CEO Tenure and Risk-taking

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Abstract

We conduct the first systematic analysis of the effect of CEO tenure on risk-taking. We document an overall positive impact of CEO tenure on risk-taking. Our results suggest that this positive relation may not be explained by tenure proxying for power, experiences, or human capital investment. Instead, the results are consistent with the hypothesis that the declining career concerns associated with longer tenure increase the risk-taking incentive of a CEO. Further, the evidence suggests that the effect of career concerns on risk-taking depends on the degree of information asymmetry about CEO ability, which is consistent with recent theoretical work.

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1. Introduction

The role of managers in influencing corporate risk taking has received increasing attention in the academic literature. A large strand of literature examines the relationship between managerial compensation incentives and risk taking (e.g., DeFusco et al. 1990; Tufano 1996; Schrand and Unal 1998; Guay 1999; Cohen et al. 2000; Chen et al. 2006; Coles et al. 2006; Chakraborty et al. 2007; Chava and Purnanandam 2010; DeYoung et al. 2010; Gormley et al. 2011; Brick et al. 2012). More recently, scholars begin to shift their attention to the effect of the innate attributes of managers on their risk-taking incentives, such as sensation seeking, overconfidence, education, military background, depression-era life experiences, religious belief, and political affiliations (Bertrand and Schoar 2003; Hilary and Hui 2009; Benmelech and Frydman 2010; Graham et al. 2010; Hirshleifer et al. 2010; Hutton et al. 2011; Malmendier et al. 2011; Cain and Mckeon 2012). We add to the study of the effect of managers on corporate risk-taking by examining the relationship between CEO tenure and risk taking.

To our knowledge, this is the first systematic study of this kind. We stress the word "systematic" here, since a significant number of studies already include CEO tenure as a control variable in the study of the effect of their major variable of interest on managerial risk taking (Tufano 1996; Bloom and Milkovich 1998; Cohen et al. 2000; Coles et al. 2006; Chakraborty et al. 2007; Hirshleifer et al. 2010; Belghitar and Clark 2011; Muscarella and Zhao 2011; Ryan and Wang 2011; Cain and Mckeon 2012).[1] Nevertheless, none of these studies adequately justifies the inclusion of this variable in their empirical work. Some lack justification at all (e.g., Cohen et

[1] These studies use the volatility of stock returns as a proxy for risk-taking, similar to our paper. Other studies examine the effect of their major variable of interest on some corporate policies that may be associated with firm risk, such as leverage, R&D expenses, etc. (Tufano 1996; Bloom and Milkovich 1998; Cohen, Hall and Viceira 2000; Coles, Daniel and Naveen 2006; Frank and Goyal 2007; Hirshleifer, Low and Teoh 2010; Belghitar and Clark 2011; Chesney, Stromberg and Wagner 2011; Cain and Mckeon 2012; Lewellyn and Muller-Kahle 2012). But as we argue below, we side away from the consideration of specific corporate policies due to the ambiguity of the interpretation of these policies.

al. 2000; Belghitar and Clark 2011). (Tufano 1996) even states that there is no explanation for the negative association between the tenure of a CFO and risk-management as documented in his paper. Most others include tenure as a proxy for risk aversion either due to CEO power or non-diversified human capital investment (e.g., Bloom and Milkovich 1998; Coles et al. 2006; Chakraborty et al. 2007; Cain and Mckeon 2012). As we argue below, however, tenure can have at least four interpretations: power, human capital investment, experiences, and career concerns. More importantly, except for human capital investment, it is not clear whether longer tenure makes a CEO more or less risk-averse based on the other three interpretations of tenure. Our study aims to shed light on the mechanisms through which CEO tenure may matter for risk-taking.

Based on a sample of S&P 1,500 firms between 1992 and 2006, we document a positive impact of CEO tenure on risk-taking as proxied by total, systematic, and idiosyncratic volatilities of stock returns. We rely on the volatility of stock returns rather than specific corporate policies such as leverage and R&D expenses, to avoid the ambiguity of the interpretation for these policies. For example, financial leverage is often used as an indicator of managerial risk taking (e.g., Cohen et al. 2000; Cain and Mckeon 2012). But leverage may also discipline managers from consuming excessive free cash flows (Jensen 1986). Similarly, R&D expenditure is frequently used as a risk-taking proxy (e.g., Ryan and Wiggins 2002; Cohen et al. 2005). But R&D may also stand as a long-term investment (e.g., Dechow and Sloan 1991). The extant evidence on the relation between CEO tenure and equity volatility in the literature is mixed.[2] Compared with the studies as cited above, our sample covers a larger set of firms and generally a

[2] Most studies do not detect a significant relation between CEO tenure and equity volatility (Cohen, Hall and Viceira 2000; Muscarella and Zhao 2011; Ryan and Wang 2011; Cain and Mckeon 2012). Some find a negative relation (Coles, Daniel and Naveen 2006; Chakraborty, Sheikh and Subramanian 2007; Hirshleifer, Low and Teoh 2010; Belghitar and Clark 2011). A few find a positive and significant relation similar to our paper (Tufano 1996; Bloom and Milkovich 1998).

longer time span, which may provide one explanation for the difference between the results. We also note the importance of including CEO age together with tenure in the risk-taking regressions, which is not done by some studies (e.g., Coles et al. 2006; Chakraborty et al. 2007; Hirshleifer et al. 2010; Muscarella and Zhao 2011). In addition, we follow (Brick et al. 2012) and control for the lagged dependent variables in all our model specifications, which also distinguishes our study from most other related work. Our results are robust to both OLS and fixed firm-CEO effects models. The fixed-effects models are particularly important in our context since, as discussed above, recent work suggests that inherent manager characteristics matter for corporate risk-taking. These models are immune to such considerations.

We then conduct a battery of tests to examine which of the four interpretations of tenure as mentioned above may best explain a positive impact of CEO tenure on risk-taking. Our evidence suggests that the commonly employed three interpretations of tenure: human capital investment, power, and experiences may not explain the results. Instead, the declining career concerns of a CEO with the accumulation of tenure may give rise to her increased incentive to take risks. Consistent with recent theoretical work on career concerns and risk-taking (Chen 2010; Fu and Li 2010), we further demonstrate a differential impact of CEO tenure on risk-taking conditional on the degree of information asymmetry regarding the ability of the CEO. The positive and significant effect of tenure on risk-taking holds only when the CEO is expected to possess little private information about her own ability. The differential effect of CEO tenure on risk-taking may also provide another explanation for the difference in the documented average effect of CEO tenure on risk-taking between this paper and other related studies.

Our work suggests the importance of career concerns in explaining managerial risk-taking behavior, which has received less attention in the literature. A significant number of studies

examine the effect of career concerns on managerial herding (Scharfstein and Stein 1990; Zwiebel 1995; Prendergast and Stole 1996; Avery and Chevalier 1999; Graham 1999; Hong et al. 2000; Lamont 2002; Boyson 2010). But herding may only be considered as a form of relative risk-taking, rather than risk-taking itself. A small strand of studies employ termination risk as a proxy for career concerns and find mixed evidence on the relation between career concerns and managerial risk-taking (Chevalier and Ellison 1999; Chakraborty et al. 2007; Zhang 2009; Hu et al. 2011). We contribute to this line of work not only through the use of a new proxy for career concerns, but also by demonstrating a differential effect of career concerns on risk-taking conditional on information asymmetry about the CEO ability. These results may provide additional insight on the effect of career concerns on managerial behavior.

We also aim to shed some light on the balance of "implicit" incentives associated with tenure with "explicit" compensation incentives, as initiated by (Gibbons and Murphy 1992). We extend their work by incorporating the considerations of the risk-taking incentives of a CEO in addition to effort incentives in their paper. We show that the pay-performance sensitivity (delta) is positively and significantly associated with CEO tenure, which is consistent with the evidence in (Cremers and Palia 2010) and the idea that the increase of delta balances the reduced effort incentives as a result of declining career concerns of a longer-tenured CEO. But given the risk-reducing effect of delta as documented in this paper, the positive association between delta and CEO tenure is also consistent with the idea that delta offsets the increasing risk-taking incentives of the CEO with the increase of her tenure. We also show that the pay-volatility sensitivity (vega) is negatively and weakly significantly associated with tenure, which contradicts the exclusion

condition as used by some studies in their simultaneous-equation models (e.g., Coles et al. 2006).[3]

The rest of the paper is structured as follows. Section 2 develops the theoretical arguments relating tenure to risk-taking. Section 3 describes the data and major variables, and reports the summary statistics. Section 4 conducts the empirical analysis. Finally, Section 5 concludes.

2. Theoretical Arguments on Managerial Tenure and Risk-taking

As discussed above, there are at least four interpretations of tenure. First, longer tenure may increase managerial power (Morck et al. 1988; Berger et al. 1997; Rose and Shepard 1997; Hermalin and Weisbach 1998; Chidambaran and Prabhala 2003; Ryan and Wiggins 2004). Second, the experiences of a manager may also accumulate with the increase of tenure (Simsek 2007). Third, as tenure increases, managers also have more non-diversified human capital invested in the firm (Berger et al. 1997). Finally, a newly-appointed manager may have strong concerns for her future career prospects. Such concerns may decline with the increase of her tenure (Gibbons and Murphy 1992). Except for the interpretation of tenure as a proxy for human capital investment, which predicts an unambiguously negative effect of CEO tenure on risk-taking (Amihud and Lev 1981; May 1995; Bloom and Milkovich 1998; Chakraborty et al. 2007; John et al. 2008), the predictions for the relationship between tenure and risk-taking based on the other interpretations are uncertain.

First, it is not clear how managerial power affects risk-taking. (Hermalin and Weisbach 1998) develop a model on board composition based on the bargaining between the CEO and the board. The turnover of the CEO is determined by her perceived ability, which is inferred from firm performance. Upon being retained, the incumbent CEO bargains for a less independent board. Therefore, longer tenure of the CEO suggests greater managerial power and entrenchment. An

[3] These studies typically assume that tenure is not related to vega, and use this assumption as an exclusion condition.

entrenched manager may also enjoy larger private benefits from control, which may motivate her to conduct low-risk projects. Indeed, a number of studies find that managerial entrenchment is associated with more conservative corporate policies (Bertrand and Mullainathan 2003; John et al. 2008; Laeven and Levine 2009; Pathan 2009). The above analysis suggests that CEO tenure should be negatively associated with risk-taking.

On the other hand, (Adams et al. 2005) show that founder CEOs, who presumably are more powerful than non-founder CEOs, are associated with greater variability in firm performance. The rationale behind these results is that the risk arising from the judgment errors of a powerful CEO is not well diversified across other executives and directors because the CEO may dictate the decision-making process (Sah and Stiglitz 1986, 1991). This leads to extreme and risky corporate actions. In a similar vein, (Cheng 2008) documents that a larger board is associated with less variable firm performance, because the decision errors of each director are dissipated over her many colleagues.

The study in social psychology suggests that power may influence the activation or deactivation of the approach/inhibition behavioral systems. An elevated power activates the approach-related behavior, (add some examples) which results in heightened sensitivity to the potential rewards of an event rather than its potential loss (Keltner et al. 2003). This often results in risk-taking of an individual (Anderson and Galinsky 2006).

Therefore, interpreting tenure as a proxy for managerial power or entrenchment, the arguments above suggest that its impact on managerial risk-taking is ambiguous.

The effect of managerial experiences on risk-taking is also uncertain. On the one hand, some studies have suggested that inexperienced individuals tend to be more overconfident, and therefore experiences may lower the level of overconfidence (Gervais and Odean 2001;

Christoffersen and Sarkissian 2002; Locke and Mann 2003). If overconfidence of an individual is associated with more risk-taking as suggested by the literature (Odean 1998; Gervais et al. 2011), the accumulation of experiences should result in less risk-taking. On the other hand, an experienced manager as a result of long tenure may possess sufficient firm- and job-specific skills that are necessary to take strategic risks (Simsek 2007). Some studies also suggest that experiences may increase the degree of overconfidence (Glaser et al. 2010), and therefore may promote risk-taking.

