Essays on corporate boards

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Declaration

I hereby declare that the work contained herein has been composed by me and is entirely my own work. No part of this thesis has been submitted for any other degree or professional qualification.

(*Vathunyoo Sila*)

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This thesis is dedicated to Phannee Sila and Chayanun Sila.

Abstract

This thesis comprises three empirical studies. These studies can be read as though they are independent. However, all three of them revolve around investigating whether and how characteristics of directors can affect firm-level outcomes.

The first study – "Does gender diversity affect firm equity risk?" – systematically investigates whether gender diversity in the boardroom influences firm equity risk. To identify the causal effect of gender on risk, I employ a dynamic model which allows for the possibilities that risk can influence the gender of appointed directors and that both director gender and risk can be influenced by other unobserved firm-level factors. The overall results in this study do not support the view that female boardroom representation influences equity risk. I also show that findings of a negative relationship between the two variables are spurious and driven by unobserved between-firm heterogeneous factors.

The second study – "Spillover effects of women on boards" – introduces an alternative way of looking at boardroom gender diversity. The definition of boardroom gender diversity is broadened to include female directors who do not sit on the board but are connected to the board through male directors or

"external" female influence. This is in addition to the "internal" influence of female directors inside the board. I find that when both external and internal influences of female directors are considered, there is evidence supporting a link between gender diversity and firm risk and that a plausible channel by which gender affects risk is through more effective monitoring. Male directors are less likely to exhibit absenteeism when they are exposed to both external and internal female influence. CEO turnover sensitivity increases with the proportion of male directors who are externally connected to women, when there is at least one female director inside the board. Risk also increases with the proportion of these connected men when they work on a board with at least one woman. The findings suggests that female directors can exert influence on firm-level outcomes despite their minority status in the boardroom.

The third study – "Independent director reputation incentives and stock price informativeness" – examines whether the reputation incentives of independent directors increase the incorporation of firm-specific information into stock prices. I find that the proportion of directors who deem their directorships to be more important based on firm market capitalization is associated with higher firm-specific information content in stock prices. This is consistent with the argument that boards that are incentivized to protect their reputation can deter managers from withholding information. I find this relation to be stronger when other external monitoring mechanisms are weak and when there is uncertainty regarding the future prospects of the firm. I also find evidence that a channel by which directors can influence stock price informativeness is through voluntary disclosure. Additionally, the presence of directors with high reputation incentives is negatively associated with stock price crash.

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CHAPTER 1

Introduction

The board of directors is widely viewed as an important institution within corporations. When things go wrong with a company, its directors become the center of attention. For example, after the collapse of Enron, the directors were blamed not only for their lack of oversight but also for being instrumental in enabling the fraud to occur[1]. According to a report prepared for the United States Congress[2]:-

> The Enron Board of Directors failed to safeguard Enron shareholders and contributed to the collapse of the seventh largest public company in the United States, by allowing Enron to engage in high risk accounting, inappropriate conflict of interest transactions, extensive undisclosed off-the-books activities, and excessive executive compensation. The Board witnessed numerous indications of questionable practices by Enron management over several years, but chose to ignore them to the detriment of Enron shareholders, employees and business associates.

[1]See, for example, *Enron's collapse: The directors; One Enron inquiry suggests board played important role*, The New York Times, January 19, 2002. See also *How Enron's directors made millions*, The Telegraph, January 27, 2002; *Commentary: No excuses for Enron's board*, Bloomberg Business, July 28, 2002.

[2]*The role of the board of directors in Enron's collapse*, Report prepared by the Permanent Subcommittee on Investigations of the Committee on Governmental Affairs, United States Senate (8 July 2002): http://www.gpo.gov/fdsys/pkg/CPRT-107SPRT80393/pdf/CPRT-107SPRT80393.pdf

The corporate scandals of Enron and many other companies resulted in a corporate governance reform where the board of directors is one of the main focuses[3]. Despite the view based on these changes that the board of directors is important, the academic literature has not yet provided a conclusive set of evidence that supports this view. Existing literature does not have a clear answer as to whether boards matter or how they matter. Theoretical studies that look at how boards function (e.g. Hermalin and Weisbach, 1998; Raheja, 2005; Adams and Ferreira, 2007; Harris and Raviv, 2008) generally categorize directors into insiders (executive directors) and outsiders (non-executive or independent directors) and postulate that these two groups differ in terms of their incentives[4]. This leads to many empirical studies using the fraction of outside directors to proxy for monitoring effectiveness of the board[5]. However, even within the same groups, these directors also differ in various other dimensions such as age, gender, connection, reputation and expertise; these differences may lead the directors to behave differently and, as a result, could have an impact on how firms perform[6]. However, whether these characteristics have any impact on the firm and how they have an impact on the firm may not be easily incorporated into theoretical models. The literature has been addressing the

[3]For example, the Sarbanes-Oxley Act of 2002 heightened the responsibilities of directors. The change in stock listing standards requires the board of directors to comprise of the majority of independent directors.

[4]Insiders are generally assumed to possess superior information about the firm (Fama and Jensen, 1983). In contrast, outsiders are seen as better monitors of the management but may lack access to firm-specific information (Adams and Ferreira, 2007).

[5]Examples of empirical studies that assumes outside directors are more effective at monitoring include Kaplan and Reishus (1990); Rosenstein and Wyatt (1990); Byrd and Hickman (1992); Brickley et al. (1994); Borokhovich et al. (1996); Cotter et al. (1997); Weisbach (1988); Rosenstein and Wyatt (1997); Bhagat and Black (2001); Hermalin and Weisbach (2003); Ryan and Wiggins (2004); Armstrong et al. (2014). See Hermalin and Weisbach (2003) and Adams et al. (2010) for comprehensive literature reviews.

[6]This point is well recognized in the literature. Many studies look at characteristics of directors beyond whether they are insiders or outsiders and analyze the influence of these characteristics on firm outcomes. Examples include gender (Adams and Ferreira, 2009; Levi et al., 2013), nationality (Masulis et al., 2012), education (Nguyen et al., 2014), allegiance to the CEO (Coles et al., 2014), social ties (Westphal, 1999), professional connections (Coles et al., 2013b), professional experience (Fich, 2005) and other board appointments (Ferris et al., 2003; Masulis and Mobbs, 2014)

lack of formal theory through empirical work (Hermalin and Weisbach, 2003).

This thesis comprises three empirical studies. These studies can be read as though they are independent. However, all three of them revolve around testing whether and how characteristics of directors can affect firm-level outcomes.

The first study – *"Does gender diversity affect firm equity risk?"* – systematically investigates whether gender diversity in the boardroom influences firm equity risk. Although women are found to be more risk averse than men and it has been suggested that female directors in the boardrooms can reduce risk taking[7], there is no documented evidence to support this claim[8]. Thus, the principal aim of this study is to examine whether overall gender diversity of the board has any influence on risk.

To test the causal effect of gender diversity on risk, I rely on a dynamic panel estimation methodology. This is because the causal link from gender to risk may be confounded by two endogenous sources. First, risk itself may causally influence gender composition of the board. Second, both boardroom gender composition and risk may be jointly determined by other factors that cannot be observed in the data. After taking these two sources of endogeneity into account, I do not find any evidence to support the claim that gender diversity in the boardroom has any causal impact on firm equity risk. This main finding is robust to several model specifications and alternative estimation techniques. Although I do not find that gender diversity influences risk,

[7]For example, Neelie Kroes, a European Commissioner for Competition, suggests that as women are "naturally more risk averse", companies with women directors are less likely to suffer loss in the economic downturn.

[8]Berger et al. (2014) finds that appointments of female executive directors lead to higher risk in banks, but the authors attribute this impact to age and experience of these executives rather than gender. Faccio et al. (2014) finds that female CEOs are associated with lower earnings volatility but they do not include other female executives or independent directors in their analysis.

the data I employ in this study exhibits a similar pattern to other studies; that is, gender-diverse firms on average have lower equity risk. I find that this relation is not causal and is driven by other unobserved factors that are fixed across time[9]. There is weak evidence that risk also influences boardroom gender diversity but the economic effect is small. Overall, the results in this study indicate that having a more gender diverse board does not lead to reduction in firm risk. This implies that the change in boardroom gender composition induced by the gender diversity quota may not have any impact the firm's risk profile[10].

In the second study – *"Spillover effects of women on boards"*, I broaden the definition of boardroom gender diversity to include the influence of female directors who are outside of the board but are connected to the board through male directors. I argue that female directors do have influence on male directors in the boardroom but the effect of these women may be small. This is because female directors are by and large minorities in most boards. The fact that female directors are minorities offers a possible explanation why studies fail to detect any significant relation between female representation on risk. In this study, I do not only consider the proportion of female directors in the boardroom, which is a proxy for "internal" female influence to the board, but also consider board connections of male directors to other female directors to proxy for "external" female influence. The idea that female directors outside of the board can influence male directors is supported by the minority influence literature (Moscovici, 1980, 1985) , which suggests that the influence of minority members (female directors in this case), albeit small, is more persistent and, as a result, can spillover to other boards. When considering both internal and external influences of female directors, I find evidence supporting

[9]Examples include corporate culture and CEO ability.
[10]See the conclusion of Chapter 2 for caveats and further discussions.

the link between gender diversity and firm risk.

In this study, I find that individual male directors are less likely to exhibit board meeting attendance problems when they are exposed to external and internal female influences. Specifically, male directors who are externally connected to women are less likely to exhibit absenteeism in gender-diverse boards. In contrast, male directors without any external connection to women do not behave differently whether or not the board on which they serve has any female director. This shows that female directors inside the boardroom affect the attendance behavior of male directors inside the board, but they only affect male directors who are connected to female directors in other boards. As board meetings provide opportunities for directors to obtain information necessary for them to perform their monitoring duties, attendance of these meetings is an observable outcome that potentially reflects director attitudes towards monitoring. The results suggest that male directors with internal and external female influences are better monitors. Next, I find that CEO turnover sensitivity increases with the proportion of male directors who have external connections, but only when there is at least one female director inside these boards. This demonstrates that gender diversity from both inside and outside of the boardroom has a positive impact on monitoring effectiveness. Finally, I find that the proportion of externally connected male directors is negatively related to firm equity risk and this relation is statistically significant in firms with at least one female director. Again, the results indicate that it is the combination of female directors inside the boardroom and other female directors that are connected to male directors on the board that affects the risk level of the firm. These empirical results are robust to various model specifications and alternative ways of proxying for female influence. Overall, the results suggest that gender diversity matters in terms of risk but the strong firm-level impact comes from the reinforcement of both gender diversity inside and outside of the board. The lack of the statistically significant relationship in the first study is potentially because male director in that study is treated of identical. This study suggests female directors can influence firm outcomes when male directors do not see them as tokens.

By showing that male directors are different based on the female directors they are connected with through the directorship network, the findings in the second study indicate that boards should not be considered in isolation. In the final study of this thesis, I also look at the heterogeneity of directors based on all directorships they hold rather than looking at each board in isolation.

The third study – "Independent director reputation incentives and stock price informativeness" – examines the relation between reputation incentives of independent directors and firm-specific information content in stock prices. Masulis and Mobbs (2014) suggest that independent directors who have multiple directorships do not allocate their monitoring effort equally amongst all their directorships. They instead are more motivated to monitor firms they see as more important i.e. the firms that allow their effort to be more visible in the labor market. I argue that when independent directors see the firm they work for as relatively more important, they encourage the firm to become more transparent.

To test the relation between reputation incentives and stock price informativeness, I follow Masulis and Mobbs (2014, 2015) and construct reputation incentive measures based on firm size. For each independent director with multiple directorships, I rank all their directorships based on firm market capitalization and assume that independent directors consider larger firms in their directorship portfolio to be more important. I find that stock price informativeness[11] increases with the proportion of independent directors that

[11] I use idiosyncratic volatility from the single-factor market model as a proxy for stock price

rank the firm as more important. The results suggest that firms in which directors are more motivated by their reputation incentives are associated with the increase in firm-specific information content in stock prices. This relation is robust to various control variables, including board size, board independence, the presence of busy directors and directors who only have one directorship, as well as various other firm-level controls. I also find that the relation between stock price informativeness and reputation incentives is stronger when external monitoring mechanisms, i.e. monitoring from stock analysts and the market for corporate control, are weak. Additionally, I find that the results are robust to the inclusion of various proxies for earnings management, which suggest that these motivated independent directors are associated with the firm's stock price informativeness through other channels besides better financial report quality. I show that one of these other channels is voluntary disclosures through SEC 8-K filings. Specifically, I find that the presence of directors with high reputation incentives is positively associated with a higher frequency of voluntary disclosures in the firm's 8-K reports when there are disagreements amongst analysts. Finally, I find that firms in which directors have high reputation incentives are less susceptible to stock price crash events. Overall, this third study shows evidence that independent directors are different in terms of the efforts they allocate to the firm and this heterogeneity in effort has a strong impact on firm stock price informativeness.

The structure of this thesis is as follows: The first chapter (this chapter) provides the motivation and brief summaries of all empirical studies included in this thesis. Chapters 2, 3 and 4 contain separate research questions, literature review, empirical results and analysis for the three studies above. Finally, Chapter 5 provides a conclusion to the thesis, including its overall contributions, limitations and directions for future research.

informativeness. See, for example, Morck et al. (2000).

CHAPTER 2

Does gender diversity affect firm equity risk?

2.1 Introduction

A substantial corporate governance literature has linked the composition of the board of directors to observable firm outcomes. This study contributes to the existing literature by examining whether the gender composition of a board affects firm risk. Recently, some firms have come under public pressure to increase gender diversity on their boards[1] and a number of European economies (among them Belgium, France, Norway and Italy) have passed legislation mandating more female board representation for certain firms. However, the economic consequences of having more female directors are not well understood. While studies in economics and psychology find women to have less risk appetite than men (Hinz et al., 1997; Byrnes et al., 1999; Barber and

[1] For instance, Twitter recently came under fire in the media over its exclusively male board of directors. Although the company's CEO replied that the director appointment process should be more than just "checking a box", the company still responded by appointing Marjorie Scardino as its first female director in December 2013. See 'Twitter has taken a good step forward, but needs more than one female director', Forbes, September 12, 2013.

Odean, 2001), it is unclear whether a more female-dominated board means less risk-taking. If firms that appoint more female directors were to become less risk taking, these firms might make less risky policy choices and investment decisions and could ultimately become less competitive players in their industries. Additionally, boards of directors now face heightened expectations regarding their role in risk oversight[2]. Therefore, the gender diversity of a board could also be important for effective risk oversight.

In this chapter, I examine whether gender diversity affects firm risk using a sample of US firms from 1996-2010. To date, the extant literature has examined how the gender of senior executives affects risk (Huang and Kisgen, 2013; Berger et al., 2014; Cole, 2013; Faccio et al., 2014) and how board diversity in banks affects bank risk (Adams and Ragunathan, 2013), but not the risk implications of gender diversity in non-financial firms. Sapienza et al. (2009) find women who enter the financial industry to be less risk averse than women entering other industries. This suggests that the findings from the banking sector on the gender-risk link cannot be applied to other sectors. The link between board diversity and risk in non-financial firms is therefore the focus of this study.

Establishing a causal relationship between gender diversity and risk is challenging. Board characteristics are not exogenous random variables. They are endogeneously chosen by firms to suit their operating and contracting environment (Adams and Ferreira, 2007; Coles et al., 2008; Harris and Raviv, 2008). Two sources of endogeneity are particularly likely to bias the OLS estimates of how gender affects firm risk.

First, the causality between firm risk and appointment decisions could run in reverse direction. That is, firm risk may affect appointment decisions. For

[2]See Securities and Exchange Commission's Regulation S-K 407(h)

instance, female directors may self-select into lower risk firms due to their higher risk aversion (Farrell and Hersch, 2005). This would result in a negative relationship between female board participation and firm risk.

Second, omitted unobservable firm characteristics (fixed and variable across time) may affect both the director selection process and firm risk at the same time. Empirical models cannot capture all the determinants of risk measures. There may be other factors, observable and unobservable, that influence both the director appointment process and risk. An example of such an unobservable variable is a firm's tendency towards social responsibility[3]. Both theory and empirical evidence from a broad literature on corporate social responsibility suggest that a firm's engagement with its stakeholders is negatively related with both systematic and idiosyncratic risk (Freeman, 1984; Waddock and Graves, 1997; Godfrey, 2005). At the same time, the firm's tendency to be (or appear to be) a good corporate citizen can influence the proportion of women on its board from both demand and supply perspectives. From the demand side, gender diversity is one of the social responsibility dimensions the firm is evaluated on by its stakeholders. For example, Coca-Cola communicates its boardroom gender diversity policy in its corporate social responsibility report. Being socially responsible can also attract women directors to the firm as evidence shows that women directors care more about self-transcendence values and thus they may identify better with socially responsible firms (Chatman, 1989; Turban and Greening, 1997; Adams and Funk, 2012). This can increase the supply of women the firm can appoint as directors. Omitted unobservables such as this would then cause us to report a negative but non-causal

[3]Whilst there are proxies for social performance such as ESG Research Data from Thomson Reuters or KLD rating data from Kinder, Lydenberg, Domini and Co., these measures come from disclosed performance outcomes. Therefore, the data is only available for a subset of firms. Furthermore, social responsibility itself could be determined by other institutional settings such as the presence of monitoring organizations, institutionalized norms and the level of engagement by their stakeholders (Campbell, 2007). These themselves cannot be readily observed and thus are generally omitted from empirical models.

relationship between female boardroom representation and firm risk.

Additionally, Wintoki et al. (2012) and Cicero et al. (2013) demonstrate that reverse causality issues around board characteristics are dynamic. In the context of this study, it means that current female boardroom representation is likely to be influenced by past realizations of firm risk.

A common empirical strategy to deal with endogeneity is to identify an instrumental variable that explains gender representation on the board but is exogenous to financial outcomes. However, it is challenging to find a truly exogenous instrumental variable for gender diversity. For instance, I present some evidence in this chapter that a variable commonly employed as a source of exogenous variation in gender diversity (the number of female connections of male directors) is not truly exogenous in the employed data set.

Taking into account these endogeneity issues, the dynamic nature of these endogeneity issues and the challenges around identifying a suitable instrument, I employ a dynamic panel system GMM estimator to estimate a dynamic model of equity risk. I find no evidence of female boardroom representation affecting any of the measures of equity risk in my analysis (total, systematic and idiosyncratic risk). The findings hold in various GMM specifications and are also robust after using propensity score matching and nearest-neighbor matching difference-in-difference estimators instead of GMM, an operating performance measure of risk (the standard deviation of a firm's return on assets) and a range of firm policy measures that proxy for risk. The results of the various tests and robustness tests presented in this chapter all point to the same conclusion. A board with a higher proportion of female directors is no more or less risk-taking than a more male-dominated board.

The results in this study also shed some light on the different sources of endogeneity and how they affect the reported gender-risk relationship. My results offer some support for reverse causality concerns. I find that firm risk is negatively related to the probability that a female director is appointed. However, this effect is economically small and therefore unlikely to drive any spurious relationship between gender and risk. Instead, the main source of endogeneity that would cause a negative but spurious relationship between gender diversity and risk is unobservable firm-level factors. This is consistent with the view that firms and executives are matched based on risk (Bandiera et al., forthcoming) I show that not controlling for these unobserved between-firm heterogeneous factors can leads to spurious results of a negative effect of gender diversity on risk.

This study provides the following contributions to the literature. First, it extends the literature that investigates the link between gender diversity and risk in banks (Adams and Ragunathan, 2013; Berger et al., 2014) by providing the first study that examines the gender-risk link for a cross-industry sample outside the banking sector. This study also contributes to a broader literature that has documented the relations between firm risk-taking and other corporate governance characteristics, including CEO gender, financial expertise, ownership, compensation and the presence of institutional investors (e.g. Wahal and McConnell, 2000; Coles et al., 2006; Kim and Lu, 2011; Faccio et al., 2014; Minton et al., 2014). For instance, Ahern and Dittmar (2012) and Matsa and Miller (2013) investigate the relationship between the presence of female directors and debt policy.

Second, this study contributes more generally to the literature on the hitherto inconclusive debate over director gender and firm value. While female board representation is linked to a range of arguably desirable firm outcomes such as board attendance, lower M&A bid premiums and less risky business decisions (e.g. Levi et al., 2013; Adams and Ragunathan, 2013), evidence linking gender diversity to firm performance is less conclusive (e.g. Adams and Ferreira, 2009; Liu et al., 2014). Many studies that examine the link between gender and performance use operating performance measures which are not risk-adjusted (e.g. ROA, ROE or other accounting variables)[4]. These studies can only reveal part of the story, because two firms with identical cash flows can exhibit different levels of risk. Therefore, even when gender does not affect operating performance, it may still have an effect on firm risk[5]. I contribute to this literature by confirming that risk is not a channel through which gender affects firm value.

In addition, I also illustrate the impact of endogeneity on the estimated relationship between gender diversity and firm risk by showing that the negative gender-risk relationship is largely driven by unobserved between-firm variation. My findings add to previous studies that document different relationships between board and performance variables depending on the estimator choice (e.g. Adams and Ferreira, 2009; Wintoki et al., 2012).

