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Corporate Risk Taking a Game of Power: an Empirical study in the US Market.

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ABSTRACT

This dissertation examines separately and jointly the relevance of CEO equity ownership structure, and board structure on corporate risk taking. Corporate risk taking is the outcome of power and influence games between the board of directors and the incumbent management lead by the CEO. The hypotheses focus on how CEOs' equity ownership mitigates or exacerbate this agency problem; on what is the CEO level of power and influence within the corporate organization and how it affects corporate risk taking; and what are the identifiable effects, if any, of different board structure characteristics on corporate risk taking. In addition, the complex relation of how different CEO ownership structure affects corporate risk taking under different board structures is approached.

The empirical evidence is gathered based on a sample constructed with NYSE and NASDAQ firms covering the period from 2001 to 2011. The empirical model is estimated using panel regressions which control for industry- and year-fixed effect.

The findings provide evidence for a hump-shaped relation between CEO equity ownership and corporate risk taking. Furthermore acting CEOs who chair the board of directors have more power to impose their risk preferences decreasing corporate risk taking. The evidence also shows that smaller boards are associated with riskier profile companies, and that more independent directors negatively affect corporate risk taking. These results are consistent with the US market contracting environment, different estimation techniques, and for different volatility measures.

Keywords: Idiosyncratic Volatility, Corporate Risk, Internal Governance, Board Structure, CEO Ownership, Managerial Ownership.

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1. INTRODUCTION

Publicly held firms have a clear separation of management and ownership, which creates an agency relationship between owners and managers (Berle and Means, 1932). Inherent in the agency relationship, managers vested with decision-making power have a fiduciary duty of loyalty and care to serve the best interests of the company maximizing shareholders wealth. Notwithstanding, "there will be some divergence between the agent's decisions and those decisions which would maximize the welfare of the principal"(Jensen and Meckling, 1976).

The principal agent conflict has been a popular subject within finance and strategic management literature where researchers analyze the link between a variety of managerial strategic decisions and critical agency issues since it can affect firm's ability to compete and thus, ultimately, its survival (Wright, Ferris and Awasthi, 1996). The importance of these decisions raise the need to understand how corporate governance mitigates or exacerbates agency critical issues, particularly after the 2007 financial crisis where public companies thought to be financially solvent were unexpectedly in financial stress.

1.1 MOTIVATION AND RESEARCH QUESTION

Carey and Stulz (2005) argue that value cannot be created without risk taking. 2007 events, however reminded us how important risk management is. Excessive risk taking can have severe consequences, although this does not necessarily implies that conservative risk taking is good. This raise the question of what is the amount of risk that a firm should target. Unfortunately, it is too ambitious and too "risky" to try to give a direct answer to this question. Yet, an understanding of what shareholders seek, how effectively boards of directors monitor the management, and what are the risk preferences and motives behind managers' decisions can provide some insights of how corporate risk is managed.

This study is a small step towards the understanding of what factors, if any, affect corporate risk taking[1] in a firm. The main focus is of both academic and practical interest as it examines from an agency theory perspective the relation of the managerial equity ownership structure and the board of directors' structure[2] with corporate risk taking measured on the level of firm volatility for a set of large US firms over the period 2001-2010.

In a first step, we address the effect of managerial ownership on corporate risk taking. First we verify empirically whether CEO ownership has more explanatory power of corporate risk taking than total insiders ownership when controlling for industry- and year-fixed effects. Within this process we test our first two hypotheses related with managerial ownership and CEO power. The first hypothesis states that for low levels of CEOs ownership the equity incentives align more closely CEOs' risk preferences with those of shareholders, which is reflected positively in corporate risk taking; however, at high levels of CEO ownership the entrenchment and non-diversification effect overcomes the incentive effect which impacts negatively corporate risk taking. The second hypothesis focus on CEOs power and influence within the corporate governance structure where two sources of power are considered: 1) CEO that chairs the board of directors and 2) interlocking. Higher levels of CEO power and influence are expected to negatively affect corporate risk taking.

In a second step we include in our empirical model controls for board characteristics, particularly board size, percentage of independent directors, and shareholder rights restriction. Our third hypothesis is based on these characteristics and states that smaller boards with a greater percentage of independent directors and less shareholder rights restrictions should be associated with companies with higher risk profiles.

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[1] Corporate risk taking, firm specific risk, idiosyncratic volatility, and idiosyncratic risk are used interchangeably in this study.

[2] The board of directors proxies for internal governance mechanism.

In a final step we separate our full sample into firms under weak, moderate or strong internal governance based on the board of directors structure to address the complex interaction effect between the board and the CEO ownership structure on corporate risk taking.

1.2 BACKGROUND AND RELATED RESEARCH

The role of corporate risk taking in firm performance has long been recognized by strategic management researchers that highlight the importance of idiosyncratic risk as a source of competitive advantages (Rumelt, 1974; Porter, 1980).

For the purposes of this study and given that CEOs are the most influent executives in the decision making process if there is any identifiable effect of managerial ownership on corporate risk taking the impact should be most visible at the CEO-level ownership (Kim and Lu, 2011). Following this reasoning, to analyze whether managerial ownership mitigates or exacerbates agency problems, the focus on CEO ownership helps to canvass if any identifiable relation exists with corporate risk taking. Furthermore, CEO ownership is a more reliable proxy than the one that takes into account the equity ownership of the total directors and officers [3] .CEO ownership does not suffer of within-firm variation by changes in number, and in the composition, of insiders over time, which might not be related with ownership per si and create confounding effects when firm fixed effects are controlled for[4] (Zhou, 2001).

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[3] Suggested by Himmelberg, Hubbard, and Palia (1999)

[4] Kim and Lu (2011) show that the focus on CEO ownership as a proxy of insider ownership make an important difference in identifying the ownership effect pointing that when they replicate Himmelberg, Hubbard, and Palia's (1999) Q regression and replace total insider ownership by CEO ownership the relation between ownership identifiable effects and Q becomes highly significant and hump shaped. The authors point that Himmelber, Hubbard and Palia's (1999) failure to find a significant relation relates to changes over time in the number and composition of insiders, rather than low within-firm variation in ownership (Zhou, 2001).

Managerial ownership relation with firm value has been often a focus in the corporate finance literature and managerial decision-making studies. Yet, the research yields conflicting results. Previous studies by Morck, Scheilfer, and Vishny (1988) and McConnell and Servaes (1990) argue that equity ownership programs have a non-monotonic effect on firm performance that results in the alignment of the managerial incentives with those of shareholders at low levels of equity ownership, but beyond an inflexion point the entrenchment effect dominates the alignment effect. Other research, however, started by Demsetz and Lehn (1985) and followed by Kole (1996), Demsetz and Villalonga (2001), and Coles, Lemmon, and Meschke (2007) argue that managerial ownership is endogenous and the non-monotonic effect is questionable[5]. In this study we acknowledge that ownership structure affects firm-performance and that oriented firm-specific risk [6] will eventually result in higher performance. Lubatkin and O'Neill (1987) support this argument with the findings that related mergers that increase the firm's competitive position by creating economies of scale and scope are associated with a decrease of systematic risk, and simultaneously with an increase of firm-specific risk.

From an agency theory perspective the understanding of how CEOs' risk preferences differ from those of the shareholders is a key issue. Galai and Malusis (1976) state that in limited liability companies shareholders effectively hold a "call option" on the firm's equity with an exercise price of the amount of the total debt outstanding, thus shareholder returns are associated with the convex pay-off of a call option with a down side protection due to the firm's limited liability, and an unlimited upside potential at the expense of debt holders. This provides the shareholders an incentive for excessive risk taking as they can diversify their personal portfolios idiosyncratic risk at the market level.

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[5] See also Agrawal and Knoeber (1996), Loderer and Martin (1997), Cho (1998), Himmelberg, Hubbard, and Palia (1999).

[6] By oriented firm-specific risk we refer to risky investment that can generate valuable growth opportunities.

From a CEOs' perspective, however, the risk appetite may shift in between more risk aversion or more risk seeking. Jensen and Meckling (1976) point that equity ownership incentive plans increase the personal benefits for corporate insiders to enhance corporate risk taking by pursuing growth opportunities. This is typically accomplished by offering stock discounted purchase programs or by granting stock options to the managers. Nonetheless, unlike shareholders, executives' wealth could be extremely related to the firm in terms of pecuniary and non-pecuniary attributes, which can lead to potential "undiversication" issues. Lu and Kim (2011) argue that CEOs high levels of equity holdings lead to high-wealth performance sensitivity that ultimately could result in value-reducing investments by accepting low risk projects at the expense of rejecting riskier positive NPV projects (Amihud and Lev, 1981; Smith and Stulz, 1985; Hirshleifer and Suh, 1992; Low, 2009; Bhattacharyya and Cohn, 2010). The likelihood of this result is higher when a CEO has sufficient voting power to challenge external shareholders or/and avoid dismissal (Demsetz, 1983; Fama and Jensen, 1983; Gibbs, 1993; Volpin, 2002; Atanassov and Kim, 2009; Kim and Lu, 2012).

Notwithstanding, there is a powerful internal corporate governance mechanism that has the duty to monitor closely the management, the board of directors. The board of directors is often described in the existent literature as the " 'apex body' of an organization's internal governance system (Fama and Jensen, 1983) and the first line of defense (Weisbach, 1988) or at least the second-best efficient solution (Hermalin and Weisbach, 2003) to the shareholders against incumbent management" (Pathan, 2009). Even if large outside active shareholders exist who have an important role in corporate governance it is likely that they impose their influence through the board of directors, that is, by occupying a position in the board himself or by controlling a number of directors

(Hermalin and Weisback, 2003). Thus, the presence of a 'strong board'[7] in a company is expected to better monitor managers for shareholders by imposing them focus on oriented-growth risk opportunities. For the purposes of this study we will focus on the board independence and in the ability of CEOs influencing the board through Chairman and CEO duality or directorship interlocks[8].

[7] A "strong board" in the existent literature is measured by board size, independence, and non-staggered and no poison pills.

[8] Board interlocks occur when a firm's CEO sits on another firm's board and that firm CEO sits on the first firm board. In this study board interlock occurs also when a CEO serves on the committee that makes his compensation decisions.

1.3 CONTRIBUTION AND MAIN RESULTS

The main contribution of this dissertation is that takes into account the specific relation of CEO ownership structure and corporate risk taking while controlling for board of directors characteristics. This contributes for the academic literature and for regulators in several ways. First it has implications to the design of optimal managerial incentive packages to align CEOs' risk preferences with those of shareholders by taking into account the board structure. Second, our findings show that equity ownership packages and a strong board are not substitutes for each other as their interaction effects are in fact more complex than previously believed. Finally, this paper provides empirical evidence particularly relevant for regulators and investors who might be interest in risk management, which is a topic of extreme relevance in the times of economic and social instability that we live nowadays.

Our main results provide evidence that low levels of CEO equity ownership have an incentive effect on CEOs' risk preferences reflected in a positive impact on corporate risk taking. However, when CEO equity ownership reaches approximately 23 percent the entrenchment and non-diversification outweigh the incentive effects, which results in a negative impact in corporate risk taking.

With regard to CEO power we find that firms that have an acting CEO who also chairs the board of directors are associated with less corporate risk.

Furthermore, the evidence support that smaller boards have a positive impact on corporate risk taking. At odds with the expectations a higher percentage of independent directors is negatively related with corporate risk taking.

Finally, the complex interaction between different CEO ownership structures and different board structures impacts corporate risk taking in different ways. For firms considered under strong governance the incentive impact of CEOs equity ownership is greater than the one for

firms under weak governance. Additionally, the level where CEOs' equity entrenchment and non-diversification effect exceed the incentive one vary according to the type of board characteristic that are controlled for. Last but not least CEOs equity ownership only has a statistically significant identifiable effect for firms under strong or moderated internal governance.

The dissertation proceeds as follows. Section 2 provides a critical review of academic literature on risk behavior and the intertemporal relation between risk and return, shareholders and managers risk-taking incentives, and board as corporate governance mechanism. Section 3 describes the hypotheses. Section 4 describes the data sources and the variables of interest. Section 5 describes the empirical model and the estimation techniques. Section 6 comments on the descriptive statistics and the correlation matrix. Section 7 provides the results. Section 8 considers different robustness checks. Section 9 concludes.

2. LITERATURE REVIEW AND HYPOTHESIS

2.1 RISK DOES MATTER

Whenever there is a decision there is uncertainty and risk involved in what will be the final outcome that decision yields.

The first step towards the understanding of how individuals perceive and incorporate risk and uncertainty in their decisions raises an important question: Is risk and uncertainty the same? Risk and uncertainty are often interchangeably used in an incorrect way. Knights (1921), in his classic study, argues that contrary to uncertainty risk can be measured precisely, thus financial institutions should be able to charge a risk premium according to the risk phenomenom event underlying an insurance contract. Furthermore, Ellsberg (1961) defines uncertainty as a random event with unknown probability. Hence, risk and uncertainty are both present in random environments but affect individual behavior in a distinct way. Of particular interest of analysis is how, if so, investors perceive and incorporate risk in their investment decisions. The classical financial theory and the behavioral finance theory are two competing theories that approach this issue. On one hand, the classical finance theory assumes that market investors are "rational". Underlying this theory are the assumptions that investors immediately incorporate new information in their decision making-process, and their choices are normatively acceptable[9]. On the other hand, the behavioral finance theory points out that "rational" and not "fully" rational investors coexist in the market. This infers that the financial phenomena analysis is not as simple as the classic theory assumes. Although the purpose of this study is not to scrutinize the differences between the two approaches, we take into account that regardless of a full or not full "rational" investor, he does take into consideration the intertemporal risk return tradeoff in his investment decisions.

[9] i.e consistent with Savage (1964) notion of Subjective Expected Utility.

The focus of this study is on how managerial ownership structure and internal corporate governance is related with corporate risk taking. Nevertheless, before focusing on corporate risk taking there is the need to understand how investors and the management perceive the intertemporal risk return tradeoff. After all corporate risk taking is the result of numerous individual decisions that might have different motivations, and might be based on different risk taking preferences and beliefs. From an agency theory perspective this can originate principal-agent problems due to conflicts between shareholders and management.

The financial research has developed an extensive literature around this topic. Included among that research, the asset pricing theory has devoted most of its literature to the study of the intertemporal tradeoff between return and risk. Most of the asset price models derive a positive relation between portfolio's expected returns and risk. However, there are often conflicting results that postulate an insignificant, or even a negative relation in such tradeoff [10]. Regardless the lack of consent among researchers, returns volatility is often used as a risk proxy in several pricing models. Sharpe (1964) and Lintner (1965) Capital Asset Pricing Model (CAPM) is referenced by Fama and French (2004) as a model that provides "powerful and intuitively predictions about how to measure risk and the relation between expected returns and risk". This model builds on Markowitz (1959) Modern Portfolio Theory (MPT). The CAPM is as follows

$$R_{i,t} - r_{f,t} = \beta_i(R_{m,t} - r_{f,t}) + \varepsilon_{i,t} \quad (1)$$

,where $R_{i,t}$ is the return on stock i, $R_{m,t}$ is the market return, $r_{f,t}$ is the risk free rate, and $\varepsilon_{i,t}$ is the idiosyncratic return.

[10] See, for example, Merton (1973, 1980), Pindyck (1983), Campbell (1987), French, Schewrt, and Stambaugh (1987), Turner, Startz, and Nelson (1989), Baillie and DeGennaro (1990), Nelson (1991), Campbell and Hentschel (1992), Chan, Karolyi, and Stulz (1992), Glosten, Jagannathan, and Runkle (1993), Whitelaw (1994), and Scruggs (1998).

Using returns volatility as a proxy for risk it is possible to derive a total volatility function from Eq. (1),

$$\sigma^2{}_i = \beta_i{}^2\sigma_m^2 + \sigma_{\varepsilon i}^2 \quad (2)$$

,where $\sigma^2{}_i$ the total volatility can be decomposed in two terms. The first term, $\beta_i{}^2\sigma_m^2$, is the firm's systematic volatility component, which captures the stock's variance that is related to the overall market volatility. The second term, $\sigma_{\varepsilon i}^2$, is the firm's idiosyncratic volatility, which captures the stock's variance that is attributable to firm specifics. The CAPM model ignores the idiosyncratic volatility, $\sigma_{\varepsilon i}^2$, based on the MPT assumption that an investor can eliminate the firm specific risk by holding a well-diversified portfolio. Hence, according to the CAPM an investor can either earn r_f by investing on a risk-free asset or a risk premium measured by the firm's systematic volatility component.

Nonetheless, the CAPM assumption that the idiosyncratic volatility is irrelevant based on the MPT diversification theory has been challenged by rational arguments and empirical evidence[11]. Transaction costs and taxes restrict the investor's ability to diversify their portfolios. Compensation plans often include equity ownership programmes with restrictive rights on the selling of the holdings for pre-defined period. Huberman (2001) provides evidence that investors ignore portfolio diversification in detriment of investing in familiar stocks[12], and Benartzi and Thaler (2001) show that employees hold a disproportional amount of their pension plans in the firm that they work. These arguments highlight that even traded assets face considerable challenges in order to completely diversify their idiosyncratic risk. This diversification problem increases furthermore with respect to nontraded assets. Goyal and Santa-Clara (2003) argue that has

[11] To address this weakness several models in the asset price literature were developed in order to take idiosyncratic risk into account. Among these models are extensions of CAPM where investors, for some exogenous reasons, hold undiversified portfolios.

[12] Goetzmann and Kumar (2008) and Polkovnichenko (2001) contribute with additional evidence on the lack of diversification of the equity portfolios of individual investors.

the risk of nontraded assets increases, and as long as the traded assets are not negatively correlated with the nontraded assets, investors will become more risk averse with respect to other traded risky assets. This argument is supported by Gollier (2001) that reports an isomorphic effect of an increase in the risk of nontraded assets in the risk aversion reflected on the investor's portfolio allocation. The most relevant examples of nontraded assets studied in the literature are human capital and private businesses. With all this contingencies it becomes evident that idiosyncratic volatility cannot be further ignored. For the purpose of our study, we assume that even if shareholders can fully diversify their portfolios, management will fail to do so because of the increased background risk[13].

Additionally, Black and Scholes (1973) and Merton (1974) view equity as a call option on the value of the firm's assets with the exercise prize that amounts to the debt outstanding infers that when the volatility of the assets increases, the value of equity goes up at the expense of the debtholders. Campbell and Taksler (2002) in a study that analyze the impact of average stock volatility in the spread of an index of A-rated bonds over treasuries from 1965 to 1999 document a positive relation of 0.7. This finding is consistent with the view of equity and debt as contingency claims, as an increase of average stock volatility will have a negative impact on corporate bonds returns and a positive impact on equity returns. Notwithstanding, it is worth to clarify that under this explanation an increase in idiosyncratic volatility does not affect the total value of the assets of the firm, although it does affect how the value is split between debt holders and equity holders (Goyal and Santa Clara, 2003). This is consistent with the idiosyncratic risk seeking behavior of the shareholders, and with the debtholders attempt of reducing this risk by introducing negative covenants in their contracts.

[13] In this study, we refer to background risk as the risk associated with the restrictions imposed in the managers' equity compensation programme, and with the non-diversifiable human capital.

The discussion so far allows us to highlight some points:

- Shareholders have an ability to at least efficiently diversify their portfolios. This and the nature inherent in their equity claims are reflected in their idiosyncratic risk seek behavior that maximizes the value of their equity holdings.
- Managers have a high background risk exposure that constraints the diversification of their personal wealth portfolios and increases their risk aversion, which creates an incentive to reduce the variance of the firm's assets under their control in order to decrease their personal wealth portfolio variance.
- Debtholders have an interest in decreasing the firm's asset volatility in order to maximize the value of their debt claims.