Finally, it is also not clear how the career concerns of a manager may affect her risk-taking incentives. (Holmstrom 1999) argues that a manager has an incentive to under-invest relative to the optimal level, since risky investment may reveal her true ability, which may compromise her future wages. Similarly, (Hirshleifer and Thakor 1992) argue that career concerns may motivate a manager to favor relatively safe projects, in an attempt to delay the resolution of the uncertainty about her privately informed ability. However, their proposition rests on the assumption that the market can only observe the outcome of a managerial decision, rather than the decision itself. If an increase of the tenure suggests a decrease of career concerns as is often assumed in the literature (Gibbons and Murphy 1992; Milbourn 2003; Cremers and Palia 2010; Zheng 2010), the arguments in (Holmstrom 1999) and (Hirshleifer and Thakor 1992) would suggest that tenure is positively associated with risk-taking.

In contrast, (Hermalin 1993) argues that a manager may prefer the riskiest project because of career concerns, since the weight put on the return of a project in updating the estimate of her ability is inversely related to the variance of the project return. Therefore, by taking a risky project, a manager can make the market rely more on the prior estimate of her ability in setting wages, which decreases the uncertainty of her utility. A crucial assumption in (Hermalin 1993) is

that the market can observe the project risk as well as the project choice of the manager. Since full disclosure of managerial actions is often unrealistic, the assumption of the observability of project risk is questionable.

In a more general setting, (Chen 2010) argues that the disincentive to take risks in (Holmstrom 1999) depends crucially on the assumption that the agent as well as the principal is uninformed about her ability. If instead a manager has private information about her own ability, (Chen 2010) shows that she always opts for a risky project. The intuition for this proposition is that a privately informed manager has the incentive to signal as a talented type. Since it is more likely for an able manager to succeed with a risky project, choosing the safe one is a sign of weakness. Therefore, the manager chooses the risky project regardless of her ability, resulting in excessive risk-taking. In the context of political reform, (Fu and Li 2010) reach the same conclusion. They argue that a privately informed politician has the incentive to engage in a risky reform in order to be perceived as capable, even if such action is detrimental to the society. The results in Chen (2010) and Fu and Li (2010) suggest that career concerns should be positively associated with risk-taking if the manager possesses private information about her own ability. In other words, tenure should be negatively associated with risk-taking under such a scenario. Combining the predictions in (Holmstrom 1999), Chen (2010), and Fu and Li (2010), a differential impact of managerial tenure on risk-taking is expected conditional on the level of information asymmetry regarding the ability of the manager.

3. Sample, Variables, and Summary Statistics

3.1. Data and Sample

We merge several databases together to form our sample for the empirical analysis. Data for CEO tenure, age, compensation, and the data used in the calculations of vega and delta are

obtained from EXECUCOMP. From this database we also identify whether the CEO is an outside hire and the number of years an internally-hired CEO had worked for the firm before being promoted to the CEO. These data are used to test our career concerns hypothesis. Daily stock returns to calculate equity volatility are from CRSP. The calculation of systematic volatility and idiosyncratic volatility requires data on market, size, book-to-market, and momentum factors (Fama and French 1993; Carhart 1997), which are obtained from Kenneth French's website. The data for firm age are also from CRSP. Financial data are from COMPUSTAT. Some data used in the tests of CEO power and experiences hypotheses are obtained from RiskMetrics (formerly IRRC) and Thomson Reuters. After merging various databases, our primary sample to examine the relationship between CEO tenure and equity volatility includes 11,526 firm-year observations and 2,072 unique firms. The sample mainly covers S&P 1,500 firms from 1992 to 2006. The primary sample includes firms with dual-class stocks, finance (one-digit SIC code equals 6) and utility firms (two-digit SIC code equals 49). In an unreported robustness check we follow the convention in the governance literature and exclude these firms from the sample, and obtain similar results.

3.2. Variables

As stated above, we use the volatility of stock returns as a proxy for managerial risk-taking. We estimate four volatility measures. Our first measure is the standard deviation of the daily stock returns over the fiscal year (Volat). We require a firm to have at least 100 observations in a year to calculate this variable. The total volatility is then decomposed into the systematic volatility and idiosyncratic volatility. The systematic volatility (Sys_mkt) is defined as the standard deviation of the predicted component based on the market model with a constant term. The idiosyncratic volatility (Idio_mkt) is the standard deviation of the residuals from the market

model with a constant term.[4] We also calculate a fourth risk-taking measure as the idiosyncratic volatility based on Fama-French-Carhart four-factor model (Idio_ff4), which is the standard deviation of the residuals from the Fama-French-Carhart four factor model (market, size, book-to-market, and momentum) with a constant term. Since equity volatilities typically have skewed distributions, we take the logs of these variables.

CEO tenure in a given year is determined as the length of time between the date when the person became the CEO ("becameceo" in EXECUCOMP) and the current fiscal year end. We further make the following corrections: (1) For those observations with missing values from the above calculation, if the CEO is hired from outside the firm and the date when the person joined the company ("joined_co" in EXECUCOMP) is available, CEO tenure in a given year is calculated as the length of time between "joined_co" and the current fiscal year end. Similar to (Allgood and Farrell 2000), (Farrell and Whidbee 2000) and (Huson et al. 2004), a CEO is determined as an outside hire if she joins the firm for less than two years at the time of succession and she is not a founder; (2) For those CEOs who held the position multiple times, EXECUCOMP only has the data for "becameceo" for either the first time or the most recent time the person became the CEO. Therefore, we manually check these cases and use the information that the previous CEO left the company to determine the data for "becameceo" for the CEO with multiple appointments. Figure 1 shows that CEO tenure has a skewed distribution. In contrast, the distribution of the log of tenure is much less skewed. Therefore, we include the log of CEO tenure in all our regressions.[5] We note that most of the studies on managerial risk-taking that include CEO tenure as one of the control variables did not include tenure in its logged format

[4] Our results are similar if we exclude the constant term in calculating the systematic and idiosyncratic volatilities.
[5] This is important for some of our results. CEO tenure is no longer significant in the risk-taking regression models with the fixed firm-CEO effects if included in an un-logged format.

(e.g., Coles et al. 2006; Chakraborty et al. 2007), which may also explain the difference between our results and theirs.

In addition to the implicit incentives associated with tenure, the explicit compensation incentives including delta and vega have also been shown to matter for managerial risk-taking. We follow (Core and Guay 2002) and use the one-year approximation (OA) method to estimate delta and vega. Delta is the sensitivity of CEO portfolio wealth to a 1% change in stock price. Vega is the sensitivity of CEO portfolio wealth to a 0.01 change in the standard deviation of stock return. Guay (1999) shows that option vega is several orders of magnitude higher than stock vega. Therefore, we follow the convention in the literature and use option vega to approximate the vega of CEO total wealth (e.g., Knopf et al. 2002; Rajgopal and Shevlin 2002; Coles et al. 2006). Similar to many others, we use the annualized standard deviation of monthly stock returns over the past sixty months as the volatility measure in the estimation of delta and vega (e.g., Brick et al. 2012). For dividend yield, we calculate the average dividend yield over the past three years. Finally, the risk-free rate is approximated by the yield-to-maturity of the constant-maturity Treasury bonds matched by the closest maturity.[6] Because delta and vega have skewed distributions, we take the logs of both variables.

In the risk-taking regressions we also control for several CEO and firm level characteristics. In terms of CEO characteristics, it is important to include CEO age together with tenure, since these two variables should be significantly correlated with each other. Managerial age has also been advanced as a proxy for career concerns (e.g., Gibbons and Murphy 1992), and hence has uncertain impact on risk-taking based on our arguments above. However, older CEOs are generally expected to be more conservative in setting corporate policies (Vroom and Pahl 1971;

[6] Our results are similar if we give the options a simple "haircut" by assuming that the remaining maturity of all options is 70% of the stated remaining maturity, and that the risk-free rate is the average yield on seven-year U.S. Treasury bonds. This is the method used by EXECUCOMP and some related studies (e.g., Brick et al. 2012).

Hitt and Tyler 1991; Tufano 1996; Bertrand and Mullainathan 2003; Chok and Sun 2007). If this demographic effect dominates, age is expected to be negatively associated with risk-taking. We also follow Guay (1999) and include CEO cash compensation, which is expected to increase the risk-taking incentive of a risk-averse CEO. The firm-level characteristics include firm size (inflation adjusted), growth opportunities (market-to-book ratio), return on assets (ROA), capital expenditures, R&D expenses, financial leverage, and firm age (Guay 1999; Coles et al. 2006; Ryan and Wang 2011; Cain and Mckeon 2012). We also control for the degree of corporate diversification as proxied by the number of business segments.

In the delta and vega regression models, we control for the inflation-adjusted cash balance of the firm in addition to the control variables in the risk-taking regressions. (Yermack 1995) documents that liquidity-constrained firms may be more inclined to pay their CEOs with options. We follow (Rajgopal and Shevlin 2002) and include the cash balance as a proxy for liquidity.

The detailed definitions for these variables are in the Appendix.

3.3. Summary Statistics

Table 1 presents summary statistics and correlations for the variables in our primary analyses. According to the summary statistics in Panel A, the average (median) firm in our sample has total volatilities of stock returns of 3% (2%) in a given year. In addition, the average (median) CEO in our sample is 55.63 (56) years old with a tenure of 7.95 (5.42) years. Furthermore, Mean (median) vega is 113.14 (32.59) thousand dollars, and mean (median) delta is 1,569.31 (182.40) thousand dollars. Panel B reports the correlation matrix for the major variables. As expected, the tenure of a CEO is significantly correlated with her age (0.35). It is therefore important to include both tenure and age in the regressions. Panel B also shows that except for the correlation between CEO tenure and delta, the correlations between tenure and the risk-taking variables and

vega are very low. With the inclusion of the control variables, however, we show subsequently that the effects of CEO tenure on these variables are significant. It is also notable that the two idiosyncratic volatility measures are highly correlated with each other, with a coefficient at almost 1.00 (a more precise coefficient is 0.9979).

4. Empirical Analysis

In this section we first examine the empirical relationship between CEO tenure and risk-taking. We then test the four hypotheses built on the four interpretations of tenure as discussed in Section 2, which may explain the documented relation. Finally, given the empirical relations between CEO tenure and risk-taking as well as between delta (vega) and risk-taking, we examine the empirical relationship between CEO tenure and delta and vega, to gauge the balance of implicit with explicit risk-taking incentives.

4.1. CEO Tenure and Risk-taking

We use two model specifications to examine the relationship between CEO tenure and risk-taking. (Brick et al. 2012) suggest that controlling for the lagged dependent variables is important to reduce the omitted variable bias. We follow their suggestion and include the lagged dependent variables in all our model specifications, which distinguishes our study from most other related work.[7] Our first model specification is OLS, which is commonly employed in the literature. But this specification is subject to severe issues of endogeneity, which may manifest itself through both reverse causality and omitted variable bias. Reverse causality may not be a serious problem in our context, however, since CEO tenure is a "state" variable.[8] But omitted variable bias is present in any empirical work especially ours since, as mentioned above, recent

[7] The dependent variables for the risk-taking regressions are lagged at the firm level. In contrast, the dependent variables for the delta and vega regressions are lagged with respect to the firm-CEO matched pair. This is because while volatilities may be firm-specific, delta and vega are CEO-specific.

[8] This feature of tenure is different from turnover, which can be determined by the risk-taking behavior of the CEO.

studies suggest that the innate characteristics of a manager can influence corporate risk-taking. Though our control of the two-digit SIC industry and year effects may alleviate this bias to some extent, it may not account for the fixed manager characteristics. Therefore, our second specification employs models with fixed firm and CEO effects, similar to Cremers and Palia (2010). This also separates our work from most others, which typically use either OLS or fixed firm-effects models (e.g., Coles et al. 2006; Chakraborty et al. 2007; Hirshleifer et al. 2010; Cain and Mckeon 2012).[9] Standard errors are adjusted for heteroskedasticity for all our regression models, and clustered at the firm level for the risk-taking regressions but at the firm-CEO level for the delta and vega regressions.