[4]Some of these studies also examine Tobin's Q, which is measured as market-to-book ratio and is a proxy for a firm's growth opportunities. Although Tobin's Q is a risk-adjusted measure based on firm market value, Wintoki et al. (2012) argue that this measure is more likely to be a cause rather than a consequence of governance structure. This argument is supported by theoretical works such as Raheja (2005) and Harris and Raviv (2008). Various empirical works including Boone et al. (2007) and Linck et al. (2008) also find evidence that supports this argument.

[5]Other studies use risk-adjusted measures of performance changes, but reach conflicting conclusions. Ahern and Dittmar (2012) document a decline in equity prices following the introduction of a gender quota in Norway, while Adams et al. (2011) find that appointments of female directors result in higher stock market performance than male director appointments.

2.2 Literature Review

Return and risk can be seen as two sides of the same coin. Firms engage in risky projects with positive net present value in order to generate returns for shareholders. As firm value can be viewed as the sum of future cash flows discounted by an appropriate rate of return that accounts for risk, it is appropriate that both risk and return are considered jointly by managers. Agency theory suggests that managers are risk averse due to concerns about their own undiversified human capital (Fama, 1980; Holmström, 1999) and the literature investigates how managers can be induced to make risky choices through various corporate governance mechanisms. These mechanisms include both external mechanisms such as monitoring by shareholders as well as internal mechanisms such as risk rewarding remuneration (e.g. Leland, 1998; Coles et al., 2006). One governance mechanism believed to have an impact on risk is the board of directors[6].

2.2.1 Board characteristics and firm risk-taking behavior

Existing literature suggests that boards matter for firm risk-taking and many studies have attempted to identify the influence of board characteristics on firm risk. Cheng (2008) finds that firms with smaller boards have higher performance variability, accounting accruals and participate more frequently in mergers and acquisitions. Pathan (2009) finds a negative relationship between board size and stock return volatility. However, the directors in these studies are treated as a homogenous group without controlling for the characteristics

[6]For example, Pathan (2009) suggests that strong boards can negate CEO's risk aversion and, as a result, increase firm risk taking. Additionally, Securities and Exchange Commission's Regulation S-K 407(h) requires companies to disclosure the board's role in risk oversight. This reflects the regulator's view that the board of directors is important to the firm in term of risk.

of individuals such as gender, ethnicity, qualifications, personalities and beliefs. Variations in characteristics, gender in particular, may be able to explain the difference in risk-taking choices amongst these firms.

2.2.2 Do female directors affect firm risk?

Studies in both the psychology and economics literature find that women tend to be more averse to risk than men. A meta-analysis of 150 studies on risk-taking behavior reports that men are more likely to be involved in "risky experiments", "intellectual risk taking" and "gambling" than women (Byrnes et al., 1999). In experimental settings, men exhibit a greater tendency to make risky choices than women. For example, women are found to be more risk averse in experiments using lotteries with known probabilities and monetary outcomes (e.g. Levin et al., 1988; Fehr-Duda et al., 2006). It is also found that women are more conservative in making investment decisions (e.g. Sunden and Surette, 1998; Bernasek and Shwiff, 2001). Croson and Gneezy (2009) provide an overview of the literature in this area.

However, these studies investigate the risk attitudes of women in the population. In their sample of economic, finance and business students, Deaves et al. (2009) do not find women to be less overconfident than men. They postulate that women who are attracted to 'male' disciplines may be different from those in the population. Female directors may possess different characteristics that have helped them to climb the corporate ladder and become directors. Adams and Funk (2012) hypothesize that the degree of risk aversion in women may vanish once they have broken through the glass ceiling and have adapted to a male-dominated culture. In a Swedish sample, they find that female directors are more risk-loving than their male counterparts. Nonetheless, provided that there are differences in risk attitude between the genders, it is possible that the gender composition of the board may explain the variation in corporate risk-taking behavior.

At the board level, the interaction between directors of different genders may also impact decisions (Hoogendoorn et al., 2013). On the one hand, board diversity may result in more board scrutiny and better decision making. On the other hand, diversity could cause conflict and, as a result, consensus may be more difficult to achieve. The risk implications of this are difficult to gauge ex-ante. More scrutiny can potentially lead to lower firm risk given the same level of return, whilst risk may increase if it is more time consuming for directors to reach decisions.

2.2.3 Empirical studies on board gender diversity

There are a limited number of studies on the impact of female board representation on firms' risk-taking behaviors. Wilson and Altanlar (2011) find insolvency risk to be negatively related to the proportion of female directors. Levi et al. (2013) find that firms with male-dominated boards are more likely to participate in M&A activities and pay higher acquisition premiums. They attribute these results to the tendency of female directors to be less overconfident than their male counterparts. Beck et al. (2013) find that loans made by female officers are less likely to result in payment in arrears as they are better at monitoring by building interpersonal relationships. However, greater female boardroom representation is not always associated with less risky behaviors. Ahern and Dittmar (2012) finds that leverage increases after the Norwegian female boardroom representation quota whilst Matsa and Miller (2013) explore the same legislative shock and find no significant change[7]. Matsa and

[7] The change in leverage is negative but not significant.

Miller (2013) posit that "risk aversion may not be a distinctive part of women's approach to corporate decision-making". Berger et al. (2014) find that an increase in the proportion of female bank directors results in increased portfolio risk.

Most of the research in the area of gender diversity on boards of directors focuses on profitability outcomes and, so far, there is no consensus in the literature on the relationship between female representation and a firm's prospects. Some studies find that board diversity increases with performance (e.g. Carter et al., 2003) whereas others find no such relationship (e.g. Carter et al., 2010; Gregory-Smith et al., 2014).

Another strand of the literature looks at the determinants of boards appointing female directors and firm risk is found to be one of the determinants of female board appointments. Adams and Ferreira (2004) find that firms with more volatile stock returns tend to have fewer female directors on their board. The authors explain these results using the argument of Kanter (1977) that group homogeneity (i.e. a male-dominated board) is essential in environments where uncertainty is high. Similarly, Farrell and Hersch (2005) find that the propensity of female director appointments is higher in less risky and better performing firms. They argue that female directors can self-select into these firms due to demand for gender diversity.

Farrell and Hersch (2005) also find that female directors are more likely to be appointed to boards with fewer female directors or when the appointment follows female director departures. Gregory-Smith et al. (2014) find similar results for UK firms. However, the authors cannot establish a relation between firm risk and the gender of directors being appointed for their sample of UK firms.

Overall, these results suggest that a director's gender or the proportion of female directors on boards are not exogenous random variables, and that reverse causality is likely to be an issue when investigating the impact of gender diversity.

2.3 Methodology

This section starts by discussing why the relationship between female boardroom representation and firm risk could be endogenous. It then discusses an empirical specification that takes into account the two sources of endogeneity that are of concern in board studies – unobserved heterogeneity and reverse causality. Lastly, I introduce a dynamic model between female boardroom representation and risk and propose the dynamic panel system generalized method of moments estimator (DPS-GMM, hereafter) as a suitable estimator that allows us to test whether female boardroom representation impacts on firm risk.

2.3.1 Endogeneity issues in estimating the relationship between female boardroom representation and risk measures

There is a general consensus in the literature that board characteristics are endogeneously chosen by the firm to suit its operating and information environments and to reflect the bargaining power of various stakeholders in the firm. Amongst others, Fama and Jensen (1983) and Coles et al. (2008) argue that board characteristics are affected by the scope and complexity of the firm. Equally, the level of information asymmetry prevailing between insiders and outsiders could affect board characteristics if board characteristics are chosen such that insiders are incentivized to reveal sufficient private information for the board to fulfil its monitoring and advising functions (Adams and Ferreira, 2007; Harris and Raviv, 2008; Linck et al., 2008)[8].

[8] This view is formally explained as theoretical models by Raheja (2005), Adams and Ferreira (2007), and Harris and Raviv (2008). Linck et al. (2008) finds that board size and independence are negatively associated with growth opportunities, R&D expenditure and R&D volatility, suggesting that these types of firms may not require intensive monitoring.

The possibility that female boardroom representation is a choice variable has to be taken into account when estimating the gender-risk relationship. To reliably test whether female boardroom representation affects firm risk, at least two alternative explanations must be considered.

2.3.1.1 Omitted unobserved factors

The first alternative explanation is that omitted unobservable firm characteristics (both fixed and variable across time) may affect both the director selection *and* firm risk. For example, a firm's desire to act as a responsible citizen (or to appear so) could be linked to both risk *and* gender diversity. There is evidence consistent with this from a broad literature on corporate social responsibility. According to the stakeholder theory (Freeman, 1984), there are various risk implications from the relationship between the firm and its various stakeholders e.g. customers, employees, community groups, governments and investors[9].

Maintaining good relationships with stakeholders increases firm legitimacy and potentially decreases the firm-specific risk of legal prosecutions, regulatory sanctions, customer boycotts, and labor-related problems (Waddock and Graves, 1997). Additionally, socially responsible firms may be perceived as better managed and, as a result, less risky (McGuire et al., 1988). Similarly, investors may be less likely to react negatively to adverse firm-specific events (Godfrey, 2005). These explanations suggests that socially responsible firms are associated with lower idiosyncratic risk.

[9] An alternative view is that only firms with abundant resources participate in socially responsible activities (i.e. slack resource theory, see McGuire et al., 1988; McGuire, 1990) and that corporate social responsibility is a result of agency conflicts within the firm (Masulis and Reza, 2015). Both stakeholder and slack resource theories predict a positive relation between corporate social responsibility and profitability. However, the social responsibility and risk relation is unclear under the slack resource view.

Being socially responsible can also reduce systematic risk. Albuquerque et al. (2014) show that social responsibility decreases the sensitivity of firm net profit to aggregate economic conditions through increased customer loyalty. These theories are supported by empirical evidence that shows a negative relation between corporate social responsibility and both systematic and idiosyncratic risk measures (Spicer, 1978; Orlitzky and Benjamin, 2001; Oikonomou et al., 2012; Lee and Faff, 2009).

At the same time, corporate social responsibility can be positively related to gender diversity through at least two mechanisms. First, socially responsible firms may be more likely to appoint women into their boardrooms. Appointing female directors is arguably a way through which firms seek legitimacy (Carleton et al., 1998; Agrawal and Knoeber, 2001). Boardroom gender diversity is also one of the various elements firms are evaluated on in terms of social responsibility[10]. Empirical studies generally show a positive association between gender diversity and corporate social performance (see e.g. Johnson and Greening, 1999; Boulouta, 2012).

There is also anecdotal evidence that gender diversity is a part of a firm's social responsibility plan. For example, Coca-Cola Enterprise explicitly states in their corporate responsibility report that the company aims for greater representation of women in their top positions[11].

Second, social responsibility may be more attractive to women directors

[10]Boardroom gender diversity is included in the environmental, social and governance factors that are used by socially responsible funds for their portfolio screening. It is also a part of the criteria of many social investment indices such as Dow Jones Sustainability Indices, in which the scoring methodology explicitly includes gender diversity as a relevant dimension in the board nomination process. See http://www.sustainability-indices.com/images/CSA_2014_Annual_Scoring_Methodology_Review.pdf.

[11]According to Coca-Cola's 2013-2014 corporate social responsibility and sustainability report, 33% of its directors (4 out of 12) are women, increasing from 21% (3 out of 14) in 2010 based on my data set. See http://www.cokecce.com/corporate-responsibility-sustainability/corporate-responsibility-sustainability-report.

(Turban and Greening, 1997). Social identity theory suggests that people define who they are based on their group memberships (Chatman, 1989; Dutton et al., 1994). Adams and Funk (2012) find in their sample of directors that women care more about *self-transcendence* values such as *universalism* and *benevolence*[12]. Therefore, social responsibility can be positively related to boardroom gender diversity through both firm's higher tendency to appoint women directors (demand) and the increased number of women in the candidate pool (supply).

Whilst the literature uses various measures of social performance to proxy for corporate social responsibility[13], these measures come from disclosed "outcomes" rather than the "tendency" for firms to be socially responsible (Ullmann, 1985). Therefore, the data is only available for a subset of firms. Furthermore, social responsibility itself could be determined by other institutional settings such as the presence of monitoring organizations, institutionalized norms and the level of engagement by their stakeholders (Campbell, 2007). These themselves cannot be readily observed and thus are generally omitted from empirical models.

Another example of omitted unobserved factors in the risk equation is managerial ability. CEOs of high ability may be more able to manage firm risk (such that firms have lower risk for a given level of profits), whilst also having more influence over director appointment decisions (Hermalin and Weisbach, 1988)[14]. While these managers may be indifferent with regards to gender of

[12]Schwartz et al. (2001) define benevolence as "preservation and enhancement of the welfare of people with whom one is in frequent personal contact and "universalism as "understanding, appreciation, tolerance and protection for the welfare of all people and for nature".

[13]Examples are environmental, social and corporate governance (ESG) data from Thomson Reuters and Kinder, Lydenberg, Domini and Co. (KLD).

[14]Prior evidence shows that CEOs have influence over the selection of board candidates (e.g. Shivdasani and Yermack, 1999). Although NYSE and NASDAQ listing rules have reduced the influence of CEOs in the nomination process, they at the very least are still able to approve the list of director candidates and these candidates are often voted in by shareholders (Cai et al., 2009; Coles et al., 2014).

the appointed directors, it is conceivable that they prefer directors who are less independent. Adams and Ferreira (2009) observe that women directors allocate more effort to monitoring compared to male directors. Futhermore, Adams and Funk (2012) find that female directors are more independently minded[15]. Ferreira (2014) argues that female boardroom representation may better represent the level of board independence than the nominal measure of independence (i.e. the proportion of outside directors). If this is the case, it is possible that unobserved managerial ability and preference for a less independent board would be correlated with gender diversity even after controlling for the conventional measure of board independence.

Under these explanations, one would observe a relation between female boardroom representation and firm risk measures even in the absence of a causal relationship between the two variables. While the literature generally deals with unobservables by using a fixed effects estimator, this is insufficient due to a second alternative explanation which needs to be considered, reverse causality.

2.3.1.2 Reverse causality

The second alternative explanation is that it is risk that influences appointment decisions. Hermalin and Weisbach (1998) suggest that monitoring intensity increases when the board finds it more difficult to judge CEO ability. If this is the case in risky firms (where the signal about CEO ability is noisy), boards may decide to increase monitoring by increasing the number of female directors (Adams and Ferreira, 2009). In this case one would observe a positive relationship between the fraction of female directors on board and risk

[15]Women directors in their sample care less about tradition, conformity and security and are more open to change.

measures. Alternatively, female directors may simply self-select into lower risk firms due to their higher risk aversion (Farrell and Hersch, 2005), which would result in a negative relationship between female board participation and firm risk.

Both of these possibilities – unobserved heterogeneity and reverse causality – could result in a significant statistical relationship between the two variables even when female boardroom representation does not affect risk. To reliably test whether female boardroom representation has an impact on firm risk, one needs to consider at least these two alternative possibilities.

In this study, I rely on the insight of Wintoki et al. (2012) and argue that reverse causality is dynamic. For the purpose of this study it means that current female boardroom representation is influenced by past realizations of firm risk. Intuitively, this is because at the time the appointment decision is made current risk level of the firm has not been realized and therefore cannot be observed. Therefore, only past risk measures would be in the information set considered by the CEO and existing directors in order to choose board characteristics. This insight leads to a dynamic model in the next section that allows unobserved heterogeneity and the influence of past risk on female boardroom representation to be controlled for.

2.3.2 Identification strategy

To reliably measure the influence of female boardroom representation on firm risk, I require an empirical model that takes into account the influence of unobserved heterogeneity and past realization of risk on the choice of director gender and current risk. This section introduces a dynamic model that allows for these possibilities. It then argues that the commonly used ordinary least squares (OLS) and fixed effects estimators cannot produce reliable inferences for models of this type. Finally, this section proposes the DPS-GMM as an appropriate estimator.

It has been established in the previous section that the proportion of female directors on board is a choice variable and that it can be influenced by other board characteristics, firm characteristics, other unobserved factors and past realizations of risk. This can be formally written as

$$\text{Proportion of Women}_{i,t} = f(\mathbf{X}_{i,t}, \text{Risk}_{i,t-1}, \text{Risk}_{i,t-2}, \ldots, \text{Risk}_{i,t-p}, \eta_i) \tag{2.1}$$

The matrix $\mathbf{X}_{i,t}$ represents other determinants of director gender such as other board and firm characteristics. The variables $\text{Risk}_{i,t-1}$, $\text{Risk}_{i,t-2}$, ..., $\text{Risk}_{i,t-p}$ represent past risk measures at lag 1, 2, ..., p respectively and η_i is time invariant unobserved heterogeneity (e.g. corporate behavior and CEO ability). These variables are not only determinants of current level of female boardroom representation, they are also likely to be correlated with the current level of risk. Thus, to accurately estimate a relationship between female boardroom representation and the risk measure, these variables need to be included, resulting in a model as follows.

$$\text{Risk}_{i,t} = \alpha + \beta \text{Proportion of Women}_{i,t} + \mathbf{X}_{i,t}\boldsymbol{\Gamma} + \sum_{s=1}^{p} \delta_s \text{Risk}_{i,t-s} + \{\eta_i + \varepsilon_{i,t}\} \tag{2.2}$$

This dynamic model with fixed effects allows for both the possibilities that current firm risk is affected by unobserved but time-invariant heterogeneity (through η_i) and past realizations of risk (through $\text{Risk}_{i,t-1}$, $\text{Risk}_{i,t-2}$, ..., $\text{Risk}_{i,t-p}$).

The relationship between firm risk and female boardroom representation is reflected in the parameter β. To consistently estimate β using the OLS estimator, the proportion of women on board must not be correlated with the residual term (which in this case is $\eta_i + \varepsilon_{i,t}$ in Equation 2.2). This is not a realistic assumption. Considering that female boardroom representation, like other board characteristics, is a choice made by a firm and can be influenced by unobserved heterogeneity such as CEO ability and corporate culture (which are encompassed in η_i), the residual term would be correlated with the proportion of women and the OLS estimates of β would be inconsistent.

Neither can the fixed effects estimator, which removes the unobserved heterogeneity from the model by demeaning all the variables, yields a consistent estimate. The implicit assumption of the fixed effects estimator that is often not acknowledged is that it requires all independent variables, both the proportion of women and control variables, to be uncorrelated with contemporaneous, past and future residual terms (the strict exogeneity assumption). Under the presence of a dynamic relationship between risk and female boardroom representation this assumption is violated by construction. This is because firm risk is highly correlated across time. The only situation where this estimator is consistent is when the effect of past risk on current risk weakens over time and the time dimension of the panel sample is large. While the former is a reasonable assumption, it is difficult to obtain a panel sample with a sufficiently long time dimension.

Considering this limitation, this study relies on the assumption that firms choose a certain proportion of female directors to achieve a certain risk profile. In order to choose a level of female representation, those charged with making appointments (the CEO and existing directors) rely on information available to them at the time of the appointment. The information set used to make appointment decisions includes past values of realized risk as well as existing board and firm characteristics. This assumption is consistent with the weak-form rational expectation theory of Muth (1961) and Lovell (1986). In essence, appointment decisions are made based on an expected level of future firm risk. Therefore, once true risk of the firm has been realized, the unexpected component of the error term can be assumed to be uncorrelated with the current information set. This satisfies the generalized method of moments orthogonality conditions (Hansen and Singleton, 1982) and it means that past realizations of variables in the information set underlying appointment decisions are suitable candidates for instrumental variables for appointment decisions.

Based on the above intuition, this study utilizes the Arellano-Bover/Blundell-Bond dynamic system generalized method of moments estimator (Arellano and Bover, 1995; Blundell and Bond, 1998) to measure the gender-risk relation. This estimator has been developed over a series of studies including Anderson et al. (1982), Holtz-Eakin et al. (1988) and Arellano and Bond (1991). The Arellano-Bond estimator removes the unobserved time-invariant heterogeneity through first differencing and uses the assumption that the current residuals are not correlated with past information under the GMM framework. Under rational expectations, past realization of variables beyond what is included in the model are assumed to be uncorrelated with the residuals; thus, the exogeneity assumption is satisfied. The identification assumption is also satisfied as the included variables are likely to be strongly correlated with the past values of themselves.

The Arellano-Bover/Blundell-Bond estimator improves on the Arellno-Bond estimator by simultaneously estimating both level and difference equations. This requires the additional assumption that first differences of lagged instrumental variables are not correlated with the unobserved heterogeneity but improves efficiency of the estimator by allowing more instruments to be included in the estimation.

