0.294***	0.37***
	(12.05)	(10.98)	(9.54)	(10.41)	(11.08)
CEO cash pay	-15.816	-13.080	-0.196	-18.980	-27.558
	(-1.38)	(-0.73)	(-0.01)	(-1.23)	(-1.54)
DCP return volatility	-0.004*	-0.008**	-0.008***	-0.006**	-0.006*
	(-1.89)	(-2.09)	(-2.88)	(-2.38)	(-1.9)
Average DCP return	0.007*	0.015	0.012*	0.012*	0.011
	(1.78)	(1.51)	(1.78)	(1.72)	(1.45)
DCP_DUMMY	-0.068	-0.105	-0.055	-0.133*	-0.173*
	(-0.95)	(-0.98)	(-0.78)	(-1.68)	(-1.92)
Obs#	1227	830	886	874	821
R-Square	0.203	0.2562	0.1855	0.2268	0.2164

Table 12D: CEO risk preferences (investment talent) and stock performance
(Model 4)

This table reports OLS regression estimates of ROA for a sample of S&P 1500 companies over 2007 to 2010. The dependent variable is annual stock return. Column 'Average' takes the mean of each variable for each case across time and run regression on the collapsed dataset of means. Column "200x" means the regression uses data of year 200x. See Table 1 for the definition of all other variables. T-statistics appear in parentheses below each estimate. Significant at 1% (***), 5% (**), and 10% (*) levels.

Variable	Average	2007	2008	2009	2010
Log(sales)	-0.039***	-0.069***	-0.045***	-0.052	-0.076***
	(-6.19)	(-5.18)	(-5.15)	(-1.14)	(-5.24)
Leverage	-0.156***	-0.144**	-0.063	0.5*	-0.029
	(-4.28)	(-2.07)	(-1.44)	(1.91)	(-0.33)
TOP5_HLD	-0.005***	-0.004**	-0.0003	-0.012**	-0.004**
	(-6.01)	(-2.29)	(-0.3)	(-2.29)	(-2.11)
SEG_NUM	0.003	0.019***	-0.014***	-0.012	-0.003
	(1.11)	(3.07)	(-3.34)	(-0.64)	(-0.43)
Board size	0.084**	0.075	0.022	-0.006	-0.058
	(2.45)	(1.14)	(0.46)	(-0.02)	(-0.76)
R&D/total assets	0.026**	0.17**	-0.015**	0.028	-0.014***
	(2.04)	(2.33)	(-2.18)	(0.45)	(-2.85)
Assets in place	0.051***	0.088**	-0.005	0.242**	0.054
	(3.05)	(2.55)	(-0.24)	(2.31)	(1.6)
CEO tenure	-0.003***	-0.007***	-0.006***	-0.002	-0.002
	(-3.17)	(-3.36)	(-4.02)	(-0.33)	(-1.06)
CEO PPS	0.054***	0.111***	0.086***	0.044	0.056***
	(10.35)	(9.11)	(12.45)	(0.99)	(4.05)
CEO cash pay	2.033	11.946**	1.793	19.337	12.229*
	(0.75)	(2.05)	(0.4)	(0.8)	(1.69)
DCP return volatility	0.001**	-0.001	-0.004***	0.019***	0.0007
	(2.05)	(-1.16)	(-4.63)	(4.7)	(0.56)
Average DCP return	0.009***	0.011***	0.005**	0.037***	0.002
	(9.99)	(3.51)	(2.17)	(3.49)	(0.51)
DCP_DUMMY	-0.005	-0.06*	0.091***	-0.202*	-0.014
	(-0.31)	(-1.71)	(3.69)	(-1.61)	(-0.37)
Obs#	1227	830	886	874	852
R-Square	0.2274	0.1539	0.2078	0.0344	0.0644

Table 12E: CEO risk preferences (investment talent) and ROA performance
(Model 5)

This table reports OLS regression estimates of ROA for a sample of S&P 1500 companies over 2007 to 2010. The dependent variable is ROA (return of asset). Column 'Average' takes the mean of each variable for each case across time and run regression on the collapsed dataset of means. Column "200x" means the regression uses data of year 200x. See Table 1 for the definition of all other variables. T-statistics appear in parentheses below each estimate. Significant at 1% (***), 5% (**), and 10% (*) levels.