These different risk preferences are of particular practical interest for corporate finance as they affect directly the capital structure and the investment decisions of a firm. In an agency theory perspective in order to maximize shareholders' value, managers should pursue oriented-growth risk taking strategies which increases idiosyncratic volatility. In practice, managers might not act in the best interest of the shareholders for their personal reasons, and can even collude with debtholders to minimize corporate risk. Hence, from the shareholders stand point it is important to determine at what levels managerial equity ownership programmes work in their benefit by aligning closer management risk preferences.

For the purposes of our study we measure corporate risk as the firm idiosyncratic volatility. Additionally, we also look at the effects on total volatility, a proxy for the firm total risk, and systematic volatility, a proxy for the market risk.

2.2 MANAGERIAL INCENTIVES, CEO POWER, AND CORPORATE RISK-TAKING

The linkage between firm's managerial ownership and its performance has been a popular topic of debate among researchers through different approaches. James and Soref (1981), and Kroll, Wright, and Theerathorn

(1993) in a sociological perspective argue that managers will enhance firm's profitability in order to maintain their positions of authority within the organization and avoid discharge, thereby aligning insider and shareholder interests. Other approaches, however, especially the ones that follow the finance and strategic management perspective, argue that managers may follow personal or political reasons rather than economic in the decision making process.

Jensen and Meckling (1976) developed an agency theory framework that analyses the relation between managerial equity ownership and firm value where the agency costs decline as the managerial equity ownership rises. For that reason, as the agency costs decline the management financial interests will converge with those of the shareholders resulting in a better alignment of interests, and ultimately increasing the firm value. The implication of their framework is that managerial equity ownership is positively associated with higher firm value.

Some researchers argue, however that when the managerial equity ownership is high the management possesses sufficient power and influence to avoid discharge and becomes entrenched (Demsetz, 1983, Fama and Jensen, 1983, and Gibbs, 1993). Morck, Shleifer, and Vishny (1988) and McConnel and Servaes (1990) find evidence that minor managerial equity stakes increase firm value, but beyond a threshold the management becomes entrenched, which infers that managerial equity interests have a non-monotonic association with firm value: positive for low managerial equity stakes, and negative for high managerial equity stakes.

Alternatively, some researchers defy this causal relation by pointing that the endogenous relationship between firm performance and ownership causes spurious results. Demsetz and Lehn (1985) provide evidence for the endogeneity of a firm's ownership structure, and when it is taken into

account do not find a significant relation between profit rate and ownership structure[14].

The focus of this study, rather than analyzing the relation between firm's equity ownership structure and its value, is to explore how managerial ownership structure impacts corporate risk taking. Previous literature has conflicting views. On one hand, some authors argue that firm's ownership equity has a positive monotonic relation with corporate risk taking. This relation is showed by Amihud and Lev (1981) study of conglomerate mergers which argues that the reason that drives management decisions, with low managerial equity ownership, is risk reduction. The explanation is that an increase in the variance of firm's returns would reflect an increase in the management income risk that is linked to corporate performance. Furthermore, Amihud and Lev (1981) state that large managerial equity holdings will decrease management's risk aversion in the decision making process bringing their interests closer to those of the shareholders when deciding based on a asset-variance-increasing criterion[15]. On the other hand, several authors find evidence of a non-monotonic effect between managerial equity stakes and corporate risk-taking. The negative slope between large managerial equity ownership and corporate risk taking could have its roots in practices that include extraction of private benefits, expropriation of minority shareholders, and empire building. However, corporate insiders with a large equity stake in the firm will also share the costs of incurring in these practices. Therefore the negative slope could not necessarily be caused by those practices. An

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[14] See also Demsetz (1983), Kole (1996), Agrawal and Knoeber (1996), Loderer and Martin (1997), Cho (1998), Himmelber, Hubbard, and Palia (1999), Demsetz and Villalonga (2001), and Coles, Lemmon, and Meschke (2007).

[15] See also Agrawal and Mandelker (1987) findings on acquisitions and divestments where large insider equity stakes result in higher corporate risk taking, Hill and Snell (1988) findings on corporate diversification that argue that large managerial equity stakes increase idiosyncratic risk and decrease corporate diversification, and Johnson, Hoskisson, and Hitt (1993) findings on corporate restructuring that state higher managerial equity holdings increase internally induced corporate restructurings.

alternatively explanation is that the negative effect is related with the components of executives' wealth that consist in their non-diversifiable human capital, their equity stakes and options in the firm, and their firm unrelated portfolio of assets. Unlike shareholders that can diversify their wealth portfolios across the capital markets, executives can only do it effectively at the firm level (May, 1995). Therefore as their equity stakes in the firm increase their ability to diversify their wealth portfolios decreases. Holmstrom (1979) provides evidence that managerial incentive programs are highly sensitive to the firm performance whereas induce a greater effort also increase the degree of risk aversion of a risk-averse agent. Thus, if a firm's executives have a significant portion of their wealth in the company they might make suboptimal investment decisions with insufficient risk just to decrease the variance of their wealth portfolio (Smith and Stulz, 1985; Hirshleifer and Suh, 1992; Low, 2009, Bhattacharyya and Cohn, 2010; and Kim and Lu, 2012). The likelihood of these insufficient risky sub-optimal investments increases when the management of the company is entrenched and can easily avoid dismissal or/and challenges the outside shareholders[16]. The sources of management power proffered in the literature include, but are not limited to, large voting rights (Kim and Lu 2012), CEO duality (Hermalin and Weisbach, 1998), executives interlocking (Hermalin and Weisback, 2003), and anti-takeover provisions (Gompers, Ishii, and Metrick, 2003; and Bebchuk, Cohen, and Ferrell, 2009).

The power and influence games at a CEO-level have been a topic that motivated several researchers in the existent literature. For instance, Hallock (1997,1998) points out that interlock can give rise to collusive or quid pro quo behavior allowing CEO's to become entrenched managers, which might compromise board independence or at least increase the CEO's bargaining power to gain a friendly board (Hermalin and Weisback,

[16] Volpin (2002) and Atanassov and Kim (2009) support this argument with evidence that top managers who are major shareholders are less likely to be discharged than those with small or no Equity holdings in the firm.

2003). Moreover, Fama and Jensen (1983) and Jensen (1993) argue that CEO duality restricts the information flow to other board directors by increasing the degree of information asymmetry within the board, which will negatively impact the board's independence and ability of effectively overseeing the management.

2.3 GROWTH OPPORTUNITIES

Miller and Modigliani (1961) suggested that a firm's value can be split in the value of its assets and the value of growth opportunities measured as the net present value (NPV) of future investment projects. Therefore, it is important to point out that corporate risk taking makes sense in firms that are presented with an investment opportunity set (IOS). Myers (1977) is the one that introduced IOS as the opportunities that come from the traditional and discretionary expenditures that are related with firm-specific factors, such as assets in place and human capital, industry-specific factors and macro-economic factors. Furthermore, Jensen (1986) argued that executives that increase the firm's risk exposure without an IOS might be motivated by their personal interests and incur harmful activities to shareholders' value like empire building or/and pursue of pet projects so that they can extract private benefits at the expense of shareholders' value. Previous literature in accounting and finance used several proxies based on price, investment or variance measures to capture Myers' IOS. Kallapur and Trombley (1999) showed, for US companies, that the price based proxies that include market and book measures have a consistent positive relation with realized growth. Following these findings we will use a market-to-book growth model to proxy the IOS that is derived by Otto (2000) to estimate the Excess Value of the Firm (EVF), and the Excess Value of the Equity (EVE). This model has the underlying assumption that if the market recognizes the value of firms' growth opportunities these should be reflected in market-to-book ratios in excess of unity because their value is mainly driven by growth opportunities (Lindenberg and Ross, 1981; Lang and Litzenberger, 1989; Johnson, 2003).

2.4 STRONG BOARDS AND CORPORATE RISK-TAKING.

From an agency theory perspective, the propensity and degree of the agency conflict can be exacerbated or mitigated according to different concentration in ownership structure. Thus, more diffused or concentrated ownership structures are related with the firm's ability of generating greater competitive advantages that arise from risk-taking strategies (Shleifer and Vishny, 1986; Admati Pfleiderer, and Zechner, 1994). In order to better align the agency and principal interests, and to mitigate the free-rider problem inherent in publicly held firms a number of firm-level mechanisms interact to determine the corporate governance structure of a firm (Cremers and Nairs, 2005).

Among the firm-level corporate governance structure, and of extreme importance to mitigate agency problems within an organization, is the board of directors. Fama and Jensen (1983) describe the board of directors has the "apex body" of an organization's internal governance system, and Weisbach (1988) as the shareholders' first-line of defense against the incumbent management, or at least the second-best efficient solution (Hermalin and Weisbach, 2003). Despite the existence of limited theory related to boards of directors there is a wide range of empirical studies that tries to capture the joint relations between board characteristics, board tasks, and firm performance.

With the empirical research available we define a strong board as an ad hoc selection of variables based on the ones most relevant and mentioned in the literature: board size, independent directors, and less restrictive constitutional limitations on shareholders' rights[17]. Hence, the degree of effectiveness and independence of a board will depend upon these characteristics.

In the finance and economic literature the most widely addressed topic concerning the board of directors is whether an increase of outside

[17] For the purpose of our study we will focus on the presence or absence of staggered boards.

directors in the board increases firm performance through better monitoring abilities. These studies yield dichotomous results. Hermalin and Weisbach (1991) and Bhagat and Black (2000) following Morck, Shleifer, and Vishny (1988) approach find no evidence of a significant relation between the percentage of outside directors and Tobin's Q[18]. MacAvoy and Millstein (1999) defend that the only reason heretofore other authors failed to find a significant relationship between board independence and firm performance is related to data selection bias, by pointing the fact that previous data covers periods prior to where boards take an active role in corporate governance. Other interesting study is the one from Rosenstein and Wyatt (1990) that present a statistically significant increase in the firm's stock price of 0.2 percent on the announcement day of a new outside director appointment to the board. Hermalin and Weisbach (2003) point out that the results in these empirical studies can be spurious due to endogeneity problems, and even when simultaneous equations are estimated errors from the underlying equation are present, which results in a low signal-to-noise ratio. This drawback could be improved by developing formal economic theory on this topic that would result on better empirical studies.

Also present in the finance and economic literature are studies that relate board size and firm performance. Jensen (1993) and Lipton and Lorsch (1992) argue that larger boards will exacerbate the agency problem of director free-riding. This theory is a key inference in the explanation of why smaller boards oversee more effectively the management then larger boards. Especially in reaction to poor performance a smaller board might not be paralyzed by free-riding or with plagued inertia in the way that large boards are (Hermalin and Weisbach, 2003). Yermack (1996) supports this theory and provides empirical evidence for a significant negative

[18] McAvoy, Cantor, Dana, and Peck (1983), Hermalin and Weisbach (1991), Mehran (1995), Klein (1998), and Bhagat and Black (2000) findings show no significant relation between performance Accounting measures and the percentage of outside directors in a board.

relation between Tobin's Q and board size on a sample of large US corporations. In addition, Gertner and Kaplan (1996) in a study of reversed-leveraged buyouts defend that when firms go private they switch to more "value maximizing" boards, and the trend in this sample is to decrease the board size. Furthermore, Wu (2000) studies the evolution of the board sizes from 1991 to 1995 and finds that the boards tend to decrease their size. This trend can be partially explained by pressures of active outside large investors, which is aligned with the view that the stage where active large investors [19] carry their duties in corporate governance is through the board itself by appointing and dismissing directors, or by controlling a number of directors.

This leads straight to the level of constitutional limitations on shareholder's voting powers[20], especially the ones that can constrain a majority of shareholders to impose a board's change of control at a given point in time. Of particular analysis of interest is when a firm has a staggered board[21]. A staggered board can act has a powerful defense against control challenges by removal of directors in either a proxy fight or proxy contest. Bebchuk and Cohen (2005) show that staggered boards are negatively correlated with Tobin's Q, and that is one of the twenty-four provisions followed by the Investor Responsibility Research Center (IRRC) that drives Bebchuk, Cohen, and Ferrel (2009) six provisions entrenchment. Moreover, Faleye (2007) provides evidence that the announcement of a staggered board adoption is followed by negative stock abnormal returns. The contrary is also verified, i.e. the announcement of the dismantling of a staggered is followed by positive stock abnormal returns (Guo, Kruse, and Nohel, 2008), which shows that investors

[19] We refer to active large investors as the group of blockholders and institutional investors.

[20] Clark (1986) argues that shareholders´ most important source of power is their voting power.

[21] When a firm has a staggered board directors are divided into classes with only one class of directors coming up for reelection each year.

perceive a staggered board as a key determinant that could threat their voting rights.

3. HYPOTHESIS

The discussion so far suggests that controlling for firms' growth opportunities and as risk-averse managers, firms CEOs will pursue risk growth-oriented strategies when holding low equity stakes in the firm. Alternatively, when CEOs hold large equity stakes with voting rights, and their power increases due to CEO duality and/or CEO interlocking, as risk-averse entrenched managers, CEOs will base their decisions in order to reduce the variance of their wealth portfolios. Consequently, the first two formal hypotheses addressed in this study are as follows:

- **Hypothesis 1. (H_1)**: For firms with growth opportunities, the relationship between the degree of CEOs' equity ownership with corporate risk taking will be positive when CEOs hold low equity stakes and negative when CEOs hold high equity stakes.
- **Hypothesis 2. (H_2)**: For firms with growth opportunities, corporate risk taking will be inversely related with the degree of CEO power measured by CEO duality and CEO interlocking.

Additionally, a strong board measured by its small size, independence, and non-staggered should better impose the shareholders' risk preferences in the corporate strategies executed by the incumbent management. Ergo, it is expected that a strong board will affect corporate risk taking positively. The formal representation of the third hypothesis of this study is as follows:

- **Hypothesis 3. (H_3)**: For firms with growth opportunities, corporate risk taking has a positive relation with strong boards[22].

[22] i.e. small board size, more independent directors, and non staggered boards.

4. DATA AND METHODOLOGY

4.1 SAMPLE AND DATA SOURCES

The initial sample examined in this study consists on all NASDAQ and NYSE constituents from 2001 throughout 2010. The data is sourced by merging executive data in ExecuComp and Corporate Library, with accounting data in Compustat and stock returns in CRSP. The obtained data set, allows us to track, through the relevant period, CEO ownership of stock, and board characteristics while controlling for other variables of interest.

The initial sample comprises 62,463 firm-year observations for which volatility measures are calculated. The data with missing values for CO_PER_ROL, an ExecuComp indicator for CEO executive/company combination data, is dropped leaving a sample with 13,320 firm-year observation. After this negative book values of equity are eliminated so that the computed ratios using this variable do not have an ambiguous interpretation, and because according to literature these firms might pursue non rational risk taking strategies. Firms with Excessive Value of Firm (Ottoo, 2000) below zero are excluded so that our final sample only includes firms with growth opportunities. After this procedure the final sample has 10,612 firm-year observations.

Thereafter, sample size for each regression varies depending on the availability of data to construct the risk taking measures, the ownership variables, the CEO power measures, the internal governance measures, and other control variables.

4.2 DATA

4.2.1 MEASUREMENT OF RISK TAKING

The dependent variable is firm volatility. In this study we use three measures of firm volatility: the standard deviation of the natural logarithm of daily stock returns, and two measures estimated using a market model for non-financial firms, and a two-factor model for financial firms. The annual daily standard deviation of stock returns is defined as total volatility (TV), and reflects the market expectations about the risk associated with each company.

For non-financial firms the measures of systematic volatility (SYST) and idiosyncratic volatility (IDIO) are based on a single-factor market model that regress the projection of the natural logarithm of daily stock returns on the daily returns of a market index.

$$r_{id} = \propto_i + \beta_{mi} r_{md} + e_j \quad (3)$$

where r_{id} is the return for stock i on day d, and r_{md} is the return on the market (proxied by the S&P 500 index) on day d, and e_j is a random error term. Estimation of Eq.(3) produces for each firm-year β_{mi}, a measure for systematic volatility, and σ_{ej}, the standard deviation of the residuals, a proxy for idiosyncratic volatility. Ferreira and Laux (2007) examine the robustness of this market model to estimate idiosyncratic volatility against Fama and French (1992) three-factor model and an industry model. The authors conclude that the estimation results are analogous.

For financial firms the measures of systematic volatility (SYS) and idiosyncratic volatility (IDIO) follow Anderson and Fraser (2000), Chen, Steiner, and Whyte (2006), Pathan (2009), and Belghitar and Clark (2012) and are based on a two-factor model.

$$r_{id} = \propto_i + \beta_{mi} r_{md} + \beta_{Ii} I_d + e_j \quad (4)$$

where r_{id} is the return for stock i on day d, r_{md} is the return on the market (proxied by the S&P 500 index) on day d, I_d is the 90-day Treasury Bill for day d, and e_j is random error term. Estimation of Eq.(4) produces for each

firm-year β_{mi}, a measure for systematic risk, and σ_{ej}, the standard deviation of the residuals, a proxy for idiosyncratic risk. Akhigbe and Whyte (2003) point that the coefficient in Eq.(4) can be biased if market returns are related with interest rate changes. Chance and Lane (1980) propose orthogonalization[23] as a solution, however this can originate biased t-statistics. Hence, for the purposes of this study the un-orthogonalized two-index market model is used (Kane and Unal, 1988, Anderson and Fraser, 2000, and Akhigbe and Whyte, 2003).

The daily stock return for all measures of risk is calculated as the natural logarithmic of the ratio of the equity return series.

$$r_{id} = \ln\left(\frac{P_{it}}{P_{it-1}}\right) \quad (4)$$

where P_{it} is the stock price provided in CRSP database adjusted for any capital adjustments including dividends and stock splits.

4.2.2 MEASUREMENT OF CEO OWNERSHIP

The explanatory variable of main interest is CEO ownership (CEO_OWN). CEO_OWN is measured has the fraction between common stock held by the CEO and the firm's total common stocks outstanding. This variable is set by

$$\text{CEO\_OWN} = \frac{\text{SHROWN\_EXCL\_OPTS}}{\text{SHROUT}*1000} \quad (5)$$

where SHROWN_EXC_OPTS (Thousands) is the number of common shares held by the CEO, and SHROUT (Millions) is the number of common shares outstanding as reported by the company, both variables are available in ExecuComp in the section ANNCOMP and CODIRFIN respectively. Furthermore, if the calculated value is greater than one it is replaced by the direct available ExecuComp's SHROWN_EXCL_OPTS_PCT ANNCOMP variable converted into

[23] i.e. $E(Y_{it}, X_{it})=0$

fraction. This variable stands for the percentage of total shares owned by the CEO excluding options. We do not use directly this variable in order to minimize missing values in our sample. We opt to exclude stock options from this variable because the level of entrenchment and the degree of freedom to make sub optimal risk choices harmful to shareholders' value is dependent on the level of voting rights that the CEO has. For example, a CEO that holds a voting stake in the company of 25% faces a lower risk of discharge than a CEO who owns a voting stake of 2%.

The relation between CEO_OWN, and TV and IDIO is expected to be positive for low levels of ownership, and negative for high levels of ownership. With respect to SYST it is expected to remain insignificant.

The second variable, used to measure ownership, is insiders' ownership (Insiders_OWN), and measures the sum of all officers and directors stock holdings excluding options divided by the total number of common shares outstanding. The data for this variable is gathered for GMI ratings Corporate Library in the Companies section.

While controlling for industry effects and year fixed effects we expect that this variable has an insignificant relation with the TV, IDIO, and SYST due to the confounding effect bias originated by changes in the number, and in the composition of insiders over time.

4.2.3 INTERNAL GOVERNANCE VARIABLES

Internal governance is measured by how strong the boards of directors are. Three proxies for strong boards are board size (BS), independent directors (INDDIR), and less shareholder restrictions (SRIGHTS).