Using the Arellano-Bover/Blundell-Bond estimator, the equation for estimating the relationship between female boardroom representation and risk is as follows

$$\begin{aligned}\begin{bmatrix}\Delta\text{Risk}_{i,t}\\ \text{Risk}_{i,t}\end{bmatrix} = \alpha + \beta\begin{bmatrix}\Delta\text{Proportion of Women}_{i,t}\\ \text{Proportion of Women}_{i,t}\end{bmatrix} + \begin{bmatrix}\Delta\mathbf{X}_{i,t}\\ \mathbf{X}_{i,t}\end{bmatrix}\mathbf{\Gamma} \\ + \sum_{s=1}^{p}\delta_s\begin{bmatrix}\Delta\text{Risk}_{t-s}\\ \text{Risk}_{t-s}\end{bmatrix} + \begin{bmatrix}\Delta\varepsilon_{i,t}\\ \eta_i+\varepsilon_{i,t}\end{bmatrix}\end{aligned} \tag{2.3}$$

The top row of the stacked equations is the difference equation where unobserved heterogeneity that is constant across time (η_i) is removed by taking first differences of all dependent and independent variables. Assuming weak-form rational expectations, the residual term ($\Delta\varepsilon_{i,t}$) is uncorrelated with past board characteristics, firm characteristics and risk measures at levels. Formally, I assume that the following orthogonality conditions are valid:-

$$\begin{aligned}\forall p > s : E(\text{Proportion of Women}_{i,t-p}\Delta\varepsilon_{i,t}) = E(\mathbf{X}_{i,t-p}\Delta\varepsilon_{i,t}) \\ = E(\text{Risk}_{i,t-p}\Delta\varepsilon_{i,t}) = 0\end{aligned} \tag{2.4}$$

First differencing can reduce the variation in all the variables, cause weak identification problems and amplify measurement errors (as discussed in Griliches and Hausman, 1986; Beck et al., 2000; Wintoki et al., 2012). The Arellano-Bover/Blundell-Bond estimator alleviates this issue by simultaneously estimating the equation at levels. The level equation is the bottom row of the stacked equation. An additional assumption required is that first differences of lagged instrumental variables are not correlated with the unobserved heterogeneity (η_i). Intuitively, I assume that the correlation between the independent variables (board and firm characteristics) and the unobserved effect is constant over time, a reasonable assumption over a short period of time. Thus, the effect is removed through first differencing of the instrumental variables. Formally, I assume that:-

$$\forall p > s : E\{\Delta \text{Proportion of Women}_{i,t-p}(\eta_i + \varepsilon_{i,t})\} = E\{\Delta \mathbf{X}_{t-p}(\eta_i + \varepsilon_{i,t})\}$$
$$= E\{\Delta \text{Risk}_{i,t-p}(\eta_i + \varepsilon_{i,t})\} = 0 \qquad (2.5)$$

DPS-GMM yields consistent estimates when all the orthogonality conditions in Equations 2.4 and 2.5 are valid, i.e. when past realizations of board characteristics, firm characteristics and risk measures are exogenous to the unexpected component of current risk. Arellano and Bond (1991) suggest two formal tests of this assumption. First, a test of second-order autocorrelation in the idiosyncratic residual term ($\varepsilon_{i,t}$) which is applied to the difference of the residuals ($\Delta\varepsilon_{i,t}$) to remove the fixed effects (η_i). As $\Delta\varepsilon_{i,t}$ is correlated with $\Delta\varepsilon_{i,t-1}$ by construction via $\varepsilon_{i,t-1}$, a significant first-order autocorrelation is expected; thus, higher-order autocorrelations are of interest. A lack of second-order autocorrelation, for instance, means there is no evidence that $\text{Risk}_{i,t-2}$ is an invalid instrument to $\varepsilon_{i,t-1}$ in the residual term. Second, a Hansen test of over-identification tests the null hypothesis that the orthogonality conditions imposed on the estimation are jointly valid. This test is only available in the case where the model is over-identified i.e. when there are more moment conditions than the number of parameters being estimated. This is the case in my estimation as I use more than one lag of past variables as the instrumental variables. Under the null hypothesis, the test statistic, J, is χ^2 distributed around 0 with a degree of freedom equal to the degree of overidentification (Roodman, 2009).

It is important to note that this identification strategy still relies on one rather strong assumption: it assumes that all time-varying factors that can influence female boardroom representation and risk measures are either included in the model or that their influence on female boardroom representation are channeled through past risk measures. A better strategy is to identify the relationship using a truly exogenous instrumental variable for female boardroom representation. However, it is commonly accepted that finding a truly exogenous instrumental variable is challenging. I show in my results some evidence that an instrumental variable that is commonly used in the gender literature (the number of female connections of male directors) is not truly exogenous. Thus, in the absence of a truly exogenous instrument[16], this study identifies the gender-risk relation using DPS-GMM.

[16]Another plausible instrument for gender diversity that has been used in the literature is the state-level gender status equality scores compiled by Sugarman and Straus (1988). Huang and Kisgen (2013) use this variable to instrument for the gender of the firm's CEO and CFO. The data set for this instrument is cross-section. Therefore, it is not suitable for this study which utilizes a combination of instrumental variable estimation and fixed effects

2.4 Data

The sample comprises observations (firm-years) with information available on the RiskMetrics, Compustat, Execucomp and CRSP databases. I obtain director-level data from the RiskMetrics database, which covers Standard & Poor's (S&P) 500, S&P MidCaps and S&P SmallCap firms. I then consolidate the data into firm-level variables. All variables are defined in Table 2.1.

As dependent variables, I use three measures of equity risk: total risk, systematic risk and idiosyncratic risk. Total risk is calculated as the standard deviation of daily stock returns over the last year. Systematic risk is the coefficient of the stock market portfolio from a market-model regression. I use the CRSP NYSE/AMEX/Nasdaq/Arca equally-weighted index as a proxy for the stock market portfolio. Idiosyncratic risk is the standard deviation of the residuals from the market model regression. All returns used for these calculations exclude dividends. To annualize total and idiosyncratic standard deviations, I multiply total and idiosyncratic risks by a square root of 250.

Proportion of women, the key independent variable, is defined as the number of female directors on the board divided by the number of all directors.

As my empirical estimation assumes that the unobserved factors that influence both female boardroom representation and risk measures are constant across time, I rely on prior literature to identify a comprehensive list of control variables in my risk equation. This minimizes the chance that my findings are driven by *time-variant* omitted variable bias.

Various board characteristics are included as control variables[17]. I control

[17] In addition to these board characteristics, average age and tenure of the board can also be important determinants of firm risk (e.g. Berger et al., 2014). As robustness checks (unreported), I include these variables as control variables and find that the results continue to hold.

Table 2.1: Definition of Variables

Variable	Definition
Board Characteristics (Source: RiskMetrics)	
Proportion of Women	Number of female directors divided by number of directors
Board Size	Number of directors on board
Board Independence.	Number of independent directors (as defined by RiskMetrics) divided by number of directors
Director Connectedness	Total number of external board seats held by all directors.
Male Director Connectedness	Total number of external board seats held by all male directors.
Proportion of Male Directors with Board Connections to Women	Number of male directors with board connections to women divided by number of male directors on board. Male directors are defined as having board connections to women when they sit on at least one other board on which there are female directors.
Proportion Of Male External Board Seats with Women	Number of outside directorships of male directors that have at least one female directors divided by total number of outside directorships.
CEO Risk-Taking Incentives (Source: Execucomp)	
CEO Vega	Dollar change in CEO compensation per 0.01 unit increase in a firm's standard deivation of stock returns ($million).
CEO Delta	Dollar change in CEO compensation per 1% increase in stock returns ($million).
CEO Tenure	The duration (years) the current CEO remains in his/her position.
CEO Cash Compensation	Dollar amount of CEO cash compensation ($million).
Firm Characteristics (Source: Compustat)	
Market-to-Book	Market value of total assets divided by the book value of total assets. Market value of total assets is defined as the book value of total assets less the book value of total equity plus share price times the number of shares outstanding.
R&D Expenditures	Research and development expenditures divided by total assets or zero if the data is missing.
Capital Expenditures	Capital expenditures less sale of property divided by total assets.
Leverage	Total liabilities divided by the book value of equity
Ln(Total Assets)	Logarithm of the book value of firm total assets
Return on Assets	Earnings before tax divided by the book value of total assets.
Ln(1+Sales Growth)	Logarithm of current year's sales minus the logarithm of previous year's sales.
Surplus Cash	Net cash flow from operating activities less depreciation and amortization plus research and development expenditures divided by the book value of total assets.
Risk Measures (Source: CRSP)	
Total Risk	Logarithm of square root of 250 times daily return standard deviation.
Systematic Risk	Coefficient of the stock market portfolio return from a market-model regression. CRSP NYSE/AMEX/NASDAQ/Arca equally-weighted index is the market portfolio proxy.
Idiosyncratic Risk	Logarithm of square root of 250 times the residuals from the market model regression.

for board size as decisions made by a large board can lead to compromises and, as a result, less risky outcomes (Sah and Stiglitz, 1986, 1991). I control for board independence as the presence of independent directors can result in a more shareholder-focused board (Fama and Jensen, 1983) which could lead to higher risk-taking. For directors to be classified as independent, they cannot be executives (formerly or presently) and cannot have any other affiliation to the company. I also control for the level of director connectedness (or "busyness"), as proxied by the total number of additional directorships held by all directors. On one hand, directors having many outside directorships may be less able to monitor (e.g. Fich and Shivdasani, 2007). On the other hand, having other directorships is a signal of director ability (e.g. Masulis and Mobbs, 2014). Both explanations suggest a relation between board connectedness and firm value and one channel through which this may affect value can be firm risk.

I also control for various proxies of CEO risk incentives. Firm risk could be responsive to risk sensitivity of CEO compensation; thus, I control for CEO vega as well as delta[18]. Vega is the dollar change in CEO compensation per 0.01 unit increase in a firm's standard deviation of stock returns. Delta is defined as the dollar change in compensation per 1% increase in stock return. The calculation of vega and delta follows Core and Guay (2002) and Coles et al. (2006). These two measures proxy for CEO pay incentives to take risk and generate value, respectively. To control for CEO risk aversion, I also collect the length of tenure and the dollar amount of their cash compensation. Berger et al. (1997) suggest that CEOs with long tenure are more entrenched and avoid risk-taking. The high amount of cash compensation means the CEOs can easily diversify their wealth outside of the firm and thus they are likely to be less risk averse (Guay, 1999). These variables are calculated from Execu-

[18]We thank Lalitha Naveen for providing a program for calculation of compensation incentives and data on her website.

comp data.

Lastly, I control for a number of firm-level characteristics using financial accounting variables obtained from the Compustat database. Firms with larger investment opportunity sets and growth options may take more risk (Guay, 1999); therefore, I include market-to-book ratio, research and development expenditures, capital expenditures and sales growth (in log form) as proxies for investment and growth opportunities.

Existing literature suggests that board characteristics are chosen based on the scope and complexity of the firm, its monitoring needs and the bargaining power of the CEO (e.g. Hermalin and Weisbach, 1998; Coles et al., 2008; Boone et al., 2007; Linck et al., 2008). Therefore, I also control for complexity and life stage of the firm using firm size (as measured by logarithm of the book value of firm's total assets), firm age (in log form) and degree of diversification (as measured by the Herfindahl-Hirschman index of revenue concentration). Firm leverage is a also a proxy for firm complexity and also a determinant of risk. On one hand, higher leverage may lead managers to take more risk as it incentivizes them to transfer wealth from bondholders to shareholders (Leland, 1998). On the other hand, a higher probability of facing financial distress may curb the firm's tendency to engage in risky activities (Friend and Lang, 1988).

I also include profitability and surplus cash as proxies for CEO bargaining power and agency costs (Hermalin and Weisbach, 1998; Jensen, 1986). To alleviate the effect of outliers, all control variables are winsorized at the 1st and 99th percentiles.

The final sample comprises 13,581 observations (firm-years) of 1,960 firms between 1996-2010. To avoid survivorship bias, I do not require a balanced panel. Following prior literature, financial services and utility firms are excluded from my sample[19]. The descriptive statistics of these variables are provided in Table 2.2.

About 63% of firms in the sample have at least one female director. In an average board of nine directors, one director is a women, resulting in the average of 10% female boardroom representation. I observe high variation in firm and CEO characteristics, particularly total assets and CEO delta. To analyze the association between female boardroom representation and these variables, I also calculate the mean of the dependent and control variables from the subsamples categorized by the number of female directors.

I find that female directors are more prevalent in large and independent boards. This is expected as most female directors are appointed as independent directors. I also find that firms with female directors are older, larger and have lower market values relative to their book values – suggesting that mature firms are more likely to appoint female directors. I also see the differences in CEO compensation packages conditional on the number of female directors on the board. However, this could be influenced by the fact that female directors are more likely to be in mature firms. I also observe negative monotonic relations between the number of female directors and all three risk measures. To evaluate whether the difference in risk measures are statistically significant, I conduct a two-sample *t*-test (with unequal variances) between the risk measures of firms with different numbers of female directors. The results (untabulated) reveal that one additional female director tends to result in lower risk. However, the effect generally decreases in both magnitude and statistical significance with the number of female directors already on the board. On average, firms with at least one female director tend to have lower

[19]We analyze a sample of bank holding companies separately in Section 2.5.6.

Table 2.2: Summary Statistics

This table reports summary statistics for the full sample and subsamples by the number of women on board. The sample comprises 13,581 observations (firm-years) from 1,960 firms between 1996-2010. Board characteristics are obtained from the RiskMetrics database. CEO risk-taking incentives are computed using data from Execucomp. Firm characteristics are obtained from Compustat and risk measures are computed using price data from the Center for Research in Security Prices. CEO risk-taking incentives and firm characteristics are winsorized at the 1st and 99th percentile values. All variables are defined in Table 2.1.

	Full Sample							Number of Women on Board						
	Mean	S.D.	Min	p25	p50	p75	Max	0	≥ 1	Diff. (|t|)	1	2	3	4 – 6
Board Characteristics														
Firms with At Least One Women	0.628	0.483	0.000	0.000	1.000	1.000	1.000							
Number of Women	0.938	0.925	0.000	0.000	1.000	1.000	6.000							
Proportion of Women	0.096	0.092	0.000	0.000	0.100	0.143	0.625							
Board Size	9.098	2.386	3.000	7.000	9.000	11.000	23.000	7.665	10.831	(60.797***)	9.392	10.638	11.251	12.506
Board Independence	0.687	0.171	0.000	0.571	0.714	0.833	1.000	0.640	0.743	(25.125***)	0.696	0.737	0.768	0.753
Director Connectedness	5.805	5.920	0.000	2.000	4.000	8.000	48.000	2.961	9.082	(46.417***)	6.490	8.797	9.888	10.976
Male Director Connectedness	5.040	5.119	0.000	1.000	4.000	7.000	39.000	2.961	7.097	(38.393***)	5.755	7.080	7.279	6.792
Proportion of Male Directors with Board Connections to Women	0.290	0.243	0.000	0.111	0.250	0.444	1.000	0.168	0.418	(48.962***)	0.327	0.405	0.464	0.479
CEO Risk-Taking Incentives														
CEO Vega	0.145	0.227	0.000	0.022	0.063	0.164	1.392	0.081	0.247	(25.599***)	0.141	0.222	0.336	0.363
CEO Delta	0.728	1.622	0.000	0.095	0.245	0.641	12.578	0.604	0.961	(6.839***)	0.700	0.959	0.946	1.024
CEO Tenure	6.924	7.513	0.000	2.000	5.000	10.000	54.000	8.121	5.518	(14.399***)	6.654	5.547	5.226	5.976
CEO Cash Compensation	1.218	1.012	0.000	0.605	0.922	1.430	6.092	0.908	1.629	(28.318***)	1.260	1.593	1.790	1.671

(Continued on next page...)

(Table 2.2 Continued)

Firm Characteristics														
Market-to-Book	2.027	1.266	0.753	1.244	1.624	2.314	7.883	2.074	2.019	(3.347***)	1.986	2.036	1.959	1.946
R&D Expenditures	0.046	0.091	0.000	0.000	0.004	0.050	0.596	0.064	0.028	(16.910***)	0.041	0.030	0.022	0.019
Capital Expenditures	0.069	0.111	0.000	0.021	0.038	0.068	0.820	0.086	0.052	(13.474***)	0.064	0.053	0.045	0.046
Leverage	0.215	0.169	0.000	0.062	0.208	0.327	0.767	0.192	0.244	(12.247***)	0.219	0.244	0.237	0.270
Ln(Total Assets)	7.398	1.482	2.819	6.330	7.246	8.325	12.627	6.670	8.299	(47.617***)	7.533	8.184	8.738	8.717
Return on Assets	0.044	0.098	-0.508	0.020	0.054	0.091	0.246	0.033	0.055	(9.619***)	0.047	0.054	0.059	0.058
Ln(1+Sales Growth)	0.090	0.237	-3.656	0.001	0.082	0.177	3.114	0.116	0.061	(9.692***)	0.084	0.063	0.052	0.058
Surplus Cash	0.092	0.097	-1.216	0.038	0.082	0.136	0.966	0.091	0.090	(0.444)	0.093	0.091	0.089	0.082
Net PP&E	0.283	0.215	0.014	0.116	0.224	0.398	0.889	0.272	0.286	(4.425***)	0.291	0.286	0.289	0.288
Dividends	0.527	0.499	0.000	0.000	1.000	1.000	1.000	0.356	0.722	(31.874***)	0.569	0.704	0.768	0.839
Firm Age	25.975	16.170	2.000	12.000	21.000	40.000	60.000	19.537	33.698	(37.536***)	27.329	32.751	37.456	36.589
Diversification	0.718	0.406	0.000	0.461	0.745	1.000	1.000	0.770	0.640	(11.350***)	0.718	0.640	0.630	0.674
Risk Measures														
Total Risk	0.451	0.214	0.108	0.303	0.400	0.545	3.061	0.516	0.388	(27.692***)	0.429	0.393	0.372	0.372
Systematic Risk	1.276	0.644	-0.555	0.839	1.186	1.600	5.126	1.452	1.091	(25.099***)	1.222	1.116	1.003	0.986
Idiosyncratic Risk	0.393	0.191	0.097	0.262	0.348	0.476	3.041	0.453	0.333	(28.915***)	0.373	0.337	0.317	0.319
S.D.(ROA)	0.055	0.094		0.015	0.028	0.058		0.068	0.041	(10.002***)	0.051	0.041	0.039	0.040
Observations	13,581							5,056	8,525		5,228	2,603	526	168
% of Full Sample	100%							37%	63%		38%	19%	4%	1%

total, systematic and idiosyncratic risk compared to firms without any female directors. Again, the univariate results cannot rule out the possibility that the relationship between female boardroom presentation and risk are influenced by other board and firm characteristics.

Empirical specifications that only exploit within-firm variation such as DPS-GMM and fixed effects may lead to hypothesis tests that are extremely underpowered when there is little time-series variation in the data. In Table 2.3, I show the proportion of firms in my sample that change their board composition in each year. On average, about 11% of the sample firms appoint or terminate female directors on their boards each year. In the whole sample period, about 40% of the firms experience a change in number of women directors on board at least once. The variation is much higher when I look at the change in the proportion of women on board, which is the measure I use in my GMM and fixed effects results. Between 29% and 38% of the firms experience a change in the proportion of women on board (33% on average). More than half of the firms in my sample (55%) change their level of gender diversity at least once by the end of the sample period. As comparisons, I also tabulate the change in board size and board independence, which average at 40% and 53% respectively. Although the change in gender diversity is lower than these two other board characteristics, the frequency of changes is still not negligible. This can alleviate some concerns that the DPS-GMM results are affected by the lack of time-series variation.

Table 2.3: Change in Board Variables Over Time

This table displays the proportion of firms in the sample that change their number of women on board, proportion of women on board, board size and board independence over any one-year period between 1996-2010. The results are based on a sample of 1,960 firms (13,581 firm-years) from the RiskMetrics database.