Variable	Average	2007	2008	2009	2010
Log(sales)	0.014***	0.003	0.014***	0.01***	0.006
	(4.5)	(0.73)	(3.94)	(2.95)	(1.55)
Leverage	-0.128***	-0.109***	-0.034**	-0.054***	-0.073***
	(-7.32)	(-5.73)	(-1.99)	(-2.74)	(-3.34)
TOP5_HLD	0.0006	-0.0001	0.0004	-0.0001	0.0004
	(1.56)	(-0.01)	(0.87)	(-0.26)	(0.86)
SEG_NUM	-0.003*	-0.004**	-0.005***	-0.004***	-0.003*
	(-1.9)	(-2.41)	(-2.67)	(-2.72)	(-1.77)
Board size	-0.026	-0.004	-0.043**	-0.027	-0.029
	(-1.51)	(-0.22)	(-2.15)	(-1.37)	(-1.45)
R&D/total assets	-0.044***	-0.139***	-0.023***	-0.045***	-0.008***
	(-7.28)	(-7.08)	(-8.6)	(-9.9)	(-5.95)
Assets in place	0.034***	0.037***	0.004	-0.002	0.023**
	(4.02)	(3.69)	(0.47)	(-0.26)	(2.56)
CEO tenure	-0.0004	-0.0007	-0.002***	-0.002***	-0.001**
	(-0.02)	(-1.32)	(-2.75)	(-3.2)	(-2.17)
CEO PPS	0.022***	0.027***	0.022***	0.025***	0.023***
	(8.82)	(7.99)	(7.8)	(7.27)	(6.41)
CEO cash pay	-2.117*	-3.135*	-2.258	-1.935	-2.83
	(-1.6)	(-1.79)	(-1.22)	(-1.05)	(-1.5)
DCP return volatility	-0.0006*	-0.0005	-0.0009**	-0.001***	-0.0006*
	(-1.81)	(-1.23)	(-2.44)	(-3.02)	(-1.61)
Average DCP return	0.0002	0.0006	0.001	0.001	0.0009
	(0.37)	(0.67)	(1.48)	(1.47)	(1.04)
DCP_DUMMY	0.006	0.003	0.007	0.002	0.002
	(0.79)	(0.32)	(0.7)	(0.25)	(0.16)
Obs#	1144	777	830	820	837
R-Square	0.2416	0.2268	0.2532	0.2569	0.134

Table 12F: CEO risk preferences (investment talent) and Idiosyncratic Risk
(Model 6)

This table reports OLS regression estimates of Idiosyncratic Risk for a sample of S&P 1500 companies over 2007 to 2010. The dependent variable is Idiosyncratic Risk (Idio_Risk). Column 'Average' takes the mean of each variable for each case across time and run regression on the collapsed dataset of means. Column "200x" means the regression uses data of year 200x. See Table 1 for the definition of all other variables. T-statistics appear in parentheses below each estimate. Significant at 1% (***), 5% (**), and 10% (*) levels.