BS is defined as the number of directors on the board. The data is collected from the GMI ratings Corporate library database in the section of Directorship.

The relation between BS and IDIO is expected to be negative because smaller boards are expected to better monitor the incumbent management, hence increasing corporate risk.

INDDIR is measured as the ratio between the number of fully independent directors and the BS.

$$\text{INDDIR} = \frac{\text{Total Number of fully Independent Directors in the Board}}{\text{Board Size}} \quad (6)$$

The total number of fully independent director in the board is gathered from GMI ratings Corporate Library database in the section of Directorship.

The relation between INDDIR and IDIO is expected to be positive. This relation is based on the belief that a higher number of fully independent directors decrease the likelihood of a board being controlled by the incumbent management.

The degree of shareholder restrictions (SRIGHTS) is measured by a dummy variable that captures whether boards are classified. The dummy variable CLASSIFIED equals one if the board is classified, otherwise zero.

CLASSIFIED data is taken directly from the GMI ratings Corporate Library in the section of Takeover Defenses.

The relation between SRIGHTS and IDIO is expected to be negative, because the higher the shareholder rights restrictions, the higher degree of management's entrenchment.

4.2.4 CEO POWER

CEO power is measured by two dummy variables.

DUALCEO equals one if the CEO chairs the board of directors, otherwise zero. The second variable (INTERLOCK) equals one if the CEO serves on the board committee that makes his compensation decisions, serves on the board of another company that has an office serving on the compensation committee of the indicated CEO's company, and serves on the compensation committee of another company that has an officer serving on the board of the indicated CEO's company (ExecuComp), otherwise zero.

DUALCEO is gathered from the GMI ratings Corporate Library database in the section CEOs.

INTERLOCK is readily available from ExecuComp data base in the section ANNCOMP.

High levels of CEO power increases his influence in the firm decision making process, therefore we expect a negative relation of DUALCEO and INTERLOCK with IDIO and TV.

4.2.5 CONTROL VARIABLES

4.2.5.1 Growth Opportunities:

Growth opportunities are not directly available, however studies have relied on several proxies to quantify the presence of growth opportunities. Danbolt, Hirst, and Jone (2011) in a comprehensive study based on UK companies address the growth opportunities puzzle by which of the eight different types of growth measures are related to future growth opportunities[24]. The authors conclude that for UK the dividend-based proxies perform best in comparison with the other proxies. However, our sample uses US data which is based on a different IOS than the one in the UK. However, Kallapur and Trombley (1999) in a related study report that for the US IOS the proxies for growth opportunities that best perform are the ones based on book and market measures. Therefore, we select our measure of growth opportunities type based on the findings on Kallapur and Trombley (1999), and the model is based on the choices presented by Danbolt, Hirst, and Jone (2011).

Thus, we follow Ottoo (2000) model that estimates the fraction of the value attributable to growth opportunities based on excess market. Ottoo (2000) derives the Excess Value of the Firm (EVF) and Excess Value of Equity (EVE)

[24] Danbolt, Hirst, and Jones (2011) point market to book proxies, earning proxies, and dividend proxies as growth opportunities proxies.

$$\text{EVF} = \frac{(\text{MV equity} + \text{BV debt}) - (\text{BV equity} + \text{BV debt})}{(\text{MV equity} + \text{BV debt})} \quad (7)$$

$$\text{EVE} = \frac{\text{MV equity} - \text{BV equity}}{\text{MV equity}} \quad (8)$$

where MV refers to market value and BV to book value. The BV of debt is calculated as the sum of book values of loans and short-term debt.

In this study our main proxy for growth opportunities is the EVF, because our interest falls on the growth opportunities at a firm level. Notwithstanding, EVE is calculated and the results are robust using this measure[25].

The MV equity, BV equity, loan BV, and short-term debt BV are collected from Compustat database.

The existent of growth opportunities is expected to be associated with higher corporate risk taking.

4.2.4.2 Firm Characteristics:

To control for firm specific characteristics we control for size, profitability, financial leverage, advertisement and research and development expenditures, cash, and frequency. The variables that are proxies to control for these effects are as follow:

- **Size** (SALES): our first choice is the total revenue (SALES). Total revenue is a cleaner proxy for size than total assets (TA) because is less subject to accounting rules and manipulation. Notwithstanding the results are robust for the use of TA[26]. Following Demtze and Lehn (1985) we also control for a possible non-linear size effect, therefore the square of SALES is included.

Larger firms are expected to have a greater ability to diversify risk across product lines therefore we expect them to have a lower risk profile.

[25] Refer to Appendix A.

[26] Refer to Appendix A.

- **Firm profitability** (ROA): is measured as the ratio of operating profits before depreciation to total assets.

$$\text{ROA} = \frac{\text{Operating Profits before Depreciation}}{\text{Total Assets}} \quad (9)$$

This variable is included based on the premise that higher profitability is related with higher corporate risk taking strategies. Hence, we expect a positive relation with IDIO.

- **Financial leverage** (LEV): is measured as the ratio between the BV of equity and the TA.

$$\text{LEV} = \frac{\text{BV equity}}{\text{TA}} \quad (10)$$

The higher this ratio the higher is the proportion of equity funds allocated in the firm capital structure, hence lower the leverage. Thus, we expect a negative relation between this ratio and the risk profile of the company.

- **Advertisement** (ADV): is calculated by the proportion between the advertisement expenditure and the total capital expenditure (CAPEX).

$$\text{ADV} = \frac{\text{Advertisement expenditures}}{\text{CAPEX}} \quad (11)$$

This variable is included on the presumption that a higher advertisement expenses is related with higher corporate risk taking.

- **Research and Development** (R&D): is measured as the ratio between research and development and property, plant, and equipment (PPE).

$$\text{R\&D} = \frac{\text{Research and Development expenditures}}{\text{PPE}} \quad (12)$$

R&D is included in order to capture the effect of discretionary spending and its association with the growth opportunities. Firms with high levels of R&D are expected to have a higher risk profile.

- **Adv and R&D dummy**[27] (ADVRD dummy): an ADV and R&D dummy is included to capture the mean of the variables in the intercept term for missing values. By using this dummy as an indicator variable for missing values it is possible to maintain the sample size. The dummy is set to zero if the values are missing, otherwise one. ADV and R&D missing values are set to zero.

- **Liquidity** (CASH): this variable is calculated as the fraction between total cash and near cash marketable securities with TA.

$$\text{CASH} = \frac{\text{Total Cash and near Cash Marketable Securities}}{\text{TA}} \tag{13}$$

The reason to control for cash is that companies with risk growth oriented profiles might have large sums of cash reserves in order to finance internally risky strategies or/and lower their costs of external financing by allocating a considerable amount of internal capital resources to the investment. A positive relation is expected between CASH and risk taking. The CASH^2 is also calculated in order to capture a non-linear effect that might be associated with practices such as "cash pilling". For this reason it is expected to be inversely related with risk.

- **Frequency** (FREQ): the frequency of trading is used as a liquidity and information measure (Jones, Kaul, and Lipson 1994). FREQ is calculated by dividing the average daily trading volume of shares with the number of common shares outstanding as reported by the company in the beginning of the fiscal year.

$$\text{FREQ} = \frac{\text{Average daily trading volume /1000}}{\text{Number of common shares outstanding}} \tag{14}$$

Control for frequency of trading is deemed important to capture the effect of equity turnover on volatility associated with the speed on which information flows (Ferreira and Laux, 2007).

[27] This dummy is used for both R&D and ADV, because if we use two different dummies one would be omitted due to multi-collinearity.

The highest the speed that information flows, the higher the speed that prices will adjust to the new information, thus FREQ should have a positive correlation with the risk measures.

All the firm characteristics variables are collected from the Compustat data base.

4.2.5.3 CEO Demographics:

CEO age (CEOAGE) is the age of the CEO measured in years.

As the CEOs get older we expect that their risk choices become more conservative.

A summary of the variables details with the predicted signs is shown in Table I.

§Table I:
Variables Description and Predicted Signs

Variables	Pred. Signs	Measures
Panel A: Dependent variables (Volatilities)		
Total Volatility (TV)		The standard deviation of the firm daily stock returns in each year in each year
Idiosyncratic Volatilility (IDIO)		The standard deviation of error terms in Eq. (3) for non-financial firms and Eq.(4) for financial firms
Systematic Volatility (SYST)		Coefficient of Rmt (i.e ßmi) for non-financial firms in Eq.(3) and for financial firms in Eq.(4)
Panel B: Ownsership Variables		
CEO Ownership (CEO_OWN)	+	The outstanding common shares held by a CEO as a fraction of
CEO_OWN^2	-	common stocks outstanding
Insiders Ownership (INSIDERS_OWN)		The sum of the fractions of shares held by all directors and officers
Panel C: Strong Board Variables		
Board Size (BS)	-	The number of directors in the board.
Independent Directors (IND_PCT)	+	The fraction of total directors who are independent
Shareholders Rights (SRIGHTS)	-	The dummy for classified boards equals 1 if the board is staggered, otherwise 0.
Panel D: CEO Power Variables		
DUALCEO	-	A dummy variable that equals 1 if the acting CEO also chairs the board, otherwise 0.
INTERLOCK	-	A dummy variable that equals 1 if the CEO serves in the compensation committe, otherwise 0.
Panel E: Control Variables		
Growth Opportunities (EVF)	+	Otto (2000) Excess Value of the Firm (EVF) which is calculated as the percentage of the sum of the market value of equity minus the book value of equity divided by the sum of the market value of equity plus the book value of debt.
Size (LNS)	-	The natural log of sales in 1000 US dollars
Profitability (ROA)	+	The ratio of operating profits before depreciation to total assets.
Leverage (LEV)	-	The firm's total book value of equity divided by the book value of total assets.
Advertisement (ADV)	+	The ratio of a firm's advertisement expenditures to total property, plant, and equipment.
Research and Development (R&D)	+	The ratio of research and development expenditures to property, plant, and equipment.
ADVRD dummy	+	A dummy variable equal to 1 if R&D and advertisement data are available, and 0 otherwise. This variable allows the intercept term to capture the mean of R&D/PPE for missing value.
CASH	+	The sum of cash and all securities readily transferable to
$CASH^2$	-	cash divided by the book value of total assets.
Frequency (FREQ)		The average daily trading volume of shares in thousands divided by the number of of the firm's total outstanding shares.
CEOAGE		CEO Age in years

5. Methodology

The objective of this study is to empirically test the impact of firm's managerial ownership structure and internal governance on the firm-level volatility over the period 2001-2010. Therefore, we rely on panel data regression models to capture the movements across time of cross-sectional units.

The use of panel data regression models have advantages relative to pure time-series or cross-sectional analysis. Baltagi (1995) points out the following advantages in the use of panel data regression models: 1) panel data estimation techniques take into account cross-sectional heterogeneity by allowing for subject-specific variables, 2) the combination of time-series and cross-sectional decreases collinearity among variables, and increases the number of degrees of freedom and efficiency, 3) it is more suited to study the dynamics of change, and 4) panel data can decrease the bias related with the integration of firms into broader aggregates.

The remainder of this section is structures as follows. Section 5.1 describes and explains the empirical models, and section 5.2 presents the estimation method.

5.1 EMPIRICAL MODELS

5.1.1 MAIN EMPIRICAL MODELS

The empirical model used to test the first two hypotheses, **H1** and **H2**, given the literature discussion in Section 2.2 is as follows:

$$Volatility_{i,t} = \alpha + \beta_1 OWN_{i,t-1} + \beta_2 CEOPOWER_{i,t} + \beta_3 CONTROL_{i,t} + \eta_i + \varphi_t + \varepsilon_{i,t} \quad (15)$$

where:

- the subscripts i denotes individual firms, t time period (t=2001,2002,…,2010), and ln the natural logarithmic.
- $Volatility_{i,t}$ represents the three measures of volatilities: TV, IDIO, and SYST.
- $OWN_{i,t-1}$ includes the ownership variables. OWN and OWN^2 is included as in McConnel and Servaes (1990).
- CEOPOWER includes the measures of CEO power.
- $CONTROL_{i,t}$ is a vector representing control variables: the natural logarithmic of size, growth opportunities, firm profitability, financial leverage, advertisement, research and development, cash, and CEO demographics.
- $\eta_i \; and \; \varphi_t$ are industry- and year-fixed effects.
- $\varepsilon_{i,t}$ is the error term.

Ferreira and Laux (2007) use a closely related empirical model to measure the effect of corporate governance on idiosyncratic volatility at firm level for US companies. In a study of Japanese firms Nguyen (2011) uses a similar specification to investigate the effect of ownership structure in the idiosyncratic volatility.

The specification used to test empirically the third hypothesis, **H₃**, given the literature discussion in Section 2.4 is as follows:

$$Volatility_{i,t} = \alpha + \beta_1 OWN_{i,t-1} + \beta_2 CEOPOWER_{i,t} + \beta_3 BOARD_{i,t} + \beta_3 CONTROL_{i,t} + \eta_i + \varphi_t + \varepsilon_{i,t} \quad (16)$$

in which:

- the subscripts i denotes individual firms, t time period (t=2001,2002,…,2010), and ln the natural logarithmic.
- $Volatility_{i,t}$ represents the three measures of volatilities: TV, IDIO, and SYST.
- $OWN_{i,t-1}$ includes the CEO ownership variables. CEO_OWN and CEO_OWN^2 is included as in McConnel and Servaes (1990).
- CEOPOWER includes the measures of CEO power.
- $BOARD_{i,t}$ includes the measures related to strong board: the natural logarithmic of board size, the percentage of independent directors, and shareholder rights restrictions.
- $CONTROL_{i,t}$ is a vector representing control variables: the natural logarithm of size, growth opportunities, firm profitability, financial leverage, advertisement, research and development, cash, CEO demographics and frequency.
- $\eta_i \; and \; \varphi_t$ are industry- and year-fixed effects.
- $\varepsilon_{i,t}$ is the error term

The p-value for an F-test where the ownership variables are jointly zero is calculated and reported in all main specifications along with the variation inflation factor (VIF) to control for multi-collinearity.

Endogeneity is a well-known concern in corporate governance regressions. As a first measure to address this issue, volatility is always regressed on ownership variables with one year lag. In the case of all other variables we use the most recent observations.

5.1.2 PIECE WISE LINEAR REGRESSION

To complement the analysis of the effect of CEO ownership in idiosyncratic volatility Eq.(15) is solved by using an alternative estimation method, a piece wise linear regression, based on Morck, Schleifer, and Vishny (1988) specification arbitrary cut off points. The cut off points are as follow:

1. The CEO ownership is less than 5 percent.
2. The CEO ownership is greater than or equal to 5% and less than or equal to 25 percent.
3. The CEO ownership is greater than 25%.

5.2 ESTIMATION METHODS

The models' estimation technique is chosen based on the Hausman test, and the Breuch and Pagan Lagrange Multiplier Test (BP).

The decision between random effects (RE) and fixed effects (FE) is made based on the null hypothesis underlying the Hausman test: the FE model and error components model or RE model estimators do not differ substantially. If the null hypothesis is rejected then the model does not fulfill the RE assumptions producing invalid RE estimators.

The Hausman test clearly rejects the null hypothesis in our empirical models for the estimated χ^2 value of 126.99 for 51 df is highly significant[28]. As a result, we can reject the RE model in detriment of the FE estimation technique.

The FE estimation technique used is a two-way fixed effect least-square dummy variable (LSDV) that captures different intercepts for invariant industry and year effects minimizing the bias of the pooled regression slope estimate. In all our specification models we use year and industry dummy variables. An exception is the panel regression in Table IV where we test Eq.(15) without industry- and time-fixed effects.

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[28] Refer to Appendix B.

To account for within firm-CEO correlation of the error terms all the specifications use cluster robust standard errors clustered at the firm-CEO level. The cluster standard errors are heteroscedasticity-consistent similarly to the White (1980) robust standard errors[29].

[29] See Rogers (1993) and Williams (2000).

6. DESCRIPTIVE STATISTICS AND CORRELATION MATRIX

6.1 UNIVARIATE ANALYSIS

The descriptive statistics for the volatility measures, ownership variables, strong board variables, CEO power variables, and control variables are presented in Table II.

Table II:
Descriptive Statistics

This table reports number of observations, mean, standard deviation, minimum, median, maximum, and skewness. All variables are as defined in Table I. The sample period is from 2001 to 2010.

Variable	Obs	Mean	Std. Dev.	Min	Median	Max	Skew.	Kurt.
Panel A: Volatility Measures:								
TV (%)	10612	2.9459	2.0556	0.3783	2.5413	92.7097	15.5292	568.4580
IDIO (%)	10612	2.6114	2.0063	0.2354	2.2091	92.7041	16.9371	637.2272
SYST	10612	1.0748	0.5252	0.0064	1.0004	3.9565	0.8718	4.1758
Panel B: Ownsership Variables:								
CEO_OWN	10612	0.0223	0.0590	0	0.0030	0.7611	4.6853	30.0215
INSIDERS_OWN	8914	0.1301	0.1667	0	0.0580	0.9855	2.0212	7.2134
Panel C: Strong Board Variables:								
BOARDSIZE	8737	9.4080	2.6101	4	9	34	1.0405	6.3263
INDDIR	8737	0.7500	0.1511	0	0.7778	1	-1.0872	4.0480
SRIGHTS	8121	0.5722	0.4948	0	1	1	-0.2912	1.0852
Panel D: CEO Power Variables:								
DUALCEO	8914	0.5509	0.4974	0	1	1	-0.2048	1.0419
INTERLOCK	8914	0.0174	0.1307	0	0	1	7.3843	55.5273
Panel E: Control Variables:								
EVF	8129	0.3844	0.2278	0.0000	0.3743	1.9845	0.2216	2.28
SALES	8914	6.1818	19.0191	0.317	1.4419	425.0710	10.3413	159.7441
ROA	8914	1.1496	5.8886	-1.3192	0.1356	134.5877	9.1344	111.7873
LEV	8129	0.4715	0.2221	0.0002	0.4673	0.9751	0.03	2.2355
ADV	8794	0.1290	3.1875	0	0	295.7746	90.7952	8417.8795
R&D	8794	0.3747	1.6469	0	0	54.6669	17.7929	451.7717
ADVRD dummy	8914	0.4766	0.4995	0	0	1	0.09389	1.0088
CASH	8415	0.1186	0.1407	0	0.0707	0.9942	2.39694	10.8091
FREQ	8554	7460.1360	8278.2950	97.7429	5430.1001	150107.9	6.7467	80.7158
CEOAGE	8914	55.4208	7.1534	30	55	94	0.2523	3.8240

The volatility measures in Table II, Panel A show that total volatility (%) mean and median are respectively 2.8459 and 2.5413 percent, with a distribution highly skewed to the left. The idiosyncratic volatility (%) is highly skewed to the right, and has a mean and median 2.0063 and 2.5413 percent. Systematic volatility mean and median are 1.0748 and 1.0004 respectively.

The ownership variables in Table II, Panel B summarize the statistics for the measures for CEO ownership and Insiders ownership. The mean and median for CEO ownership are 2.23 and 0.3 percent respectively, and are similar to the ones reported by Kim and Lu (2011). This variable distribution is highly skewed to the right, which is consistent with previous studies that document that managerial ownership distribution is highly skewed (Morck, Schleifer, and Vishny, 1988, Himmelberg, Hubbard, and Palia, 1999, and Cho, 1998). Of 10612 observations, 4153 observations (39.13%) show CEO ownership above 0.5 percent, 1154 observations (10.87%) above 5 percent, 435 observations (4.1%) above 15 percent, and 290 observations (2.73%) above 20 percent. The CEO ownership maximum is 76.11 percent. The Insiders ownership variable mean and median is 13 and 5.8 percent respectively, which is similar to the ones reported by Wright, Ferris, Sarin, and Awashi (1996). The maximum ownership held by insiders is 98.55 percent.