	Change in				
Year	Number of Women	Proportion of Women	Board Size	Board Independence	# Firms (Firm-Years)
1997	7.61%	29.39%	37.24%	50.23%	854
1998	9.61%	30.60%	40.69%	54.80%	843
1999	9.72%	29.86%	36.46%	51.85%	864
2000	11.58%	29.98%	38.74%	52.38%	924
2001	11.86%	30.21%	39.69%	54.02%	970
2002	11.46%	31.48%	40.25%	52.63%	969
2003	13.60%	35.38%	45.30%	60.22%	978
2004	14.24%	36.18%	45.15%	59.39%	948
2005	13.06%	36.72%	43.79%	56.00%	934
2006	12.60%	37.53%	42.82%	55.96%	738
2007	10.49%	28.54%	32.53%	46.07%	953
2008	12.63%	35.11%	41.68%	49.08%	974
2009	11.24%	34.95%	43.61%	50.62%	970
2010	10.80%	32.82%	37.35%	44.55%	972
Average	11.46%	32.77%	40.38%	52.70%	921
1997-2010					
Percentage of Firms	40.26%	54.59%	74.80%	80.36%	1,960
Percentage of Firm-Years	10.92%	31.09%	38.34%	49.97%	(13,581)

2.5 Results

2.5.1 Does risk affect the appointment of female directors?

I argue that the dynamic model presented in this paper is suitable for estimating the relationship between female boardroom representation and risk due to the presence of both unobserved heterogeneity and the influence of past risk on the gender of appointed directors. To test whether this is the case, I focus on the firm-year observations where at least one director is appointed and conduct a Probit estimation as per Equation 2.6 below.

$$\Pr(\text{Female Appointment}_{i,t} = 1) = \mathbf{\Phi}(\alpha_0 + \alpha_1 \text{Risk}_{i,t-1} + \boldsymbol{X}_{i,t-1}\mathbf{\Gamma} + \varepsilon_{i,t}) \qquad (2.6)$$

The dependent variable, *female appointment*, is a dummy variable which is set to 1 when the appointed director is a woman and 0 otherwise. Here the probability of a female director appointment is modeled as normally distributed. The cumulative probability (denoted by Φ) can be explained by past risk measures and a number of other variables as guided by prior literature. Lack of access to what are predominantly all-male networks is widely seen as one reason for the low number of female directors (Medland, 2004; Adams and Ferreira, 2009). In each board, I measure the extent of connectedness between male directors and female directors in other firms. I control for the proportion of male directors with board connections with women i.e. sitting on the same board with at least one female director in other firms. The more male directors have experience working with female directors in other firms, the higher the likelihood that women would be brought onto the board that male directors currently sit on. On average, 29% of male directors sit on the same board as female directors in other firms. To measure the tendency of firms to maintain the status quo with regards to gender diversity, I include two additional dummy variables in the model – *women departing the board* and *men departing the board*. I also include the proportion of women already on the board. Similar to Farrell and Hersch (2005) and Gregory-Smith et al. (2014), I control for board size and board independence. I also include firm-level determinants of board structure as documented by prior literature (Linck et al., 2008; Coles et al., 2008).

Focusing on those firm-years where at least one director is appointed, I obtain 7,101 observations. Table 2.4 displays the results. There is evidence that firm risk influences the gender choice in director appointments. The coefficient on the logarithm of the standard deviation of stock returns is negative and significant at the 5% level.

The negative coefficient in my results suggests that riskier firms are less likely to appoint female directors. This rules out the possibility that female directors are appointed to the board to increase its monitoring intensity as it would mean a higher likelihood of female director appointments when uncertainty surrounding the firm is high (i.e. a positive coefficient). Two possible explanations for the negative coefficient are group homogeneity (more male-dominated boards are prevalent under high-uncertainty environments (Kanter, 1977)) and self-selection (female directors select less risky firms (Farrell and Hersch, 2005)). To distinguish between these two explanations, I calculate the marginal effects of an increase in the log of total risk for an average firm with different levels of female boardroom representation.

Figure 2.1 reveals that the effect of risk on gender decreases with more female directors. This supports the group homogeneity argument. This is because the first female director will disrupt group homogeneity with a greater effect than the second female director. Self-selection does not explain the

Table 2.4: Determinants of Gender in Director Appointments

The dependent variable, *Female Appointment*, is a dummy variable which equals one when women directors are appointed and zero otherwise. Columns 1-2 reports results from probit regressions and Columns 3-4 reports results from a linear probability model with firm-level fixed effects. Marginal effects are reported in squared brackets. The sample includes all firm-years where at least one director is appointed. Cluster-robust standard errors are reported in parentheses. All independent variables are lagged by one period. All specifications include year fixed effects. Columns 1-2 include industry fixed effects based on two-digit NAICS code. Intercepts are included but not reported. *, **, *** denote statistical significance at 10%, 5% and 1% respectively.

Dependent Variable =	Female Appointment					
	Probit				Fixed Effects	
	(1)		(2)		(3)	(4)
Total Risk	−0.168**	[−0.045]			−0.060*	
	(0.073)				(0.035)	
Systematic Risk			−0.041	[−0.011]		0.007
			(0.045)			(0.019)
Idiosyncratic Risk			−0.112	[−0.030]		−0.072*
			(0.085)			(0.037)
Women Departing the Board	0.688***	[0.184]	0.688***	[0.184]	0.237***	0.237***
	(0.068)		(0.068)		(0.027)	(0.027)
Men Departing the Board	−0.049	[−0.013]	−0.050	[−0.013]	−0.011	−0.010
	(0.041)		(0.041)		(0.015)	(0.015)
Proportion of Male Directors with	0.229**	[0.061]	0.230**	[0.062]	0.037	0.037
Board Connections to Women	(0.104)		(0.104)		(0.056)	(0.056)
Proportion of Women	−2.721***	[−0.728]	−2.726***	[−0.729]	−3.401***	−3.398***
	(0.325)		(0.324)		(0.159)	(0.158)
Board Size	0.011	[0.002]	0.011	[0.002]	−0.023***	−0.023***
	(0.011)		(0.011)		(0.007)	(0.007)
Board Independence	0.156	[0.042]	0.156	[0.042]	0.110	0.111
	(0.130)		(0.130)		(0.073)	(0.073)
Ln(Total Assets)	0.079***	[0.021]	0.081***	[0.022]	0.063**	0.061**
	(0.019)		(0.019)		(0.026)	(0.026)
Market-to-Book	0.039**	[0.010]	0.041**	[0.011]	0.010	0.009
	(0.018)		(0.018)		(0.009)	(0.009)
R&D Expenditures	−0.356	[−0.095]	−0.340	[−0.091]	−0.162	−0.173
	(0.315)		(0.316)		(0.226)	(0.225)
Capital Expenditures	−0.311	[−0.083]	−0.302	[−0.081]	−0.054	−0.064
	(0.242)		(0.243)		(0.121)	(0.122)
Leverage	−0.034	[−0.009]	−0.038	[−0.010]	−0.089	−0.086
	(0.139)		(0.139)		(0.079)	(0.079)
Return on Assets	−0.105	[−0.028]	−0.112	[−0.030]	−0.110	−0.111
	(0.266)		(0.266)		(0.107)	(0.107)
Observations	7,101		7,101		7,101	7,101
Firms	1,506		1,506		1,506	1,506
R^2	0.059		0.059		0.401	0.401

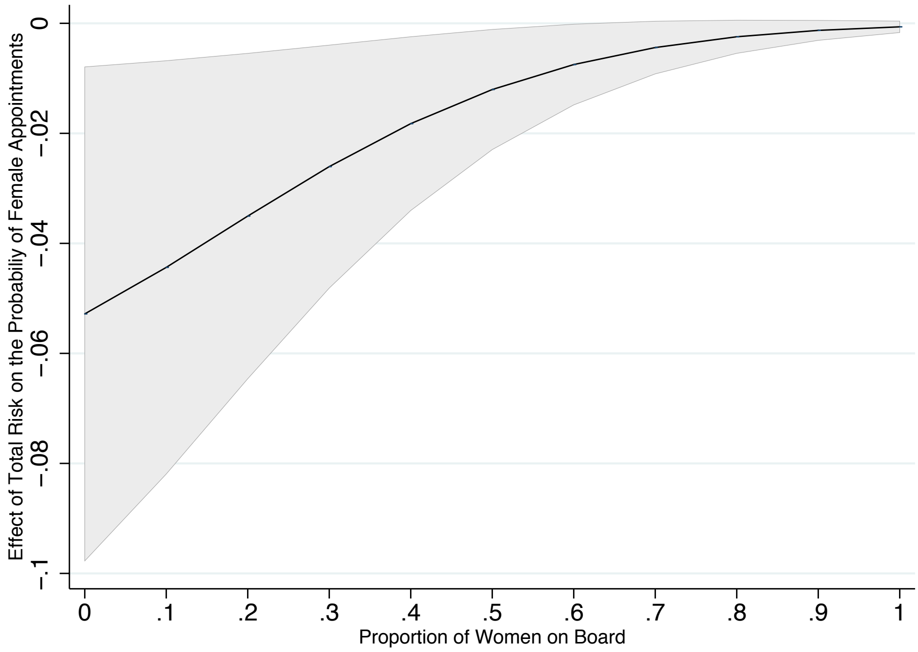

Figure 2.1: Marginal Effects of Risk on Female Director Appointment

This figure illustrates the marginal effects of log total risk on the probably that the appointed directors are women, conditional on the proportion of female directors on board. The area indicates 95% confidence interval.

marginally decreasing risk effects linked to increases in the proportion of female directors. If female directors were to self-select into lower risk firms, the choice should not be dependent on how many female directors are already on the board. One may argue, however, that female directors are more inclined to sit on boards in which there already are female directors. Yet, this is not consistent with the negative and significant coefficient for the proportion of female directors who already sit on the board.

The economic effect of risk on the probability of appointing a female director is small. For an average firm, 100% increase in total risk is associated with only a 4.50% decrease in the probability that female directors are appointed. In addition, when I use the systematic and idiosyncratic components of firm risk, there is no evidence that these two risk components affect the probability that a female director is appointed. Overall, the evidence is only suggestive of the possibility that risk affects the gender choice. Nonetheless, the presence of some relationship means I cannot rule out the possibility of reverse causality when testing whether female boardroom representation affects firm risk.

To rule out the possibility that the relation between risk and appointment is caused by other time-invariant factors not included in the model, I also estimate Models 1-2 using a linear probability model with firm-level fixed effects and find that the coefficient for total risk remains significant. The coefficient for idiosyncratic risk also becomes significant but only at 10% level.

The remaining results serve as evidence that there is a gender bias in the director appointment process. I find that firms are less likely to appoint female directors if they already have a high proportion of female directors on their board, which could suggest tokenism. Networking plays a role as postulated by Adams and Ferreira (2009): the presence of male directors who are more connected with female directors in other firms is associated with a higher probability that a female director is appointed. I also find evidence for a recruitment bias in favor of the status quo: women are more likely to be appointed when female directors departed the firm in the previous period. In contrast, the probability of a female director appointment is lower after a male director departed the board (although this is not statistically significant at conventional levels). Overall, my results demonstrate that board appointments are not gender neutral and show some evidence consistent with tokenism whereby boards seek to maintain a certain representation of women on boards without allowing an equal opportunity of appointment to board positions.

2.5.2 Does female boardroom representation affect firm risk?

2.5.2.1 Dynamic panel GMM estimation

Considering the evidence that past risk influences the choice of selecting women into the boardroom, I proceed with the estimation of the dynamic model in Equation 2.2. In my baseline results, I include two lags of risk measures in the model as use two further lags as instruments.

The results from DPS-GMM are reported in Table 2.5. I find no evidence in support of the view that female directors reduce equity risk. None of the coefficients for *female* are statistically significant. In addition, these coefficients are too small to have any economic impact. For example, a 10% increase in female boardroom representation, which is approximately equivalent to appointing one female director to an average-sized board of nine directors, would lead to a 0.0031 unit increase in stock return beta. This is very small considering that the average systematic risk in my sample is 1.276.

In this table, I also report the results of the two specification tests – the Hansen test of overidentifying restrictions and the autocorrelation test. The null hypothesis for the Hansen test is that all orthogonality conditions specified in the model are valid; that is, past values of board characteristics, firm characteristics and risk measures are exogenous. The Hansen J statistics are χ^2 distributed with 38 degress of freedom. The p-values are 0.231, 0.539 and 0.196 respectively for total, systematic and idiosyncratic risk measures. This implies that the past information I use as instrumental variables are not related to the unexpected change in risk. The AR(2) tests yield p-values of 0.284, 0.303 and 0.901, which also suggests no evidence of second-order autocorrelation in the residuals. Overall, the specification tests reveal no evidence that the instruments used in identifying the relationship between female boardroom representation and all three risk measures are endogenous.

2.5.2.2 Robustness checks

Our baseline results include two lags of the risk measures in the model and use two further lags of risk measures and other variables as the instrumental variables. The choice of lag length is made as a result of a trade-off between exogeneity and identification. The included lag must be long enough to ensure that the model is dynamically complete such that further information in the past is not related to the expectational error in the data. Yet information too long in the past may not be sufficiently relevant to identify the parameters.

As robustness checks, I estimate the models similar to those in Table 2.5 but include only one lag of past risk (see Panel A of Table 2.6). Although the inference is identical, i.e. there is no significant relation between the proportion of women and my risk measures, Hansen overidentification tests reject the null hypothesis that the instrumental variables are exogenous and AR(2)

Table 2.5: Risk Measures on Female Boardroom Representation (Dynamic Panel System GMM)

This table reports two-step Dynamic Panel System GMM estimations of risk measures on the proportion of women on board and control variables. All models include year dummy variables. All independent variables are treated as endogenous except *Ln(1+Firm Age)* and year dummy variables. Endogenous variables are instrumented by two of their past values. In parentheses are finite-sample robust standard errors (Windmeijer, 2005). The null hypothesis for the Hansen test of overidentification is that all instruments are exogenous. AR(1) and AR(2) are test statistics for the null hypothesis that there is no serial correlation of order 1 and 2 in the first-difference residuals. * , ** , *** denote statistical significance at 10%, 5% and 1% respectively.

Risk Measure =	Total Risk (1)	Systematic Risk (2)	Idiosyncratic Risk (3)
Proportion of Women	0.075	−0.743	0.134
	(0.157)	(0.566)	(0.168)
Board Size	0.018*	0.023	0.015
	(0.011)	(0.034)	(0.012)
Board Independence	0.169	0.482	0.062
	(0.132)	(0.403)	(0.147)
Director Connectedness	−0.004	−0.016	−0.004
	(0.004)	(0.013)	(0.004)
CEO Vega	−0.065	−0.036	−0.098
	(0.068)	(0.245)	(0.070)
CEO Delta	0.016	0.024	0.008
	(0.015)	(0.045)	(0.016)
CEO Tenure	0.002	−0.008	0.003
	(0.002)	(0.006)	(0.002)
CEO Cash Compensation	−0.036*	0.081	−0.005
	(0.022)	(0.066)	(0.022)
Market-to-Book	0.039	0.139	0.037
	(0.029)	(0.095)	(0.030)
R&D Expenditures	0.234	−0.527	0.277
	(0.419)	(0.928)	(0.424)
Capital Expenditures	−0.246	−0.090	−0.279
	(0.261)	(0.683)	(0.297)
Ln(1+Sales Growth)	0.147*	0.178	0.078
	(0.081)	(0.196)	(0.085)
Leverage	−0.232**	−0.824**	−0.201**
	(0.098)	(0.342)	(0.102)
Ln(Total Assets)	−0.039*	−0.068	−0.043**
	(0.021)	(0.053)	(0.022)
Ln(1+Firm Age)	0.046**	−0.021	0.022
	(0.021)	(0.056)	(0.023)
Diversification	0.184	−0.240	0.172
	(0.119)	(0.199)	(0.111)
Return on Assets	−1.443***	−0.326	−1.708***
	(0.409)	(0.784)	(0.438)
Surplus Cash	−0.448	−2.384**	−0.247
	(0.491)	(1.166)	(0.459)
Risk Measure (Lag 1)	0.451***	0.281	0.512***
	(0.114)	(0.178)	(0.130)
Risk Measure (Lag 2)	0.163*	0.264*	0.046
	(0.091)	(0.136)	(0.099)
Observations	8,629	8,629	8,629
Firms	1,960	1,960	1,960
Hansen (df=38)	44.032	36.489	45.202
AR(1)	−4.557***	−2.365**	−4.549***
AR(2)	−1.072	−1.029	0.124

tests suggest that the residuals are serially correlated when only one lag of risk is included. This indicates that one lag of past risk is insufficient in capturing the dynamic relations between risk and my independent variables.

In Panel B and C, I estimate the models using three and four lags of risk variables respectively and obtain similar results. The specification tests show no evidence that the instruments are correlated with the residuals nor is there any serial correlation remaining in the residuals. I also replicate my analysis on data sampled every two years (Panel D and E). Reducing sampling frequency can reduce serial correlation in the residuals although it also reduces the sample size and, consequently, test power. Both these results confirm my earlier findings that there is no statistically significant relation between the proportion of women and any of my equity risk measures.

2.5.2.3 Distinguishing the sources of endogeneity

The inferences from DPS-GMM suggest no relationship between female boardroom representation and any of the three equity risk measures. However, the summary statistics suggest that female directors are more prevalent in lower risk firms. I analyze further why this is the case. There are three alternative explanations. The first explanation is that the inverse relationship is driven by other observed factors such as board size, firm size or the level of CEO compensation. The second explanation is that the relationship is driven by other unobserved factors such as corporate culture or managerial ability. The third explanation is that it is risk that influences female boardroom representation.

We distinguish between these three sources of endogeneity by estimating a static model between female boardroom representation and risk using two estimators: OLS and a fixed effects estimator. Both estimators would yield bi-

Table 2.6: Dynamic Panel System GMM Robustness Checks

This table reports two-step Dynamic Panel System GMM estimations of risk measures on the proportion of women on board and other control variables. The specifications are identical to the models presented in Table 2.5 except Panels A, B and C include one, three and four lags of the dependent variable as control variables instead of two lags. Panel D shows two-lag estimations based on a subsample of data from 1996, 1998, ... 2008 and 2010. Panel E uses male director connectedness as a control variable instead of director connectedness. All independent variables are treated as endogenous except *Ln(1+Firm Age)* and year dummy variables. Endogenous variables are instrumented by two of their past values. In parentheses are finite-sample robust standard errors (Windmeijer, 2005). The null hypothesis for the Hansen Overidentification test is that all instruments are exogenous. AR(1) and AR(2) are test statistics for the null hypothesis that there is no serial correlation of order 1 and 2 in the first-difference residuals. * , ** , *** denote statistical significance at 10%, 5% and 1% respectively.

	(A) One Lag of Risk Measures			(B) Three Lag of Risk Measures		
Risk Measure =	Total Risk	Systematic Risk	Idiosyncratic Risk	Total Risk	Systematic Risk	Idiosyncratic Risk
Proportion of Women	-0.064	-0.164	-0.145	0.123	-0.323	0.097
	(0.119)	(0.242)	(0.127)	(0.361)	(0.554)	(0.392)
Board Size	-0.002	0.008	-0.007	0.005	0.007	-0.000
	(0.008)	(0.016)	(0.008)	(0.018)	(0.034)	(0.020)
Board Independence	0.096	0.311	-0.021	-0.256	0.031	-0.606^{***}
	(0.092)	(0.192)	(0.094)	(0.215)	(0.372)	(0.222)
Dir. Connectedness	-0.001	-0.010^{*}	0.002	-0.009	-0.013	-0.004
	(0.003)	(0.006)	(0.003)	(0.007)	(0.012)	(0.008)
CEO Vega	-0.163^{***}	-0.331^{***}	-0.155^{***}	-0.259^{*}	-0.196	-0.357^{**}
	(0.051)	(0.098)	(0.052)	(0.147)	(0.243)	(0.167)
CEO Delta	0.012	0.031	0.012	0.057^{*}	0.036	0.057
	(0.009)	(0.021)	(0.009)	(0.034)	(0.050)	(0.035)
CEO Tenure	0.000	0.000	0.000	0.000	-0.007	0.005
	(0.001)	(0.003)	(0.001)	(0.004)	(0.007)	(0.004)
CEO Cash Comp.	0.003	0.029	0.017	0.042	0.076	0.051
	(0.015)	(0.037)	(0.014)	(0.031)	(0.057)	(0.035)
Market-to-Book	0.086^{***}	0.117^{***}	0.078^{***}	0.043	0.192^{*}	0.034
	(0.016)	(0.034)	(0.017)	(0.046)	(0.104)	(0.044)
R&D Expenditures	-0.829^{**}	-0.684	-0.911^{**}	0.980^{*}	0.295	1.164^{*}
	(0.405)	(0.802)	(0.441)	(0.574)	(1.101)	(0.603)
Capital Expenditures	0.123	1.000^{**}	-0.040	-0.234	-0.197	-0.783
	(0.191)	(0.413)	(0.209)	(0.432)	(0.663)	(0.527)
Leverage	0.168^{**}	-0.022	0.194^{**}	-0.427^{*}	-0.892^{**}	-0.425
	(0.079)	(0.153)	(0.081)	(0.229)	(0.365)	(0.261)
Ln(Total Assets)	-0.039^{**}	-0.014	-0.040^{**}	-0.052	-0.058	-0.033
	(0.016)	(0.033)	(0.018)	(0.036)	(0.054)	(0.043)
Return on Assets	-1.624^{***}	-2.459^{***}	-1.303^{***}	-0.261	1.000	-0.307
	(0.314)	(0.840)	(0.325)	(0.506)	(1.059)	(0.523)
Ln(1+Sales Growth)	0.040	-0.078	0.014	0.018	0.167	-0.016
	(0.043)	(0.086)	(0.047)	(0.116)	(0.230)	(0.125)
Surplus Cash	0.332	1.187	-0.157	-1.460^{**}	-3.669^{**}	-1.884^{***}
	(0.343)	(0.972)	(0.332)	(0.600)	(1.622)	(0.578)
Diversification	-0.031	-0.015	-0.047	-0.124	-0.370^{*}	-0.147
	(0.024)	(0.063)	(0.030)	(0.144)	(0.217)	(0.116)
Ln(1+Firm Age)	-0.006	0.056	-0.044^{**}	0.066^{*}	-0.009	0.017
	(0.018)	(0.038)	(0.020)	(0.037)	(0.062)	(0.039)
Risk Measure (Lag 1)	0.557^{***}	0.655^{***}	0.541^{***}	0.294^{*}	0.237	0.103
	(0.041)	(0.051)	(0.046)	(0.164)	(0.162)	(0.138)
Risk Measure (Lag 2)				-0.101	0.204	-0.032
				(0.164)	(0.129)	(0.157)
Risk Measure (Lag 3)				0.414^{***}	0.059	0.453^{***}
				(0.143)	(0.111)	(0.156)
Observations	10,859	10,859	10,859	6,802	6,802	6,802
Firms	1,960	1,960	1,960	1,960	1,960	1,960
Hansen	71.059^{***}	76.001^{***}	61.855^{***}	46.860	36.113	46.882
AR(1)	-13.517^{***}	-12.920^{***}	-13.564^{***}	-3.945^{***}	-3.535^{***}	-4.110^{***}
AR(2)	2.193^{**}	4.067^{***}	2.723^{***}	1.458	-0.642	0.843

(Continued on next page...)