Table 2 reports the OLS regression results on the four volatility measures as discussed in Section 3. Model 1 shows a positive and highly significant impact of CEO tenure on total volatility. In contrast, the effect of CEO age on risk-taking is negative and significant. Therefore, the results suggest that though both tenure and age may proxy for the career concerns of the CEO, they have directly opposite effects on risk-taking. This may reflect an increasing degree of risk-aversion when a CEO ages. Consistent with the evidence in (Brick et al. 2012), both compensation vega and delta are negatively associated with risk-taking. The negative effect of delta on risk-taking is consistent with many others and may reflect the reluctance of a CEO to take risks when her portfolio wealth is sensitive to the fluctuation of stock price (e.g., Coles et al. 2006; Gormley et al. 2011). The risk-reducing effect of vega, however, is harder to reconcile. In contrast, most empirical studies document a positive effect of vega on risk-taking (e.g., Coles et

[9] Although the reverse causality of CEO tenure is not a major concern in this study, the reverse causality of other independent variables such as vega and delta may still affect the consistency of the coefficient estimate on CEO tenure, provided that these variables are correlated with tenure. To consider this possibility, in an untabulated analysis, we examine the robustness of the effect of CEO tenure on risk-taking through system GMM models (Arellano and Bover 1995; Blundell and Bond 1998). In these models, except for CEO tenure and age, and firm size and age, other independent variables are treated as endogenous variables. The positive effect of CEO tenure on risk-taking still holds across all the volatility measures.

al. 2006; Chakraborty et al. 2007; Low 2009; Gormley et al. 2011). Subsequently we show the importance of including the lagged dependent variable in the effect of vega on risk-taking, which may explain the difference between the results. Here we note one possible explanation for the negative effect of vega on risk-taking as suggested by (Hjortshoj 2007). He demonstrates that the sensitivity of option value to volatility (vega) may not be equivalent to the sensitivity of the certainty equivalent option cash flows to volatility, especially for an undiversified CEO with significant amount of in-the-money options. Since the latter sensitivity is a better indicator of the risk-taking incentive of a CEO, a higher vega does not necessarily induce a CEO to take more risks. We also note that though the coefficients on vega and delta are both negative, the magnitude on vega is only half of that on delta. In an unreported F-test, we confirm the statistical difference between these two coefficients. These results suggest a stronger risk-reducing effect of pay-performance sensitivity as compared with pay-volatility sensitivity.

The positive effect of CEO tenure on total volatility is consistent with a few studies (Tufano 1996; Bloom and Milkovich 1998), but is in contrast with many others (Coles, Daniel and Naveen 2006; Chakraborty, Sheikh and Subramanian 2007; Hirshleifer, Low and Teoh 2010; Belghitar and Clark 2011). We note three possible reasons for the difference between the results. First, our sample covers a larger set of firms with a longer time span than these other studies. Second, none of the studies cited above controls for the lagged dependent variable as we do. Third, most of these papers do not include CEO age together with tenure (Coles et al. 2006; Chakraborty et al. 2007; Hirshleifer et al. 2010). Yet as shown in Section 3, tenure and age are significantly correlated with each other, and hence the omission of CEO age in the regression may generate the bias on the coefficient of tenure.

In Model 2 we examine whether the results in Model 1 change with the exclusion of the lagged dependent variable and CEO age. To be consistent with the specification in (Coles et al. 2006), we also exclude the year dummies. Interestingly, once CEO age and the lagged dependent variable are dropped, CEO tenure becomes *negative* and weakly significant at the 10% level. The contrast between the results in Models 1 & 2 demonstrates that the previous findings for a negative effect of CEO tenure on risk-taking may be at least partly due to not controlling for CEO age.[10] Indeed, once we control for CEO age in Model 3, the age variable picks up all the significance of CEO tenure. The results in Models 2 & 3 also show that once we exclude the lagged dependent variable, vega becomes *positive* and significant. Since the lagged dependent variable is highly significant as shown in Model 1 and it is reasonable to expect that lagged firm risk should affect the risk-taking incentives of a CEO, the results in these two models suggest a possible omitted variable bias on vega with the exclusion of the lagged dependent variable.

In Models 4-6, we use the other three risk-taking variables to further examine the relation between CEO tenure and risk-taking: systematic volatility, idiosyncratic volatility based on the market model, and idiosyncratic volatility based on the Fama-French-Carhart four-factor model. The positive and significant effect of tenure on risk-taking holds across all these models. The results also show a consistently negative impact of CEO age on risk-taking. The negative effects of vega and delta on risk-taking also hold for most of the models, except for the model on systematic volatility. In this case, both vega and delta are positive and the coefficient on delta is significant at the 5% level. However, we show later that once the fixed firm and CEO effects are controlled for, the positive coefficient on delta is no longer significant.

[10] (Coles, Daniel and Naveen 2006) state that their major results regarding the relation between vega and delta and risk-taking remain when CEO age is controlled for, but did not discuss whether the inclusion of CEO age changes the coefficient on CEO tenure.

The control variables generally have their expected signs. However, in contrast with (Coles et al. 2006) but similar to (Ryan and Wang 2011) and (Muscarella and Zhao 2011), we document a positive impact of capital expenditures on equity volatility. We also note that some firm-level characteristics have opposite effects on the systematic volatility as compared with idiosyncratic volatilities (firm size, market-to-book ratio, and leverage).

In Table 3 we examine the robustness of the positive effect of tenure on risk-taking using fixed firm-CEO effects models. These models are immune to the consideration that the innate attributes of a CEO may influence her risk-taking incentives and that these attributes may also affect her tenure. The results confirm the findings in Table 2, except for the model with systematic volatility as the dependent variable, where tenure is positive but no longer significant. But we note that the coefficient on tenure in this model is comparable to the coefficients on tenure in other models. The results in Table 3 also show that vega and delta continue to be negative and significantly associated with risk-taking in most of the models. The negative effect of CEO age, however, loses significance. This result suggests that the significant effect of age on risk-taking as documented in Table 2 may be picking up the effect of some innate attributes of the CEO on risk-taking. A possible candidate for this attribute is the "sensation-seeking" tendency, which typically diminishes with the aging of an individual (Cain and Mckeon 2012).

Overall, the results in Tables 2 & 3 document a consistently positive impact of CEO tenure on risk-taking. This positive relation between tenure and risk-taking is not consistent with the interpretation of tenure as a proxy for human capital investment, since this interpretation predicts a negative effect of tenure on risk-taking. However, the other three interpretations of tenure, including power, experiences, and career concerns, may all explain this positive relation, based on our arguments in Section 2. In the next subsection we conduct a battery of tests to examine

which interpretation(s) among the three may best explain the results. We employ the specifications in Table 3 with firm and CEO fixed effects for these tests. To save space, we only report the results using total volatility as the risk-taking variable. Results with respect to the other risk-taking proxies are similar qualitatively.

4.2. Hypotheses Tests

4.2.1. Power Hypothesis

We first examine whether the positive effect of CEO tenure on risk-taking is driven by managerial power. As discussed in Section 2, the increased power associated with longer tenure may either drive the CEO to take extreme actions as a result of the non-diversified decision errors, or activate the approach-related behavioral tendencies that may lead to risk-taking. To test this power hypothesis, we examine whether a long-tenured and powerful CEO as afforded by weak governance mechanisms of the firm, has even stronger incentives to take risks compared with a long-tenured but less powerful CEO with strong governance mechanisms, as would be predicted by this hypothesis.[11] We entertain several proxies of governance mechanisms and CEO entrenchment based on the literature. First, independent directors may have stronger incentives to monitor a CEO and reduce her power (see, e.g., the evidence as surveyed in Hermalin and Weisbach 2003). We use the fraction of the number of independent directors to total board size to indicate the level of board independence. We then define a dummy variable that equals one if the board independence of the firm is at or below its sample median, and zero otherwise (Low board ind). Our second measure of CEO power follows (Bebchuk et al. 2011). They show that the fraction of the aggregate compensation of the top five executives captured by the CEO – the

[11] For example, a more independent board may balance the power of a long-tenured CEO to some extent, and therefore should decrease the risk-taking incentive of the CEO. Therefore, compared with a firm with more independent directors, a similarly-tenured CEO of the firm with less independent directors should have even stronger incentives to take risks based on the power hypothesis.

CEO Pay Slice (CPS), is an indicator of the relative importance of the CEO and the extent to which the CEO is able to extract rents. We define a dummy variable that equals one if the CPS of the firm is above the sample median, and zero otherwise (High CPS).[12] Another important governance mechanism is blockholders, who may have stronger incentives to incur the necessary costs to monitor management than dispersed shareholders (Shleifer and Vishny 1986; Agrawal and Mandelker 1990; Bertrand and Mullainathan 2001). Due to the difficulty of collecting data for all the blockholders, we follow (Cremers et al. 2007) and use the percentage of shares held by institutional blockholders with at least 5% ownership as a measure of blockholdings (Inst block). We then define a dummy variable that equals one if the fraction of the institutional blockholdings of the firm is at or below the sample median, and zero otherwise (Low inst block).[13] Our fourth measure of corporate governance is based on (Agrawal and Nasser 2011). They show that independent directors who are blockholders at the same time have both a strong incentive and the ability to monitor management. We define a dummy variable to equal to one if the firm does not have an independent blockholder with at least 5% ownership, and zero otherwise (No ind block). Finally, (Gompers et al. 2003) show that antitakeover provisions may entrench managers and decrease firm performance. They define a composite score - the G-index, which may take a maximum value of 24, to indicate the number of antitakeover provisions in the firm's charter, bylaw, and the state where the firm is incorporated. Based on this measure, we define a dummy variable that equals one if the G-index of the firm is above the sample median, and zero otherwise (High G-index).[14] We then interact these dummy variables indicating high

[12] Results using the industry-adjusted CPS (either based on the two-digit SIC code or four-digit SIC code) are similar.

[13] Results are similar with a more conventional definition of the institutional blockholdings, which is a dummy variable if the firm does not have an institutional blockholder with at least 5% ownership, and zero otherwise.

[14] Results are similar if we define the high entrenchment dummy based on a refined measure of the antitakeover strength of the firm from the components of the G-index - the E-index, which indicates the number of the six most

CEO power with CEO tenure in the risk-taking regressions. The power hypothesis would predict that the interaction terms are positive and significant. Table 4 reports the results. Since the data for independent directors and independent blockholders are available only after 1996 and 1998, respectively, the sample sizes based on these two measures of CEO power are significantly smaller.

The evidence in Table 4 does not support the power hypothesis.[15] Most of the interaction terms are insignificant. The interaction term Tenure * Low board ind is even *negative* and weakly significant at the 10% level, which is in direct contrast to the prediction of this hypothesis. We also note that in Models 3 & 4 once the interaction terms are included, CEO tenure also becomes insignificant.[16]

4.2.2. Experiences Hypothesis

The second hypothesis that may explain a positive relation between CEO tenure and risk-taking – the experiences hypothesis, states that a more experienced CEO with longer tenure may take more risks either because the CEO has the required skills to take strategic risks, or because experiences make the CEO to become more overconfident. If this hypothesis holds, one would expect that a more capable CEO with experiences as a result of long tenure may be more inclined to take risks than a less capable CEO with similar tenure. We examine several proxies of CEO

important antitakeover provisions at the firm level (Bebchuk et al. 2009). The results are also similar if we use the presence of a classified board as an indicator of managerial power (Bebchuk and Cohen 2005).

[15] In untabulated analysis, we also entertain more proxies of CEO power. We follow (Ashbaugh-Skaife et al. 2006) and measure CEO power as the number of positions a CEO holds inside the firm, including chairman of the board and membership of the three major committees (audit, compensation, and nomination). We also use the combination of chairman and CEO positions as an indicator of CEO power (revise). Results with these proxies of CEO power are also not consistent with the power hypothesis.