Table II, Panel C report the strong board variables, and show that the smallest board in the sample has 4 directors and the largest board has 34. The average board size is 9.4 and the median is 9 directors. The percentage of fully independent directors in a board has a mean of 75 percent and a median of 77.78 percent. The maximum and the minimum percentage of independent directors in a board are respectively the extreme values of 100 and 0 percent. 57.22 percent of the boards in our sample are classified.

Table II, Panel D provides a description of the CEO power measures. 55 percent of the companies in our sample have an active CEO that also chairs the board of directors, and 1.7 percent a CEO that is Interlocked.

Finally, Table II, Panel E summarizes the statistic descriptive for our control variables. EVF has a mean (median) of 38.43 percent (37.43%) which shows that the firms in our sample on average have good growth prospects. The companies in our sample have a reasonable large size show by the mean of total revenue of $6.18 billion. The distribution is highly skewed to the right with a difference of the mean and median of $4.7399 billion, and where the smallest company has $317 million of revenues against the $425 billion of the largest.

The return on operating profits has a mean of 1.1495 whereas the median is 0.1355, which indicates a big difference in the efficiency among the companies in our sample probably caused by technological capabilities or industry specific factors. The financial leverage of the firms' median in our sample is highly centered in the sample mean of 47.51 percent, and has a maximum of equity funds allocated in the company capital structure equivalent to 97.5 percent of the total capital structure. 47.65 percent of our companies report either advertisement or research and development expenditure.

The ratio of advertisement to PPE has a mean 0.129, and the ratio of research and development to PPE has a mean of 0.3747. Cash to total assets percentage is on average is 11.85 percent. Nevertheless 4,207 (50%) and 2,228 (26.47%) firm year observations have a cash to total assets ratio below 7.07 percent and 2.5 percent level respectively, which could be related with liquidity problems or different business models. The firms' stocks on our sample are on average liquid has their mean frequency of trading is of 7460 thousand trades per day. Finally the CEO demographics show that the youngest CEO in our sample has 30 years old and the oldest 94 years old. Our average firm CEO has 55 years.

In Table II EVF, sales, and advertisement have maximums of 1.98, 425.071, and 295.7746 respectively. When these variables are winsorized at the 1% and 99% level, the minimum and the maximum for EVF become 0.0098 and 0.8491, for sales 0.0566 and 78.938, and for advertisement 0 and 1.579. The reported results are based on the non-winsorized sample presented in Table II and are robust to using the winsorized sample reported in Appendix C.

6.2 CORRELATION MATRIX

The Pearson pair wise correlation matrix between variables is presented in Table III. The correlation coefficient between CEOs ownership and the volatility measures are largely consistent with the expectations. Relative to the strong board measures the coefficients between board size and the volatility measures are consistent with the expectation. Yet, despite not being significant at 1% level the coefficients from independent directors and shareholder restrictions are opposite to our expectations. With regard to the measures of CEO power and measures of volatility, the correlation coefficients between CEO duality and risk measures are consistent with the expectations, but CEO interlock goes against our expectations.

Multicollinearity among the regressors should not be a problem as the maximum value of correlation coefficient is 0.5034 between the natural logarithmic of sales and board size. Notwithstanding, in the estimation of our empirical models, we use a post-estimation technique, the average inflation factor that reports a maximum result of 5.96 among our specifications. This suggests that multicollinearity should not be a source of bias in the coefficient estimates in our multivariate empirical models.

Table III:
Correlation Matrix

	Variables	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	TV (%)	**0.0783**	**0.1536**	**-0.3329**	**0.0541**	0.0172	**-0.1321**	0.0157	**-0.0688**	**-0.3458**	**-0.106**	**0.2036**	**0.0396**	**0.1698**	**0.1602**	**0.1879**	**0.2887**	**-0.0961**
2	IDIO (%)	**0.0893**	**0.1856**	**-0.3538**	-0.0143	0.0023	**-0.132**	**0.0344**	**-0.0441**	**-0.3969**	**-0.0956**	**0.2087**	**0.0436**	**0.1811**	**0.1451**	**0.1958**	**0.2744**	**-0.0996**
3	SYST	-0.0095	**-0.0672**	**-0.1865**	-0.0188	**0.0339**	**-0.0725**	**-0.0341**	0.0227	**-0.1553**	0.0165	**0.1386**	-0.0108	**0.0689**	**0.139**	**0.1567**	**0.2447**	**-0.0547**
4	CEO_OWN																	
5	INSIDERS_OWN	**0.3916**																
6	BOARDSIZE	**-0.1521**	**-0.1148**															
7	INDDIR	**-0.2006**	**-0.3018**	**0.142**														
8	SRIGHTS	**-0.0331**	**-0.1141**	-0.002	**0.0729**													
9	DUALCEO	**0.0902**	**-0.0359**	**0.1018**	**0.0985**	-0.0074												
10	INTERLOCK	**0.1057**	**0.08**	-0.0253	**-0.0919**	-0.0252	0.0218											
11	EVF	**0.0719**	**0.0337**	**-0.2097**	**-0.1366**	**-0.0718**	**-0.063**	-0.0075										
12	LN(SALES)	**-0.1523**	**-0.1705**	**0.5034**	**0.193**	**-0.0805**	**0.1941**	**-0.0371**	**-0.1388**									
13	ROA	0.0177	**-0.0383**	**0.0357**	-0.0209	**-0.068**	**0.0355**	-0.0231	**0.0767**	0.0207								
14	LEV	**0.1437**	**0.1096**	**-0.433**	**-0.1854**	-0.0088	**-0.1605**	**0.033**	**0.454**	**-0.3952**	**0.0621**							
15	ADV	0.0002	0.0002	-0.0206	0.0076	-0.0162	-0.0174	-0.003	0.0189	**-0.0348**	-0.0081	-0.0108						
16	R&D	-0.0099	-0.0243	**-0.1524**	**0.0279**	0.0054	**-0.0823**	-0.0114	**0.1299**	**-0.238**	**-0.0425**	**0.1396**	**0.2383**					
17	ADVRD dummy	**-0.0729**	**-0.0715**	**-0.1572**	**0.0949**	**0.0466**	-0.0245	**-0.0307**	**0.2508**	-0.1243	**-0.0814**	**0.2682**	0.0117	**0.2372**				
18	CASH	**0.0604**	-0.01	**-0.2374**	**-0.0333**	**-0.0565**	**-0.1071**	0.0023	**0.3335**	**-0.2846**	**0.2341**	**0.411**	**0.0418**	**0.2259**	**0.2173**			
19	FREQ	**-0.0476**	**-0.0918**	**-0.1438**	**0.0608**	-0.0167	**-0.0475**	**-0.0392**	**0.1134**	**-0.0566**	**0.1941**	**0.1537**	0.0005	**0.0568**	**0.0383**	**0.2616**		
20	CEOAGE	**0.1531**	**0.061**	**0.0838**	-0.0193	-0.0075	**0.2443**	**0.0596**	**-0.0895**	**0.0795**	0.0073	**-0.0563**	-0.0091	**-0.0531**	**-0.0535**	**-0.0867**	**-0.0585**	

The table shows Pearson pair-wise correlation matrix. Bold text indicates statistically significant at 1% level or better. Refer to table I for variable definitions.

7. RESULTS

7.1 EMPIRICAL EVIDENCE: MANAGERIAL OWNERSHIP, CEO POWER AND FIRM VOLATILITY

In this section, we provide, based on our basic empirical design, panel regression evidence on the relation between managerial ownership structure, CEO power and firm volatility.

Table IV reports the basic empirical design panel regression without controlling for industry- and time-fixed effects. In this table, two ownership variables are used, insiders ownership and CEO ownership. According to the results presented both CEO ownership and insider ownership show a significant hump-shaped relation at the 1 percent level with total and idiosyncratic volatility. Previous studies which relate and compare the effect of different managerial ownership proxies with Tobin's Q report that the relation between insider ownership and Tobins' Q has no identifiable effect when controlled for firm and time fixed effects (Himmelberg, Hubbard, and Palia, 1999). Kim and Lu (2011) point out that Insiders Ownership suffers from number and composition variation, which weakens the power of the test when firm-fixed effects are controlled for. The changes in ownership structure composition are of particularly importance to our empirical study as they might affect corporate risk. Insiders ownership composition characteristics can bias the results as it captures changes of equity holders with power to influence the strategic decisions jointly with equity holders with no such power. This dilutes the identifiable effect of variations within ownership structure that matters and affect corporate risk taking.

Table IV:
Panel Regression of Volatility on Managerial Ownership Structure

This table reports estimates of coefficients of the yearly time-series cross-sectional firm-level regression

$$Volatility_{i,t} = \alpha + \beta_1 OWN_{i,t-1} + \beta_2 OWN^2_{i,t-1} + \beta_2 DUALCEO_{i,t} + \beta_3 INTERLOCK_{i,t} + \beta_4 CEOAGE_{i,t} + \beta_5 EVF_{i,t} + \beta_3 \ln(SALES)_{i,t} + \beta_6 \ln(SALES)^2_{i,t} + \beta_7 ROA_{i,t} + \beta_8 LEV_{i,t} + \beta_9 ADV_{i,t} + \beta_{10} R\&D_{i,t} + \beta_{11} ADVRD_{i,t} + \beta_{11} CASH_{i,t} + + \beta_{12} CASH^2_{i,t} + \varepsilon_{i,t}$$

Subscripts i denotes individual firm, t time period, ln natural logarithms. The dependent variable volatility is either idiosyncratic volatility [IDIO (%) in Panel A], or total volatility [TV (%) in Panel B], or systematic volatility (SYST in Panel C) . OWN is alternatively: CEOs equity ownership (column 1, 3, and 5) and Insiders equity ownership (column 2, 4, and 6). DUALCEO is one if CEO chairs the board, otherwise zero. INTERLOCK, which is one if the CEO is interlocked with in the compensation committee or other board, otherwise zero. The regressors include CEO demographics (CEOAGE), growth opportunities (EVF), size [ln(SALES) and ln(SALES)^2], profitability (ROA), leverage (LEV), advertisement (ADV), research and development (R&D), research and development dummy (ADVRD dummy), and liquidity (CASH and CASH^2). Refer to Table I for variable definitions. α is the constant, ß are the parameters to be estimated, ε is the error term. The sample period is from January 2001 to December 2011. Robust standard errors are clustered at the firm-CEO level and are reported in parenthesis. Prob>F(OWN) represents p-value for an F-test the ownership variables are jointly zero. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Volatility					
	Panel A: Idiosyncratic		Panel B: Total		Panel C: Systematic	
	CEO OWN	Insiders OWN	CEO OWN	Insiders OWN	CEO OWN	Insiders OWN
Variables	(1)	(2)	(3)	(4)	(5)	(6)
OWN	2.3993***	1.2798***	2.5284***	1.0783***	0.0619	-0.5231***
	(0.727)	(0.269)	(0.789)	(0.295)	(0.329)	(0.123)
OWN^2	-5.7131***	-1.2521***	-5.9933***	-1.0205**	-0.5566	0.2894
	(1.694)	(0.390)	(1.853)	(0.426)	(0.829)	(0.196)
CEOAGE	-0.0120***	-0.0088***	-0.0136***	-0.0098***	-0.0026**	-0.0003
	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)
DUALCEO	-0.0556	-0.0902**	-0.0815*	-0.1250***	-0.0271	-0.0400**
	(0.042)	(0.040)	(0.045)	(0.043)	(0.018)	(0.017)
INTERLOCK	0.2583**	-0.0228	0.1121	-0.0936	-0.0964*	-0.0875*
	(0.120)	(0.097)	(0.105)	(0.103)	(0.049)	(0.053)
EVF	-0.6759***	-0.8718***	-0.9349***	-1.1779***	-0.1709***	-0.2054***
	(0.093)	(0.085)	(0.102)	(0.094)	(0.057)	(0.048)
ln(SALES)	-0.8606***	-0.7706***	-0.7823***	-0.6845***	-0.0673	-0.0749*
	(0.088)	(0.089)	(0.090)	(0.093)	(0.045)	(0.042)
ln(SALES)^2	0.0407***	0.0370***	0.0369***	0.0323***	0.0017	0.0014
	(0.005)	(0.005)	(0.005)	(0.006)	(0.003)	(0.003)
ROA	-0.2384	-0.1039	-0.2807	-0.1280	-0.2477	-0.1766*
	(0.156)	(0.075)	(0.184)	(0.087)	(0.166)	(0.107)

Table IV (continued)

LEV	-0.0248	-0.0607	0.1451	0.0285	0.1227**	0.0673
	(0.122)	(0.116)	(0.130)	(0.125)	(0.053)	(0.049)
ADV	-0.0391	-0.0098	-0.0495	-0.0181	-0.0386**	-0.0220*
	(0.043)	(0.041)	(0.047)	(0.044)	(0.017)	(0.013)
R&D	0.0405**	0.0428**	0.0402**	0.0411**	0.0075	0.0015
	(0.020)	(0.019)	(0.020)	(0.018)	(0.007)	(0.006)
ADVRD dummy	0.1435***	0.1420***	0.2019***	0.1842***	0.1095***	0.0735***
	(0.039)	(0.039)	(0.042)	(0.042)	(0.018)	(0.018)
CASH	3.6728***	3.7080***	4.5772***	4.5545***	1.9521***	1.5983***
	(0.418)	(0.407)	(0.446)	(0.436)	(0.198)	(0.183)
$CASH^2$	-5.3868***	-4.9491***	-6.5388***	-5.9733***	-3.0981***	-2.5850***
	(0.880)	(0.854)	(0.922)	(0.885)	(0.408)	(0.364)
Constant	6.9153***	6.1401***	6.9175***	6.2171***	1.5344***	1.6319***
	(0.394)	(0.401)	(0.404)	(0.420)	(0.190)	(0.184)
Industry FE & Year FE	N	N	N	N	N	N
Observations	5,735	5,006	5,735	5,006	5,726	5,003
R-squared	0.213	0.226	0.206	0.205	0.130	0.119
Prob>F(OWN)	0.0010	0.0000	0.0014	0.0003	0.8507	0.0000

Table V reports the results for the same specification while controlling for industry and year unobserved heterogeneity. Unsurprisingly, the results support the previous argument as the insider ownership variable coefficients have lost their significant explanatory power of firm total and idiosyncratic volatility. This results are consistent with Himmelberg, Hubbard, and Palia (1999) and Kim and Lu (2011) findings. They support our decision to use CEO ownership to proxy for managerial ownership structure as they do not suffer from the insiders' ownership composition confounding effects bias towards finding no effect.

The results of Table V call for a closer examination of the relation between CEO ownership and firm volatility. In Table V, Panel A, Columm 1 the idiosyncratic volatility estimation results are presented using CEO ownership as the ownership variable. CEO ownership as it was expected continues to have a significant hump-shaped relation with idiosyncratic volatility. The estimated coefficients have an inflexion point when CEO ownership reaches the threshold of 17.61 percent [(1.3783/(2*3.9122))*100]. The marginal effect of CEO ownership level at 2.23 percent (sample mean), 15 percent, and 30 percent on idiosyncratic volatility are approximately 1.198 percent [1.3783-2*3.9122*0.023=1.198], 0.205 percent [1.3783-2*3.9122*0.15=0.205], and -0.969 percent [1.3783-2*3.9122*0.3=-0.969] respectively. Our sample includes 360 firm-year observations with CEO ownership greater than the inflexion point corresponding to 3.39 percent of the total sample. The inference on this argument is that high level CEO ownership is not rare. Kim and Lu (2011) attribute this fact to exogenous reasons such as young firms with limited access to external finance. Furthermore aligned with this reasoning Fahlenbrach and Stulz (2009) argue that with time CEOs reduce their equity stakes to achieve better diversification.

Table V
Panel Regression of Volatility on Managerial Ownership Structure

This table reports estimates of coefficients of the yearly time-series cross-sectional firm-level regression

$$Volatility_{i,t} = \alpha + \beta_1 OWN_{i,t-1} + \beta_2 OWN^2_{i,t-1} + \beta_2 DUALCEO_{i,t} + \beta_3 INTERLOCK_{i,t} + \beta_4 CEOAGE_{i,t} + \beta_5 EVF_{i,t} + \beta_3 \ln(SALES)_{i,t} + \beta_6 \ln(SALES)^2_{i,t} + \beta_7 ROA_{i,t} + \beta_8 LEV_{i,t} + \beta_9 ADV_{i,t} + \beta_{10} R\&D_{i,t} + \beta_{11} ADVRD_{i,t} + \beta_{11} CASH_{i,t} + + \beta_{12} CASH^2_{i,t} + \eta_i + \varphi_t + \varepsilon_{i,t}$$

Subscripts i denotes individual firm, t time period, ln natural logarithms. The dependent variable volatility is either idiosyncratic volatility [IDIO (%) in Panel A], or total volatility [TV (%) in Panel B], or systematic volatility (SYST in Panel C) . OWN is alternatively: CEOs equity ownership (column 1, 3, and 5) and Insiders equity ownership (column 2, 4, and 6). DUALCEO is one if CEO chairs the board, otherwise zero. INTERLOCK, which is one if the CEO is interlocked with in the competation committee or other board, otherwise zero. The regressors include CEO demographics (CEOAGE), growth opportunities (EVF), size [ln(SALES) and ln(SALES)^2], profitability (ROA), leverage (LEV), advertisement (ADV), research and development (R&D), research and development dummy (ADVRD dummy), and liquidity (CASH and CASH^2). Refer to Table I for variable definitions. α is the constant, ß are the parameters to be estimated, η_i is industry-fixed effects, φ_t year-fixed effects, ε is the error term. The sample period is from January 2001 to December 2011. Robust standard errors are clustered at the firm-CEO level and are reported in parenthesis. Prob>F(OWN) represents p-value for an F-test the ownership variables are jointly zero. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Volatility					
	Panel A: Idiosyncratic		Panel B: Total		Panel C: Systematic	
	CEO	Insiders	CEO	Insiders	CEO	Insiders
Variables	(1)	(2)	(3)	(4)	(5)	(6)
OWN	1.3783**	0.2149	1.4475**	0.2190	0.2079	-0.0058
	(0.630)	(0.247)	(0.653)	(0.258)	(0.281)	(0.116)
OWN^2	-3.9122***	-0.4461	-4.1321***	-0.4948	-0.5523	-0.1444
	(1.482)	(0.350)	(1.583)	(0.363)	(0.720)	(0.157)
CEOAGE	-0.0053**	-0.0022	-0.0066**	-0.0031	-0.0036***	-0.0016
	(0.003)	(0.002)	(0.003)	(0.002)	(0.001)	(0.001)
DUALCEO	-0.0712*	-0.0782**	-0.0552*	-0.0721*	0.0058	-0.0061
	(0.039)	(0.039)	(0.041)	(0.041)	(0.017)	(0.015)
INTERLOCK	-0.0296	-0.0464	-0.0955	-0.0742	-0.0136	-0.0135
	(0.117)	(0.097)	(0.104)	(0.104)	(0.049)	(0.052)
EVF	-0.6571***	-0.7036***	-0.6964***	-0.7772***	-0.1010*	-0.1840***
	(0.093)	(0.085)	(0.103)	(0.092)	(0.052)	(0.043)
ln(SALES)	-0.8051***	-0.8186***	-0.7725***	-0.7568***	-0.0892**	-0.0940**
	(0.099)	(0.091)	(0.102)	(0.093)	(0.044)	(0.043)
ln(SALES)^2	0.0365***	0.0369***	0.0348***	0.0332***	0.0027	0.0025
	(0.006)	(0.006)	(0.006)	(0.006)	(0.003)	(0.003)
ROA	-0.4138**	-0.3111**	-0.5135**	-0.3741**	-0.3041**	-0.2056**
	(0.201)	(0.146)	(0.259)	(0.185)	(0.148)	(0.095)

Table V (continued)

LEV	-0.5224***	-0.6320***	-0.4706***	-0.6106***	-0.0540	-0.1282**
	(0.129)	(0.124)	(0.132)	(0.125)	(0.056)	(0.052)
ADV	-0.0065	0.0177	-0.0173	0.0059	-0.0195	-0.0109
	(0.045)	(0.039)	(0.044)	(0.039)	(0.014)	(0.012)
R&D	0.0347**	0.0298*	0.0318**	0.0279**	0.0009	-0.0007
	(0.017)	(0.015)	(0.015)	(0.014)	(0.005)	(0.005)
ADVRD dummy	0.1274**	0.0939*	0.1193**	0.0824	0.0530**	0.0247
	(0.053)	(0.049)	(0.055)	(0.052)	(0.024)	(0.024)
CASH	3.1792***	2.5859***	3.3771***	2.7704***	1.1916***	1.0023***
	(0.389)	(0.359)	(0.398)	(0.365)	(0.185)	(0.167)
$CASH^2$	-5.0224***	-3.9440***	-5.4752***	-4.3115***	-2.0933***	-1.7322***
	(0.781)	(0.696)	(0.772)	(0.679)	(0.370)	(0.321)
Constant	8.8940***	8.4804***	8.9861***	8.6549***	2.0331***	2.0268***
	(0.514)	(0.489)	(0.586)	(0.568)	(0.296)	(0.294)
Industry FE & Year FE	Y	Y	Y	Y	Y	Y
Observations	5,735	5,006	5,735	5,006	5,726	5,003
R-squared	0.465	0.447	0.502	0.504	0.338	0.336
Prob. > F(OWN)	0.0287	0.3840	0.0267	0.3956	0.4593	0.96
VIF	5.57	5.64	5.57	5.64	5.83	5.89

Table V, Panel B, column 3, presents the estimate results for firm's total volatility using CEO ownership as the ownership variable. As it is expected the same relation identified between CEO ownership and idiosyncratic volatility is verified which means that as CEOs equity stake increases their risk preferences become more aligned with those of the shareholders, and after an inflexion point the entrenchment and the non-diversification effects overcome the incentive effects, which originates the negative sign.