(Table 2.6 continued)

Risk Measure =	(C) Four Lags of Risk Measures Total Risk	Systematic Risk	Idiosyncratic Risk	(D) Sample from 1996,1998,..., 2010 Total Risk	Systematic Risk	Idiosyncratic Risk
Proportion of Women	−0.031	−0.150	−0.020	0.048	−0.871	0.040
	(0.367)	(0.500)	(0.401)	(0.405)	(0.804)	(0.422)
Board Size	0.016	0.020	0.010	−0.018	−0.009	−0.031
	(0.019)	(0.032)	(0.021)	(0.020)	(0.045)	(0.021)
Board Independence	−0.308	0.136	−0.557**	−0.555**	−0.163	−0.780***
	(0.217)	(0.349)	(0.233)	(0.250)	(0.509)	(0.256)
Dir. Connectedness	−0.008	−0.012	−0.003	0.003	−0.030*	0.008
	(0.007)	(0.012)	(0.008)	(0.007)	(0.016)	(0.008)
CEO Vega	−0.156	−0.224	−0.243	−0.276*	−0.707**	−0.268
	(0.150)	(0.219)	(0.170)	(0.149)	(0.321)	(0.164)
CEO Delta	0.054	0.037	0.060	0.035	0.049	0.030
	(0.035)	(0.045)	(0.038)	(0.039)	(0.069)	(0.036)
CEO Tenure	0.001	−0.002	0.006	−0.005	−0.010	−0.006
	(0.004)	(0.006)	(0.004)	(0.004)	(0.009)	(0.004)
CEO Cash Comp.	0.048	0.047	0.058*	0.017	0.082	0.026
	(0.029)	(0.050)	(0.035)	(0.037)	(0.077)	(0.038)
Market-to-Book	0.046	0.107	0.025	0.124***	0.324***	0.079*
	(0.041)	(0.087)	(0.042)	(0.044)	(0.087)	(0.045)
R&D Expenditures	0.775	0.169	0.913*	1.921**	4.687***	1.948**
	(0.501)	(0.969)	(0.530)	(0.754)	(1.732)	(0.795)
Capital Expenditures	−0.405	−0.135	−0.903	−0.279	0.431	−0.467
	(0.464)	(0.656)	(0.571)	(0.475)	(1.047)	(0.509)
Leverage	−0.480**	−0.806**	−0.418	−0.183	0.245	−0.081
	(0.235)	(0.335)	(0.264)	(0.281)	(0.576)	(0.297)
Ln(Total Assets)	−0.076**	−0.057	−0.064	−0.061	0.017	−0.047
	(0.035)	(0.049)	(0.041)	(0.042)	(0.084)	(0.042)
Return on Assets	−0.419	0.428	−0.580	0.148	0.800	−0.018
	(0.582)	(0.772)	(0.619)	(0.539)	(1.101)	(0.546)
Ln(1+Sales Growth)	0.056	0.232	0.036	0.305**	0.713**	0.299*
	(0.106)	(0.230)	(0.117)	(0.139)	(0.290)	(0.158)
Surplus Cash	−1.564***	−1.731	−1.845***	−1.702***	−3.694***	−1.598***
	(0.559)	(1.074)	(0.530)	(0.530)	(1.042)	(0.533)
Diversification	−0.112	−0.325*	−0.108	−0.111	−0.355	−0.063
	(0.136)	(0.178)	(0.118)	(0.129)	(0.286)	(0.148)
Ln(1+Firm Age)	0.050	0.051	0.004	0.075	0.131	0.031
	(0.044)	(0.062)	(0.046)	(0.047)	(0.099)	(0.048)
Risk Measure (Lag 1)	0.280*	0.404***	0.057	0.324***	0.334***	0.316**
	(0.151)	(0.143)	(0.134)	(0.104)	(0.084)	(0.128)
Risk Measure (Lag 2)	−0.064	0.066	0.090	0.044	−0.112	0.019
	(0.166)	(0.137)	(0.160)	(0.109)	(0.113)	(0.121)
Risk Measure (Lag 3)	0.435***	−0.013	0.461***			
	(0.133)	(0.105)	(0.149)			
Risk Measure (Lag 4)	−0.106	0.144*	−0.135			
	(0.121)	(0.082)	(0.128)			
Observations	5,296	5,296	5,296	3,087	3,087	3,087
Firms	1,960	1,960	1,960	1,960	1,960	1,960
Hansen	46.554	39.420	46.580	47.623	48.087	39.203
AR(1)	−3.955***	−3.309***	−3.525***	−4.480***	−4.462***	−4.070***
AR(2)	1.421	−0.092	0.017	−0.996	0.448	−0.605

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(Table 2.6 continued)

	(E) Sample from 1997, 1999, ..., 2009			(F) Male Director Connectedness		
Risk Measure =	Total Risk	Systematic Risk	Idiosyncratic Risk	Total Risk	Systematic Risk	Idiosyncratic Risk
Proportion of Women	0.400	0.830	0.306	0.054	−0.865	0.115
	(0.605)	(1.170)	(0.621)	(0.161)	(0.586)	(0.172)
Board Size	0.021	−0.111	0.028	0.017	0.022	0.013
	(0.034)	(0.072)	(0.031)	(0.011)	(0.034)	(0.012)
Board Independence	−0.104	−0.989	0.037	0.152	0.498	0.041
	(0.409)	(0.753)	(0.367)	(0.130)	(0.409)	(0.144)
Dir. Connectedness	0.018	0.045**	0.020	−0.004	−0.016	−0.004
	(0.012)	(0.022)	(0.013)	(0.004)	(0.014)	(0.004)
CEO Vega	−0.050	−0.072	−0.123	−0.061	−0.063	−0.090
	(0.212)	(0.420)	(0.206)	(0.069)	(0.253)	(0.070)
CEO Delta	−0.017	0.018	−0.012	0.017	0.021	0.009
	(0.033)	(0.073)	(0.029)	(0.015)	(0.046)	(0.016)
CEO Tenure	−0.002	−0.000	0.002	0.002	−0.008	0.003
	(0.009)	(0.016)	(0.009)	(0.002)	(0.006)	(0.002)
CEO Cash Comp.	−0.102***	−0.156**	−0.085**	−0.038*	0.076	−0.007
	(0.035)	(0.066)	(0.036)	(0.022)	(0.067)	(0.022)
Market-to-Book	0.050	−0.123	0.049	0.034	0.141	0.032
	(0.065)	(0.133)	(0.058)	(0.029)	(0.095)	(0.030)
R&D Expenditures	−0.410	0.819	−0.364	0.231	−0.601	0.282
	(0.625)	(1.507)	(0.649)	(0.419)	(0.938)	(0.430)
Capital Expenditures	0.876	0.691	0.784	−0.248	−0.141	−0.267
	(0.607)	(1.058)	(0.627)	(0.264)	(0.696)	(0.301)
Leverage	0.740**	0.455	0.822**	−0.239**	−0.794**	−0.210**
	(0.335)	(0.565)	(0.347)	(0.098)	(0.342)	(0.102)
Ln(Total Assets)	−0.052	0.039	−0.078*	−0.041*	−0.057	−0.047**
	(0.045)	(0.085)	(0.046)	(0.021)	(0.051)	(0.022)
Return on Assets	−2.070***	−4.164**	−1.419*	−1.431***	−0.344	−1.684***
	(0.733)	(1.725)	(0.789)	(0.406)	(0.782)	(0.436)
Ln(1+Sales Growth)	0.401*	0.160	0.234	0.152*	0.178	0.084
	(0.227)	(0.353)	(0.237)	(0.081)	(0.196)	(0.085)
Surplus Cash	0.359	2.736**	0.424	−0.412	−2.371**	−0.224
	(0.650)	(1.306)	(0.681)	(0.484)	(1.195)	(0.452)
Diversification	0.058	−0.062	0.062	0.193	−0.222	0.180
	(0.153)	(0.274)	(0.159)	(0.118)	(0.202)	(0.110)
Ln(1+Firm Age)	0.003	0.166**	−0.038	0.050**	−0.032	0.027
	(0.044)	(0.083)	(0.046)	(0.021)	(0.057)	(0.024)
Risk Measure (Lag 1)	0.591***	0.459***	0.550***	0.465***	0.280	0.523***
	(0.138)	(0.108)	(0.145)	(0.113)	(0.182)	(0.130)
Risk Measure (Lag 2)	0.067	0.185	0.032	0.157*	0.264*	0.041
	(0.161)	(0.122)	(0.180)	(0.091)	(0.139)	(0.099)
Observations	2,972	2,972	2,972	8,629	8,629	8,629
Firms	1,960	1,960	1,960	1,960	1,960	1,960
Hansen Overidentification	30.826	31.570	24.008	43.969	36.846	45.052
AR(1)	−3.819***	−3.408***	−3.664***	−4.567***	−2.318***	−4.557***
AR(2)	−0.117	−1.420	0.039	−1.004	−1.013	0.174

ased estimates under the presence of unobserved heterogeneity and/or reverse causality. However, they can be useful in identifying what causes the negative relation observed in the data. On one hand, if the relationship is driven by other factors that can be observed in the sample, OLS estimates would yield no significant relation between the proportion of women and risk measures once these observable factors are included. On the other hand, if it is unobserved factors that influence the relation, their influences should be captured by the fixed effects. The results obtained from the fixed effects estimator would still be asymptotically biased by the influence of past risk. However, the magnitude of the estimation bias would depend on the strength of the influence of past risk on current female boardroom representation.

Table 2.7 reports the OLS and fixed effects results. The OLS results (Columns 1-3) show negative and significant relationships between the proportion of women on board and total risk as well as systematic risk. The coefficients are also much larger in magnitude compared to the DPS-GMM results in Table 2.5. In the case of systematic risk for example, a 10% increase in female boardroom representation is associated with 0.035 unit decrease in the market model beta. The statistically significant relation remains even after controlling for the determinants of equity risk documented in the literature. The fixed effects results (Columns 4-6) on the other hand show no significant relationship between the proportion of women and any of the three risk measures. All three coefficients are much closer to zero compared to the OLS results whereas the standard errors remain similar for both sets of results. The comparison between OLS and fixed effects results suggests that the negative relationships come from unobservable sources of firm heterogeneity. The fixed effects estimator, which uses only within-firm variation to identify the parameters, are not susceptible to unobserved differences between the firms; therefore, the fixed effects estimates are not subject to the same bias that drives the negative

Table 2.7: Risk Measures on Female Boardroom Representation (OLS and Firm-Level Fixed Effects)

This table reports ordinary least squares (OLS) and firm-level fixed effects estimations of risk measures on proportion of women and control variables. Cluster-robust standard errors are reported in parentheses. All models include year dummy variables. OLS models also include industry dummy variables based on two-digit NAICS code. Within-cluster heteroskedasticity and serial correlation robust standard errors are reported in parentheses. Intercepts are included but not reported. * , ** , *** denote statistical significance at 10%, 5% and 1% respectively.

	Panel A: Ordinary Least Squares			Panel B: Firm-level Fixed Effects		
Risk Measure =	Total Risk	Systematic Risk	Idiosyncratic Risk	Total Risk	Systematic Risk	Idiosyncratic Risk
Proportion of Women	−0.123**	−0.351***	−0.085	0.032	−0.030	0.056
	(0.052)	(0.089)	(0.053)	(0.065)	(0.121)	(0.065)
Board Size	−0.015***	−0.030***	−0.013***	−0.008***	−0.018***	−0.008***
	(0.003)	(0.004)	(0.003)	(0.003)	(0.005)	(0.003)
Board Independence	0.003	0.012	0.006	−0.017	0.006	−0.025
	(0.030)	(0.054)	(0.030)	(0.031)	(0.063)	(0.030)
Director Connectedness	−0.002**	−0.003	−0.002*	0.002	0.002	0.002*
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
CEO Vega	−0.101***	−0.307***	−0.074***	−0.159***	−0.300***	−0.146***
	(0.023)	(0.044)	(0.022)	(0.024)	(0.041)	(0.023)
CEO Delta	0.012***	0.019***	0.011***	0.008**	0.005	0.009***
	(0.003)	(0.006)	(0.003)	(0.003)	(0.006)	(0.003)
CEO Tenure	−0.000	0.000	−0.000	0.001**	0.003**	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
CEO Cash Compensation	−0.001	−0.012	0.003	−0.014***	−0.023***	−0.012***
	(0.005)	(0.008)	(0.004)	(0.004)	(0.008)	(0.004)
Market-to-Book	0.006	0.065***	0.001	0.018***	0.108***	0.006
	(0.004)	(0.010)	(0.004)	(0.004)	(0.009)	(0.004)
R&D Expenditures	0.494***	1.252***	0.486***	−0.269***	0.384	−0.357***
	(0.060)	(0.143)	(0.060)	(0.094)	(0.233)	(0.089)
Capital Expenditures	0.017	0.271***	−0.015	0.026	0.426***	−0.030
	(0.045)	(0.092)	(0.045)	(0.055)	(0.118)	(0.051)
Ln(1+Sales Growth)	0.072***	0.127***	0.082***	0.049***	0.088***	0.053***
	(0.015)	(0.028)	(0.015)	(0.014)	(0.025)	(0.014)
Leverage	−0.044	−0.306***	−0.002	0.092**	−0.019	0.130***
	(0.031)	(0.057)	(0.031)	(0.041)	(0.084)	(0.040)
Ln(Total Assets)	−0.047***	0.037***	−0.063***	−0.065***	0.050**	−0.088***
	(0.005)	(0.010)	(0.005)	(0.013)	(0.024)	(0.013)
Ln(1+Firm Age)	−0.078***	−0.076***	−0.088***	−0.336***	−0.596***	−0.262***
	(0.009)	(0.016)	(0.009)	(0.037)	(0.071)	(0.035)
Diversification	0.012	−0.020	0.023*	0.006	−0.009	0.007*
	(0.009)	(0.014)	(0.013)	(0.004)	(0.011)	(0.004)
Return on Assets	−0.993***	−1.224***	−1.007***	−0.531***	−0.610***	−0.548***
	(0.048)	(0.104)	(0.050)	(0.045)	(0.093)	(0.046)
Surplus Cash	−0.166***	−0.579***	−0.101**	−0.174***	−0.544***	−0.131***
	(0.053)	(0.131)	(0.050)	(0.040)	(0.093)	(0.041)
Observations	13,581	13,581	13,581	13,581	13,581	13,581
Firms	1,960	1,960	1,960	13,581	1,960	1,960
R^2	0.595	0.327	0.596	0.613	0.205	0.595

and significant coefficients of the OLS estimator.

To further analyze this, I conduct Sargan-Hansen tests to compare the estimations based on fixed effects and those based on random effects. The null hypothesis of the Sargan-Hansen test is that the random effects model, which uses variation both within and between firms, estimates the same set of parameters as the fixed effects model, which uses only variation within the firms. This is similar to the Durbin-Wu-Hausman specification test but is robust under heteroskedasticity. The test statistics, which are χ^2 distributed with 32 degrees of freedom, are 432.696, 319.687 and 380.950 for the estimation of total, systematic and idiosyncratic respectively. I reject the null hypothesis in all three cases, suggesting that within-firm variation and between-firm variation produce statistically different sets of coefficient estimates. This leads us to conclude that the negative relationship found in the OLS results is driven by other time-invariant factors between firms.

As I have noted previously, the fixed effects estimator is not robust to the influence of past risk on female boardroom representation. In this case, I find that, despite the influence of risk on gender choice in the director appointment process, the fixed effects results yield the same inference as DPS-GMM; that is, there is no significant relationship between female boardroom representation and risk.

Considering all the evidence together, I conclude the following. Although I find that low risk firms tend to have a higher proportion of female directors in their boardroom, there is no robust evidence suggesting that higher female boardroom representation leads to lower equity risk. There is suggestive evidence that firms take their existing risk profile into account when deciding on the gender of new director appointments. However, any negative association found between female directors and firm risk is most likely to be attributable to other unobserved factors in a firm's contracting environment such as corporate culture or managerial ability. These unobserved factors may cause the spurious negative relationship as they simultaneously influence firm risk and the proportion of female directors on the board.

2.5.3 Is 'female connections of male directors' a valid instrument?

Many boardroom gender diversity studies employ connection of male directors to other women directors as an instrumental variable (e.g. Adams and Ferreira, 2009; Levi et al., 2013; Gregory-Smith et al., 2014). In this section, I show that this instrumental variable is not valid in my examination. I first describe the conditions on which the instrumental variable would be valid. I then show the evidence against its validity in my data set.

As director gender is a choice variable, the correlation between female representation in the boardroom and risk can be due to the three following possibilities: (1) female representation in the boardroom influences firm risk; (2) firm risk influences female boardroom representation; and (3) other unobserved factors influence both female boardroom representation and firm risk.

The two-stage least squares (2SLS) estimator isolates the effect of female boardroom representation on risk (the first possibility) from the other two possibilities by exploiting only the variation in female boardroom representation that is not related to risk. To do so, it requires an instrumental variable that can determine the proportion of female directors in the boardroom but is not related to risk (except through the proportion of women and other controls). The 2SLS estimator captures the correlation between risk and only the variation in female boardroom representation explained by this instrumental variable. As the instrumental variable is not related to risk, this part of the variation in female boardroom representation is considered random and as such its correlation with risk can then be evidence that female representation in the boardroom influences firm risk.

Formally, a valid instrumental variable must satisfy two assumptions. First, the instrumental variable must be exogenous; that is, it must not be correlated with the residual term or the part of risk measures that is not explained by any of the independent variables. Second, it must be strongly correlated with the endogenous variable – the proportion of female directors on board.

Adams and Ferreira (2009) propose female connections of male directors as a plausibly valid instrumental variable. This variable is constructed by first examining each male director on the board. A male director is considered as connected to female directors if he also sits in other boards and one of those boards has at least one female director. The instrumental variable is then constructed as the proportion of male directors on board who have at least one external board connection to women. This variable is assumed to be exogenous because the fact that male directors know women from their other directorship should not have any relation to firm performance or risk. At the same time, if male directors on the board know more female directors, there is a higher likelihood that more female directors will be appointed. Thus, the identification assumption is satisfied.

Although the probability that a male director would sit on the same board as female directors appears random, the more connected the directors (as measured by additional directorships) the more likely he would be connected to female directors through outside directorships. On one hand, multiple directorships suggest that the director is talented as his human capital is in high demand. On the other hand, directors with multiple outside board seats may be too busy to pay attention to their duties at the firm (Fich & Shivdasani 2006; Field et al. 2013; Masulis & Mobbs 2014). The ability and attention of directors in performing their monitoring and advising functions can influence the firm's risk profile and this influence can be embedded in the instrument. Therefore, in addition to including *director connectedness* in the model, I follow Adams and Ferreira (2009) and estimate the results using an alternative measure of board connectedness, i.e. *male director connectedness*, which is defined as the total number of external board seats held by *male* directors, included as a control variable. Additionally, as the estimation may not be consistent due to unobserved factors that are present in both first and second stage equations (Cornwell et al., 1992), I time-demean all the variables including the instrument in both stages to remove unobserved time-invariant factors.

The results are presented in Table 2.8. Surprisingly, I find that the significance of the coefficient for *female* depends on the measure of board connectedness employed in the model despite the high correlation between these two measures (correlation coefficient = 0.968). On one hand, when controlling for *director connectedness* (Columns 1-4) I do not find any significant relationship between female representation and risk measures and the Kleibergen-Papp statistic suggests that the instrument is weak (1.986 against the 25% critical value of 5.53). On the other hand, when I control for *male director connectedness* (Columns 5-8), I find that female board representation reduces risk (significant at 5% level) and that this instrument is strong (the Kleibergen-Papp statistic equals to 47.933 compared to the 10% critical value of 16.38). Although the coefficients on the proportion of women are not significant in Columns 1-3, they are negative and very large in magnitude, suggesting that the estimates have a negative bias in a finite sample, which is in the same direction as the bias in my OLS results (Table 2.7). This shows that, even if the proportion

Table 2.8: Instrumental Variable Regression with Firm-Level Fixed Effects

This table reports two-stage least squares regressions with firm-level fixed effects of firm equity risk measures on the proportion of women on board and control variables. Proportion of women is treated as endogenous and is instrumented using the proportion of male directors with board connections to female directors. Director connectedness is defined as the average number of external board seats held by a director. Male director connectedness is defined as the average number of external board seats held by a male director. Other control variables are defined in Table 2.1. All dependent and independent variables are time-demeaned in both first-stage and second-stage regressions. All models include year dummy variables. Within-cluster heteroskedasticity and serial correlation robust standard errors are reported in parentheses. Intercepts are included but not reported. *, **, *** denote statistical significance at 10%, 5% and 1% respectively.