[16] The results in Model 4 may be affected by a significantly-reduced sample size since the data for independent blockholders are available only after 1998. The insignificant CEO tenure and the interaction term in Model 3, however, may be a result of the multicollinearity. To examine this possibility, in unreported analysis, we run regressions on sub-samples as defined by Low inst block = 1 and Low inst block = 0, respectively. Contrary to the prediction of the power hypothesis, we find that CEO tenure is positive and significant only in the sub-sample with Low inst block = 0.

ability and interact them with CEO tenure to test the experiences hypothesis. Positive coefficients on these interaction terms should be consistent with the prediction of this hypothesis.

Our first proxy for the ability of the incumbent CEO is the number of external boards she sits on. An abler CEO is expected to sit on more boards (Padmanabhan and Ghosh 2009). We create a dummy variable that equals one if a CEO sits on at least two outside boards, and zero otherwise (CEO_2boards).[17] Since the data for external directorships are available only after 1998, the sample size with this measure of CEO ability is severely reduced. In addition, (Chang et al. 2010) suggest that CEO ability matters for her compensation. Therefore, our second proxy for CEO ability is the total size of the compensation of the CEO. Since larger firms are more complex and presumably require a higher level of skills to manage (and take risks), the residual pay after taking into account the effect of firm size on CEO compensation should be a better indicator of the CEO ability for our purpose. We also consider the potential life-cycle effect of the required ability. Therefore, in generating the residual CEO pay, we run regressions of (the log of) the (inflation-adjusted) total size of CEO compensation on (the log of) the market capitalization and (the log of) firm age, controlling for year and two-digit SIC industry effects. The latter two controls consider the fluctuation of CEO compensation over time that may not be related to ability, and the fact that different industries may have different compensation policies. We then create a dummy variable that equals one if the residual from the above regression is greater than the sample median, and zero otherwise (High CEO compensation).[18] Finally, we

[17] The results are robust to an alternative definition of the dummy variable to be equal to one if the number of external boards a CEO sits on is above the sample median, and zero otherwise.

[18] If we define our High CEO compensation dummy based on the total size of CEO compensation rather than the residual size, the results would provide direct evidence contradicting the experiences hypothesis – this dummy variable interacted with CEO tenure is negative and significant. In addition, the results are similar to those reported in Table 5 if we include more controls in the compensation regression to generate the residual CEO pay (including the lagged value of compensation, lagged stock return, lagged equity volatility, market-to-book ratio, lagged ROA, sales grow rate, CEO tenure, capital expenditures, R&D expenses, leverage, PPE (property, plant, and equipment), dividend yield, E-index, institutional blockholdings, and CEO shareholdings).

follow (Milbourn 2003) and define our third and fourth proxies for CEO ability as the lagged industry-adjusted ROA and lagged industry-adjusted stock return, respectively. We use the two-digit SIC code to define industries.[19] Better performance relative to industry peers may suggest that the CEO is abler. We also create dummy variables by comparing these industry-adjusted performance variables with their respective sample medians (High ind-adj ROA and High ind-adj stkret). These four proxies of CEO ability are then interacted with CEO tenure respectively in the risk-taking regressions. Table 5 reports the results.

Consistent with the prediction of the experiences hypothesis, the interaction term Tenure * High ind-adj stkret is positive and weakly significant at the 10% level. However, all other three interaction terms are negative and significant, which is in direct contrast to the prediction of this hypothesis. Taken as a whole, the evidence in Table 5 does not support the experiences hypothesis.

4.2.3. Career Concerns Hypothesis

The positive relationship between CEO tenure and risk-taking and the results in Tables 4 & 5 suggest that the commonly employed interpretations of tenure as a measure of human capital investment, power, and experiences may not be valid, or at least not the driving factors behind the relationship between tenure and managerial risk-taking. In the following test, we examine the third hypothesis that may explain the relationship between CEO tenure and risk-taking – the career concerns hypothesis. The positive relationship between tenure and risk-taking is consistent with (Holmstrom 1999), who argues that career concerns should cause an agent to become more

[19] Specifically, industry-adjusted ROA is the lagged ratio of the difference between firm ROA and median industry ROA to the standard deviation of ROA for all the firms in the same two-digit SIC industry in a given year. Industry-adjusted stock return is the lagged ratio of the difference between firm stock return and median industry stock return to the standard deviation of stock return for all the firms in the same two-digit SIC industry in a given year. Our results remain if we use the average ROA over the past three years and three-year stock return, and follow the above procedure to define the industry-adjusted performance measures.

risk-averse. However, as Chen (2010) points out, the effect of career concerns on risk-taking depends on whether the manager is privately informed about her own ability or not. If she is, then the manager may instead take excessive risks as a result of career concerns. Therefore, we examine the career concerns hypothesis by conducting two types of tests. First, CEO age is often used as another proxy for her career concerns (e.g., Gibbons and Murphy 1992; Chevalier and Ellison 1999; Lamont 2002). Accordingly, we create a dummy variable that equals one if the CEO age is above the sample median, and zero otherwise (Old CEO). We then examine the effect of the interaction of this dummy variable with CEO tenure on risk-taking. If the positive effect of tenure on risk-taking is through the career concerns of the CEO, this interaction term Tenure * Old CEO is expected to be positive and significant, since an old CEO with long tenure should have small career concerns.

Second, we test a potential differential impact of CEO tenure on risk-taking conditional on the degree of information asymmetry regarding the CEO ability as suggested by Chen (2010) and Fu and Li (2010). We use two proxies for this information asymmetry. Since a CEO hired from outside the firm does not have a proven record in managing the firm compared with a CEO hired from inside, we expect an outsider CEO to possess more private information about her ability than a CEO hired internally. We create a dummy variable that equals one for an externally hired CEO, and zero for an internally hired CEO (CEO outsider). In our sample 27.3% of the CEOs are outside hires. Furthermore, for the internally hired CEOs, the degree of information asymmetry about their ability may depend on the length of time they worked for the firm before they were promoted to CEOs. Therefore, our second measure for the degree of information asymmetry is a dummy variable that equals one if the length of time a person worked for the firm before she was hired as the CEO is at or below the sample median, and zero otherwise (Low firm

tenure). Note that since outsider CEOs did not work for the firm before they were hired, the non-CEO firm tenure for these CEOs is zero. We then interact these dummy variables with CEO tenure to examine the career concerns hypothesis. Because outsider CEOs or insider CEOs with less non-CEO firm tenure may possess more private information regarding their abilities, it is expected that the interaction terms Tenure * CEO outsider and Tenure * Low firm tenure are negative and significant, since longer tenure with less career concerns may motivate them to take less risks.[20]

The results reported in Table 6 conform to these predictions. The coefficients on all the interaction terms have their expected signs and are significant.[21] Therefore, these results not only suggest that the positive relationship between CEO tenure and risk-taking as documented in this paper may be due to the career concerns of the CEO, but also demonstrate a differential impact of CEO tenure on risk-taking depending on the degree of information asymmetry regarding the ability of the CEO. However, we note that none of the existing studies on risk-taking includes CEO tenure as a proxy for career concerns. Instead, tenure is often interpreted as a measure of human capital investment, power, or experiences. Yet our results suggest that none of these interpretations seems to be able to explain the relationship between tenure and risk-taking as documented in this paper.

4.2.4. The Balance of Explicit and Implicit Risk-taking Incentives

The evidence in this paper suggests that the declining career concerns associated with longer tenure increase the risk-taking incentives of a CEO. In the context of effort incentives, (Gibbons and Murphy 1992) document that as the implicit effort incentive diminishes with the decline of

[20] Since there is a large number of missing observations for "joined_co" in EXECUCOMP, which is necessary to identify outsider CEOs and to calculate the non-CEO job tenure, the sample sizes with these two interaction terms are reduced significantly.

[21] A concern for the results in Model 1 is that we control for Old CEO dummy as well as CEO age, which may create multicollinearity. However, the results remain if we exclude CEO age from the regression.

career concerns as a CEO approaches her retirement age, the CEO's pay is more sensitive to firm performance to provide her with a stronger explicit incentive. Recent work suggests that the provision of risk-taking incentives is as important as the provision of effort incentives through managerial compensation (Dittmann and Yu 2011). Therefore, it is informative to examine the relationship between delta and vega and CEO tenure, to gauge the optimal provision of effort as well as risk-taking incentives with the declining career concerns. A rigorous treatment of this issue requires parsimonious theoretical modeling, which is beyond the scope of this paper. Consequently, our analysis below is meant to be suggestive.

On the one hand, the effort provision through explicit compensation is mainly through delta. On the other hand, consistent with many others (e.g., Coles et al. 2006; Brick et al. 2012), our evidence suggests that delta induces CEOs to take less risks. As the declining career concerns associated with longer tenure decrease the incentive of the CEO to exert effort (Holmstrom 1999), but at the same time increase her incentive to take risks as this paper suggests, delta should be positively associated with tenure, since higher pay-performance sensitivity is needed to balance the effort-reducing and risk-inducing effects of tenure.

However, without a rigorous theoretical model, it is hard to predict the specific relationship between vega and tenure. Our results show that, similar to delta, vega also decreases the risk-taking incentives of a CEO. The evidence also suggests that compared with the risk-reducing effect of delta, the risk-reducing effect of vega is much smaller (see the evidence in Tables 2 & 3). Therefore, vega may potentially serve as a finer means to fill the gap between the optimal risk-taking incentives and the risk-taking incentives provided through tenure and delta. In the absence of a rigorous model, however, it is hard to predict whether the provision of delta has under-balanced or over-balanced the increasing risk-taking effect associated with tenure.

Therefore, it is also hard to predict the specific direction in the relationship between vega and tenure. Nevertheless, since delta plays a dual role of balancing the decreasing effort incentives and the increasing risk-taking incentives of a longer-tenured CEO, it is reasonable to expect that delta alone may not precisely cover the necessary adjustment of risk incentives. Therefore, vega should step in and is expected to be significantly associated with CEO tenure, despite the uncertain sign between their relationship. We examine the relations between CEO tenure and delta and vega in Table 7. Similar to the risk-taking regressions, we also control for the lagged dependent variables as well as the lagged value of total volatility. Besides, we follow (Coles et al. 2006) and control for vega in the delta regression and vice versa.

Consistent with the evidence in (Cremers and Palia 2010), Model 1 shows that CEO tenure is positively and highly significantly associated with delta. But unlike their interpretation of this result solely based on the provision of optimal effort incentives, the positive relation between CEO tenure and delta is also consistent with the idea that the risk-reducing effect of delta balances the risk-inducing effect of tenure. Also consistent with the prediction about a significant relation between tenure and vega, Model 2 shows that these two variables are negatively and weakly significantly associated. Given the risk-reducing effect of vega, this relationship suggests that as delta increases with tenure to provide an optimal level of effort incentives for a CEO, its risk-reducing effect may have over-balanced the risk-inducing effect of tenure. Therefore, vega is decreased with tenure to provide the CEO with an optimal level of risk-taking incentives. We also note that the significant relationship between vega and tenure is inconsistent with the exclusion condition as employed in some empirical papers where vega is the dependent variable in their simultaneous equations (e.g., Coles et al. 2006).

5. Conclusion

We conduct the first systematic analysis of the relationship between CEO tenure and risk-taking. Our work intends to fill a gap in the literature on managerial risk-taking that often includes tenure as a control variable without adequately justifying its inclusion. Tenure has commonly been interpreted as a proxy for CEO power, experiences, and human capital investment. But empirical studies not specifically on risk-taking also use tenure to proxy for the career concerns of the CEO. We develop theoretical arguments based on these four interpretations. Despite the general prediction of a negative relation between tenure and risk-taking in the literature, we argue that this may only hold if tenure is a proxy for human capital investment. The relationship between tenure and risk-taking is ambiguous based on the other three interpretations of tenure.