Table V, Panel C, Column 5, presents the estimate results for CEO ownership in relation to systematic volatility. CEO ownership has an insignificant relation with systematic volatility. This is expected as systematic volatility is a proxy for the aggregated market volatility. Hence, decisions at a firm-CEO level should not be able to have an identifiable effect with this measure of volatility.

Thus, with regard to hypothesis $\mathbf{H_1}$, the evidence support that low levels of CEOs' equity ownership incentive them to pursue risk oriented-growth strategies aligning closely their risk preferences with those of shareholders. In addition, Hypothesis $\mathbf{H_1}$ non-monotonic relation between CEO ownership and idiosyncratic, and total volatility is supported with the significant negative impact on corporate risk taking that follows the 17.61 percent of CEO ownership levels.

To illustrate the relationship between CEO ownership we estimate the piecewise linear regression following the arbitrary cut off points in Morck, Scheilfer, and Vishny (1988). The summarized[30] coefficient estimates are presented in Table VI and they suggest the hump-shaped relation reported previously. The significance for these coefficients is weak because unlike the quadratic specification this imposes a restriction that forces the relation between the cut off points to be linear.

[30] For the extended results refer to Appendix D.

Table VI:
Piece Wise Linear Regression

This table reports estimates of coefficients of the yearly time-series cross-sectional firm-level piece wise regression regression

$$Volatility_{i,t} = \alpha + \beta_1 OWN_{i,t-1} + \beta_2 OWN^2_{i,t-1} + \beta_2 DUALCEO_{i,t} + \beta_3 INTERLOCK_{i,t} + \beta_4 CEOAGE_{i,t} + \beta_5 EVF_{i,t} + \beta_3 \ln(SALES)_{i,t} + \beta_6 \ln(SALES)^2_{i,t} + \beta_7 ROA_{i,t} + \beta_8 LEV_{i,t} + \beta_9 ADV_{i,t} + \beta_{10} R\&D_{i,t} + \beta_{11} ADVRD_{i,t} + \beta_{11} CASH_{i,t} + + \beta_{12} CASH^2_{i,t} + \eta_i + \varphi_t + \varepsilon_{i,t}$$

Subscripts i denotes individual firm, t time period, ln natural logarithms. The dependent variable volatility is either idiosyncratic volatility [IDIO (%) in Panel A], or total volatility [TV (%) in Panel B], or systematic volatility (SYST in Panel C). OWN is alternatively: CEO_OWN [0,5%[(column 1, 4, and 7), CEO_OWN [5,25%] (column 2, 5, and 8), and CEO_OWN >25 (column 3, 5, and 9). All regressions include the same control variables used in Table V but their coefficients are not reported. Refer to Table I for variable definitions. α is the constant, ß are the parameters to be estimated, η_i is industry-fixed effects, φ_t year-fixed effects, ε is the error term. The sample period is from January 2001 to December 2011.Robust standard errors are clustered at the firm-CEO level. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Volatility								
	Panel A: Idiosyncratic			Panel B:Total			Panel C: Systematic		
	CEO_OWN [0,5%[	CEO_OWN [5%,25]	CEO_OWN >25%	CEO_OWN [0,5%[	CEO_OWN [5%,25]	CEO_OWN >25%	CEO_OWN [0,5%[	CEO_OWN [5%,25]	CEO_OWN >25%
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
OWN	1.1297*	0.2399	-0.3948	0.8212	0.4167	-0.4949	-0.1762	0.6244*	-0.0815
Constant	7.9197***	10.6673***	-0.9477	7.8096***	10.6358***	-3.2328	1.4987***	1.5258***	-2.8644*
	(0.574)	(1.566)	(3.518)	(0.625)	(1.521)	(3.214)	(0.292)	(0.544)	(1.641)
Observations	5,105	530	98	5,105	530	98	5,096	530	98

The estimates for the effect of CEO power measures across the different measures of volatility are reported in Table V. CEO duality has a statistically significant negative effect on idiosyncratic and total volatility. This effect is consistent with the ability of an acting CEO that chairs the board to exert influence and power to impose his risk preferences on corporate risk taking. The marginal effect on idiosyncratic and total volatility is a decrease of 0.0712 percent, and 0.0552 percent respectively. CEO interlocking has a negative coefficient across the three volatility measures, albeit not statistically significant. Hence, Hypothesis $\mathbf{H_2}$ is partially supported by the existent empirical evidence. With respect to CEO duality there is enough empirical evidence to support $\mathbf{H_2}$. With respect to CEO Interlock we fail to present sufficient empirical evidence to support $\mathbf{H_2}$.

The coefficients of the other control variables provide important insights. For instance, CEO age coefficient is significantly negative correlated with total and idiosyncratic volatility, which suggests that as CEOs get older their decisions are more cautious and conservative. Our findings provide conflicting evidence with Chok and Sun (1997) findings that conclude that only experience leaders take big risks, and that idiosyncratic volatility is related with age. Hitt and Tyler (1991), and Vroom and Pahl (1971), however report findings similar findings to ours. The proxy for growth opportunities, EVF, unexpectedly has a statistically significant negative impact across all measures of volatility. One of the possible causes of the unexpected relation could be related with an intrinsic limitation of the EVF proxy that likely underestimates the value of assets in place, and overestimates the proportion attributable to growth opportunities. Danbolt, Hirst, and Jones (2010) support this explanation by stating that the book value of equity likely underestimates the value on the assets in place, to the extent that at least under historic cost the market value of current operations will exceed their book value by the NPV of future excess earnings related to those projects. The statistically significant coefficients of ln(SALES) have a negative significant relation with the three risk measures. This effect is aligned with the expectations that

larger companies can diversify their risk among their operations. However, ln(SALES)^2 has a significant positive impact with total and idiosyncratic volatility, meaning that at the inflexion point of approximately $11 billion the firm's ability to diversify its risk internally disappears. Moreover, this effect could be related with value reducing practices such as empire building that increase the idiosyncratic and total risk of the company, but without having a significant impact in systematic volatility. At odds with the expectation, the negative significant coefficient of ROA across the three measures of volatility indicates that firms with higher profitability have lower risk exposure. This finding can be related with the period of economic and social instability that the sample captures: the ending of the 2000 NASDAQ bubble, and the nowadays financial crisis, which is consistent with the view that excessive risk taking not necessarily means higher profitability. Aligned with the predicted sign leverage has a significant negative impact on total and idiosyncratic volatility. The results show that the higher the proportion of external financing in the capital structure more incentives equity holders have to increase risk exposure to maximize the value of their equity residual claims. This finding is consistent with Black and Scholes (1973) and Merton (1974) view of equity and debt as contingency claims. Advertisement has not a significant relation to any of the volatility measures, and the signs in the CEO Ownership specification are contrary to the ones expected. Research and development has a significant positive impact across the volatility measures, which is consistent with the risk oriented growth and discretionary nature of R&D investments. Finally CASH and CASH^2 are consistent with the expectations. CASH has a significant positive coefficient across the three volatilities, which indicates that firms that pursue risk growth oriented strategies have higher cash reserves to back up their risky investments to achieve lower cost of external financing and to decrease debtholders' restrictive covenants. Nonetheless, when the ratio between cash to total assets measured as a percentage reaches 31.65 the relation becomes significantly negative across the three measures of volatility. The significant negative hump-

shaped relation could be a sign of managerial hubris, conservative risk taking strategies, or practices associated with other reasons than the benefit of shareholders such as empire building and cash pilling.

Overall, these results suggest that managerial ownership and CEO power have an identifiable effect on the firm-level volatility. The same applies to the majority of control variables.

7.2 EMPIRICAL EVIDENCE: CEO OWNERSHIP, CEO POWER, STRONG BOARDS AND FIRM VOLATILITY

In this subsection we report the panel regression with the respective analysis when internal governance is controlled for in Eq.(16).

Table VII shows the estimate results across the three volatility measures. After controlling for internal governance the CEOs' ownership hump-shaped relation remains significant for total and idiosyncratic volatility, but the inflexion point increases to approximately 23 percent [1.4270/2*3.1086=0.2295]. This suggests the importance of controlling for internal governance mechanisms as they play an important role in the corporate affairs decision making process by monitoring the management. Regarding to CEO power we drop CEO interlock as it was not significant in Table V empirical model and focus on CEO duality that remains significant and negatively related with idiosyncratic and total volatility.

With respect to the strong board proxies that work as an internal governance mechanism the board size coefficient is negative and significant relative to all the volatility measures. This indicates that after controlling for CEO ownership, CEO power, and other characteristics, large board of directors is associated with less corporate risk taking. Hence, smaller boards monitor and align more effectively the incumbent management. This evidence supports the literature that states that smaller boards communicate more effectively minimizing the free-rider problem. For example, an increase of the board size by one sample standard deviation (i.e as reported in Table I 2.61 points) would decrease the average firm corporate risk taking by approximately 11.73 percentage points [ln(2.6101)*(-0.3195)/(2.6114)=0.1173]. In opposition to the

expectations the independent directors' percentage coefficient is negative and statistically significant for total and idiosyncratic volatility, which indicates that more independent boards are also more independent from the shareholders' risk preferences. Pathan (2009) in a study that covers the effect of financial institutions boards on financial institution risk taking suggests that this negative relation is due to the regulatory compliance that independent directors are liable for. In addition to this explanation, we suggest that a market with demand and supply for independent directors exist. Thus, independent directors have an incentive to protect their reputation, which motivates them to manage expectations between the incumbent management, the firm shareholders, and firm debtholders, that ultimately is translated into a passive role in the board or collusion with the management. Shareholders restrictive rights variable coefficients are negative in relation with all volatility measures, but statistically insignificant.

The control variables used in this model are the same as the previous specification with the exception of frequency of trading, and overall carry the same statistical and economic significance. Frequency is added as a measure of how quick prices integrate new material information. As expected this variable has a statistically significant positive coefficient across the three measures of volatility. It is worth mentioning that CEO age and, research and development coefficients lost their statistical explanatory power. Nevertheless, these variables and advertisement are not dropped of the model because in our view they have sufficient economic significance in explaining firm volatility.

Table VII:
Panel Regression of Volatility on Managerial Ownership Structure and Strong Boards

This table reports estimates of coefficients of the yearly time-series cross-sectional firm-level regression

$$Volatility_{i,t} = \alpha + \beta_1 OWN_{i,t-1} + \beta_2 OWN_{i,t-1}^2 + \beta_2 DUALCEO_{i,t} + \beta_3 \ln(BS)_{i,t} + \beta_4 \text{INDDIR}_{i,t} + \beta_5 \text{SRIGHTS}_{i,t} + \beta_5 CEOAGE_{i,t} + \beta_6 EVF_{i,t} + \beta_7 \ln(SALES)_{i,t} + \beta_8 \ln(SALES)_{i,t}^2 + \beta_9 ROA_{i,t} + \beta_{10} LEV_{i,t} + \beta_{11} ADV_{i,t} + \beta_{12} R\&D_{i,t} + \beta_{13} ADVRD_{i,t} + \beta_{14} CASH_{i,t} + \beta_{15} CASH_{i,t}^2 + \eta_i + \varphi_t + \varepsilon_{i,t}$$

Subscripts i denotes individual firm, t time period, ln natural logarithms. The dependent variable volatility is either idiosyncratic volatility [IDIO (%) column 1], or total volatility [TV (%) column 2], or systematic volatility (SYST column 3). OWN is the CEOs equity ownership. Board Size (BS) is number of directors in the board. INDDIR is the percentage of independent directors in the board. SRIGHTS is the shareholder rights index. DUALCEO is one if CEO chairs the board, otherwise zero. The regressors include CEO demographics (CEOAGE), growth opportunities (EVF), size [ln(SALES) and ln(SALES)^2], profitability (ROA), leverage (LEV), advertisement (ADV), research and development (R&D), research and development dummy (ADVRD dummy), liquidity (CASH and CASH^2), and trading frequency (FREQ). Refer to Table I for variable definitions. α is the constant, ß are the parameters to be estimated, η_i is industry-fixed effects, φ_t year-fixed effects, ε is the error term. The sample period is from January 2001 to December 2011. Robust standard errors are clustered at the firm-CEO level and are reported in parenthesis. Prob>F(OWN) represents p-value for an F-test the ownership variables are jointly zero. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Volatility		
	Idiosyncratic	Total	Systematic
VARIABLES	(1)	(2)	(3)
CEO_OWN	1.4270**	1.5036**	0.3254
	(0.574)	(0.594)	(0.265)
(CEO_OWN)^2	-3.1086**	-3.2792**	-0.3665
	(1.341)	(1.434)	(0.670)
CEOAGE	-0.0007	-0.0016	-0.0016
	(0.002)	(0.002)	(0.001)
DUALCEO	-0.0934**	-0.0811**	-0.0074
	(0.037)	(0.037)	(0.015)
ln(BS)	-0.3195***	-0.3570***	-0.1154***
	(0.074)	(0.075)	(0.032)
INDDIR	-0.2749***	-0.2692**	-0.0250
	(0.104)	(0.105)	(0.053)
SRIGHTS	-0.0159	-0.0157	-0.0212
	(0.030)	(0.032)	(0.015)
EVF	-0.5701***	-0.5361***	0.0359
	(0.099)	(0.104)	(0.052)
ln(SALES)	-0.8444***	-0.7775***	-0.0452
	(0.108)	(0.112)	(0.048)
ln(SALES)^2	0.0420***	0.0386***	0.0012
	(0.007)	(0.007)	(0.003)

Table VII (continued)

ROA	-1.4350***	-1.9323***	-1.2000***
	(0.297)	(0.307)	(0.146)
LEV	-0.5286***	-0.4572***	-0.0168
	(0.122)	(0.123)	(0.049)
ADV	-0.0062	-0.0149	-0.0174
	(0.041)	(0.040)	(0.013)
R&D	0.0087	0.0010	-0.0140**
	(0.014)	(0.013)	(0.006)
ADVRD dummy	0.0890*	0.0734	0.0301
	(0.048)	(0.050)	(0.023)
CASH	2.0584***	2.1119***	0.6607***
	(0.365)	(0.371)	(0.175)
$CASH^2$	-3.4301***	-3.6716***	-1.3154***
	(0.742)	(0.736)	(0.378)
FREQ	0.0001***	0.0001***	0.0000***
	(0.000)	(0.000)	(0.000)
Constant	8.9774***	8.9279***	1.7355***
	(0.544)	(0.596)	(0.285)
Industry FE & Year FE	Y	Y	Y
Observations	5,679	5,679	5,670
R-squared	0.546	0.589	0.434
Prob. > F(OWN)	0.0130	0.0115	0.2205
VIF	5.71.	5.71	5.96

With respect to Hypothesis **H_3** our results show mixed evidence for the three proxies used for strong boards. Relative to board size we find evidence that supports **H_3** as smaller boards coefficients have a statistically positive impact in total and idiosyncratic volatility. At odds with our Hypothesis **H_3** is the percentage of independent directors that has a statistically significant relation with total and idiosyncratic volatility, but in the opposite direction. Finally, shareholder rights restrictions have a negative sign across the three volatility measures, but we fail to reject the null hypothesis due to lack of statistical evidence.

The results so far allow us to conclude that there is a statistically significant relation between CEOs equity ownership and board with corporate risk. What we could not address so far is the complex interaction

between managerial ownership and internal governance on corporate risk taking.

The relation between CEO ownership and idiosyncratic volatility should be less identifiable for firms under weak internal governance (IG). When IG is weak as the board monitoring abilities decrease, the equity incentive effects with idiosyncratic volatility are expected to be less or not identifiable as CEOs have more room to pursuit their risk preferences. Furthermore, in firms under weak IG the equity entrenchment and non-diversification effect should be more pronounced. This argument is based on the assumption that an optimal managerial equity package is not a substitute for a good IG mechanism. On the contrary, firms under strong IG should monitor more effectively the incumbent management which should create a synergy with the CEO equity incentive effect bolstering the positive relation with idiosyncratic risk. This implies that optimal managerial equity packages have a complementary relation with strong IG.

Thus, in comparison to firms under weak IG, firms under strong IG are expected to have a more identifiable positive effect of managerial equity ownership on idiosyncratic volatility when the managerial equity incentive effects are greater than the entrenchment or non-diversification effect, and a less pronounced negative effect after the inflexion point. This interaction relation is addressed in the next subsection 7.3.

7.3 EMPIRICAL EVIDENCE: INTERACTION EFFECT OF INTERNAL CORPORATE GOVERNANCE AND CEO OWNERSHIP WITH IDIOSYNCRATIC VOLATILITY.

The results in section 7.2 may mask important heterogeneity that difficult the analysis of the interaction between CEO ownership and IG on corporate risk taking. Therefore in order to analyze the interactive effects between internal governance and CEO ownership we separate firm-year observations into strong and weak boards. Hence, an observation is considered to be under strong (weak) IG if it meets one of the following criteria:

1. If it belongs to a firm with the number of directors below (above) the board size sample median.
2. If it belongs to a firm with the percentage of independent directors above (below) the percentage of independent directors sample median.
3. If it belongs to a firm with the number of directors below (above) the board size sample median and with the percentage of independent directors above (below) the percentage of independent directors sample mean. Otherwise it is considered a firm under moderate IG.

The panel regression results based on the first criteria are reported in Table VIII Panel A, the ones based on the second criteria are reported in Panel B, and the ones based on the third criteria are reported in Panel C.