	(A) Director Connectedness as Control				(B) Male Director Connectedness as Control			
	Proportion of Women	Total Risk	Systematic Risk	Idiosyncratic Risk	Proportion of Women	Total Risk	Systematic Risk	Idiosyncratic Risk
Proportion of Women		−6.734	−9.885	−6.780		−1.063**	−1.880**	−1.076**
		(5.352)	(8.729)	(5.320)		(0.479)	(0.946)	(0.473)
Board Size	0.000	−0.008	−0.018**	−0.009	0.003***	−0.005*	−0.014***	−0.006**
	(0.001)	(0.006)	(0.009)	(0.006)	(0.001)	(0.003)	(0.006)	(0.003)
Board Independence	0.066***	0.432	0.660	0.428	0.068***	0.065	0.141	0.059
	(0.008)	(0.360)	(0.584)	(0.358)	(0.008)	(0.047)	(0.092)	(0.047)
CEO Vega	0.005	−0.124**	−0.249***	−0.110**	0.002	−0.155***	−0.292***	−0.141***
	(0.006)	(0.054)	(0.085)	(0.054)	(0.006)	(0.024)	(0.042)	(0.024)
CEO Delta	0.000	0.009	0.007	0.010	0.000	0.008**	0.005	0.009**
	(0.001)	(0.007)	(0.011)	(0.007)	(0.001)	(0.004)	(0.006)	(0.004)
CEO Tenure	−0.000	0.000	0.001	−0.000	−0.000	0.001	0.003**	0.001
	(0.000)	(0.002)	(0.003)	(0.002)	(0.000)	(0.001)	(0.001)	(0.001)
CEO Cash Compensation	0.000	−0.013	−0.022	−0.011	0.000	−0.013***	−0.022***	−0.011**
	(0.001)	(0.008)	(0.013)	(0.008)	(0.001)	(0.005)	(0.008)	(0.005)
Market-to-Book	0.000	0.021**	0.113***	0.009	0.001	0.019***	0.110***	0.007
	(0.001)	(0.008)	(0.015)	(0.008)	(0.001)	(0.004)	(0.010)	(0.004)
R&D Expenditures	−0.050**	−0.604*	−0.104	−0.695**	−0.052**	−0.322***	0.295	−0.411***
	(0.024)	(0.324)	(0.531)	(0.327)	(0.023)	(0.097)	(0.235)	(0.095)
Capital Expenditures	−0.015	−0.075	0.280	−0.131	−0.016*	0.006	0.394***	−0.050
	(0.009)	(0.119)	(0.208)	(0.116)	(0.009)	(0.057)	(0.123)	(0.053)
Ln(1+Sales Growth)	−0.000	0.045**	0.082**	0.049**	−0.001	0.048***	0.085***	0.052***
	(0.002)	(0.021)	(0.033)	(0.022)	(0.002)	(0.014)	(0.025)	(0.015)
Leverage	−0.002	0.076	−0.043	0.113	−0.002	0.089**	−0.024	0.126***
	(0.009)	(0.075)	(0.123)	(0.076)	(0.009)	(0.042)	(0.085)	(0.041)

(Continued on next page...)

(Table 2.8 Continued)

Ln(Total Assets)	0.001	−0.060***	0.058	−0.082***	0.002	−0.063***	0.054**	−0.085***
	(0.003)	(0.022)	(0.036)	(0.023)	(0.003)	(0.013)	(0.025)	(0.013)
Ln(1+Firm Age)	0.013	−0.252***	−0.473***	−0.177*	0.022**	−0.310***	−0.556***	−0.236***
	(0.009)	(0.096)	(0.155)	(0.096)	(0.009)	(0.039)	(0.074)	(0.038)
Diversification	−0.003	−0.012	−0.035	−0.011	−0.002	0.002	−0.014	0.003
	(0.002)	(0.019)	(0.033)	(0.018)	(0.002)	(0.005)	(0.013)	(0.004)
Return on Assets	−0.011	−0.602***	−0.714***	−0.620***	−0.013	−0.546***	−0.635***	−0.564***
	(0.009)	(0.096)	(0.161)	(0.097)	(0.009)	(0.047)	(0.097)	(0.048)
Surplus Cash	−0.004	−0.203***	−0.587***	−0.161**	−0.004	−0.180***	−0.555***	−0.138***
	(0.010)	(0.075)	(0.127)	(0.076)	(0.010)	(0.040)	(0.092)	(0.040)
Director Connectedness	0.000	0.005	0.006	0.006				
	(0.000)	(0.004)	(0.006)	(0.004)				
Male Director Connectedness					−0.004***	−0.001	−0.003	−0.001
					(0.000)	(0.002)	(0.003)	(0.002)
Proportion of Male Directors with Board Connections to Women	0.011				0.062***			
	(0.008)				(0.008)			
Observations	13,581	13,581	13,581	13,581	13,581	13,581	13,581	13,581
Observations	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960
Kleibergen-Paap	1.986				47.933			

of male directors with female board connections was exogenous, the reported results cannot be relied upon. Moreover, finding that the strength of the instrumental variable critically depends on the included control variables casts further doubt on the validity of female board connection of male directors as an instrument for my analysis[20]. These findings motivate us to conduct further tests in regards to the exogeneity of the instrument.

The proportion of male directors with board connections to women is a valid instrument when it can explain risk only through the proportion of women and other control variables[21]. It is not possible, however, to test for instrument validity when the model is exactly identified (Wooldridge, 2009, p. 529). Therefore, to test this assumption, I employ the Hansen test for overidentifying restrictions.

The Hansen test for overidentifying restrictions tests the null hypothesis that all the instrumental variables in the model are jointly valid. This test is viable only when the model is overidentified i.e. when the number of instrumental variables is greater than the number of endogenous variables. I overidentify my model using another variation of Adams and Ferreira's (2009) instrument – the proportion of male directors' board seats in other firms with female directors. Both this instrument and the original instrument rely on the same identification assumption; that is, the firm is likely to appoint more female directors if male directors are more familiar with women through their directorship networks. The implication is that the overidentification test in this case can be a weak test – if both instruments bias the estimated relation

[20] We also re-estimate my GMM results using male director connectedness as a control variable. The results (in Panel F of Table 2.6) are consistent with my other results.

[21] We find that the instrumental variable enters the model significantly in both OLS and fixed effects models (see Table 2.9). However, these results cannot be used as evidence against the validity of the instrument. As the residuals are estimated from a model with endogenous variables, the non-zero correlation between the instrument and the estimated residuals may be due to the possibility that the estimated residuals are biased.

Table 2.9: Results with Female Board Connections of Male Director as Control

This table reports ordinary least square, fixed effects and dynamic panel system GMM regressions of equity risk measures on proportion of women and other control varialbes. Proportion of male directors with board connections to women is included as an additional control variable. All models include year dummy variables. Firm-level cluster-robust standard errors are reported fro ordinary least squares and fixed effects models. Finite-sample robust standard errors (Windmeijer, 2005) are reported for dynamic panel system GMM. Intercepts are included but not reported. * , ** , *** denote statistical significance at 10%, 5% and 1% respectively.

	Ordinary Least Squares			Fixed Effects			Dynamic Panel System GMM		
Dependent Variable =	Total Risk	Systematic Risk	Idiosyncratic Risk	Total Risk	Systematic Risk	Idiosyncratic Risk	Total Risk	Systematic Risk	Idiosyncratic Risk
Prop. of Men with Board Connections to Women	-0.156^{***}	-0.194^{***}	-0.171^{***}	-0.076^{***}	-0.111^{**}	-0.077^{***}	0.016	−0.084	−0.062
	(0.030)	(0.055)	(0.030)	(0.028)	(0.055)	(0.028)	(0.118)	(0.386)	(0.118)
Proportion of Women	-0.094^{*}	-0.315^{***}	−0.053	0.036	−0.025	0.059	0.088	−0.407	0.154
	(0.052)	(0.090)	(0.054)	(0.065)	(0.121)	(0.065)	(0.154)	(0.520)	(0.167)
Board Size	-0.017^{***}	-0.033^{***}	-0.016^{***}	-0.009^{***}	-0.020^{***}	-0.010^{***}	0.021^{*}	−0.037	0.017
	(0.003)	(0.005)	(0.003)	(0.003)	(0.006)	(0.003)	(0.012)	(0.032)	(0.012)
Board Independence	0.023	0.036	0.027	−0.013	0.012	−0.021	0.172	0.154	0.074
	(0.030)	(0.055)	(0.030)	(0.031)	(0.063)	(0.030)	(0.132)	(0.352)	(0.147)
Director Connectedness	0.002^{*}	0.003	0.003^{***}	0.004^{***}	0.005^{*}	0.005^{***}	-1.427^{***}	−0.005	-1.697^{***}
	(0.001)	(0.002)	(0.001)	(0.002)	(0.003)	(0.002)	(0.409)	(0.797)	(0.440)
CEO Vega	-0.095^{***}	-0.300^{***}	-0.068^{***}	-0.157^{***}	-0.297^{***}	-0.143^{***}	0.213	0.822	0.225
	(0.023)	(0.044)	(0.021)	(0.024)	(0.041)	(0.023)	(0.406)	(1.307)	(0.415)
CEO Delta	0.011^{***}	0.019^{***}	0.010^{***}	0.008^{**}	0.005	0.009^{**}	−0.241	0.940	−0.278
	(0.003)	(0.006)	(0.003)	(0.003)	(0.006)	(0.003)	(0.259)	(0.829)	(0.301)
CEO Tenure	−0.000	0.000	−0.001	0.001^{**}	0.003^{**}	0.001	-0.233^{**}	−0.390	-0.189^{*}
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.099)	(0.321)	(0.102)
CEO Cash Compensation	−0.001	−0.013	0.003	-0.014^{***}	-0.023^{***}	-0.012^{***}	-0.039^{*}	−0.035	-0.042^{**}
	(0.005)	(0.008)	(0.004)	(0.004)	(0.008)	(0.004)	(0.020)	(0.057)	(0.021)
Market-to-Book	0.007^{*}	0.066^{***}	0.001	0.018^{***}	0.108^{***}	0.006	−0.072	−0.101	−0.102
	(0.004)	(0.009)	(0.004)	(0.004)	(0.009)	(0.004)	(0.068)	(0.210)	(0.069)
R&D Expenditures	0.482^{***}	1.237^{***}	0.473^{***}	-0.262^{***}	0.394^{*}	-0.350^{***}	0.003	−0.004	0.004^{*}
	(0.060)	(0.143)	(0.060)	(0.093)	(0.232)	(0.088)	(0.002)	(0.007)	(0.002)
Capital Expenditures	0.010	0.262^{***}	−0.023	0.025	0.425^{***}	−0.030	-0.036^{*}	−0.014	−0.007
	(0.045)	(0.091)	(0.045)	(0.055)	(0.118)	(0.051)	(0.021)	(0.057)	(0.022)

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(Table 2.9 Continued)

Ln(1+Sales Growth)	0.068***	0.122***	0.077***	0.049***	0.087***	0.053***	0.144*	0.306	0.060
	(0.015)	(0.028)	(0.015)	(0.014)	(0.025)	(0.014)	(0.082)	(0.207)	(0.084)
Leverage	−0.039	−0.300***	0.002	0.092**	−0.020	0.129***	0.033	0.116*	0.036
	(0.031)	(0.057)	(0.031)	(0.040)	(0.083)	(0.039)	(0.030)	(0.069)	(0.032)
Ln(1+Total Assets)	−0.044***	0.041***	−0.060***	−0.065***	0.051**	−0.087***	−0.004	0.005	−0.003
	(0.005)	(0.010)	(0.005)	(0.013)	(0.024)	(0.013)	(0.004)	(0.015)	(0.005)
Ln(1+Firm Age)	−0.076***	−0.073***	−0.086***	−0.337***	−0.597***	−0.262***	0.046**	0.024	0.024
	(0.009)	(0.016)	(0.009)	(0.037)	(0.071)	(0.035)	(0.021)	(0.055)	(0.023)
Diversification	0.011	−0.022	0.022*	0.005	−0.010	0.006	0.205*	−0.503***	0.176
	(0.009)	(0.014)	(0.013)	(0.004)	(0.011)	(0.004)	(0.119)	(0.189)	(0.115)
Return on Assets	−0.992***	−1.222***	−1.005***	−0.530***	−0.610***	−0.547***	0.017	0.060	0.010
	(0.048)	(0.104)	(0.049)	(0.045)	(0.093)	(0.046)	(0.015)	(0.043)	(0.016)
Surplus Cash	−0.170***	−0.584***	−0.105**	−0.177***	−0.549***	−0.134***	−0.310	−2.607**	−0.121
	(0.052)	(0.130)	(0.050)	(0.040)	(0.093)	(0.041)	(0.464)	(1.139)	(0.434)
Risk Measure (Lag 1)							0.501***	0.239	0.569***
							(0.115)	(0.149)	(0.129)
Risk Measure (Lag 2)							0.133	0.309***	0.005
							(0.089)	(0.111)	(0.096)
Observations	13,581	13,581	13,581	13,581	13,581	13,581	8,629	8,629	8,629
Observations	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960
R^2	0.597	0.328	0.599	0.613	0.205	0.596			
Hansen (df=40)							45.998	50.810	48.777
AR(1)							−4.609***	−2.746***	−4.827***
AR(2)							−0.776	−1.504	0.518

between gender and risk, the bias from both instrument would be in the same direction. Therefore, it is likely that I will fail to reject the null hypothesis even when the instruments are not valid. However, as both instrument share a common rationale, rejecting the null hypothesis for Hansen test would indicate that both instruments are invalid (see, e.g., Murray, 2006).

I instrument the proportion of women using the proportion of men's board seats in other boards with women and present the results in Table 2.10. In Panel A, I estimate exactly-identified models and find that the relationship between gender and risk in second stage regressions are positive. Although both instruments share a common rationale for identification, they do not identify the same gender-risk relation. Further, in the first stage, I find that the proportion of men's other board seats with women are negatively related to the proportion of women on board. In Panel B, I combine the two instruments in overidentified models and find that the relation between gender and risk is not statistically significant in any of the models. Additionally, the Hansen test statistics lead us to reject the null hypothesis that the instrument are jointly valid. This suggests that both variations of the instrumental variable are not valid, at least in my setting where risk measures are used as the dependent variable[22].

2.5.4 Difference-in-differences matching estimator

The failure to detect any gender-risk relationship could be caused by the fact that the proportion of female directors might not be an appropriate measure. Figure 2 shows a line plot of the proportion of female directors on boards over

[22]As the Hansen test suggests that the instrument is correlated with the residuals, I also include the instrument in the DPS-GMM models to check whether my main results are sensitive to the inclusion of this variable. The results (shown in Table 2.9) still indicate no statistically significant relation between proportion of women and risk.

Table 2.10: Alternative Instrumental Variable

This table reports two-stage least squares regressions with firm-level fixed effects of firm equity risk measures on the proportion of women on board and control variables. In Panel A, the proportion of women and is instrumented using the proportion of male directors with board connections to female directors. In Panel B, the proportion of women is instrumented using the proportion of male directors with board connections and the proportion of men's other directorships with at least one female director. Other control variables are defined in Table 2.1. All dependent and independent variables are time-demeaned in both first-stage and second-stage regressions. All models include year dummy variables. Within-cluster heteroskedasticity and serial correlation robust standard errors are reported in parentheses. Intercepts are included but not reported. * , ** , *** denote statistical significance at 10%, 5% and 1% respectively.

	(A) Exactly Identified Model				(B) Overidentified Model			
	Proportion of Women	Total Risk	Systematic Risk	Idiosyncratic Risk	Proportion of Women	Total Risk	Systematic Risk	Idiosyncratic Risk
Proportion of Women		0.864*	1.467	0.814*		−0.116	−0.235	−0.147
		(0.468)	(0.996)	(0.461)		(0.224)	(0.434)	(0.224)
Board Size	0.002**	−0.009***	−0.020***	−0.009***	0.004***	−0.007***	−0.017***	−0.008***
	(0.001)	(0.003)	(0.006)	(0.003)	(0.001)	(0.003)	(0.005)	(0.003)
Board Independence	0.074***	−0.075	−0.102	−0.078*	0.067***	−0.004	0.022	−0.008
	(0.008)	(0.047)	(0.099)	(0.046)	(0.008)	(0.035)	(0.070)	(0.034)
Male Director Connectedness	−0.002***	0.003*	0.005	0.004**	−0.005***	0.001	0.001	0.001
	(0.000)	(0.002)	(0.003)	(0.002)	(0.000)	(0.002)	(0.003)	(0.002)
CEO Vega	0.004	−0.162***	−0.306***	−0.149***	−0.001	−0.158***	−0.299***	−0.145***
	(0.006)	(0.025)	(0.043)	(0.024)	(0.006)	(0.024)	(0.041)	(0.023)
CEO Delta	0.000	0.008**	0.005	0.008**	0.000	0.008**	0.005	0.009**
	(0.001)	(0.003)	(0.006)	(0.003)	(0.001)	(0.003)	(0.006)	(0.003)
CEO Tenure	−0.000	0.002**	0.003***	0.001*	−0.000	0.001**	0.003**	0.001
	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
CEO Cash Compensation	0.000	−0.014***	−0.023***	−0.012***	0.000	−0.014***	−0.022***	−0.012***
	(0.001)	(0.004)	(0.008)	(0.004)	(0.001)	(0.004)	(0.008)	(0.004)
Market-to-Book	0.001	0.018***	0.107***	0.005	0.001	0.018***	0.109***	0.006
	(0.001)	(0.004)	(0.009)	(0.004)	(0.001)	(0.004)	(0.009)	(0.004)
R&D Expenditures	−0.044*	−0.230**	0.454*	−0.321***	−0.050**	−0.277***	0.373	−0.367***
	(0.023)	(0.099)	(0.245)	(0.093)	(0.022)	(0.094)	(0.234)	(0.089)
Capital Expenditures	−0.016*	0.039	0.451***	−0.018	−0.014	0.022	0.422***	−0.034
	(0.009)	(0.056)	(0.117)	(0.052)	(0.009)	(0.055)	(0.118)	(0.051)

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(Table 2.10 Continued)

Ln(1+Sales Growth)	−0.001	0.050***	0.090***	0.054***	−0.001	0.049***	0.088***	0.053***
	(0.002)	(0.014)	(0.025)	(0.014)	(0.002)	(0.014)	(0.025)	(0.014)
Leverage	−0.004	0.095**	−0.015	0.131***	−0.005	0.092**	−0.019	0.129***
	(0.009)	(0.041)	(0.085)	(0.040)	(0.008)	(0.041)	(0.084)	(0.040)
Ln(1+Total Assets)	0.003	−0.067***	0.047*	−0.089***	0.003	−0.065***	0.051**	−0.087***
	(0.003)	(0.013)	(0.025)	(0.013)	(0.003)	(0.013)	(0.024)	(0.013)
Ln(1+Firm Age)	0.022**	−0.352***	−0.628***	−0.276***	0.023***	−0.331***	−0.591***	−0.255***
	(0.009)	(0.039)	(0.077)	(0.036)	(0.009)	(0.037)	(0.072)	(0.035)
Diversification	−0.003*	0.008*	−0.004	0.009**	−0.002	0.005	−0.010	0.006
	(0.002)	(0.004)	(0.010)	(0.004)	(0.002)	(0.004)	(0.011)	(0.004)
Return on Assets	−0.014	−0.520***	−0.590***	−0.538***	−0.015	−0.533***	−0.613***	−0.551***
	(0.009)	(0.045)	(0.094)	(0.047)	(0.009)	(0.045)	(0.094)	(0.046)
Surplus Cash	−0.006	−0.169***	−0.535***	−0.127***	−0.003	−0.175***	−0.545***	−0.133***
	(0.009)	(0.042)	(0.097)	(0.043)	(0.009)	(0.040)	(0.093)	(0.040)
Proportion Of Male External Board	−0.023***				−0.048***			
Seats with Women	(0.003)				(0.003)			
Proportion of Men's Other Board Seats					0.126***			
with Women on Board					(0.009)			
Observations	13,360	13,360	13,360	13,360	13,360	13,360	13,360	13,360
Observations	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960
Kleibergen-Paap	62.782				130.544			
Hansen ($\chi^2 = 1$)						5.698**	3.928**	5.657**

time. I observe that changes in female boardroom representation come from two sources of variation. First, the increase in the number of female directors on boards and, second, the decrease in overall board size. It is evident from Figure 2.2 that the average board size has decreased faster than the rate at which the number of female directors has increased over my sampling period. I also observe in Table 2.3 that the change in the proportion of female directors on boards is mainly driven by the change in board size whereas new appointments and departures of female directors affect about 10% of firms each year. Therefore, in this section I use difference-in-difference matching estimator to focus on the incidents where changes in gender diversity comes from female director appointments.