Our empirical analysis reveals a positive relationship between CEO tenure and risk-taking, which is opposite to the prediction of the human capital hypothesis. We also find that the other two common interpretations of tenure: power and experiences, are not supported by the empirical evidence. Instead, it appears that the career concerns of a CEO may be the driving force behind the positive relation between tenure and risk-taking.

Finally, we also examine an optimal provision of risk-taking as well as effort incentives through implicit incentives associated with tenure and explicit incentives provided through delta and vega. We document a positive relation between delta and CEO tenure and a negative relation between vega and tenure. The positive relation between delta and CEO tenure is consistent with the idea that the provision of delta is not only to balance the declining effort incentives associated with tenure, but also to balance the increasing risk-taking effect of tenure. Nevertheless, the negative relation between vega and tenure may suggest that the dual role that

delta plays in balancing two types of incentives makes the provision of delta excessive in reducing the risk-taking incentives of the CEO, and therefore vega is decreased to fine-tune the balance for an optimal level of risk-taking incentives.

Appendix

Table A1. Variable Definitions

Variable	Definitions
Volat	The log of the standard deviation of daily stock returns for at least 100 days over the year.
Sys_mkt	The log of the standard deviation of the predicted value of stock return from the market model (with a constant term) by using daily returns over the year.
Idio_mkt	The log of the standard deviation of the residuals of stock return from the market model (with a constant term) by using daily returns over the year.
Idio_ff4	The log of the standard deviation of the residuals of stock returns from the Fama-French-Carhart four-factor model (with a constant term) by using daily returns over the year.
Tenure	The log of CEO tenure in years. CEO tenure in a given year is determined as the length of time between the date that the person became the CEO ("becameceo" in EXECUCOMP) and the current fiscal year end. We further make the following corrections: (1) For those observations with missing values from the above calculation, if the CEO is hired from outside the firm and the date when the person joined the company ("joined_co" in EXECUCOMP) is available, CEO tenure in a given year is calculated as the length of time between "joined_co" and the current fiscal year end. A CEO is determined as an outside hire if she joins the firm for less than two years at the time of succession and she is not a founder; (2) For those CEOs who held the position multiple times, EXECUCOMP only has the data for "becameceo" for either the first time or the most recent time the person became the CEO. Therefore, we manually check these cases and use the information that the previous CEO left the company to determine the data for "becameceo" for the CEO with multiple appointments.
Vega	The log of one plus the sensitivity of CEO option portfolio value to a 0.01 change in the annualized standard deviation of stock returns. We follow Core and Guay (2002)'s "one-year approximation" (OA) method for the estimation of the average exercise price and remaining time-to-maturity for outstanding options. Specifically, for the inputs for stock return volatility, dividend yield, and risk-free rate, we use the annualized standard deviation of monthly stock returns over the past 60 months, the average dividend yield over the past three years, and the yield-to-maturity of Treasury bonds matched by the closest maturities, respectively.
Delta	The log of one plus the sensitivity of CEO option and stock portfolio value to a 1% change in stock price, where the estimation of the average exercise price and remaining time-to-maturity for outstanding options follows Core and Guay (2002)'s OA method. Specifically, for the inputs for stock return volatility, dividend yield, and risk-free rate, we use the annualized standard deviation of monthly stock returns over the past 60 months, the average dividend yield over the past three years, and the yield-to-maturity of Treasury bonds matched by the closest maturities, respectively.
CEO age	CEO age in years.
CEO cash	Inflation-adjusted CEO salary plus bonus (with year 1992 as the basis year).
Size	The log of the inflation-adjusted total assets (with year 1992 as the basis year).
Mb	Market-to-book ratio.
Capexp	Net capital expenditure scaled by total assets, with missing values coded as zeros.
R&D	R&D expenses scaled by total assets, with missing values coded as zeros.
Leverage	Debt in current liabilities plus long-term debt scaled by total assets.
Segment	The log of the number of business segments.
Firm age	The log of the number of years since the firm went public.
ROA	Operating income before depreciation divided by total assets.
Cash bal	Inflation adjusted firm cash balance (with year 1992 as the basis year).

References

Adams, R., H. Almeida and D. Ferreira, 2005. Powerful CEOs and their impact on corporate performance. Review of Financial Studies 18, 1403-1432

Agrawal, A. and G.N. Mandelker, 1990. Large shareholders and the monitoring of managers - the case of antitakeover charter amendments. Journal of Financial and Quantitative Analysis 25, 143-161

Agrawal, A. and T. Nasser, 2011. Blockholders on boards and CEO compensation, turnover and firm valuation. Working Paper, University of Alabama

Allgood, S. and K.A. Farrell, 2000. The effect of CEO tenure on the relation between firm performance and turnover. The Journal of Financial Research 23, 373-390

Amihud, Y. and B. Lev, 1981. Risk reduction as a managerial motive for conglomerate mergers. Bell Journal of Economics 12, 605-617

Anderson, C. and A.D. Galinsky, 2006. Power, optimism, and risk-taking. European Journal of Social Psychology 36, 511-536

Arellano, M. and O. Bover, 1995. Another look at the instrumental variable estimation of error-components models. Journal of Econometrics 68, 29-51

Ashbaugh-Skaife, H., D.W. Collins and R. LaFond, 2006. The effects of corporate governance on firms' credit ratings. Journal of Accounting & Economics 42, 203-243

Avery, C.N. and J.A. Chevalier, 1999. Herding over the career. Economics Letters 63, 327-333

Bebchuk, L., A. Cohen and A. Farrell, 2009. What matters in corporate governance? Review of Financial Studies 22, 783-827

Bebchuk, L.A., K.J.M. Cremers and U.C. Peyer, 2011. The CEO pay slice. Journal of Financial Economics 102, 199-221

Belghitar, Y. and E.A. Clark, 2011. The effect of CEO risk appetite on firm volatility: an empirical analysis of financial firms. International Journal of the Economics of Business Forthcoming

Benmelech, E. and C. Frydman, 2010. Military CEOs. Working Paper, Harvard University

Berger, P.G., E. Ofek and D.L. Yermack, 1997. Managerial entrenchment and capital structure decisions. Journal of Finance 52, 1411-1438

Bertrand, M. and S. Mullainathan, 2001. Are CEOs rewarded for luck? the ones without principals are. Quarterly Journal of Economics 116, 901-932

Bertrand, M. and S. Mullainathan, 2003. Enjoying the quiet life? corporate governance and managerial preferences. Journal of Political Economy 111, 1043-1075

Bertrand, M. and A. Schoar, 2003. Managing with style: The effect of managers on firm policies. Quarterly Journal of Economics 118, 1169-1208

Bloom, M. and G.T. Milkovich, 1998. Relationships among risk, incentive pay, and organizational performance. Academy of Management Journal 41, 283-297

Blundell, R. and S. Bond, 1998. Initial conditions and moment restrictions in dynamic panel data models. Journal of Econometrics 87, 115-143

Boyson, N.M., 2010. Implicit incentives and reputational herding by hedge fund managers. Journal of Empirical Finance 17, 283-299

Brick, I.E., O. Palmon and J. Wald, 2012. Too much pay-performance sensitivity. Review of Economics and Statistics 94, 287-303

Cain, M.D. and S.B. Mckeon, 2012. Cleared for takeoff? CEO personal risk-taking and corporate policies. Working Paper, University of Notre Dame

Carhart, M.M., 1997. On persistence of mutual fund performance. Journal of Finance 52, 57-82

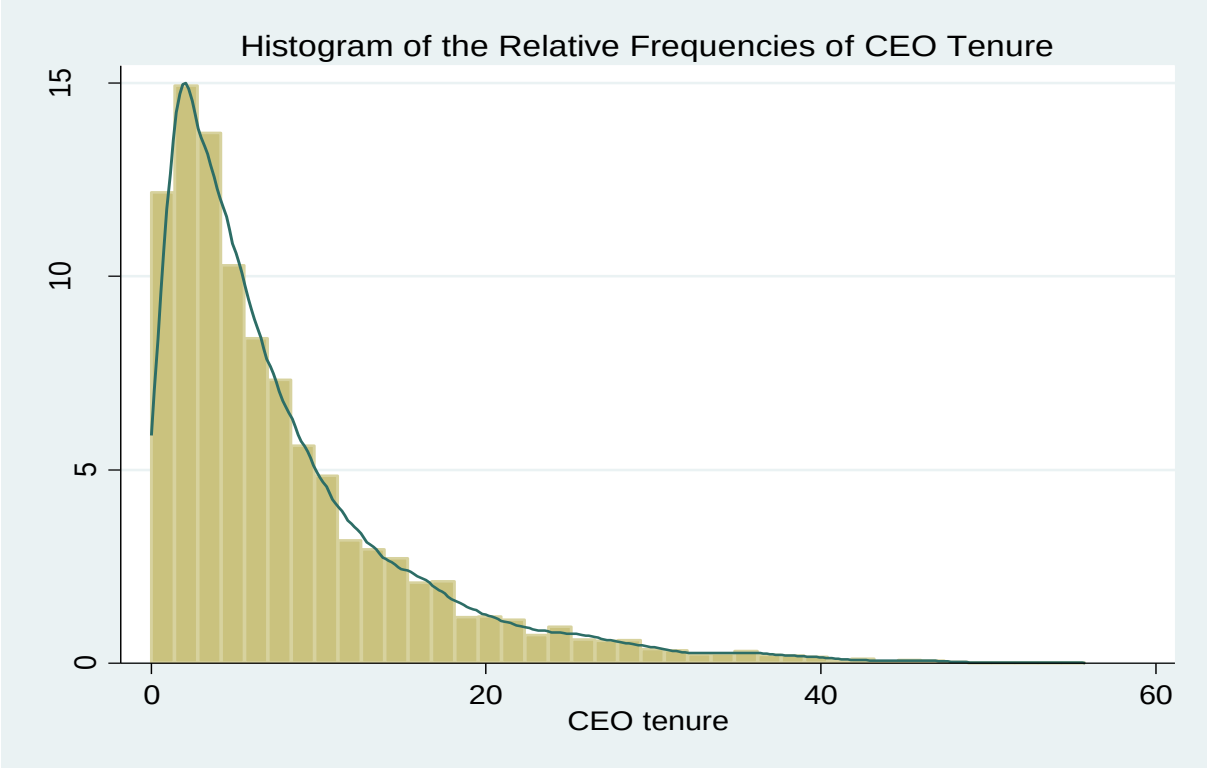
Chakraborty, A., S. Sheikh and N. Subramanian, 2007. Termination risk and managerial risk taking. Journal of Corporate Finance 13, 170-188
Chang, Y.Y., S. Dasgupta and G. Hilary, 2010. CEO ability, pay, and firm performance. Management Science 56, 1633-1652
Chava, S. and A. Purnanandam, 2010. CEOs versus CFOs: Incentives and corporate policies. Journal of Financial Economics 97, 263-278
Chen, C.R., T.L. Steiner and A.M. Whyte, 2006. Does stock option-based executive compensation induce risk-taking? An analysis of the banking industry. Journal of Banking & Finance 30, 915-945
Chen, Y., 2010. Career concerns and excessive risk taking. Working Paper, Arizona State University
Cheng, S., 2008. Board size and the variability of corporate performance. Journal of Financial Economics 87, 157-176
Chevalier, J.A. and G. Ellison, 1999. Career concerns of mutual fund managers. The Quarterly Journal of Economics 114, 389-432
Chidambaran, N.K. and N.R. Prabhala, 2003. Executive stock option repricing, internal governance mechanisms, and management turnover. Journal of Financial Economics 69, 153-189
Chok, J.I. and Q. Sun, 2007. Determinants of idiosyncratic volatility for biotech IPO firms. Financial Management 36, 107-122
Christoffersen, S. and S. Sarkissian, 2002. Location overconfidence. Working Paper, McGill University
Cohen, D.A., A. Dey and T.Z. Lys, 2005. The Sarbanes Oxley Act of 2002: implications for compensation structure and risk-taking incentives of CEOs. Working paper, New York University
Cohen, R.B., B.J. Hall and L.M. Viceira, 2000. Do executive stock options encourage risk-taking? Working Paper, Harvard University
Coles, J.L., N.D. Daniel and L. Naveen, 2006. Managerial incentives and risk-taking. Journal of Financial Economics 79, 431-468
Core, J.E. and W.R. Guay, 2002. Estimating the value of employee stock option portfolios and their sensitivities to price and volatility. Journal of Accounting Research 40, 613-630
Cremers, K.J.M., V.B. Nair and C. Wei, 2007. Governance mechanisms and bond prices. Review of Financial Studies 20, 1359-1388
Cremers, M. and D. Palia, 2010. Tenure and CEO pay. Working Paper, Yale University
Dechow, P.M. and R.G. Sloan, 1991. Executive incentives and the horizon problem: An empirical investigation. Journal of Accounting & Economics 14, 51-89
DeFusco, R.A., R.R. Johnson and T.S. Zorn, 1990. The effect of executive stock option plans on stockholders and bondholders. Journal of Finance 45, 617-627
DeYoung, R., E.Y. Peng and M. Yan, 2010. Executive compensation and business policy choices at U.S. commercial banks. Journal of Financial and Quantitative Analysis Forthcoming
Dittmann, I. and K.-C. Yu, 2011. How important are risk-taking incentives in executive compensation. Working Paper, Erasmus University Rotterdam
Fama, E.F. and K.R. French, 1993. Common risk factors in the returns on stocks and bonds. Journal of Financial Economics 33, 3-56
Farrell, K.A. and D.A. Whidbee, 2000. The consequences of forced CEO succession for outside directors. Journal of Business 73, 597-627