Variable	Average	2007	2008	2009	2010
Log(sales)	-0.065***	-0.083***	-0.036***	-0.046***	-0.086***
	(-7.59)	(-8.27)	(-3.26)	(-3.64)	(-6.45)
TOBINSQ	-0.023***	0.008	-0.045***	-0.041***	-0.010
	(-2.58)	(0.98)	(-3.15)	(-2.85)	(-0.81)
Leverage	0.073	0.022	0.140**	0.330***	0.194**
	(1.49)	(0.42)	(2.52)	(4.57)	(2.52)
TOP5_HLD	0.008***	0.005***	0.004***	0.006***	-0.002
	(7.05)	(4.02)	(2.61)	(4.04)	(-1.37)
SEG_NUM	-0.009**	0.005	0.004	-0.001	-0.005
	(-2.26)	(1.15)	(0.71)	(-0.09)	(-1.00)
Board size	-0.218***	-0.134***	-0.137**	-0.079	-0.173**
	(-4.75)	(-2.76)	(-2.31)	(-1.15)	(-2.56)
R&D/total assets	0.009	0.036	0.005	0.020	-0.003
	(0.55)	(0.66)	(0.63)	(1.17)	(-0.58)
Assets in place	0.031	0.051**	0.034	0.119***	0.114***
	(1.37)	(2.01)	(1.22)	(4.16)	(3.77)
CEO tenure	0.004***	0.004**	0.006***	0.007***	0.006***
	(2.71)	(2.44)	(3.29)	(3.48)	(3.01)
CEO PPS	-0.070***	-0.055***	-0.094***	-0.131***	-0.121***
	(-9.44)	(-5.68)	(-10.3)	(-10.1)	(-9.18)
CEO cash pay	5.928	-1.993	1.676	10.201	11.616*
	(1.65)	(-0.47)	(0.3)	(1.54)	(1.79)
DCP return volatility	0.002***	0.002*	0.003***	0.006***	0.005***
	(3.21)	(1.87)	(2.6)	(5.24)	(4.34)
Average DCP return	-0.005***	-0.008***	-0.007***	-0.016***	-0.014***
	(-4.5)	(-3.37)	(-2.38)	(-5.6)	(-5.05)
DCP_DUMMY	-0.083***	-0.069**	-0.076**	-0.076**	-0.072**
	(-3.63)	(-2.56)	(-2.45)	(-2.22)	(-2.1)
Obs#	1202	816	870	857	809
R-Square	0.4505	0.4672	0.3585	0.4033	0.4027

Table 12G: CEO risk preferences (investment talent) and Diversification (Entropy) (Model 7)

This table reports OLS regression estimates of Entropy for a sample of S&P 1500 companies over 2007 to 2010. The dependent variable is Diversification (Entropy). Column 'Average' takes the mean of each variable for each case across time and run regression on the collapsed dataset of means. Column "200x" means the regression uses data of year 200x. See Table 1 for the definition of all other variables. T-statistics appear in parentheses below each estimate. Significant at 1% (***), 5% (**), and 10% (*) levels.

Variable	Average	2007	2008	2009	2010
Log(sales)	0.948***	0.932***	0.939***	0.915***	0.930***
	(43.42)	(32.86)	(37.15)	(34.89)	(36.83)
TOBINSQ	-0.009*	-0.041*	-0.072**	-0.084***	-0.037
	(-1.83)	(-1.75)	(-2.23)	(-2.76)	(-1.52)
Leverage	0.010	0.045	0.087	0.181	0.187
	(0.08)	(0.31)	(0.69)	(1.21)	(1.28)
TOP5_HLD	-0.004	-0.003	-0.003	-0.003	-0.005
	(-1.39)	(-0.96)	(-1.00)	(-1.12)	(-1.61)
SEG_NUM	0.179***	0.181***	0.187***	0.164***	0.148***
	(16.91)	(14.19)	(15.68)	(15.23)	(15.08)
Board size	0.090	0.165	0.318**	0.362**	0.286**
	(0.77)	(1.2)	(2.33)	(2.54)	(2.22)
R&D/total assets	0.008	0.084	-0.002	0.003	0.008
	(0.17)	(0.54)	(-0.09)	(0.08)	(0.93)
Assets in place	-0.154***	-0.108	-0.184***	-0.220***	-0.084
	(-2.7)	(-1.51)	(-2.87)	(-3.7)	(-1.46)
CEO tenure	-0.005**	-0.012***	-0.009***	-0.007*	-0.007*
	(-1.41)	(-2.76)	(-2.14)	(-1.73)	(-1.92)
CEO PPS	-0.010	0.010	-0.010	0.008	-0.035
	(-0.55)	(0.37)	(-0.48)	(0.3)	(-1.41)
CEO cash pay	-5.478	4.962	-1.396	3.292	22.658*
	(-0.59)	(0.41)	(-0.11)	(0.24)	(1.86)
DCP return volatility	0.004*	0.002	0.002	0.001	0.001
	(1.95)	(0.73)	(1.04)	(0.7)	(0.58)
Average DCP return	0.001	0.010	0.008	0.008	0.003
	(0.48)	(1.51)	(1.25)	(1.4)	(0.74)
DCP_DUMMY	0.138**	0.158**	0.183***	0.171**	0.164**
	(2.37)	(2.08)	(2.61)	(2.42)	(2.5)
Obs#	1227	830	886	874	821
R-Square	0.8393	0.8402	0.8526	0.849	0.8731