The difference-in-difference matching estimator is a combination of the difference-in-difference estimator (DID) and the matching estimator. DID exploits the 'parallel trends' assumption; that is, two similar firms are likely to follow the same change without any treatment. Therefore, if the treatment has any impact on the outcome, the impact should be reflected in the difference between the changes of the two firms (Roberts and Whited, 2011). The DID estimator can be implemented by estimating the following equation.

$$\begin{aligned}\text{Risk}_{i,t} = \alpha_0 &+ \alpha_1(\text{Female Appointment})_{i,t} \times (\text{Post Period})_{i,t} \\ &+ \alpha_2(\text{Female Appointment})_{i,t} + \alpha_3(\text{Post Period})_{i,t} \\ &+ \boldsymbol{X}_{i,t}\boldsymbol{\Gamma} + \varepsilon_{i,t} \qquad (2.7)\end{aligned}$$

The variable *female appointment* is a dummy variable which takes the value of one when the firm is in the treatment group and zero when the firm is in the control group. Another dummy variable, *post period*, takes the value of zero in the time period before the treatment and one in the post-treatment period.

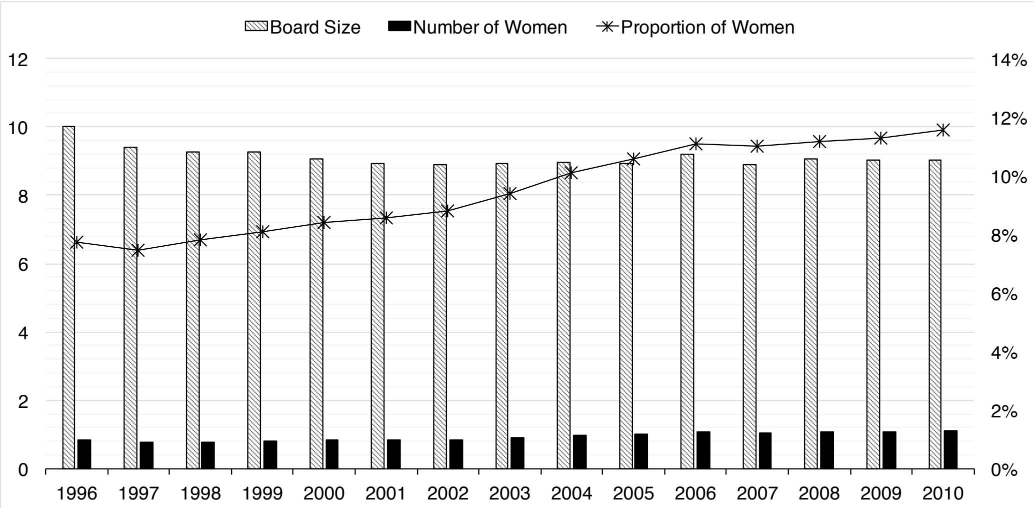

Figure 2.2: Board Characteristics by Year

Included control variables are the same as the DPS-GMM results in Table 2.5.

Often, a change in board structure reflects other changes in the organization such as corporate restructuring, mergers and acquisitions, or a large shift in strategy. All these changes are likely to have an impact on risk. I try to alleviate these concerns in two ways. First, I select my treatment group such that it excludes director appointments that are more likely to be a result of a change in strategy. To be included in the treatment group, the firm must only appoint one female director in that year to replace a departing male director. I require that the departing director must be older than 60 years. This ensures that director turnover is more likely to be caused by retirement than by shareholders forcing out a director over dissatisfaction with the firm. Applying these criteria, I am able to identify 153 female director appointments for my treatment group. Second, I match these treatment firms to similar control firms. I identify 737 control observations that appoint one male director in that year to replace another departing male director. The departing director in my control firms also must be older than 60 years. I then match treatment and control firms using their propensity to replace a departing male director with a female director. The propensity scores of these observations are computed based on Model 1 in Table 2.6. I employ matching with replacement and require that the difference in the propensity scores of treatment and matched firms does not exceed 5%. I am able to match 103 observations in the treatment group to at least one control observation. In addition to propensity score matching, I also employ the nearest-neighbor matching method in order to include all my treatment firms in the estimation. I use the matching procedure of Abadie et al. (2004) and use variables from Model 1 in Table 2.6 as my matching covariates. I match each treatment firm with its four nearest neighbors.

The difference-in-differences results using both matching techniques are reported in Table 2.11. I find that the average difference in risk measures across the two periods of firms with female director appointments is not statistically different from those firms that do not experience any change in board structure (we fail to reject the null hypothesis that the coefficients for the interaction term, (Female Appointment)$_{i,t}$ × (Post Period)$_{i,t}$, are statistically different from zero). My results are consistent across all three risk measures and both matching procedures.

As robustness checks, I also perform propensity-score matching DID using various levels of restrictions (see Table 2.12). I expand the number of matches by relaxing the propensity score restriction to 10% where I am able to match 112 out of 153 firms. More relaxed restrictions leads to more firms to be included in the estimation but it means that the control firms may be too dissimilar to my treatments. Therefore, I also estimate the model where the restriction is set at to 2%, 1% and 0.5%. I end up with 79, 65 and 43 matched firms respectively. All these results confirm my 10% baseline that there is no statistically significant change in risk after a male director is replaced by a female director. Similarly for the nearest neighbor matching procedure, there is a trade-off between efficiency gain from using multiple matches and including too dissimilar firms in the estimation. Therefore, I also vary the number of matches for each treatment firm from 4 to 1, 2, 3, 5 and 6 and confirm my baseline results. Overall, although I find in the sample that on average firms with a larger proportion of female directors on board have lower equity risk, the empirical evidence does not support the notion that greater female boardroom representation leads to lower firm risk.

However, the risk measures employed so far in this study are based on stock price information. Market-based risk measures, similar to profitability measures, are also functions of many other factors than board, CEO and firm char-

Table 2.11: Effect of Female Director Appointment on Risk Measures

This table report results from difference-in-difference estimations. Dependent variables are firm equity risk measures. Treatment observations are firms that replace a departing male director with a female directors. Control observations are firms that replace a departing male director with another male directors. In Panel A, treatment firms are matched with control firms of similar propensity (within 5%) of appointing a women director. Propensity scores are calculated from Model 1 in Table 2.4. In Panel B, treatment firms are matched with control firms using the nearest-neighbor matching methods (Abadie et al., 2004). Matching variables are independent variables in Model 1 of Table 2.4. Additionally, treatment firms and matched control firms must be in the same year and industry. *Female Appointment* is a dummy variable which equals one if the firm appoints a female director and zero otherwise. *Post Period* is a dummy variable which equals one in the period after the appointment and zero in the period before. Control variables are defined in Table 4.1. Within-cluster heteroskedasticity and serial correlation robust standard errors are reported in parentheses. Intercepts are included but not reported. *, **, *** denote statistical significance at 10%, 5% and 1% respectively.

	Panel A: Propensity Score Matching			Panel B: Nearest Neighbor Matching		
Dependent Variable =	Total Risk	Systematic Risk	Idiosyncratic Risk	Total Risk	Systematic Risk	Idiosyncratic Risk
Female Appointment × Post Period	−0.007	0.020	−0.002	−0.005	0.01	−0.005
	(0.038)	(0.066)	(0.039)	(0.021)	(0.042)	(0.022)
Female Appointment	−0.054*	−0.093*	−0.056*	−0.032	−0.056	−0.031
	(0.028)	(0.050)	(0.029)	(0.024)	(0.045)	(0.024)
Post Period	−0.003	−0.003	−0.007	−0.003	0.004	−0.003
	(0.015)	(0.029)	(0.016)	(0.013)	(0.024)	(0.013)
Board Size	−0.032***	−0.072***	−0.029***	−0.024***	−0.046***	−0.020**
	(0.004)	(0.007)	(0.004)	(0.008)	(0.014)	(0.009)
Board Independence	−0.064	−0.119	−0.103*	−0.059	−0.067	−0.064
	(0.052)	(0.102)	(0.053)	(0.084)	(0.153)	(0.082)
Director Connectedness	0.034**	0.053*	0.039**	0.022	0.112**	0.006
	(0.017)	(0.032)	(0.017)	(0.030)	(0.053)	(0.029)
CEO Vega	−0.000***	−0.000***	−0.000***	−0.180***	−0.469***	−0.134**
	(0.000)	(0.000)	(0.000)	(0.067)	(0.108)	(0.063)
CEO Delta	0.000*	0.000	0.000	0.009	0.02	0.007
	(0.000)	(0.000)	(0.000)	(0.009)	(0.016)	(0.008)
CEO Tenure	0.002***	0.002	0.002**	0.001	0.001	0.001
	(0.001)	(0.002)	(0.001)	(0.002)	(0.003)	(0.002)
CEO Cash Compensation	−0.000	0.000	−0.000	0.005	−0.019	0.01
	(0.000)	(0.000)	(0.000)	(0.011)	(0.019)	(0.011)

(Continued on next page...)

(Table 2.11 Continued)

Market-to-Book	0.044***	0.117***	0.039***	0.015	0.064**	0.012
	(0.007)	(0.016)	(0.007)	(0.017)	(0.032)	(0.017)
R&D Expenditures	0.118*	0.259**	0.116*	0.690***	1.336***	0.730***
	(0.065)	(0.111)	(0.063)	(0.221)	(0.481)	(0.219)
Capital Expenditures	0.102	0.298*	0.036	0.098	0.277	0.076
	(0.080)	(0.169)	(0.081)	(0.140)	(0.316)	(0.132)
Ln(Sales Growth)	−0.565***	−1.188***	−0.446***	0.052	0.094	0.056
	(0.111)	(0.217)	(0.109)	(0.047)	(0.103)	(0.045)
Leverage	−0.045	−0.285***	−0.004	−0.116	−0.302*	−0.086
	(0.051)	(0.097)	(0.052)	(0.093)	(0.168)	(0.094)
Ln(Total Assets)	−0.013	0.070***	−0.030***	−0.045***	0.023	−0.058***
	(0.009)	(0.017)	(0.008)	(0.017)	(0.029)	(0.016)
Ln(1+Firm Age)	−0.078***	−0.087***	−0.091***	−0.065***	−0.093**	−0.067***
	(0.013)	(0.025)	(0.013)	(0.025)	(0.040)	(0.025)
Diversification	0.004	−0.063	0.011	0.056	0.064	0.074
	(0.035)	(0.072)	(0.034)	(0.051)	(0.091)	(0.051)
Return on Assets	−0.775***	−1.251***	−0.756***	−1.206***	−1.297***	−1.233***
	(0.130)	(0.212)	(0.125)	(0.158)	(0.332)	(0.165)
Surplus Cash	0.038	−0.012	0.076***	−0.506**	−1.216***	−0.406**
	(0.028)	(0.052)	(0.028)	(0.196)	(0.346)	(0.205)
Observations	1,781	1,781	1,781	2,448	2,448	2,448
R^2	0.565	0.373	0.557	0.65	0.435	0.651

Table 2.12: Difference-in-Difference Robustness Checks

This table report results from difference-in-difference estimations. Dependent variables are firm equity risk measures. Treatment observations are firms that replace a departing male director with a female directors. Control observations are firms that replace a departing male director with another male directors. All control variables from Table 4.8 are included but not reported for brevity. In Panel A, treatment firms are matched with control firms of which the differences in propensity of appointing a women director are with 10%, 2%, 1% and 0.5% of the treatment firms. Propensity scores are calculated from Model 1 in Table 2.4. In Panel B, treatment firms are matched with control firms using the nearest-neighbor matching methods (Abadie et al., 2004). Instead of four nearest matches, treatment firms are matched with one, two, three, five and six nearest matches from the control group. Matching variables are independent variables in Model 1 of Table 2.4. Treatment firms and matched control firms are in the same year and industry. *Female Appointment* is a dummy variable which equals one if the firm appoints a female director and zero otherwise. *Post Period* is a dummy variable which equals one in the period after the appointment and zero in the period before. Control variables are defined in Table 2.1. Within-cluster heteroskedasticity and serial correlation robust standard errors are reported in parentheses. Intercepts are included but not reported. *, **, *** denote statistical significance at 10%, 5% and 1% respectively.

	Panel A: Propensity Score Matching		
Dependent Variable =	Total Risk	Systematic Risk	Idiosyncratic Risk
		10% (112 Matched Firms)	
Female Appointment × Post Period	−0.013	0.008	−0.007
	(0.036)	(0.062)	(0.037)
Female Appointment	−0.045*	−0.088*	−0.048*
	(0.027)	(0.046)	(0.028)
Post Period	−0.004	−0.003	−0.006
	(0.012)	(0.023)	(0.012)
Observations	2,672	2,672	2,672
R^2	0.566	0.372	0.557
		2% (79 Matched Firms)	
Female Appointment × Post Period	−0.026	−0.016	−0.014
	(0.047)	(0.082)	(0.048)
Female Appointment	−0.028	−0.040	−0.038
	(0.034)	(0.062)	(0.035)
Post Period	0.008	0.016	0.002
	(0.023)	(0.042)	(0.023)
Observations	854	854	854
R^2	0.579	0.369	0.560
		1% (65 Matched Firms)	
Female Appointment × Post Period	−0.054	−0.036	−0.039
	(0.051)	(0.095)	(0.051)
Female Appointment	−0.002	−0.019	−0.015
	(0.036)	(0.073)	(0.036)
Post Period	0.027	0.025	0.019
	(0.030)	(0.058)	(0.031)
Observations	506	506	506
R^2	0.620	0.401	0.597
		0.5% (43 Matched Firms)	
Female Appointment × Post Period	−0.049	−0.077	−0.029
	(0.068)	(0.127)	(0.068)
Female Appointment	0.069	0.115	0.055
	(0.046)	(0.095)	(0.047)
Post Period	0.050	0.080	0.045
	(0.041)	(0.081)	(0.044)
Observations	266	266	266
R^2	0.666	0.499	0.644

(Continued on next page...)

(Table 2.12 continued)

	Panel B: Nearest Neighbor Matching		
Dependent Variable =	Total Risk	Systematic Risk	Idiosyncratic Risk
	One Nearest Match Per Treatment Firm		
Female Appointment × Post Period	0.017	0.064	0.014
	(0.027)	(0.052)	(0.028)
Female Appointment	−0.01	−0.028	−0.008
	(0.030)	(0.055)	(0.030)
Post Period	−0.024	−0.053	−0.02
	(0.021)	(0.038)	(0.022)
Observations	612	612	612
R^2	0.682	0.464	0.675
	Two Nearest Matches Per Treatment Firm		
Female Appointment × Post Period	−0.004	0.029	−0.005
	(0.023)	(0.045)	(0.024)
Female Appointment	−0.027	−0.051	−0.028
	(0.027)	(0.049)	(0.027)
Post Period	−0.001	−0.014	0
	(0.016)	(0.029)	(0.017)
Observations	1,224	1,224	1,224
R^2	0.65	0.428	0.652
	Three Nearest Matches Per Treatment Firm		
Female Appointment × Post Period	−0.001	0.015	−0.002
	(0.022)	(0.043)	(0.023)
Female Appointment	−0.025	−0.043	−0.025
	(0.025)	(0.046)	(0.025)
Post Period	−0.004	0.002	−0.003
	(0.014)	(0.025)	(0.014)
Observations	1,836	1,836	1,836
R^2	0.656	0.443	0.658
	Five Nearest Matches Per Treatment Firm		
Female Appointment × Post Period	−0.012	0.004	−0.011
	(0.021)	(0.042)	(0.021)
Female Appointment	−0.024	−0.044	−0.024
	(0.024)	(0.043)	(0.024)
Post Period	0.004	0.01	0.003
	(0.012)	(0.023)	(0.013)
Observations	3,060	3,060	3,060
R^2	0.639	0.418	0.643
	Six Nearest Matches Per Treatment Firm		
Female Appointment × Post Period	−0.008	0.001	−0.009
	(0.020)	(0.041)	(0.021)
Female Appointment	−0.029	−0.044	−0.03
	(0.023)	(0.042)	(0.024)
Post Period	0.002	0.011	0.002
	(0.012)	(0.022)	(0.012)
Observations	3,672	3,672	3,672
R^2	0.642	0.418	0.646

acteristics. Any relationship between board composition and firm outcomes may therefore be difficult to detect (Hermalin and Weisbach, 2003). The limitations of stock price information as a proxy for risk motivate us to consider corporate risk-taking actions that are reflected in accounting information in the next section.

2.5.5 Alternative measures of firm risk

Although I report no evidence that links boardroom gender diversity to equity risk, gender difference in risk appetite may still be reflected in firm policies. That is, a more gender-balanced board may act differently from a more male-dominated board in terms of risk-taking behavior even though these differences cannot be detected in a firm's stock volatility. Therefore, I explore various corporate risk-taking policies and investigate their relationship with boardroom gender diversity.

One function of the board is to set the remuneration structure to align CEO incentives with a company's objectives. If female directors differ in terms of risk-taking tolerance and behavior, this may also be revealed in the compensation packages that gender diverse boards offer to the CEO. I investigate the link between gender diversity and CEO risk-taking incentives, proxied by CEO vega. Vega measures the sensitivity of compensation to risk taking (as the change in compensation per 0.01 unit increase in the standard deviation of stock returns). In addition to other board characteristics (board size, board independence and director connectedness), I follow Coles et al. (2006) and include CEO delta, cash compensation, various firm characteristics and firm total risk as control variables.

I also investigate the relation between gender diversity and the following corporate risk-taking policies: R&D expenditures, diversification and leverage. R&D spending is considered risky as the payoffs are highly uncertain. Thus, gender diversity could have some relation to the level of R&D spending after controlling for its other determinants. A more narrow range of revenue sources means a firm's turnover is likely to be more sensitive to demand for fewer products. Thus, more diversified firms are considered less risky. I use the Herfindhal-Hisschman index for revenue concentration to measure the degree of diversification[23]. Lastly, higher leverage can also be considered risky. Leverage is measured by the debt-to-equity ratio using the book value of firm equity. Control variables for these estimations follow prior literature (see e.g. Coles et al., 2006).

Finally, I use an alternative proxy of firm risk based on operating performance. The variable *S.D.(ROA)* is constructed as the standard deviation of firm return on assets in the next five years. Control variables for the *S.D.(ROA)* equation are the same as for my model of equity risk measures.

The first column of Table 2.13 shows no statistically significant relation between the proportion of women and CEO Vega. I also explore the relationship between CEO compensation and the proportion of female directors on the compensation committee and find no evidence that female representation affects compensation.

The rest of Table 2.13 shows the estimated relation between gender diversity and various risk-taking policy measures. Female boardroom representation cannot explain the variation in any of the risk-relevant firm policies, except for the level of diversification where it is significant at 10% level[24].

[23]We also use number of business segments (in log form) as a proxy for diversification and find qualitatively similar results.

[24]It is possible that if a company is more diversified, it will be more willing to undertake more risks. Faccio et al. (2011) find that firms controlled by diversified large shareholders has a riskier investment policy. Therefore, it is possible that the CEO may be able to undertake

Table 2.13: Other measures of firm risk

This table reports fixed effects estimation of CEO Vega, research and development expenditures, Herfindahl-Hirschman index of firm diversification and the standard deviation of firm's return on assets on proportion of women on board and control variables. *Stock Returns* is average daily returns multiplied by 250. *Dividends* is a dummy which equals one if the firm pays dividends. *Net PP&E* is the net value of firm's property, plant and equipment scaled by total assets. Other control variables are defined in Table 2.1. All models include year dummy variables. Within-cluster heteroskedasticity and serial correlation robust standard errors are reported in parentheses. Intercepts are included but not reported. *, **, *** denote statistical significance at 10%, 5% and 1% respectively.