Fu, Q. and M. Li, 2010. Policy making with reputation concerns. Working Paper, National University of Singapore
Gervais, S., J.B. Heaton and T. Odean, 2011. Overconfidence, compensation contracts, and capital budgeting. Journal of Finance 66, 1735-1777
Gervais, S. and T. Odean, 2001. Learning to be overconfident. Review of Financial Studies 14, 1-27
Gibbons, R. and K.J. Murphy, 1992. Optimal incentive contracts in the presence of career concerns: theory and evidence. Journal of Political Economy 100, 468-505
Glaser, M., T. Langer and M. Weber, 2010. Overconfidence of professionals and lay people: individual differences within and between tasks? Working Paper, University of Mannheim
Gompers, P., J. Ishii and A. Metrick, 2003. Corporate governance and equity prices. Quarterly Journal of Economics 118, 107-155
Gormley, T.A., D.A. Matsa and T. Milbourn, 2011. CEO compensation and corporate risk-taking: evidence from a natural experiment. Working Paper, University of Pennsylvania
Graham, J.R., 1999. Herding among investment newsletters: theory and evidence. Journal of Finance 54, 237-268
Graham, J.R., C.R. Harvey and M. Puri, 2010. Managerial attitudes and corporate actions. Working Paper, Duke University
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
Hermalin, B. and M. Weisbach, 2003. Boards of directors as an endogenously determined institution, a survey of the economic literature. FRBNY Economic Policy Review April, 7-26
Hermalin, B.E., 1993. Managerial preferences concerning risky projects. Journal of Law, Economics, and Organization 9, 127-135
Hermalin, B.E. and M.S. Weisbach, 1998. Endogenously chosen boards of directors and their monitoring of the CEO. American Economic Review 88, 96-118
Hilary, G. and K.W. Hui, 2009. Does religion matter in corporate decision making in America? Journal of Financial Economics 93, 455-473
Hirshleifer, D. and A.V. Thakor, 1992. Managerial conservatism, project choice, and debt. Review of Financial Studies 5, 437-470
Hirshleifer, D.A., A. Low and S.H. Teoh, 2010. Are overconfident CEOs better innovators? Working Paper, University of California, Irvine
Hitt, M.A. and B.B. Tyler, 1991. Strategic decision models: integrating different perspectives. Strategic Management Journal 12, 327-351
Hjortshoj, T.L., 2007. Managerial risk-shifting incentives of option-based compensation: firm risk, leverage, and moneyness. Working Paper
Holmstrom, B., 1999. Managerial incentive problems: a dynamic perspective. Review of Economic Studies 66, 169-182
Hong, H., J.D. Kubik and A. Solomon, 2000. Security analysts' career concerns and herding of earnings forecasts. Rand Journal of Economics 31, 121-144
Hu, P., J.R. Kale, M. Pagani and A. Subramanian, 2011. Fund flows, performance, managerial career concerns, and risk taking. Management Science 57, 628-646
Huson, M.R., P.H. Malatesta and R. Parrino, 2004. Managerial succession and firm performance. Journal of Financial Economics 74, 237-275
Hutton, I., D. Jiang and A. Kumar, 2011. Corporate policies of republican managers. Working Paper, The Florida State University

Jensen, M.C., 1986. Agency costs of free cash flow, corporate-finance, and takeovers. American Economic Review 76, 323-329
John, K., L. Litov and B. Yeung, 2008. Corporate governance and risk-taking. Journal of Finance 63, 1679-1728
Keltner, D., D.H. Gruenfeld and C. Anderson, 2003. Power, approach, and inhibition. Psychological Review 110, 265-284
Knopf, J.D., J. Nam and J.H.J. Thornton, 2002. The volatility and price sensitivities of managerial stock option portfolios and corporate hedging Journal of Finance 57, 801-813
Laeven, L. and R. Levine, 2009. Bank governance, regulation, and risk taking. Journal of Financial Economics 93, 259-275
Lamont, O.A., 2002. Macroeconomic forecasts and microeconomic forecasters. Journal of Economic Behavior & Organization 48, 265-280
Locke, P.R. and S.C. Mann, 2003. Prior outcomes and risky choices by professional traders. Working Paper, George Washington University
Low, A., 2009. Managerial risk-taking behavior and equity-based compensation. Journal of Financial Economics 92, 470-490
Malmendier, U., G. Tate and J. Yan, 2011. Overconfidence and early-life experiences: the effect of managerial traits on corporate financial policies. Working Paper, University of California, Berkeley
May, D.O., 1995. Do managerial motives influence firm risk reduction strategies? Journal of Finance 50, 1291-1308
Milbourn, T.T., 2003. CEO reputation and stock-based compensation. Journal of Financial Economics 68, 233-262
Morck, R., A. Shleifer and R.W. Vishny, 1988. Management ownership and market valuation - an empirical-analysis. Journal of Financial Economics 20, 293-315
Muscarella, C. and J. Zhao, 2011. Promoting the quiet life or risk-taking? CEO severance contracts and managerial decision-making. Working Paper, Penn State University
Odean, T., 1998. Volume, volatility, price, and profit when all traders are above average. Journal of Finance 53, 1887-1934
Padmanabhan, D. and C. Ghosh, 2009. The impact of CEO quality on the number of outside directorships, CEO cash compensation and firm performance. Working Paper, University of Connecticut
Pathan, S., 2009. Strong boards, CEO power and bank risk-taking. Journal of Banking & Finance 33, 1340-1350
Prendergast, C. and L. Stole, 1996. Impetuous youngsters and jaded old-timers: acquiring a reputation for learning. Journal of Political Economy 104, 1105-1134
Rajgopal, S. and T. Shevlin, 2002. Empirical evidence on the relation between stock option compensation and risk taking. Journal of Accounting & Economics 33, 145-171
Rose, N.L. and A. Shepard, 1997. Firm diversification and CEO compensation: managerial ability or executive entrenchment? Rand Journal of Economics 28, 489-514
Ryan, H.E.J. and L. Wang, 2011. The variety of CEO experience and the CEO-firm match: evidence from CEO employment history. Working Paper, Georgia State University
Ryan, H.E.J. and R.A.I. Wiggins, 2002. The interactions between R&D investment decisions and compensation policy. Financial Management 31, 5-29
Ryan, H.E.J. and R.A.I. Wiggins, 2004. Who is in whose pocket? Director compensation, board independence, and barriers to effective monitoring. Journal of Financial Economics 73, 497-524

Sah, R.K. and J. Stiglitz, 1986. The architecture of aconomic systems: hierarchies and polyarchies. American Economic Review 76, 716-727
Sah, R.K. and J. Stiglitz, 1991. The quality of managers in centralized versus decentralized organizations. Quarterly Journal of Economics 106, 289-295
Scharfstein, D.S. and J.C. Stein, 1990. Herd behavior and investment. American Economic Review 80, 465-479
Schrand, C. and H. Unal, 1998. Hedging and coordinated risk management: evidence from thrift conversions. Journal of Finance 53, 979-1013
Shleifer, A. and R.W. Vishny, 1986. Large shareholders and corporate control. Journal of Political Economy 94, 461-488
Simsek, Z., 2007. CEO tenure and organizational performance: an intervening model. Strategic Management Journal 28, 653-662
Tufano, P., 1996. Who manages risk? An empirical examination of risk management practices in the gold mining industry. Journal of Finance 51, 1097-1137
Vroom, V.H. and B. Pahl, 1971. Relationship between age and risk taking among managers. Journal of Applied Psychology 55, 399-405
Yermack, D., 1995. Do corporations award CEO stock options effectively? Journal of Financial Economics 39, 237-269
Zhang, L., 2009. CEO career concerns and corporate policy. Working Paper, McGill University
Zheng, Y., 2010. The effect of CEO tenure on CEO compensation: Evidence from inside CEOs vs outside CEOs. Managerial Finance 36, 832-859
Zwiebel, J., 1995. Corporate conservatism and relative compensation. Journal of Political Economy 103, 1-25

Figure 1. Histograms of the Relative Frequencies of CEO Tenure and the Log of CEO Tenure



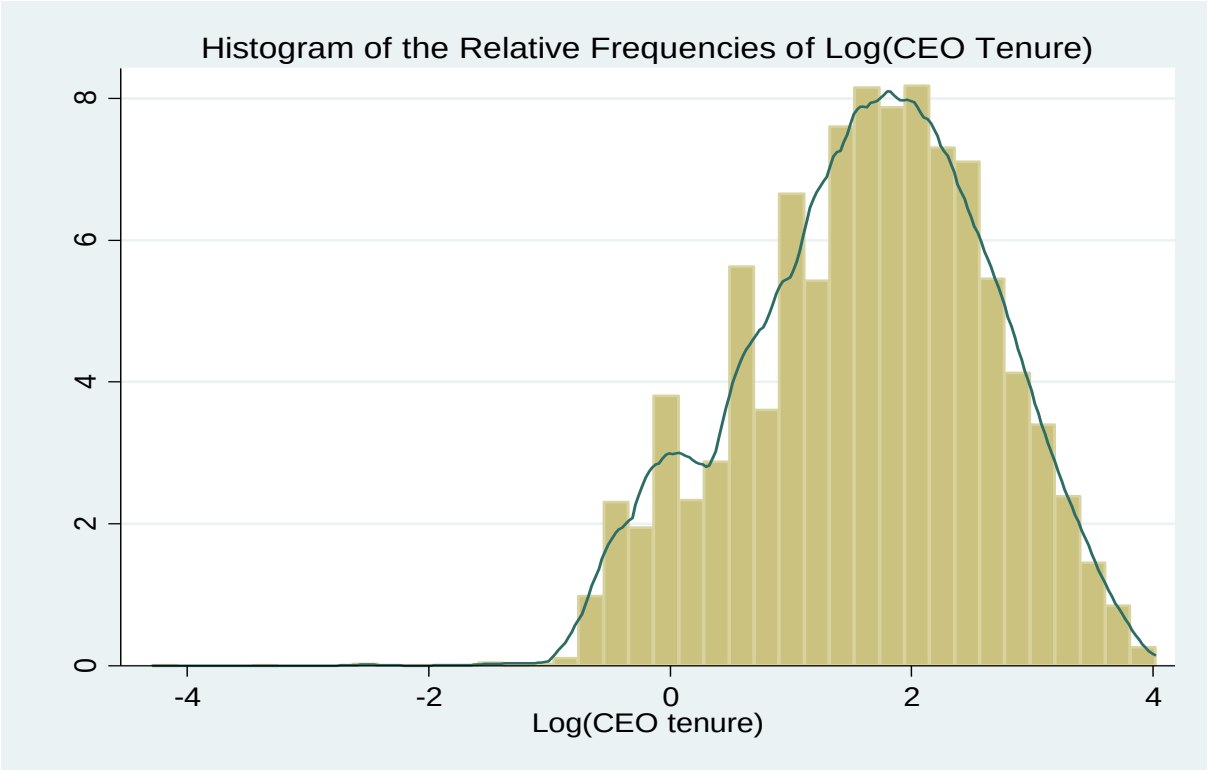


Table 1. Summary Statistics

This table reports the summary statistics and correlations of the major variables used in the empirical analysis. Panel A lists the summary statistics. Panel B reports the correlation matrix for the major variables. Volat, Sys_mkt, Idio_mkt, Idio_ff4, Tenure, Vega, Delta Segment, Firm age are in their raw format in Panel A, but they are transformed into the logged format in Panel B and onward. CEO cash, Capexp, R&D, Leverage, ROA, and Cash bal have been winsorized at the 1st and 99th percentiles. See the Appendix for the definitions of all variables.