Table VIII:
Idiosyncratic Volatility and CEO ownership under strong and weak internal governance (IG)

This table reports estimates of coefficients of the yearly time-series cross-sectional firm-level regression

$$IDIO(\%)_{i,t} = \alpha + \beta_1 OWN_{i,t-1} + \beta_2 OWN^2_{i,t-1} + \beta_2 DUALCEO_{i,t} + \beta_3 INTERLOCK_{i,t} + \beta_4 CEOAGE_{i,t} + \beta_5 EVF_{i,t} + \beta_3 \ln(SALES)_{i,t} + \beta_6 \ln(SALES)^2_{i,t} + \beta_7 ROA_{i,t} + \beta_8 LEV_{i,t} + \beta_9 ADV_{i,t} + \beta_{10} R\&D_{i,t} + \beta_{11} ADVRD_{i,t} + \beta_{11} CASH_{i,t} + + \beta_{12} CASH^2_{i,t} + \eta_i + \varphi_t + \varepsilon_{i,t}$$

Subscripts i denotes individual firm, t time period, ln natural logarithms. The dependent variable volatility is idiosyncratic volatility [IDIO (%)]. OWN is the CEOs equity ownership. Refer to Table I for variable definitions. α is the constant, ß are the parameters to be estimated, η_i is industry-fixed effects, φ_t year-fixed effects, ε is the error term. IG is measured in Panel A by board size (BS), in Panel B by independent directors percentage (INDDIR), or in Panel C by both. Strong IG is presented in column 1, 3, and 5 where SB indicates a BS below the sample median, IND indicates INDDIR above the sample median, and STRONG indicates the previous two criteria together. Weak IG is presented in column 2, 4, and 6 where LB indicates a BS above the sample median, DEP indicates INDDIR below the sample median, and WEAK indicates the previous two criteria together. Moderate IG is presented for Panel C subsample and refers to the firm-year observations that do not fulfill the STRONG and WEAK criteria. The sample period is from January 2001 to December 2011. The number of observations varies depending on data availability. Robust standard errors are clustered at the firm-CEO level and are reported in parenthesis. Prob>F(OWN) represents p-value for an F-test the ownership variables are jointly zero. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Idiosyncratic Volatility						
	Panel A: Board Size		Panel B: Independent Directors		Panel C: Board Size & Independent Directors		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	SB	LB	IND	DEP	STRONG	WEAK	MODERATED
CEO_OWN	1.8643**	1.3825*	4.6746***	0.7672	8.1501***	1.0849	1.4805*
	(0.845)	(0.838)	(1.597)	(0.625)	(2.442)	(0.966)	(0.814)
$(CEO\_OWN)^2$	-3.4442**	-4.2844*	-14.875***	-1.4478	-26.85***	-3.3606	-2.8388*
	(1.636)	(2.462)	(4.658)	(1.406)	(7.231)	(2.671)	(1.652)
CEOAGE	-0.0005	0.0015	0.0013	-0.0007	-0.0091	0.0019	0.0011
	(0.005)	(0.002)	(0.004)	(0.003)	(0.007)	(0.003)	(0.004)
DUALCEO	-0.1458	-0.0663**	-0.0765*	-0.1224**	-0.0703	-0.0478	-0.1527**
	(0.089)	(0.033)	(0.043)	(0.061)	(0.072)	(0.052)	(0.069)
ln(BS)			-0.1793*	-0.3407***			
			(0.104)	(0.117)			
INDDIR	-0.2789	-0.2090*					
	(0.202)	(0.114)					
CLASSIFIED	0.0470	-0.0300	-0.0351	0.0430	-0.0416	-0.0668	0.0106
	(0.069)	(0.031)	(0.038)	(0.049)	(0.080)	(0.048)	(0.043)
EVF	-0.6724***	-0.643***	-0.7752***	-0.6193***	-0.766***	-0.455***	-0.6107***
	(0.183)	(0.115)	(0.140)	(0.136)	(0.235)	(0.143)	(0.150)
ln(SALES)	-0.5422**	-0.848***	-0.9662***	-0.7045***	-0.6343**	-0.996***	-0.6572***
	(0.221)	(0.130)	(0.123)	(0.144)	(0.250)	(0.193)	(0.160)

Table VIII (continued)

ln(SALES)²	0.0183	0.0421***	0.0477***	0.0331***	0.0219	0.0489***	0.0303***
	(0.015)	(0.008)	(0.007)	(0.009)	(0.017)	(0.012)	(0.010)
ROA	-1.8062***	-0.4141	-0.6629**	-1.4564***	-1.3082**	-0.6072	-1.4954***
	(0.518)	(0.320)	(0.330)	(0.415)	(0.629)	(0.453)	(0.473)
LEV	-0.7418***	-0.435***	-0.8965***	-0.3211*	-1.211***	-0.3800**	-0.1980
	(0.228)	(0.131)	(0.174)	(0.180)	(0.277)	(0.192)	(0.195)
ADV	-0.0022	0.0451	0.0363	0.0388	0.0235	0.0301	-0.0286
	(0.066)	(0.036)	(0.038)	(0.036)	(0.054)	(0.050)	(0.054)
R&D	0.0279	0.0228	0.0272	-0.0021	0.0372	0.0702	0.0247
	(0.021)	(0.037)	(0.021)	(0.031)	(0.025)	(0.043)	(0.037)
ADVRDdummy	0.0610	0.0332	0.0919	0.0630	-0.0787	-0.0604	0.1379**
	(0.089)	(0.050)	(0.070)	(0.065)	(0.138)	(0.072)	(0.064)
CASH	1.5382**	2.1801***	1.6312***	1.8871***	0.7433	1.4250*	2.9184***
	(0.662)	(0.474)	(0.463)	(0.557)	(0.759)	(0.734)	(0.547)
CASH²	-2.4791**	-3.877***	-2.2268**	-3.4574***	-0.9629	-2.4617	-4.8576***
	(1.079)	(1.204)	(0.865)	(1.021)	(1.242)	(1.671)	(1.144)
FREQ	0.0001***	0.0001***	0.0001***	0.0001***	0.0001***	0.0001***	0.0001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	10.2829***	7.1932***	8.4023***	8.3282***	7.7771***	8.2187***	6.6256***
	(0.899)	(0.613)	(0.679)	(0.621)	(0.984)	(0.873)	(0.813)
Industry FE & Year FE	Y	Y	Y	Y	Y	Y	Y
Observations	1,669	2,772	2,117	2,125	577	1,006	2,726
R-squared	0.428	0.564	0.559	0.474	0.599	0.614	0.510
Prob>F(OWN)	0.0278	0.0994	0.0035	0.2202	0.0009	0.2622	0.0691

In Table VIII, Panel A the CEO ownership hump-shaped relation with idiosyncratic volatility is statistically significant in both subsamples. In the subsample with smaller boards (SB) the positive impact for low levels of equity ownership is greater than for firms with large boards (LB), which indicates that smaller boards monitor more efficiently the management, and can enhance the impact of the equity ownership incentive plan. SB have an inflexion point at 27 percent [1.8643/2*3.444=0.2706] against the one of LB of 16.13 percent [1.3825/2*4.2844=0.1613], which suggest that CEO entrenchment level comes sooner in LB. Additionally, the magnitude of the negative non-diversification effect on corporate risk taking associated with higher levels of CEO ownership is minimized for firms with SB ($1.8643-3.4442OWN_{SB}>1.3825-4.2844OWN_{LB}$, if $OWN_{SB}>0.27$ and

OWN_{LB}>0.1613). An interesting effect is that a CEO that also chairs the board of directors will have more influence in a SB than in a large board, which points that perhaps it is easier to influence or/and control the board of directors if the board is smaller. Additionally, the coefficient of INDDIR in the SB subsample is negative, but statistically insignificant suggesting that in a smaller board it is easier for shareholders to make directors account for their decisions aligning more closely the independent directors with their risk preferences.

The results in Panel B are at least curious. The subsample with strong governance (IND) shows a CEO ownership hump-shaped relation with idiosyncratic volatility with an inflexion point at 15.71% [4.6746/2*14.8755=0.1571] statistically significant at the 1% level. The magnitude of the negative impact when the CEO is entrenched suggests that as shareholders lose control, the independent directors shift their loyalty to the CEO in order to protect their roles boosting the negative impact on corporate risk taking associated with the CEOs' risk preference. For firms under weak IG (DEP) CEO ownership is not statistically significant. This fact is intriguing and at the same time enlightening, as it suggests that in the DEP subsample CEO equity ownership programmes do not have a visible impact on corporate risk taking indicating that IG and equity incentive programme are not substitutes governance mechanisms but instead complementary. However, the analysis of this relation and the respective implications is an interesting topic to address on future research. Moreover, if a CEO chairs the board of directors the negative impact on corporate risk taking is more evident in the DEP subsample. Thereby consistent with the literature that CEO influence has an inverse relation with the percentage of independent directors on the board. The magnitude of the negative impact in the idiosyncratic volatility associated with an increase in the board size of the DEP subsample is approximately twice of the one in the IND subsample.

The intercepts for Table VIII, Panel A and B show that firms associated with strong IG *ceteris paribus* are associated with more risk taking than the ones under weak IG.

In Panel C our sample is divided and ranked into three subsamples strong IG, weak IG, and moderated IG. In Panel C, column 5 the estimates for the subsample under strong IG are presented. Aligned with our expectations the positive impact of CEO ownership is the highest among the three subsamples and statistically significant at the 1% level. The identifiable positive effect on corporate risk taking is aligned with the superior monitor capabilities, the effectiveness of communication, and the decrease on information asymmetry between the board and the management inherent in a small board with above median independent directors. Contrary to the expectations, the negative impact of the entrenchment effect is also the one that ranks highest among the different subsamples in magnitude and in the equity level that occurs with inflexion points of 15.18 percent [8.1501/2*26.8503=0.1518] against the 16.14 percent [1.0849/2*3.3606=0.1614] and 26.07 percent [1.4805/2*2.8388=0.2607] in the weak IG and moderate IG subsamples. Yet, the notorious negative effect could be related with the characteristics of the board at least for four reasons: 1) after some time of working closely together with the CEO, the board might give a vote of trust to the CEO, 2) it is easier for the CEO to exert influence in a smaller board than in a large board, 3) with a smaller board structure is easier for a CEO to achieve the necessary voting rights to control the board and to challenge shareholders and 4) as the CEO becomes entrenched the loyalty of the independent directors shift from the shareholders to the CEO. In addition, the CEO duality coefficient maintains its negative sign but is statistical insignificant. This could be related that in a smaller independent board a CEO chairing the board does not necessarily increase his power. On one hand the board is efficient and independent of the management increasing the difficult for a CEO to control the board even if he chairs the board. On the other hand a CEO in a smaller independent board needs to control fewer directors to gain a friendly board than in a larger board. Panel C,

column 6, presents the estimates results for the subsample under weak IG. Similarly to the results of the weak IG subsample in Panel B the CEOs equity ownership and CEO duality does not have any identifiable effect on corporate risk taking. Panel C, column 7, presents the results for the moderated IG subsample that is the most common governance combination within our full sample including 2726 firm-year observations (63.26%). In this subsample CEO ownership has a marginal statistical significant hump-shaped relation with idiosyncratic volatility. The magnitude of the positive and negative impact on idiosyncratic volatility is more balanced and falls in between the strong and weak IG subsamples. With respect to CEO power, in this subsample the DUALCEO coefficient has a statistically significant negative relation with idiosyncratic volatility, which indicates that in the most common governance combination structure a CEO chairing the board of directors increases his power and influence over the board activities. Although not the main focus of this dissertation in Table VIII, Panel C, the intercept of firms under weak governance is the one associated with higher risk profile firms, which suggests that these firms could be associated with excessive risk taking practices due to weak IG and poor risk management control mechanisms.

8 ROBUSTNESS CHECKS

Demsetz and Lehn (1985), and Hermalin and Weisbach (2003) claim that CEO ownership structure and board structure are endogenously formed, if this holds true than the coefficient estimates in Table VII may be biased. Therefore, to address the endogeneity issue relative to the CEO ownership a first step was taken when we used the CEO ownership lag values in Eq.(15) and Eq.(16). Relative to the ownership structure and to confirm that the causation comes from board structure in subsection 8.1 Eq.(16) is re-estimated using the board structure lagged variables. Subsection 8.2 address the simultaneity bias, caused by endogeneity problems by the re-estimation of Eq.(16) using a two stage least square (2SLS). In subsection 8.3, Eq.(16) is re-estimated excluding from the sample financial institutions and utilities. As a final robustness check we re-estimate Eq.(16) for the firms with no growth opportunities.

8.1 BOARD STRUCTURE – REVERSE CAUSALITY

The interpretation of the results in Table IX remains qualitatively the same as the one in Table VII. Thus, we confirm that the causation runs from ownership and board structure to firm's volatility.

Table IX:
Robustness Check of Volatility on Managerial Ownership Structure and Board Structure – Lagged Board Characteristics

This table reports the robustness results of Table VII with instrumented board variables of the yearly time-series cross-sectional firm-level regression

$$Volatility_{i,t} = \alpha + \beta_1 OWN_{i,t-1} + \beta_2 OWN^2_{i,t-1} + \beta_2 DUALCEO_{i,t} + \beta_3 \ln(BS)_{i,t-1} + \beta_4 \text{INDDIR}_{i,t-1} + \beta_5 \text{SRIGHTS}_{i,t-1} + \beta_5 CEOAGE_{i,t} + \beta_6 EVF_{i,t} + \beta_7 \ln(SALES)_{i,t} + \beta_8 \ln(SALES)^2_{i,t} + \beta_9 ROA_{i,t} + \beta_{10} LEV_{i,t} + \beta_{11} ADV_{i,t} + \beta_{12} R\&D_{i,t} + \beta_{13} ADVRD_{i,t} + \beta_{14} CASH_{i,t} + \beta_{15} CASH^2_{i,t} + \eta_i + \varphi_t + \varepsilon_{i,t}$$

Subscripts i denotes individual firm, t time period, ln natural logarithms. The dependent variable volatility is either idiosyncratic volatility [IDIO (%) column 1], or total volatility [TV (%) column 2], or systematic volatility (SYST column 3). OWN is the CEOs equity ownership. Board Size (BS) is number of directors in the board. INDDIR is the percentage of independent directors in the board. SRIGHTS is the shareholder rights index. DUALCEO is one if CEO chairs the board, otherwise zero. INTERLOCK, which is one if the CEO is interlocked with in the competation committee or other board, otherwise zero. The regressors include CEO demographics (CEOAGE), growth opportunities (EVF), size [ln(SALES) and ln(SALES)^2], profitability (ROA), leverage (LEV), advertisement (ADV), research and development (R&D), research and development dummy (ADVRD dummy), liquidity (CASH and CASH^2), and trading frequency (FREQ). Refer to Table I for variable definitions. α is the constant, ß are the parameters to be estimated, η_i is industry-fixed effects, φ_t year-fixed effects, ε is the error term. The sample period is from January 2001 to December 2011. Robust standard errors are clustered at the firm-CEO level and are reported in parenthesis. Prob>F(OWN) represents p-value for an F-test the ownership variables are jointly zero. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Volatility		
	Idiosyncratic	Total	Systematic
VARIABLES	(1)	(2)	(3)
CEO_OWN	1.0636**	1.0951**	0.0482
	(0.519)	(0.541)	(0.242)
(CEO_OWN)^2	-2.3404*	-2.2848*	0.2592
	(1.215)	(1.307)	(0.652)
CEOAGE	0.0004	-0.0004	-0.0005
	(0.002)	(0.002)	(0.001)
DUALCEO	-0.0924**	-0.0905**	-0.0135
	(0.036)	(0.037)	(0.014)
ln(BS)	-0.3088***	-0.3276***	-0.0903***
	(0.073)	(0.074)	(0.030)
INDDIR	-0.2945***	-0.2695**	-0.0556
	(0.109)	(0.111)	(0.049)
SRIGHTS	-0.0308	0.0028	0.0039
	(0.044)	(0.049)	(0.022)

Table IX (continued)

EVF	-0.6046***	-0.6092***	-0.0682
	(0.095)	(0.099)	(0.051)
ln(SALES)	-0.8711***	-0.7898***	-0.0889**
	(0.089)	(0.091)	(0.042)
$ln(SALES)^2$	0.0432***	0.0387***	0.0034
	(0.005)	(0.005)	(0.003)
ROA	-1.2613***	-1.6702***	-0.9200***
	(0.269)	(0.273)	(0.134)
LEV	-0.6178***	-0.5717***	-0.0882*
	(0.118)	(0.118)	(0.048)
ADV	0.0146	0.0031	-0.0130
	(0.038)	(0.037)	(0.012)
R&D	0.0078	0.0021	-0.0115**
	(0.013)	(0.012)	(0.006)
ADVRD dummy	0.0852*	0.0681	0.0135
	(0.045)	(0.048)	(0.023)
CASH	1.8482***	1.8895***	0.5894***
	(0.353)	(0.366)	(0.165)
$CASH^2$	-3.0829***	-3.1928***	-1.1031***
	(0.703)	(0.717)	(0.339)
FREQ	0.0001***	0.0001***	0.0000***
	(0.000)	(0.000)	(0.000)
Constant	8.7973***	8.8583***	1.9199***
	(0.468)	(0.531)	(0.277)
Industry FE & Year FE	Y	Y	Y
Observations	4,990	4,990	4,987
R-squared	0.513	0.568	0.400
Prob. > F(OWN)	0.0454	0.0650	0.7016
VIF	5.96	5.96	6.26

8.2 TWO STAGE LEAST SQUARE (2SLS) REGRESSION

To test if CEO ownership structure and Board structure suffer from simultaneity bias caused by endogeneity we will re-estimate Eq.(16) solved in a system of simultaneous equations using 2SLS estimation method. First we endogenize the variables in question based on existent literature on CEO ownership structure (such as Belghitar and Clark, 2012) and Board structure (such as Linck, Netter, Yang, 2008) by following the three equation models:

$$OWN_{i,t} = \alpha + \beta_1 IDIO_{i,t} + \beta_2 CEOAGE_{i,t} + \beta_2 CEOTENURE_{i,t} + \beta_3 \ln(SALES)_{i,t} + \beta_4 Price_{i,t} + \eta_i + \varphi_t + \varepsilon_{i,t} \quad (17)$$

$$OWN^2_{i,t} = \alpha + \beta_1 IDIO_{i,t} + \beta_2 CEOAGE_{i,t} + \beta_2 CEOTENURE_{i,t} + \beta_3 \ln(SALES)_{i,t} + \beta_4 Price_{i,t} + \eta_i + \varphi_t + \varepsilon_{i,t} \quad (18)$$

$$\ln(BS)_{i,t} = \alpha + \beta_1 IDIO_{i,t} + \beta_2 INDDIR_{i,t} + \beta_2 SRIGHTS_{i,t} + \beta_3 \text{CEO\_OWN}_{i,t} + \beta_4 \ln(SALES) + \beta_5 LEV_{i,t} + \beta_6 DIRECTORS_{i,t} + \eta_i + \varphi_t + \varepsilon_{i,t} \quad (19)$$

$$\text{INDDIR}_{i,t} = \alpha + \beta_1 \text{IDIO}_{i,t} + \beta_2 \ln(BS)_{i,t} + \beta_2 SRIGHTS_{i,t} + \beta_3 \text{DUALCEO}_{i,t} + \beta_4 \ln(SALES) + \beta_5 DIRECTORS_{i,t} + \eta_i + \varphi_t + \varepsilon_{i,t} \quad (20)$$

The definition for the variables except for DIRECTORS, CEOTENURE, and Price remains the same as in Table I. DIRECTORS is the fraction of shares held by the members of the board to the common shares outstanding with the exception of CEO. CEO tenure is the time of the CEO on the role in years. Price stands for the fiscal-year end stock price[31]. The solution for the simultaneous equation system formed by Eqs. (16) – (20) is presented in Table X. DUALCEO is excluded from the initial specification to make the system identified.