Panel A: Summary Statistics

Variable	Observations	P25	Mean	Median	P75	Std
Volat	11,526	0.02	0.03	0.02	0.03	0.01
Sys_mkt	11,526	0.01	0.01	0.01	0.01	0.01
Idio_mkt	11,526	0.02	0.02	0.02	0.03	0.01
Idio_ff4	11,526	0.01	0.02	0.02	0.03	0.01
Tenure	11,526	2.59	7.95	5.42	10.59	7.80
Vega (10^3)	11,526	3.53	113.14	32.59	107.26	278.81
Delta (10^3)	11,526	58.84	1,569.31	182.40	568.35	16,104.72
CEO age	11,526	51.00	55.63	56.00	60.00	7.51
CEO cash (10^6)	11,526	0.46	1.03	0.75	1.27	0.94
Size	11,526	5.93	7.11	6.93	8.14	1.66
Mb	11,526	1.19	2.02	1.54	2.25	1.50
Capexp	11,526	0.09	0.13	0.13	0.19	0.10
R&D	11,526	0.00	0.04	0.02	0.06	0.05
Leverage	11,526	0.00	0.03	0.00	0.03	0.05
Segment	11,526	0.07	0.23	0.22	0.35	0.18
Firm age	11,526	3.00	5.01	4.00	7.00	2.97
ROA	11,523	9.84	24.96	19.85	33.53	19.11
Cash bal (10^6)	11,523	18.50	463.34	64.11	210.53	1,804.73

Panel B: Correlations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Tenure (1)	1.00																	
Volat (2)	0.00	1.00																
Sys_mkt (3)	0.02	0.48	1.00															
Idio_mkt (4)	0.00	0.99	0.36	1.00														
Idio_ff4 (5)	0.00	0.98	0.35	1.00	1.00													
Vega (6)	0.00	-0.03	0.23	-0.08	-0.09	1.00												
Delta (7)	0.36	-0.07	0.24	-0.12	-0.12	0.46	1.00											
CEO age (8)	0.35	-0.19	-0.10	-0.19	-0.19	-0.06	0.11	1.00										
CEO cash (9)	0.06	-0.23	0.05	-0.27	-0.28	0.35	0.37	0.14	1.00									
Size (10)	-0.06	-0.46	0.00	-0.50	-0.51	0.32	0.34	0.13	0.58	1.00								
Mb (11)	0.06	0.15	0.21	0.12	0.12	0.11	0.35	-0.09	0.02	-0.16	1.00							
Capexp (12)	0.09	-0.27	-0.09	-0.27	-0.26	0.09	0.26	0.05	0.14	0.05	0.33	1.00						
R&D (13)	0.08	0.08	-0.02	0.10	0.10	-0.08	0.01	-0.05	-0.12	-0.18	0.13	0.21	1.00					
Leverage (14)	-0.03	0.38	0.29	0.36	0.35	0.05	0.00	-0.13	-0.12	-0.28	0.34	-0.26	-0.01	1.00				
Segment (15)	-0.07	-0.12	-0.15	-0.10	-0.11	0.02	-0.11	0.06	0.13	0.29	-0.25	-0.11	-0.05	-0.24	1.00			
Firm age (16)	-0.04	-0.10	0.10	-0.14	-0.15	0.17	0.09	0.10	0.20	0.32	-0.08	-0.06	-0.21	0.03	0.07	1.00		
ROA (17)	-0.05	-0.45	-0.18	-0.45	-0.46	0.08	-0.04	0.21	0.24	0.41	-0.17	0.05	-0.14	-0.20	0.14	0.32	1.00	
Cash bal (18)	-0.01	-0.07	0.10	-0.12	-0.12	0.15	0.26	0.05	0.41	0.48	0.01	-0.06	-0.11	-0.01	0.11	0.13	0.06	1.00

Table 2. CEO Tenure and Risk-taking (OLS Models)

These models use OLS regressions to examine the relation between CEO tenure and risk-taking. The sample consists of S&P 1,500 firms from 1992 to 2006. See the Appendix for the definitions of all variables. All models include dummies for two-digit SIC code and a constant term. Except for Models 2 and 3, all the other models also include year dummies. These coefficients are not reported to save space. Standard errors are adjusted for heteroskedasticity and clustered at the firm level. t-statistics are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Votal	Votal	Votal	Sys_mkt	Idio_mkt	Idio_ff4
Tenure	0.008***	-0.009*	-0.002	0.012**	0.007***	0.007***
	(3.140)	(-1.712)	(-0.298)	(1.978)	(2.863)	(2.724)
Vega	-0.004***	0.011***	0.010***	0.003	-0.005***	-0.005***
	(-3.540)	(4.111)	(3.544)	(0.828)	(-3.980)	(-3.749)
Delta	-0.008***	-0.001	-0.001	0.010**	-0.008***	-0.008***
	(-3.905)	(-0.306)	(-0.198)	(1.966)	(-4.224)	(-4.090)
CEO age	-0.001***		-0.003***	-0.003***	-0.001**	-0.001***
	(-2.736)		(-3.547)	(-3.370)	(-2.365)	(-2.622)
CEO cash	-0.004	-0.000	0.001	-0.018**	-0.004	-0.004
	(-1.404)	(-0.071)	(0.196)	(-2.521)	(-1.269)	(-1.267)
Size	-0.018***	-0.083***	-0.082***	0.048***	-0.024***	-0.025***
	(-7.577)	(-15.517)	(-15.400)	(7.848)	(-9.517)	(-9.827)
Mb	0.008***	0.025***	0.024***	0.053***	0.003	0.003
	(3.644)	(6.248)	(6.038)	(12.004)	(1.371)	(1.457)
ROA	-0.435***	-1.179***	-1.177***	-0.283***	-0.440***	-0.448***
	(-14.217)	(-18.516)	(-18.605)	(-3.786)	(-14.305)	(-14.556)
Capexp	0.188***	0.293***	0.278***	0.417***	0.182***	0.169***
	(4.173)	(2.842)	(2.706)	(3.504)	(3.999)	(3.739)
R&D	0.345***	1.178***	1.155***	0.782***	0.404***	0.387***
	(6.268)	(9.399)	(9.208)	(5.852)	(7.167)	(6.878)
Leverage	0.067***	0.223***	0.225***	-0.080**	0.077***	0.081***
	(4.188)	(6.014)	(6.023)	(-2.250)	(4.634)	(4.853)
Segment	0.010**	0.065***	0.065***	0.027***	0.008**	0.009**
	(2.556)	(7.023)	(7.104)	(2.622)	(2.047)	(2.107)
Firm age	-0.025***	-0.121***	-0.117***	-0.041***	-0.027***	-0.027***
	(-8.047)	(-15.326)	(-14.732)	(-5.260)	(-8.187)	(-8.163)
Lagged Volat	0.670***					
	(75.519)					
Lagged Sys_mkt				0.403***		
				(33.770)		
Lagged Idio_mkt					0.669***	
					(75.556)	
Lagged Idio_ff4						0.668***
						(74.548)
Observations	11,526	11,526	11,526	11,526	11,526	11,526
Number of firms	2,072	2,072	2,072	2,072	2,072	2,072
Adjusted R^2	0.81	0.49	0.49	0.54	0.81	0.80

Table 3. CEO Tenure and Risk-taking (Fixed Firm-CEO Effects Models)

These models use fixed firm-CEO effects regressions to examine the relation between CEO tenure and risk-taking. The sample consists of S&P 1,500 firms from 1992 to 2006. See the Appendix for the definitions of all variables. All models include year dummies and a constant term. These coefficients are not reported to save space. Standard errors are adjusted for heteroskedasticity and clustered at the firm level. t-statistics are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
Dependent variable	Votal	Sys_mkt	Idio_mkt	Idio_ff4
Tenure	0.017**	0.011	0.013*	0.014*
	(2.226)	(0.537)	(1.689)	(1.721)
Vega	-0.005**	-0.005	-0.006**	-0.005*
	(-2.188)	(-0.867)	(-2.351)	(-1.911)
Delta	-0.022***	0.017	-0.025***	-0.026***
	(-4.228)	(1.251)	(-4.734)	(-4.969)
CEO age	-0.002	-0.007	-0.002	-0.002
	(-0.260)	(-0.419)	(-0.276)	(-0.214)
CEO cash	-0.028***	-0.036***	-0.030***	-0.032***
	(-4.597)	(-2.917)	(-5.075)	(-5.324)
Size	-0.014	0.080***	-0.027**	-0.029***
	(-1.358)	(2.783)	(-2.514)	(-2.752)
Mb	0.012***	0.069***	0.005	0.006*
	(3.354)	(9.685)	(1.432)	(1.781)
ROA	-0.375***	-0.183	-0.339***	-0.355***
	(-6.854)	(-1.377)	(-6.142)	(-6.487)
Capexp	-0.032	0.476**	-0.062	-0.082
	(-0.399)	(2.330)	(-0.756)	(-0.992)
R&D	0.158	-0.179	0.242*	0.233
	(1.116)	(-0.602)	(1.652)	(1.604)
Leverage	0.074**	-0.102	0.099***	0.099***
	(2.187)	(-1.295)	(2.800)	(2.822)
Segment	0.035***	0.025	0.036***	0.034***
	(3.975)	(0.883)	(3.873)	(3.720)
Firm age	-0.151***	-0.131**	-0.144***	-0.142***
	(-6.981)	(-2.305)	(-6.338)	(-6.248)
Lagged Volat	0.202***			
	(13.208)			
Lagged Sys_mkt		0.055***		
		(3.357)		
Lagged Idio_mkt			0.199***	
			(12.876)	
Lagged Idio_ff4				0.195***
				(12.481)
Observations	11,526	11,526	11,526	11,526
Number of firm-CEOs	3,378	3,378	3,378	3,378
Adjusted R^2	0.54	0.27	0.54	0.53

Table 4. Test of Power Hypothesis

These models use fixed firm-CEO effects regressions to test the power hypothesis, which states that the positive effect of CEO tenure on risk taking is due to longer tenure proxying for higher CEO power, and that power increases the risk-taking incentives of the CEO because the increased power may either drive the CEO to take extreme actions as a result of non-diversified decision errors, or activate the approach-related behavioral tendencies that may lead to risk-taking. The sample consists of S&P 1,500 firms from 1992 to 2006. Low board ind is a dummy variable that equals one if the percentage of outside directors on the board is at or below the sample median, and zero otherwise. High CPS is a dummy variable that equals one if the fraction of the aggregate compensation of the top five executives captured by the CEO – the CEO Pay Slice or CPS, is above the sample median, and zero otherwise. Low inst block is a dummy variable that equals one if the percentage of shareholdings held by institutional block holders with at least 5% ownership is at or below the sample median, and zero otherwise. No ind block is a dummy variable that equals one if the firm does not have an independent director with at least 5% stock ownership, and zero otherwise. High G-index is a dummy variable that equals one if the G-index of the firm is above the sample median, and zero otherwise. See the Appendix for the definitions of all other variables. All models include year dummies and a constant term. These coefficients are not reported to save space. Standard errors are adjusted for heteroskedasticity and clustered at the firm level. t-statistics are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
Dependent variable	Votal	Votal	Votal	Votal	Votal
Tenure	0.020*	0.017**	0.008	0.004	0.022**
	(1.876)	-1.98	(0.942)	(0.210)	(2.103)
Tenure * Low board ind	-0.015*				
	(-1.851)				
Low board ind	0.034**				
	(2.471)				
Tenure * High CPS		0.004			
		-0.625			
High CPS		-0.003			
		(-0.294)			
Tenure * Low inst block			0.005		
			(0.871)		
Low inst block			0.002		
			(0.177)		
Tenure * No ind block				-0.002	
				(-0.124)	
No ind block				-0.008	
				(-0.215)	
Tenure * High G-index					-0.012
					(-1.374)
High G-index					0.014
					(0.636)
Vega	-0.007**	-0.005**	-0.006***	-0.008***	-0.003
	(-2.459)	(-2.125)	(-2.587)	(-2.740)	(-1.393)
Delta	-0.029***	-0.022***	-0.023***	-0.026***	-0.024***
	(-4.483)	(-4.366)	(-4.063)	(-3.842)	(-4.347)
CEO age	0.003	0	0.003	-0.000	-0.001
	(0.259)	-0.059	(0.679)	(-0.015)	(-0.110)
CEO cash	-0.030***	-0.030***	-0.029***	-0.034***	-0.028***
	(-4.670)	(-4.913)	(-4.731)	(-4.814)	(-4.958)
Size	-0.023	-0.004	-0.017	-0.015	-0.020
	(-1.645)	(-0.399)	(-1.537)	(-0.893)	(-1.536)
Mb	0.012***	0.013***	0.012***	0.015***	0.018***
	(3.007)	-3.394	(3.266)	(3.383)	(4.449)

ROA	-0.269***	-0.359***	-0.366***	-0.260***	-0.369***
	(-3.770)	(-6.110)	(-6.169)	(-3.061)	(-5.741)
Capexp	0.023	-0.054	-0.012	0.059	0.047
	(0.236)	(-0.605)	(-0.141)	(0.490)	(0.529)
R&D	0.035	0.194	0.060	0.161	0.198
	(0.223)	-1.328	(0.437)	(0.897)	(1.236)
Leverage	0.103**	0.076**	0.092***	0.114**	0.104***
	(2.504)	-2.155	(2.598)	(2.453)	(2.797)
Segment	0.031***	0.030***	0.036***	0.027**	0.028***
	(3.286)	-3.333	(3.743)	(2.323)	(2.935)
Firm age	-0.171***	-0.153***	-0.154***	-0.157***	-0.187***
	(-5.841)	(-6.453)	(-6.645)	(-4.653)	(-5.969)
Lagged Volat	0.191***	0.198***	0.191***	0.174***	0.192***
	(10.892)	-12.439	(11.534)	(8.707)	(11.330)
Observations	8,733	10,735	10,518	7,179	9,822
Number of firm-CEOs	2,757	3,262	3,166	2,414	2,992
Adjusted R^2	0.58	0.55	0.55	0.57	0.55

Table 5. Test of Experiences Hypothesis

These models use fixed firm-CEO effects regressions to test the experiences hypothesis, which states that the positive effect of CEO tenure on risk taking is either due to the accumulation of experiences with tenure which are necessary for the CEO to take strategic risks, or due to higher degree of overconfidence associated with the expertise coming from longer tenure. The sample consists of S&P 1,500 firms from 1992 to 2006. CEO_2boards is a dummy variable that equals one if the CEO sits on at least two other external boards, and zero otherwise. High CEO compensation is a dummy variable that equals one if the residual compensation of the CEO is above the sample median, and zero otherwise. The residual CEO compensation is the residual of the regression of (the log of) the total inflation-adjusted size of CEO compensation on (the log of) market capitalization and (the log of) firm age, controlling for year and two-digit SIC industry effects. High ind-adj ROA is a dummy variable that equals one if the lagged industry-adjusted ROA (equals the ratio of the difference between firm ROA and the median industry ROA to the standard deviation of ROA for all the firms in the same two-digit SIC industry in a given year) is above the sample median, and zero otherwise. High ind-adj stkret is a dummy variable that equals one if the lagged industry-adjusted annual stock return (equals the ratio of the difference between firm stock return and median industry stock return to the standard deviation of stock returns for all the firms in the same two-digit SIC industry in a given year) is above the sample median, and zero otherwise. See the Appendix for the definitions of all other variables. All models include year dummies and a constant term. These coefficients are not reported to save space. Standard errors are adjusted for heteroskedasticity and clustered at the firm level. t-statistics are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
Dependent variable	Votal	Votal	Votal	Votal
Tenure	0.006	0.022***	0.023***	0.012
	(0.549)	(2.732)	(2.775)	(1.530)
Tenure * CEO_2boards	-0.021*			
	(-1.698)			
CEO_2boards	0.045*			
	(1.882)			
Tenure * High CEO compensation		-0.010*		
		(-1.731)		
High CEO compensation		0.036***		
		(3.438)		
Tenure * High ind-adj ROA			-0.011*	
			(-1.729)	
High ind-adj ROA			0.004	
			(0.292)	
Tenure * High ind-adj stkret				0.008*
				(1.899)
High ind-adj stkret				-0.006
				(-0.689)
Vega	-0.007**	-0.005**	-0.005**	-0.005**
	(-2.295)	(-2.319)	(-2.257)	(-2.105)
Delta	-0.030***	-0.021***	-0.021***	-0.022***
	(-4.452)	(-4.195)	(-4.068)	(-4.360)
CEO age	0.001	-0.002	-0.002	-0.002
	(0.072)	(-0.280)	(-0.316)	(-0.249)
CEO cash	-0.033***	-0.030***	-0.027***	-0.028***
	(-4.654)	(-4.855)	(-4.485)	(-4.752)
Size	-0.010	-0.014	-0.013	-0.014
	(-0.581)	(-1.375)	(-1.276)	(-1.313)
Mb	0.016***	0.012***	0.012***	0.011***
	(3.607)	(3.479)	(3.306)	(3.266)
ROA	-0.256***	-0.376***	-0.361***	-0.380***
	(-2.995)	(-6.913)	(-6.576)	(-6.719)
Capexp	0.087	-0.030	-0.015	-0.056

	(0.703)	(-0.372)	(-0.180)	(-0.691)
R&D	0.145	0.159	0.163	0.167
	(0.795)	(1.128)	(1.147)	(1.168)
Leverage	0.107**	0.073**	0.071**	0.082**
	(2.296)	(2.173)	(2.092)	(2.409)
Segment	0.028**	0.035***	0.035***	0.033***
	(2.368)	(3.984)	(3.922)	(3.686)
Firm age	-0.156***	-0.148***	-0.153***	-0.168***
	(-4.588)	(-6.826)	(-7.051)	(-7.282)
Lagged Volat	0.172***	0.200***	0.200***	0.204***
	(8.429)	(13.164)	(13.101)	(13.158)
Observations	6,980	11,526	11,483	11,394
Number of firm-CEOs	2,360	3,378	3,364	3,334
Adjusted R^2	0.57	0.54	0.54	0.54

Table 6. Test of Career Concerns Hypothesis

These models use fixed firm-CEO effects regressions to test the career concern hypothesis, which states that the positive effect of CEO tenure on risk taking is due to the reduced risk-aversion of the CEO as a result of the declining career concerns associated with longer tenure. The sample consists of S&P 1,500 firms from 1992 to 2006. Old CEO is a dummy variable that equals one if the CEO age is above the sample median, and zero otherwise. CEO outsider is a dummy variable that equals one if the CEO was hired from outside the firm, and zero otherwise. We determine a CEO as an outside hire if she has joined the firm for less than two years at the time of succession and she is not a founder. Low firm tenure is a dummy variable that equals one if the CEO's non-CEO job tenure within the firm is at or below the sample median, and zero otherwise. See the Appendix for the definitions of all other variables. All models include year dummies and a constant term. These coefficients are not reported to save space. Standard errors are adjusted for heteroskedasticity and clustered at the firm level. t-statistics are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
Dependent variable	Votal	Votal	Votal
Tenure	0.015**	0.024**	0.025**
	(1.975)	(2.184)	(2.286)
Tenure*Old CEO	0.021**		
	(2.426)		
Old CEO	-0.047**		
	(-2.530)		
Tenure* CEO outsider		-0.025**	
		(-2.056)	
CEO outsider		0.060	
		(0.722)	
Tenure*Low firm tenure			-0.029**
			(-2.321)
Low firm tenure			0.099
			(1.266)
Vega	-0.005**	-0.005*	-0.005*
	(-2.183)	(-1.763)	(-1.777)
Delta	-0.021***	-0.018***	-0.018***
	(-4.126)	(-2.915)	(-2.893)
CEO age	-0.001	0.027**	0.027**
	(-0.182)	(2.155)	(2.147)
CEO cash	-0.028***	-0.029***	-0.029***
	(-4.609)	(-3.722)	(-3.741)
Size	-0.014	-0.006	-0.006
	(-1.391)	(-0.437)	(-0.442)
Mb	0.012***	0.010**	0.010**
	(3.347)	(2.250)	(2.233)
ROA	-0.377***	-0.368***	-0.368***
	(-6.917)	(-5.606)	(-5.607)
Capexp	-0.033	0.009	0.008
	(-0.411)	(0.090)	(0.079)
R&D	0.155	0.171	0.181
	(1.093)	(1.067)	(1.126)
Leverage	0.074**	0.003	0.003
	(2.192)	(0.073)	(0.060)
Segment	0.034***	0.038***	0.038***
	(3.866)	(3.374)	(3.378)
Firm age	-0.150***	-0.172***	-0.161***
	(-6.868)	(-6.246)	(-5.750)
Lagged Volat	0.202***	0.198***	0.198***

	(13.184)	(10.782)	(10.744)
Observations	11,526	6,586	6,583
Number of firm-CEOs	3,378	1,864	1,863
Adjusted R^2	0.54	0.57	0.57

Table 7. CEO Tenure and Compensation Vega and Delta

These models use fixed firm-CEO effects regressions to examine the relation between CEO tenure and vega and delta. The sample consists of S&P 1,500 firms from 1992 to 2006. See the Appendix for the definitions of all variables. All models include year dummies and a constant term. These coefficients are not reported to save space. Standard errors are adjusted for heteroskedasticity and clustered at the firm-CEO level. t-statistics are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)
Dependent variable	Delta	Vega
Tenure	0.188***	-0.155*
	(3.526)	(-1.769)
Vega	0.275***	
	(23.490)	
Delta		0.907***
		(16.368)
CEO age	-0.016	0.022
	(-1.387)	(1.113)
CEO cash	0.067**	-0.040
	(2.217)	(-0.931)
Size	0.337***	-0.138*
	(6.558)	(-1.840)
Mb	0.215***	-0.168***
	(11.858)	(-8.032)
Capexp	0.129	0.085
	(0.382)	(0.168)
R&D	-1.190	0.772
	(-1.563)	(0.913)
Leverage	-0.341**	0.127
	(-2.174)	(0.578)
Segment	-0.013	0.098*
	(-0.428)	(1.945)
ROA	1.347***	-0.678**
	(5.560)	(-2.066)
Cash bal	0.000	0.000
	(0.043)	(0.485)
Lagged Vega		0.130***
		(8.566)
Lagged Delta	0.173***	
	(6.623)	
Lagged Volat	0.034	-0.077
	(0.774)	(-1.048)
Observations	8,398	8,553
Number of firm-CEOs	2,745	2,779
Adjusted R^2	0.56	0.50