The findings are robust with the previous results except for the independent directors that now have a statistically significant positive coefficient, which suggests that the previous results for independent

[31] Descriptive for this variable for this variables are provided in the Appendix E.

directors may be biased and that a more independent board could align more effectively the management risk preferences to those of the shareholders. However, this requires further research.

Table X:
Robustness Check: two stage least square (2SLS) regression for Idiosyncratic Volatility on Managerial Ownership Structure and Board Structure

This table presents two-stage least square (2sls) estimates of the system of five equations, i.e. Eq.(16)-(19) for Idiosyncratic Volatility (IDIO), CEO ownership (CEO_OWN), CEO ownership square (CEO_OWN^2), board size (BS), and percentage of independent directors (IND_DIR) respectively. OWN is the CEOs equity ownership. Board Size (BS) is number of directors in the board. INDDIR is the percentage of independent directors in the board. SRIGHTS is the shareholder rights index. DUALCEO is one if CEO chairs the board, otherwise zero. The regressors include CEO demographics (CEOAGE), growth opportunities (EVF), size [ln(SALES) and $\ln(SALES)^2$], profitability (ROA), leverage (LEV), advertisement (ADV), research and development (R&D), research and development dummy (ADVRD dummy), liquidity (CASH and $CASH^2$), and trading frequency (FREQ). Refer to Table I for variable definitions. The sample period is from January 2001 to December 2011. Robust standard errors are clustered at the firm-CEO level and are reported in parenthesis. Wald:χ^2-statistic is presented for column 1 Eq. for the joint significance of the year fixed-effects. F-statistic is presented for columns 2-5 for the joint significance of time- and industry-effects. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

	Explanatory Variables				
	IDIO	CEO_OWN	$(CEO\_OWN)^2$	BS	IND_DIR
Variables	(1)	(2)	(3)	(4)	(5)
CEO_OWN	62.6643**			-0.3240***	
	(28.778)			(0.047)	
$(CEO\_OWN)^2$	-213.3044**				
	(105.328)				
ln(BS)	-12.2418***				0.0386***
	(3.785)				(0.007)
INDDIR	24.0795**			0.0447**	
	(9.508)			(0.019)	
SRIGHTS	-0.0771			0.0410***	0.0096***
				(0.005)	(0.003)
DUALCEO					0.0314***
					(0.003)
IDIO		0.0000	-0.0001	-0.0198***	0.0003
		(0.001)	(0.000)	(0.003)	(0.001)
DIRECTORS				-0.0001***	-0.0001***
				(0.000)	(0.000)
PRICE		0.0001***	0.0000*		
		(0.000)	(0.000)		

Table X (continued)

CEOAGE		0.0002	0.0001		
		(0.000)	(0.000)		
CEOTENURE		0.0030***	0.0007***		
		(0.000)	(0.000)		
EVF	0.0236				
	(0.487)				
ln(SALES)	-0.1160	-0.0048***	-0.0010***	0.0796***	0.0119***
	(0.370)	(0.001)	(0.000)	(0.002)	(0.001)
$ln(SALES)^2$	0.0360**				
	(0.018)				
ROA	-3.3302***				
	(0.833)				
LEV	-1.4845***			-0.1092***	
	(0.487)			(0.015)	
R&D	-0.0687				
	(0.043)				
ADV	0.0081*				
	(0.004)				
ADVRS dummy	-0.7880**				
	(0.352)				
CASH	4.0728***				
	(1.408)				
$CASH^2$	-7.9888***				
	(2.724)				
	(0.143)				
FREQ	0.0000				
	(0.000)				
Constant	7.9545***	0.0138	0.0001	1.8704***	0.5130***
	(2.385)	(0.010)	(0.003)	(0.043)	(0.025)
Time Effects	Y	Y	Y	Y	Y
Fixed Effects	N	Y	Y	Y	Y
Observations	5,580	5,708	5,708	8,052	8,052
R-squared		0.240	0.107	0.460	0.322
Wald:χ^2-statistic	587.82***	-	-	-	-
F-Statistic	-	102.62***	30.25***	589.90***	99.92***

8.3 EXCLUDING FINANCIALS AND UTILITIES

Demsetz and Lehn (1985) point that financial institutions and regulated utilities have different ownership structures due to the impact of systematic regulation, which can restrict shareholders rights or provide subsidized monitoring. To address the issue pointed by Demsetz and Lehn (1985) we omit financial industries and utilities (SIC 6000-6999 and 4900-4999) and re-estimate eq.(16). The results are presented in table XI and do not change our conclusions.

Table XI:
Robustness Check: Panel Regression of Volatility on Managerial Ownership Structure and Board Structure – Excluding Financial and Utilities

This table reports estimates of coefficients of the yearly time-series cross-sectional firm-level regression. Financial industries and utilities are omitted (SIC 6000-6999 and 4900-4999)

$$Volatility_{i,t} = \alpha + \beta_1 OWN_{i,t-1} + \beta_2 OWN_{i,t-1}^2 + \beta_2 DUALCEO_{i,t} + \beta_3 \ln(BS)_{i,t} + \beta_4 \text{INDDIR}_{i,t} + \beta_5 \text{SRIGHTS}_{i,t} + \beta_5 CEOAGE_{i,t} + \beta_6 EVF_{i,t} + \beta_7 \ln(SALES)_{i,t} + \beta_8 \ln(SALES)_{i,t}^2 + \beta_9 ROA_{i,t} + \beta_{10} LEV_{i,t} + \beta_{11} ADV_{i,t} + \beta_{12} R\&D_{i,t} + \beta_{13} ADVRD_{i,t} + \beta_{14} CASH_{i,t} + \beta_{15} CASH_{i,t}^2 + \eta_i + \varphi_t + \varepsilon_{i,t}$$

Subscripts i denotes individual firm, t time period, ln natural logarithms. The dependent variable volatility is either idiosyncratic volatility [IDIO (%) column 1], or total volatility [TV (%) column 2], or systematic volatility (SYST column 3). OWN is the CEOs equity ownership. Board Size (BS) is number of directors in the board. INDDIR is the percentage of independent directors in the board. SRIGHTS is the shareholder rights index. DUALCEO is one if CEO chairs the board, otherwise zero. The regressors include CEO demographics (CEOAGE), growth opportunities (EVF), size [ln(SALES) and ln(SALES)^2], profitability (ROA), leverage (LEV), advertisement (ADV), research and development (R&D), research and development dummy (ADVRD dummy), liquidity (CASH and CASH^2), and trading frequency (FREQ). Refer to Table I for variable definitions. α is the constant, ß are the parameters to be estimated, η_i is industry-fixed effects, φ_t year-fixed effects, ε is the error term. The sample period is from January 2001 to December 2011. Robust standard errors are clustered at the firm-CEO level and are reported in parenthesis. Prob>F(OWN) represents p-value for an F-test the ownership variables are jointly zero. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Volatility		
	Idiosyncratic	Total	Systematic
VARIABLES	(1)	(2)	(3)
CEO_OWN	1.4135**	1.4972**	0.3701
	(0.592)	(0.623)	(0.281)
(CEO_OWN)^2	-3.1500**	-3.3173**	-0.4822
	(1.376)	(1.492)	(0.707)
CEOAGE	-0.0010	-0.0020	-0.0016
	(0.003)	(0.003)	(0.001)
DUALCEO	-0.0876**	-0.0773*	-0.0058
	(0.039)	(0.040)	(0.016)

Table XI (continued)

ln(BS)	-0.3072***	-0.3462***	-0.1216***
	(0.084)	(0.086)	(0.036)
INDDIR	-0.2786**	-0.2748**	-0.0204
	(0.112)	(0.116)	(0.059)
SRIGHTS	-0.0043	0.0015	-0.0160
	(0.033)	(0.035)	(0.016)
EVF	-0.5791***	-0.5467***	0.0283
	(0.103)	(0.107)	(0.054)
ln(SALES)	-0.8391***	-0.7485***	-0.0209
	(0.114)	(0.118)	(0.050)
$ln(SALES)^2$	0.0400***	0.0351***	-0.0004
	(0.007)	(0.007)	(0.003)
ROA	-1.5050***	-1.9964***	-1.2352***
	(0.304)	(0.315)	(0.148)
LEV	-0.6102***	-0.5418***	-0.0310
	(0.129)	(0.129)	(0.051)
ADV	-0.0200	-0.0336	-0.0225*
	(0.049)	(0.047)	(0.012)
R&D	0.0087	0.0027	-0.0129**
	(0.014)	(0.013)	(0.006)
ADVRD dummy	0.0663	0.0558	0.0257
	(0.048)	(0.051)	(0.024)
CASH	1.9433***	2.0382***	0.7111***
	(0.368)	(0.372)	(0.182)
$CASH^2$	-3.3748***	-3.6458***	-1.3922***
	(0.747)	(0.741)	(0.391)
FREQ	0.0001***	0.0001***	0.0000***
	(0.000)	(0.000)	(0.000)
Constant	9.1281***	9.0669***	1.7128***
	(0.567)	(0.615)	(0.292)
Industry FE & Year FE	Y	Y	Y
Observations	4,878	4,878	4,871
R-squared	0.542	0.573	0.419
Prob. > F(OWN)	0.0171	0.0164	0.1883
VIF	5.63	5.63	5.86

8.4 FIRMS WITH NO GROWTH OPPORTUNITIES

As a final robustness check in Table XII we re-estimate Eq.(16) for a sample where the firms with no growth opportunities, i.e. EVF less than or equal to zero. We verify that for this sample CEO ownership still has an identifiable effect on corporate risk taking. Nevertheless, when compared with firms with growth opportunities this effect is marginal. The strong board characteristics remain qualitatively and quantitatively the same as in the firms with growth opportunities.

Table XII:
Robustness Check: Panel Regression of Volatility on Managerial Ownership Structure and Board Structure – Firms with No Growth Opportunities

This table reports estimates of coefficients of the yearly time-series cross-sectional firm-level regression. This panel regression uses the sample that covers firms with EVF less than or equal to zero.

$$Volatility_{i,t} = \alpha + \beta_1 OWN_{i,t-1} + \beta_2 OWN_{i,t-1}^2 + \beta_2 DUALCEO_{i,t} + \beta_3 \ln(BS)_{i,t} + \beta_4 \text{INDDIR}_{i,t} + \beta_5 \text{SRIGHTS}_{i,t} + \beta_5 CEOAGE_{i,t} + \beta_6 EVF_{i,t} + \beta_7 \ln(SALES)_{i,t} + \beta_8 \ln(SALES)_{i,t}^2 + \beta_9 ROA_{i,t} + \beta_{10} LEV_{i,t} + \beta_{11} ADV_{i,t} + \beta_{12} R\&D_{i,t} + \beta_{13} ADVRD_{i,t} + \beta_{14} CASH_{i,t} + \beta_{15} CASH_{i,t}^2 + \eta_i + \varphi_t + \varepsilon_{i,t}$$

Subscripts i denotes individual firm, t time period, ln natural logarithms. The dependent variable volatility is either idiosyncratic volatility [IDIO (%) column 1], or total volatility [TV (%) column 2], or systematic volatility (SYST column 3). OWN is the CEOs equity ownership. Board Size (BS) is number of directors in the board. INDDIR is the percentage of independent directors in the board. SRIGHTS is the shareholder rights index. DUALCEO is one if CEO chairs the board, otherwise zero. The regressors include CEO demographics (CEOAGE), growth opportunities (EVF), size [ln(SALES) and ln(SALES)^2], profitability (ROA), leverage (LEV), advertisement (ADV), research and development (R&D), research and development dummy (ADVRD dummy), liquidity (CASH and CASH^2), and trading frequency (FREQ). Refer to Table I for variable definitions. α is the constant, β are the parameters to be estimated, η_i is industry-fixed effects, φ_t year-fixed effects, ε is the error term. The sample period is from January 2001 to December 2011. Robust standard errors are clustered at the firm-CEO level and are reported in parenthesis. Prob>F(OWN) represents p-value for an F-test the ownership variables are jointly zero. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Volatility		
	Idiosyncratic	Total	Systematic
VARIABLES	(1)	(2)	(3)
CEO_OWN	0.0109**	0.0097*	
	(0.005)	(0.005)	0.0001*
(CEO_OWN)^2	-0.0002**	-0.0001*	(0.000)
	(0.000)	(0.000)	-0.0000
CEOAGE	-0.0022	-0.0018	(0.000)
	(0.003)	(0.003)	0.0055
DUALCEO	-0.1128***	-0.1216***	(0.112)
	(0.035)	(0.037)	-3.0982*
ln(BS)	-0.4888***	-0.5143***	(1.624)
	(0.072)	(0.076)	-13.9531***

Table XII (continued)

INDDIR	-0.3458***	-0.3573***	(3.429)
	(0.110)	(0.113)	-9.8513*
SRIGHTS	-0.0247	-0.0126	(5.865)
	(0.031)	(0.033)	(1.649)
EVF	-0.3261***	-0.3600***	-7.2444
	(0.096)	(0.099)	(5.262)
ln(SALES)	-0.8437***	-0.7595***	-6.4636
	(0.082)	(0.081)	(4.302)
ln(SALES)^2	0.0433***	0.0385***	0.2193
	(0.005)	(0.005)	(0.264)
ROA	-1.2994***	-1.7398***	-104.0144***
	(0.280)	(0.280)	(14.684)
LEV	-0.2078**	-0.1412	6.0593
	(0.105)	(0.108)	(4.613)
ADV	0.0230	0.0100	-2.1138*
	(0.038)	(0.037)	(1.093)
R&D	0.0138	0.0046	-1.5634**
	(0.015)	(0.013)	(0.615)
ADVRD dummy	0.1551***	0.1889***	9.7491***
	(0.034)	(0.036)	(1.757)
CASH	2.6551***	2.2275***	-28.3722
	(0.654)	(0.679)	(36.592)
CASH^2	-6.4826***	-4.0739**	136.3997
	(2.046)	(2.006)	(133.748)
FREQ	0.0001***	0.0001***	0.0029***
	(0.000)	(0.000)	(0.000)
Constant	7.9106***	7.9651***	161.8096***
	(0.433)	(0.433)	(20.354)
Industry FE & Year FE	Y	Y	Y
Observations	4,955	4,955	4,955
R-squared	0.473	0.528	0.295
Prob. > F(OWN)	0.0282	0.0597	0.4683
VIF	5.18	5.18	5.18

9. CONCLUSION

This dissertation investigates in an agency theory perspective how the contemporaneous game of power and influence between management and board affects corporate risk taking in the US market environment. Thereby, we focus on the different CEOs equity ownership structure, on how powerful and influent is the CEO in the corporate governance structure (i.e whether or not chairs the board of directors, or is interlocked in another committee), and on how effectively different board structures monitor the management and align management risk preferences with those of the shareholders. We also examine how the different board structures as an internal governance mechanism interact with CEOs ownership structure and power.

In section 7.1 we examine the effect of CEOs ownership structure and power in corporate risk taking. Our results show that there is a statistical and economical significant impact of CEOs ownership structure and power on corporate risk taking. For low level of CEOs equity ownership the incentive effect outweighs the non-diversification effect of an increased background risk reflected in the statistically significant positive impact on corporate risk taking. Nonetheless, for high levels of CEOs' equity ownership non-diversification and entrenchment effect is more pronounced than the incentive effect which results in a negative impact on corporate risk taking. An acting CEO that chairs the board of directors increases his ability to influence and to pursuit his risk preferences, which is reflected on a significant negative impact on corporate risk taking. With regards to CEO interlocking, despite the negative sign across all measures of volatility we fail to provide significant evidence to argue that decreases corporate risk taking.

After testing CEOs ownership structure and power in a controlled environment we re-examine it again in section 7.2 controlling for deemed important board characteristics. After all corporate risk taking will be the result of executive and non-executive directors' power struggle. The relation between CEOs ownership structure and corporate risk taking,

and CEO power and corporate risk taking remains qualitatively robust. Notwithstanding, controlling for board size, independent directors percentage, and shareholder rights restriction adds some new insights to the relation between corporate governance and corporate risk taking. The results suggest that smaller boards will have a positive impact on corporate risk taking, which indicates that smaller boards have more power to monitor the management and to impose shareholders' risk preferences to the management. Against our expectation the percentage of independent directors has a statistically significant negative impact on corporate risk taking, which points that independent directors in addition of being independent from the management are also independent from shareholders. This could be related with the compliance frameworks that they are liable for, which creates an incentive for not being associated with excessive risk taking, or with the existence of an active market for independent directors, which creates an incentive to manage shareholders, executive officers, and debt holders expectations to protect their reputation in the market. With respect to the shareholder rights provisions we find a negative relation across the different measures of volatility, but statistically insignificant.

Conversely, if this was the full story we would expect to see boards fulfilling only the minimum regulatory requirements with respect to the number of directors, and the number of independent directors. So why do boards have such different structures and are a prominent internal corporate governance mechanism across the world. We attempt to provide an explanation based on empirical evidence by focusing on how different board structures affect CEOs risk taking preferences captured by the incentive or non-diversification effect of CEO equity ownership, and CEO power. Section 7.3 provides our empirical results for this interaction. The findings suggest that CEOs risk taking preferences are more aligned with those of shareholders for firms under strong internal governance, which is reflected in a more pronounced incentive effect on corporate risk taking for low levels of equity ownership. The negative effect on corporate risk taking associated with high levels of ownership yields intriguing results.

In the subsample where weak or strong internal governance is defined by the board size we find that smaller boards minimize the negative effect of high levels of CEOs ownership. This is aligned with the view that smaller boards monitor more effectively the management giving less room for managerial slack. At odds, in the other two subsamples where strong internal governance is measured by the number of independent directors, and by the board size and independent directors together the negative effect of high levels of ownership is exacerbated in firms under strong internal governance. With respect to the sample of more independent directors an explanation is that high levels of CEOs ownership comes at the expense of shareholders control, so independent directors shift their loyalty towards the CEO colluding with his risk preferences exacerbating the agency problem. With regard to the subsample where we use smaller boards and high percentage of independent directors the negative effect is even more pronounced, because adding to the previous explanation it is easier for an entrenched CEO to gain the sufficient voting rights to control a smaller board than a larger board. The moderated internal governance subsample that has either a smaller board and below median independent directors or large board and above median independent directors, is the most common board characteristics combination structure and the one with more balanced CEO equity ownership effects on corporate risk taking. Finally with respect to CEO power as expected under strong internal governance CEO duality is not significant, except for the subsample based on independent directors that shows a marginally statistical significant negative effect on corporate risk taking, yet with a smaller impact than the one under weak governance.

The findings in this dissertation provide some interesting insights on how the power and influence between different board structures and CEOs ownership structure interact with corporate risk taking helping to identify where potential alignment of shareholder risk preferences and management coexist. From the investors stand point this is helpful as it points some CEO equity ownership and Board structure combinations that increase the likelihood of maximizing the value of their equity claims.

Conversely, the findings also give some insight of which CEO equity ownership and Board structure combinations regulators should monitor more closely to prevent excessive risk taking.

10. LIMITATIONS

This study is limited to the US market contracting environment and it may suffer from selection bias as all the firms are constituents of either NASDAQ or NYSE. Another factor that might contribute to the selection bias is the number of missing values that ownership variables have, from the 62,463 firm-year observations of NYSE and NASDAQ we end up with 10,612 firm year observations. Furthermore, our study is constrained to how efficient EVF does capture growth opportunities.

This dissertation ignores stock options based on the assumption that they do not accord voting rights. However, stock options are still an important part of the executives' incentives and despite that per si stock options are not a sufficient condition that allows management entrenchment they might still influence the executives' risk preferences and beliefs, and not taking them into accounting is a limitation present in this study.

Even that we controlled for endogeneity reverse causality bias and simultaneity bias to the best of our knowledge there might still be endogeneity problems due to errors in the instruments used. In particular, firm volatility is a function of so many factors that makes difficult to find efficient instruments.

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APPENDICES

Appendix A: Total Assets and EVE

Panel Regression of Volatility on Managerial Ownership Structure and Strong Boards

This table reports estimates of coefficients of the yearly time-series cross-sectional firm-level regression

$$Volatility_{i,t} = \alpha + \beta_1 OWN_{i,t-1} + \beta_2 OWN_{i,t-1}^2 + \beta_2 DUALCEO_{i,t} + \beta_3 \ln(BS)_{i,t} + \beta_4 \text{INDDIR}_{i,t} + \beta_5 \text{SRIGHTS}_{i,t} + \beta_5 CEOAGE_{i,t} + \beta_6 EVE_{i,t} + \beta_7 \ln(TOTALASSETS)_{i,t} + \beta_8 \ln(TOTALASSETS)_{i,t}^2 + \beta_9 ROA_{i,t} + \beta_{10} LEV_{i,t} + \beta_{11} ADV_{i,t} + \beta_{12} R\&D_{i,t} + \beta_{13} ADVRD_{i,t} + \beta_{14} CASH_{i,t} + \beta_{15} CASH_{i,t}^2 + \eta_i + \varphi_t + \varepsilon_{i,t}$$

Subscripts i denotes individual firm, t time period, ln natural logarithms. The dependent variable volatility is either idiosyncratic volatility [IDIO (%) column 1], or total volatility [TV (%) column 2], or systematic volatility (SYST column 3). OWN is the CEOs equity ownership. Board Size (BS) is number of directors in the board. INDDIR is the percentage of independent directors in the board. SRIGHTS is the shareholder rights index. DUALCEO is one if CEO chairs the board, otherwise zero. The regressors include CEO demographics (CEOAGE), growth opportunities (EVE), size [ln(TOTALASSETS) and ln(TOTALASSETS)^2], profitability (ROA), leverage (LEV), advertisement (ADV), research and development (R&D), research and development dummy (ADVRD dummy), liquidity (CASH and CASH^2), and trading frequency (FREQ). Refer to Table I for variable definitions. α is the constant, β are the parameters to be estimated, η_i is industry-fixed effects, φ_t year-fixed effects, ε is the error term. The sample period is from January 2001 to December 2011. Robust standard errors are clustered at the firm-CEO level and are reported in parenthesis. Prob>F(OWN) represents p-value for an F-test the ownership variables are jointly zero. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Volatility		
	Idiosyncratic	Total	Systematic
VARIABLES	(1)	(2)	(3)
CEO_OWN	1.2173**	1.3034**	0.3151
	(0.518)	(0.544)	(0.265)
(CEO_OWN)^2	-2.6949**	-2.8827**	-0.3508
	(1.209)	(1.298)	(0.668)
CEOAGE	-0.0013	-0.0022	-0.0017*
	(0.002)	(0.002)	(0.001)
DUALCEO	-0.0923**	-0.0803**	-0.0082
	(0.036)	(0.037)	(0.015)
ln(BS)	-0.2167***	-0.2606***	-0.1101***
	(0.072)	(0.073)	(0.032)
INDDIR	-0.2667***	-0.2628**	-0.0263
	(0.101)	(0.103)	(0.053)
SRIGHTS	-0.0242	-0.0224	-0.0216
	(0.030)	(0.031)	(0.015)
EVE	-0.3668***	-0.3659***	0.0337
	(0.083)	(0.088)	(0.045)
ln(TOTALASSETS)	-1.1058***	-1.0482***	-0.0792*
	(0.092)	(0.092)	(0.041)

Table VII (continued)

ln(TOTALASSETS)^2	0.0543***	0.0517***	0.0032
	(0.005)	(0.005)	(0.002)
ROA	-2.2622***	-2.6724***	-1.2537***
	(0.264)	(0.282)	(0.147)
LEV	-0.7740***	-0.6988***	-0.0003
	(0.129)	(0.130)	(0.052)
ADV	-0.0282	-0.0354	-0.0188
	(0.031)	(0.031)	(0.012)
R&D	0.0116	0.0036	-0.0136**
	(0.013)	(0.012)	(0.006)
ADVRD dummy	0.1225***	0.1050**	0.0329
	(0.046)	(0.048)	(0.023)
CASH	1.7029***	1.7958***	0.6289***
	(0.345)	(0.353)	(0.175)
CASH^2	-2.9925***	-3.2991***	-1.2744***
	(0.696)	(0.694)	(0.375)
FREQ	0.0001***	0.0001***	0.0000***
	(0.000)	(0.000)	(0.000)
Constant	10.3154***	10.2931***	1.8720***
	(0.528)	(0.568)	(0.273)
Industry FE & Year FE	Y	Y	Y
Observations	5,679	5,679	5,670
R-squared	0.567	0.606	0.435
Prob. > F(OWN)	0.0189	0.0166	0.2341
VIF	5.7	5.70	5.95

Appendix B: Hausman Test

Stata Output

```
. estimates store random

. hausman fixed random
```

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
L.CEO_OWN	.5613034	1.358324	-.7970204	1.211431
L.CEOsq	-.5624373	-3.362611	2.800174	2.627459
CEOAGE	.0679476	-.0026332	.0705808	.0428501
DUALCEO	-.1302065	-.090862	-.0393445	.0392971
INTERLOCK	.0702204	.0169394	.053281	.0594472
EVF	-.7770829	-.7453174	-.0317655	.1072823
LNS	-.7285232	-.8556993	.1271761	.1897774
LNSsq	.0336728	.0390063	-.0053335	.0128204
OPERPROBD	.0532136	-.1624791	.2156927	.0364685
LEV	-.9620052	-.7080304	-.2539748	.1567347
ADVPPE	-.0688102	.0372784	-.1060885	.0733402
RDPPE	-.0030025	.0226199	-.0256224	.017994
RD_PPED	.0339565	.0780811	-.0441246	.116741
CASHTA	.3475682	1.817569	-1.47	.3172018
CASHTasq	-.6027207	-2.60304	2.000319	.5669868
2003bn.Year	-.6624871	-.6057498	-.0567372	.0449358
2004.Year	-.9835353	-.8275724	-.1559629	.0886344
2005.Year	-1.099194	-.8741193	-.2250745	.1323344
2007.Year	-1.882673	-.0817573	-1.800916	.415985
2008.Year	-.053743	.3627216	-.4164646	.2233817
2009.Year	-.5747732	-.130601	-.4441722	.2642979
2010.Year	-1.439262	-.8956058	-.5436563	.3064155
13bn.INDUS	.2448671	-1.105041	1.349908	.8035201
15.INDUS	-.204829	-1.155953	.9511236	.8662523
24.INDUS	-.6982308	-1.895888	1.197657	1.553484
27.INDUS	-.5866709	-1.451888	.8652174	1.591442
28.INDUS	.4909328	-1.316959	1.807892	1.030787
29.INDUS	.1427488	-1.346273	1.489021	1.091117
30.INDUS	.3598476	-1.380363	1.74021	1.110078
31.INDUS	.928282	-1.181119	2.109401	1.323413
33.INDUS	-.6316289	-.9219945	.2903656	1.384415
34.INDUS	-.4711438	-1.593318	1.122174	1.1845
35.INDUS	-.7164658	-1.239869	.523403	1.064281
36.INDUS	-.7673026	-.9153948	.1480922	1.192718
37.INDUS	-.6132267	-1.379798	.7665711	1.184632
38.INDUS	-.6930432	-1.448833	.7557897	1.029523
39.INDUS	.7725383	-1.422578	2.195117	1.291376
42.INDUS	-.6519652	-1.21205	.560085	1.419874
48.INDUS	-.8748485	-1.077513	.202664	1.404239
49.INDUS	.2764973	-1.932591	2.209088	.6874982
51.INDUS	.1107771	-1.17764	1.288417	.6769863
52.INDUS	-.5889422	-1.266743	.6778009	1.374417
56.INDUS	-.2725643	-.8702541	.5976898	1.140723
59.INDUS	-.2618134	-1.130138	.8683248	1.203182
61.INDUS	.2012953	-1.423635	1.62493	1.790707
62.INDUS	-.2583796	-1.585842	1.327462	1.808438
67.INDUS	-.738755	-1.956843	1.218088	1.652645
73.INDUS	-.423797	-1.120211	.6964144	1.13768
79.INDUS	-.1391436	-1.24842	1.109277	1.324985
80.INDUS	.6987293	-.9326071	1.631336	1.170273
87.INDUS	-.4438151	-1.24131	.7974953	1.090517

```
                b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                chi2(51) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                         =      126.99
              Prob>chi2 =      0.0000
```

Appendix C: Winsorized Data – EVF, SALES, and ADV

Panel Regression of Volatility on Managerial Ownership Structure and Strong Boards

This table reports estimates of coefficients of the yearly time-series cross-sectional firm-level regression

$$Volatility_{i,t} = \alpha + \beta_1 OWN_{i,t-1} + \beta_2 OWN_{i,t-1}^2 + \beta_2 DUALCEO_{i,t} + \beta_3 \ln(BS)_{i,t} + \beta_4 \text{INDDIR}_{i,t} + \beta_5 \text{SRIGHTS}_{i,t} + \beta_5 CEOAGE_{i,t} + \beta_6 EVF_{i,t} + \beta_7 \ln(SALES)_{i,t} + \beta_8 \ln(SALES)_{i,t}^2 + \beta_9 ROA_{i,t} + \beta_{10} LEV_{i,t} + \beta_{11} ADV_{i,t} + \beta_{12} R\&D_{i,t} + \beta_{13} ADVRD_{i,t} + \beta_{14} CASH_{i,t} + \beta_{15} CASH_{i,t}^2 + \eta_i + \varphi_t + \varepsilon_{i,t}$$

Subscripts i denotes individual firm, t time period, ln natural logarithms. The dependent variable volatility is either idiosyncratic volatility [IDIO (%) column 1], or total volatility [TV (%) column 2], or systematic volatility (SYST column 3). OWN is the CEOs equity ownership. Board Size (BS) is number of directors in the board. INDDIR is the percentage of independent directors in the board. SRIGHTS is the shareholder rights index. DUALCEO is one if CEO chairs the board, otherwise zero. The regressors include CEO demographics (CEOAGE), growth opportunities (EVF), size [ln(SALES) and ln(SALES)^2], profitability (ROA), leverage (LEV), advertisement (ADV), research and development (R&D), research and development dummy (ADVRD dummy), liquidity (CASH and CASH^2), and trading frequency (FREQ). Refer to Table I for variable definitions. α is the constant, ß are the parameters to be estimated, η_i is industry-fixed effects, φ_t year-fixed effects, ε is the error term. The sample period is from January 2001 to December 2011. Robust standard errors are clustered at the firm-CEO level and are reported in parenthesis. Prob>F(OWN) represents p-value for an F-test the ownership variables are jointly zero. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Volatility		
	Idiosyncratic	Total	Systematic
VARIABLES	(1)	(2)	(3)
CEO_OWN	1.3565**	1.4337**	0.3070
	(0.564)	(0.585)	(0.264)
(CEO_OWN)^2	-2.9602**	-3.1225**	-0.3181
	(1.308)	(1.406)	(0.663)
CEOAGE	-0.0006	-0.0015	-0.0016
	(0.002)	(0.002)	(0.001)
DUALCEO	-0.0974***	-0.0847**	-0.0074
	(0.037)	(0.037)	(0.015)
ln(BS)	-0.3008***	-0.3356***	-0.1055***
	(0.074)	(0.075)	(0.032)
INDDIR	-0.2843***	-0.2775***	-0.0255
	(0.103)	(0.104)	(0.053)
SRIGHTS	-0.0098	-0.0099	-0.0196
	(0.030)	(0.031)	(0.015)
EVF	-0.5000***	-0.4702***	0.0385
	(0.089)	(0.093)	(0.053)
ln(SALES)	-1.0679***	-1.0109***	-0.1227***
	(0.096)	(0.099)	(0.047)

Table VII (continued)

ln(SALES)²	0.0562***	0.0533***	0.0060**
	(0.006)	(0.006)	(0.003)
ROA	-1.6590***	-2.1235***	-1.1753***
	(0.250)	(0.259)	(0.151)
LEV	-0.5524***	-0.4864***	-0.0338
	(0.122)	(0.122)	(0.049)
ADV	-0.0648	-0.0940	-0.0524
	(0.077)	(0.079)	(0.035)
R&D	0.0130	0.0048	-0.0145**
	(0.015)	(0.013)	(0.006)
ADVRD dummy	0.0688	0.0535	0.0257
	(0.048)	(0.049)	(0.023)
CASH	1.9941***	2.0639***	0.6792***
	(0.374)	(0.372)	(0.171)
CASH²	-3.3750***	-3.6590***	-1.3958***
	(0.769)	(0.733)	(0.360)
FREQ	0.0001***	0.0001***	0.0000***
	(0.000)	(0.000)	(0.000)
Constant	9.8110***	9.7943***	2.0162***
	(0.513)	(0.563)	(0.281)
Industry FE & Year FE	Y	Y	Y
Observations	5,679	5,679	5,670
R-squared	0.550	0.593	0.436
Prob. > F(OWN)	0.0163	0.0144	0.2457
VIF	6.15	6.15	6.4

Appendix D

Table VI

Piece Wise Linear Regression

This table reports estimates of coefficients of the yearly time-series cross-sectional firm-level piece wise regression regression

$$Volatility_{i,t} = \alpha + \beta_1 OWN_{i,t-1} + \beta_2 OWN^2_{i,t-1} + \beta_2 DUALCEO_{i,t} + \beta_3 INTERLOCK_{i,t} + \beta_4 CEOAGE_{i,t} + \beta_5 EVF_{i,t} + \beta_3 \ln(SALES)_{i,t} + \beta_6 \ln(SALES)^2_{i,t} + \beta_7 ROA_{i,t} + \beta_8 LEV_{i,t} + \beta_9 ADV_{i,t} + \beta_{10} R\&D_{i,t} + \beta_{11} ADVRD_{i,t} + \beta_{11} CASH_{i,t} + + \beta_{12} CASH^2_{i,t} + \eta_i + \varphi_t + \varepsilon_{i,t}$$

Subscripts i denotes individual firm, t time period, ln natural logarithms. The dependent variable volatility is either idiosyncratic volatility [IDIO (%) in Panel A], or total volatility [TV (%) in Panel B], or systematic volatility (SYST in Panel C). OWN is alternatively: CEO_OWN [0,5%[(column 1, 4, and 7), CEO_OWN [5,25%] (column 2, 5, and 8), and CEO_OWN >25 (column 3, 5, and 9). All regressions include the same control variables used in Table V but their coefficients are not reported. Refer to Table I for variable definitions. α is the constant, ß are the parameters to be estimated, η_i is industry-fixed effects, φ_t year-fixed effects, ε is the error term. The sample period is from January 2001 to December 2011.Robust standard errors are clustered at the firm-CEO level. Superscripts *, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

	Dependent Variable: Volatility								
	Panel A: Idiosyncratic			Panel B:Total			Panel C: Systematic		
VARIABLES	CEO_OWN [0,5%] (1)	CEO_OWN]5%,25[(2)	CEO_OWN ≥25% (3)	CEO_OWN [0,5%] (4)	CEO_OWN]5%,25[(5)	CEO_OWN ≥25% (6)	CEO_OWN [0,5%] (7)	CEO_OWN]5%,25[(8)	CEO_OWN ≥25% (9)
OWN	1.1297*	0.2399	-0.3948	0.8212	0.4167	-0.4949	-0.1762	0.6244*	-0.0815
	(0.658)	(0.708)	(0.591)	(0.650)	(0.749)	(0.659)	(0.336)	(0.351)	(0.309)
CEOAGE	0.0021	-0.0151***	-0.0082	0.0015	-0.0153***	-0.0097	-0.0006	-0.0055**	0.0020
	(0.003)	(0.005)	(0.012)	(0.003)	(0.005)	(0.012)	(0.001)	(0.002)	(0.005)
DUALCEO	-0.1056***	-0.0629	0.0730	-0.0900**	-0.0494	0.1244	-0.0071	0.0466	0.0795
	(0.040)	(0.104)	(0.263)	(0.041)	(0.106)	(0.250)	(0.016)	(0.047)	(0.130)
EVF	-0.5723***	-0.8526***	-0.9305	-0.5507***	-0.7444**	-0.6680	0.0176	-0.0208	0.4504
	(0.105)	(0.295)	(0.567)	(0.110)	(0.302)	(0.630)	(0.056)	(0.159)	(0.312)
LNS	-0.8489***	-0.9038**	1.1993	-0.7918***	-0.7957*	1.8616**	-0.0663	0.0824	0.8628*
	(0.113)	(0.431)	(0.963)	(0.118)	(0.420)	(0.879)	(0.051)	(0.156)	(0.457)
LNSsq	0.0408***	0.0378	-0.0921	0.0376***	0.0335	-0.1363**	0.0018	-0.0053	-0.0582*
	(0.007)	(0.028)	(0.072)	(0.007)	(0.028)	(0.065)	(0.003)	(0.010)	(0.033)
OPERPROBD	-1.4243***	-1.5323	0.1206	-1.8775***	-2.3139**	-0.2284	-1.1766***	-1.3273***	-0.7070
	(0.310)	(1.077)	(1.406)	(0.324)	(1.039)	(1.494)	(0.155)	(0.479)	(0.580)
LEV	-0.3872***	-0.9702***	-0.0719	-0.3127**	-0.7687**	-0.2021	-0.0005	0.2959*	-0.2142
	(0.128)	(0.349)	(0.543)	(0.129)	(0.350)	(0.551)	(0.052)	(0.156)	(0.331)
ADVPPE	-0.0087	-0.2343	0.4218	-0.0174	-0.2473	0.3948	-0.0148	-0.1379	-0.0873
	(0.041)	(0.196)	(0.503)	(0.040)	(0.201)	(0.481)	(0.013)	(0.093)	(0.197)
RDPPE	0.0093	0.0305	1.4376***	0.0023	0.0207	1.5139***	-0.0131**	-0.0076	0.4612***
	(0.014)	(0.081)	(0.219)	(0.013)	(0.082)	(0.211)	(0.006)	(0.035)	(0.111)
RD_PPED	0.0530	0.0849	0.0060	0.0377	0.0662	0.0594	0.0077	0.0776	0.1033
	(0.049)	(0.199)	(0.255)	(0.051)	(0.209)	(0.265)	(0.024)	(0.098)	(0.118)
CASHTA	1.9112***	4.1507***	5.6300***	1.9844***	4.1114***	4.9027**	0.6618***	0.6596	0.8308
	(0.374)	(1.168)	(2.020)	(0.383)	(1.207)	(2.118)	(0.180)	(0.556)	(1.124)
CASHTasq	-2.9355***	-8.0340***	-11.2382**	-3.2420***	-7.8402***	-9.4113**	-1.3549***	-0.6324	-1.0513
	(0.715)	(2.092)	(4.303)	(0.718)	(2.203)	(4.213)	(0.372)	(1.261)	(2.043)
FREQ	0.0001***	0.0001***	0.0001*	0.0001***	0.0001***	0.0001	0.0000***	0.0000***	0.0000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	7.9197***	10.6673***	-0.9477	7.8096***	10.6358***	-3.2328	1.4987***	1.5258***	-2.8644*
	(0.574)	(1.566)	(3.518)	(0.625)	(1.521)	(3.214)	(0.292)	(0.544)	(1.641)
Observations	5,105	530	98	5,105	530	98	5,096	530	98
R-squared	0.531	0.700	0.906	0.574	0.729	0.918	0.432	0.545	0.839

Appendix E

Descriptive Statistic – Instrument Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
DIRECTORS	8887	0.061609	0.109969	0	0.997968
Price	8887	34.4328	34.77699	0.12	983.02