Dependent Variable =	CEO Vega (1)	R&D (2)	Diversification (3)	Leverage (4)	S.D.(ROA) (5)
Proportion of Women	0.032	−0.004	−0.085*	−0.006	0.006
	(0.045)	(0.004)	(0.044)	(0.028)	(0.025)
Board Size	−0.003*	−0.000	−0.003*	−0.001	0.001
	(0.002)	(0.000)	(0.002)	(0.001)	(0.001)
Board Independence	0.020	0.001	−0.039	−0.010	0.022***
	(0.021)	(0.002)	(0.026)	(0.015)	(0.007)
Director Connectedness	−0.007	0.001	−0.008	−0.004	−0.006*
	(0.012)	(0.001)	(0.010)	(0.006)	(0.004)
CEO Vega		0.004**	0.025	−0.033***	−0.002
		(0.002)	(0.017)	(0.010)	(0.006)
CEO Delta	0.022***	−0.000	−0.001	−0.001	0.002
	(0.005)	(0.000)	(0.002)	(0.001)	(0.002)
CEO Tenure		−0.000	−0.001*	0.000	−0.000
		(0.000)	(0.000)	(0.000)	(0.000)
CEO Cash Compensation	0.029***	−0.001***	0.011***	−0.007***	−0.000
	(0.006)	(0.000)	(0.003)	(0.002)	(0.001)
Ln(Total Assets)	0.062***	−0.001	−0.048***	0.036***	0.017**
	(0.008)	(0.001)	(0.009)	(0.007)	(0.007)
Market-to-Book	−0.010**	−0.001***	0.007**	−0.011***	0.004
	(0.004)	(0.000)	(0.003)	(0.002)	(0.002)
Return on Assets	0.058***		0.086***	−0.240***	0.022
	(0.021)		(0.026)	(0.021)	(0.025)
R&D Expenditures	0.345**			0.008	0.150
	(0.147)			(0.112)	(0.149)
Capital Expenditures	0.043*				0.061*
	(0.024)				(0.033)
Leverage	−0.066***	0.008**	−0.004		−0.044**
	(0.022)	(0.003)	(0.024)		(0.021)
Diversification					0.007
					(0.009)
Ln(1+Sales Growth)		−0.005***	0.013*		0.014**
		(0.001)	(0.008)		(0.006)
Surplus Cash		−0.001			−0.032
		(0.005)			(0.036)
Total Risk	−0.051***				
	(0.008)				
Stock Returns		−0.001*	−0.013***		
		(0.000)	(0.004)		
Dividends			−0.007		
			(0.011)		
Net PP&E				−0.016	
				(0.033)	
Observations	13,581	13,581	13,581	13,581	8,379
Firms	11,070	10,057	10,052	14,114	8,503
R^2	0.199	0.037	0.143	0.108	0.044

I also do not find any significant relation between the proportion of women and the standard deviation of return on assets. Overall, female boardroom representation does not appear to have much impact on risk policies nor the accounting-based measure of risk.

2.5.6 Are banks different? Evidence from bank holding companies

In this section, I analyze a sample of bank holding companies (BHCs) that has been excluded from the main analysis. The sample comprises 138 BHCs (881 observations) with data available on RiskMetrics, Compustat, Execucomp and CRSP.

Table 2.14 reports ordinary least squares, fixed effects and dynamic panel estimates of equity risk measures on the proportion of female directors and control variables. I include the same set of board characteristics and CEO risk-taking incentives as the models in my main analysis. All my models also include several BHC characteristics. I include bank size as proxied by logarithm of total assets to control for bank complexity and ability to absorb risk. I control for growth rate using logarithm of asset growth (Berger et al., 2014) and charter value as proxied by Tobin's Q (Morrison and White, 2005). I also control for differences in balance-sheet composition using the ratios of loans and deposits to total assets and the proportion of bank loans that are non-performing. Finally, I include capital adequacy ratio to control for moral hazard and monitoring incentives (Keeley, 1990).

risker projects in a diversified firm. Under this explanation, the negative relation between the proprotion of women and diversification supports the view that gender diversity decreases risk. However, as the specification for all my key results includes diversification as a control variable, these results indicate that gender diversity is not related to risk *holding diversification constant*.

Table 2.14: Women on Boards and Bank Risk

The sample comprises 794 observations from 130 bank holding companies (BHCs) with data available on RiskMetrics, Compustat, Execucomp and CRSP. Ln(1+Asset Growth) is the logarithm of current year's total assets divided by previous year's total assets. Deposit ratio is total deposit divided by total assets. Capital adequacy ratio is the sum of tier-1 and tier-2 capital ratio. Charter value is the market value divided by the book value of firm's total assets. Loan ratio is total loan divided by total assets. Non-performing loan ratio is non-performing loan scaled by total loan. All models include year dummy variables. Bank-level cluster-robust standard errors are reported fro ordinary least squares and fixed effects models. Finite-sample robust standard errors (Windmeijer, 2005) are reported for dynamic panel system GMM. Intercepts are included but not reported. * , ** , *** denote statistical significance at 10%, 5% and 1% respectively.

	Ordinary Least Squares			Fixed Effects			Dynamic Panel System GMM		
Dependent Variable =	Total Risk	Systematic Risk	Idiosyncratic Risk	Total Risk	Systematic Risk	Idiosyncratic Risk	Total Risk	Systematic Risk	Idiosyncratic Risk
Proportion of Women	0.258	0.266	0.287	0.258	0.109	0.272	0.721	0.218	0.052
	(0.181)	(0.222)	(0.208)	(0.222)	(0.282)	(0.257)	(1.237)	(1.731)	(1.229)
Board Size	−0.008*	−0.011*	−0.008*	−0.002	−0.012*	−0.001	−0.004	0.006	0.004
	(0.003)	(0.004)	(0.003)	(0.004)	(0.006)	(0.004)	(0.014)	(0.030)	(0.015)
Board Independence	−0.038	−0.002	−0.046	−0.082	−0.194	−0.065	−0.352	−0.455	−0.660*
	(0.095)	(0.122)	(0.104)	(0.113)	(0.156)	(0.117)	(0.387)	(0.623)	(0.394)
Director Connectedness	0.004*	0.005*	0.004*	0.003	0.006	0.003	0.005	0.016	0.003
	(0.002)	(0.003)	(0.002)	(0.003)	(0.004)	(0.003)	(0.011)	(0.016)	(0.012)
CEO Vega	−0.184*	−0.317*	−0.187*	−0.198*	−0.338*	−0.194*	−0.042	−0.426	−0.046
	(0.091)	(0.143)	(0.086)	(0.086)	(0.137)	(0.080)	(0.258)	(0.477)	(0.282)
CEO Delta	0.012***	0.018***	0.013***	−0.002	−0.004	−0.001	0.000	0.010	0.000
	(0.003)	(0.005)	(0.003)	(0.004)	(0.008)	(0.004)	(0.012)	(0.021)	(0.012)
CEO Tenure	0.001	0.002	0.000	−0.003	−0.004	−0.003	0.007	0.004	0.012
	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.008)	(0.013)	(0.008)
CEO Cash Comp.	0.010	0.024*	0.006	−0.007	−0.008	−0.008	0.012	−0.004	0.003
	(0.008)	(0.011)	(0.009)	(0.006)	(0.009)	(0.007)	(0.035)	(0.057)	(0.036)
Ln(Total Assets)	−0.025	0.016	−0.028*	−0.004	0.078	0.003	−0.012	0.057	0.021
	(0.016)	(0.022)	(0.017)	(0.048)	(0.073)	(0.051)	(0.058)	(0.113)	(0.070)
Ln(1+Asset Growth)	−0.124*	−0.220***	−0.120*	−0.216***	−0.287***	−0.245***	−1.112***	−0.840*	−1.340***
	(0.063)	(0.084)	(0.071)	(0.065)	(0.104)	(0.068)	(0.403)	(0.455)	(0.456)
Deposit Ratio	0.016	0.092	0.008	0.643*	0.676*	0.809***	−0.131	1.712	−0.206
	(0.170)	(0.227)	(0.180)	(0.279)	(0.384)	(0.283)	(0.682)	(1.424)	(0.835)

(Continued on next page...)

(Table 2.14 Continued)

Capital Adequacy Ratio	−0.363	−0.352	−0.366	0.999*	2.504***	0.755	−2.593	−1.914	−2.372
	(0.569)	(0.716)	(0.609)	(0.490)	(0.803)	(0.561)	(2.272)	(4.611)	(2.260)
Charter Value	−0.225*	−0.176	−0.267*	−0.145	−0.117	−0.169	0.693	1.872*	0.762
	(0.127)	(0.203)	(0.146)	(0.115)	(0.262)	(0.127)	(0.625)	(1.117)	(0.469)
Loan Ratio	−0.324***	−0.421***	−0.268*	−0.174	0.069	−0.185	0.271	−0.384	0.409
	(0.118)	(0.152)	(0.129)	(0.183)	(0.273)	(0.184)	(0.557)	(0.791)	(0.519)
Non-performing Loan	2.601*	2.404	3.110*	2.223	2.457	2.515	2.287	6.171	4.070
	(1.375)	(1.532)	(1.544)	(1.455)	(1.508)	(1.682)	(5.329)	(9.657)	(5.228)
Risk Measure (Lag 1)							0.407	0.003	0.283
							(0.260)	(0.136)	(0.220)
Risk Measure (Lag 2)							−0.128	0.111	0.041
							(0.270)	(0.177)	(0.270)
Observations	881	881	881	881	881	881	632	632	632
Firms	138	138	138	138	138	138	138	138	138
R^2	0.819	0.537	0.770	0.881	0.610	0.853			
Hansen (df=29)							25.947	26.392	25.964
AR(1)							−2.294**	−2.152**	−2.495**
AR(2)							0.026	−1.436	−0.139

My results regarding the effect of gender diversity on risk of BHCs are the same as those in my main sample. I find no statistically significant relation between the proportion of women and risk measures in all specifications. In contrast to my main sample, I find that the proportion of female directors on board and risk measures are positively correlated. These results corroborate the results in Adams and Ragunathan (2013) who also find positive relations between the proportion of women on bank boards and equity risk[25]. Despite using different measures for risk[26], our results are also consistent with Berger et al. (2014) who find that female executives are associated with higher risk.

[25]Adams and Ragunathan (2013) use weekly stock return volatility and volatility of market model residuals as proxies for risk. Their coefficients are also not statistically significant.

[26]Berger et al. (2014) use bank portfolilo risk.

2.6 Conclusion

Many firms are under increasing public pressure to embrace more gender diversity in the boardroom. Although there presently is no mandatory gender quota in the US, SEC disclosure rules and pressure from various firm stakeholder groups are likely to nudge US firms towards appointing a greater proportion of female directors in the near future. As the level of female participation on boards of directors increases, the current literature provides only limited and inconsistent evidence regarding the economic impact that higher female representation might bring to the firm.

Drawing on 15 years of data and almost 2,000 firms, this study contributes to this debate by investigating the relationship between boardroom gender diversity and equity risk. In this study, I show that female boardroom representation is a choice that boards make, and that firm risk influences this choice. I then demonstrate that after controlling for two sources of endogeneity – unobserved heterogeneity and reverse causality – there is no evidence that female boardroom representation affects any of the equity risk measures included in this study. Associations between gender diversity and risk are found to be driven by unobserved heterogeneity that influences both the gender composition of a board and a firm's risk measures. Consistent with my finding that the gender make-up of the board does not affect equity risk, I also show that neither a range of firm policy measures or an operating measure of risk are affected by female board representation.

The main conclusion of this study is straightforward. A board with a higher proportion of female directors is no more or less risk-taking than a more male-dominated board. This result hinges on a careful identification of the causal relationship between director gender and firm risk. A key implication of my paper, therefore, is that studies which attempt to link the demographic characteristics of corporate decision-makers to firm outcomes have to carefully consider how to causally isolate firm outcomes from between-firm heterogeneous factors that influence both the demographic characteristics in the boardroom and the firm outcomes. Empirical set-ups which are unable to distinguish between the two will lead to biased results and policy conclusions which are not empirically justified.

Ultimately, the case for gender diversity on corporate boards rests on a sense of fairness rather than on pure economic considerations or what in essence could be called the "business case" for more gender diversity. The lack of strong empirical evidence on the relationship between gender diversity and risk, therefore, does not make gender diversity any more or less desirable. Still, my results, as well as those reported in Farrell and Hersch (2005) and Gregory-Smith et al. (2014), point to a gender bias in the director appointment process. Discriminatory practices in the recruitment of directors should attract scrutiny by regulators. Since I find evidence of gender bias in the director recruitment process, the results in this study at first glance support mandatory gender quotas. However, the possibility that firms' existing board characteristics are already optimal given a firms's internal characteristics and external environments has to be taken into consideration. Regulations such as a gender quota could cause a deviation from optimality and may have an adverse impact on firm value. Consistent with this, Ahern and Dittmar (2012) show value losses around the implementation of a gender quota law in Norway. Therefore, regulations around increased diversity disclosure and demands for more diversity by outside stakeholders offer a more cautious approach of encouraging firms to bring more gender diversity to their boardrooms.

CHAPTER 3

Spillover effects of women on boards

3.1 Introduction

Despite the increasing political and social pressure for firms to adopt greater gender diversity in the boardroom, the literature has yet to document consistent evidence on the relation between gender diversity and firm value. Studies find mixed evidence in regards to the relation between gender diversity and performance (e.g. Carter et al., 2003; Adams and Ferreira, 2009; Carter et al., 2010) and no study has yet established any evidence that board-level gender diversity is related to risk (e.g. Adams and Ragunathan, 2013; Matsa and Miller, 2013)[1]. Some argue that this is due to the fact that female directors are by and large minorities in the boardroom and thus are not able to

[1] Huang and Kisgen (2013) finds that male executives are more acquisitive and issue debt more often than female executives. Faccio et al. (2014) find female CEO to be negatively associated with firm risk. It is not certain that these results will hold for other directors. Berger et al. (2014) find that female executive director appointments increase bank risk-taking but the authors argue that this could be attributed to the differences in age and experience of female executives.

make any firm-level impact (Torchia et al., 2011; Schwartz-Ziv, 2015)[2]. However, these studies only look at gender diversity inside the boardroom of each particular firm.

In this study, I propose and empirically test an alternative way of looking at boardroom gender diversity. Instead of focusing only on female directors inside the boardroom of each firm, I look at gender diversity of the firm in a broader sense. Specifically, the measure of gender diversity employed in this study also incorporates the influence of female directors that male directors work with in other firms. Under this view, I find that gender diversity is a strong determinant of the board's monitoring behavior as well as firm risk. Specifically, I find that the interaction between the presence of female directors inside the boardroom and the presence of female directors within male directors' directorship network is related to attendance behavior of male directors, CEO turnover-performance sensitivity and equity risk.

To illustrate this idea, Figure 3.1 shows the composition of the board of directors of three companies – A, B and C. The board of company A comprises nine directors, only one of which is a female director. In order to reach a board-level consensus, these directors have to influence one another of their ideas. In order for Mary – a minority member on the board of company A – to influence a board-level consensus, she has to influence all other directors, including John. In this study, I argue that whether or not John is receptive to Mary's idea does not only depend on the influence of Mary on John (*internal influence*), but also depends on the influence of other women John works with

[2]Kanter (1977) postulates that minorities in group settings are usually seen as tokens; thus their performance is less likely to be noticed by the majority members of the group and their opinions may not be readily accepted. In her study of interaction between genders in a large corporation, she finds that the dominance group (men) are more likely to notice tokens (women) based on "appearance and other non-ablity traits" (p. 217). It is also possible that, as minorities, female directors are more inclined to agree with the opinions of male directors in the boardroom, as a number of conformity experiments, pioneered by Asch (1951), show that minorities tend to conform to a group's way of thinking.

on other boards (*external influence*, in this case – Ann in company B as well as Beth and Christine in company C). I argue that not only does the internal influence of female directors matters as a determinant of firm-level outcomes but so does the external influence of other female directors. If John is more receptive to Mary's ideas because of the presence of Ann, Beth and Christine, it means that the influence of Mary (internal influence) is reinforced by the influence of other women he knows in other boards (external influence).

The idea that board decisions can be influenced by people on other boards is plausible, based on the *conversion theory* developed by Sergio Moscovici (1980). Moscovici suggests that both majority and minority members influence each other in group decisions. Whilst minority members in a group generally conform to the opinions of the majority, minorities' opinions may still have an influence on the majority members of the group. Moreover, minority influence is found to be more persistent (Crano and Chen, 1998) and to have an indirect impact beyond the key message under discussion (Alvaro and Crano, 1997). This opens up the possibility that the influence can remain in the mind of the male directors even when they perform their duties on other boards. I call this the "spillover effect" of female influence. Many studies find that interpersonal contacts between groups can reduce intergroup prejudice (See Pettigrew and Tropp (2006) for a meta analysis)[3]. Specifically, Bhatnagar and Swamy (1995) and Palmer and Lee (1990) show empirical evidence that men's professional experience with women leads to more favorable attitudes towards women in their professional roles. A recent Gallup survey also finds that more Americans (both men and women) prefer to have a man as their boss rather than a woman (35% respond that they prefer a male boss whereas 23% respond they prefer a female boss). However, those who currently work for a

[3]These studies are based on the contact hypothesis (Allport, 1954), which stipulates that, under certain conditions, interpersonal contact can reduce prejudice between groups. These conditions include being of equal status and the interactions based on a common goal.

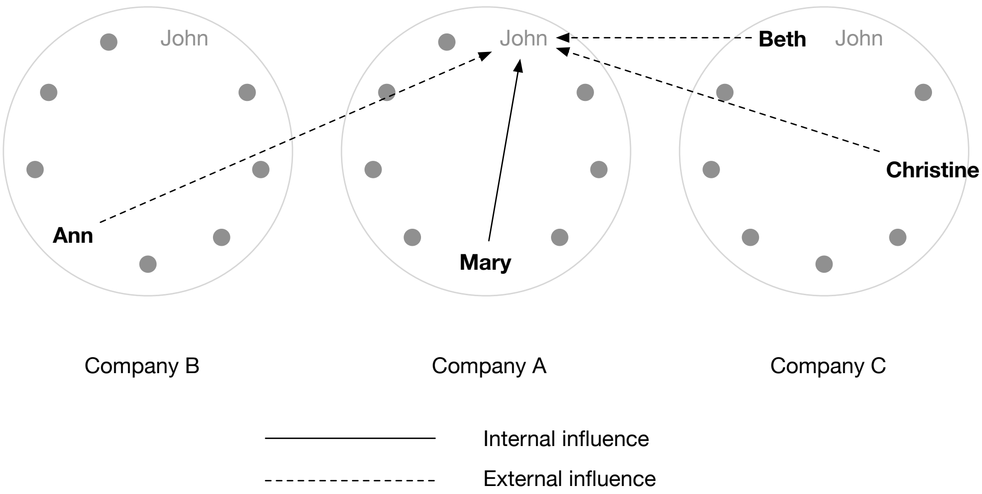

Figure 3.1: Internal and External Influences of Female Directors

women are equally likely to respond that they prefer a women as their boss as they would a man. This is indicative of the persistence of the influence of female directors. As a result, in order to truly analyze the impact of boardroom gender diversity, it is important to consider the influence of female directors both inside and outside of the board.

To measure the influence of female directors inside the board ("internal influence"), I follow the existing literature; that is, I observe whether there is any female director within the boardroom of each firm. This is the "internal connection" of male directors to female directors. To measure the influence of female directors outside of the firm's board, I observe whether male directors in each board are connected to female directors through their other directorships. If a male director sits on at least one other board that has female representation, I classify this director as being "externally connected" to women. I argue that these "external connections" to female directors lead to "external influence" from women to men. Both sources of influence may lead to male directors becoming closer to female directors in terms of ideas and attitudes.

I first test whether external influence of female directors affects individual male directors. As female directors are found to be associated with better monitoring behaviors (e.g. Adams and Ferreira, 2009; Adams and Ragunathan, 2013), I hypothesize that external influence of female directors may lead a male director to become more effective at monitoring. I look at board meeting attendance behavior as it is an observable outcome for individual directors that can be related to their attitude towards monitoring (Adams and Ferreira, 2008). The results indicate that the interaction between internal and external influences is a strong determinant of male directors' attendance behavior[4]. I

[4]External influence of a female director alone also appears to have some impact. Male directors who are connected to a female director in other boards are 7% less likely to exhibit absenteeism. However, this difference is not statistically significant.

find that for male directors who are externally connected to women, a 10% increase in the proportion of female directors inside the board is associated with an approximately 24% reduction in the probability that the director would exhibit absenteeism. In contrast, for those male directors who do not have any external female connection, the effect of having female directors on board is close to zero. On the basis that these meetings are opportunities for directors to monitor performance of the firms and its executives (Adams and Ferreira, 2008), these results suggest that male directors are more effective monitors when they are under both internal and external influences from women.

Next, I test whether the presence of these externally influenced men can explain the variation in firm-level outcomes. As most boards comprise a majority of male directors, the opinions of these influenced male directors would be more likely to be accepted by the group than if they were from minority members. This is because male directors are a part of the majority and thus are not seen as tokens (Kanter, 1977). As a result, their opinions may be more likely to affect firm-level outcomes. For each board, I measure the proportion of male directors on board that have external connections to women as a board-level proxy of external female influence. In firms with at least one female director, I find that this measure can explain the probability of CEO turnover when the firm performs poorly. When there is at least one woman on the board, a 10% increase in the proportion of connected men is associated with a 20% increase the probability of CEO turnover. In contrast, when there is no woman on the board, a 10% increase in the proportion of connected men is associated with only a non-statistically significant increase of 5% in CEO turnover probability. Again, this indicates that the interaction between internal and external influence of female directors is a determinant of a board monitoring behavior. In firms where male directors are both internally and externally connected to women, CEO turnover is more sensitive to stock performance.

Finally, I find that the interaction between external and internal influence of female directors also decreases firm equity risk. I find that firm total, systematic and idiosyncratic risks increase with the proportion of connected men, but only in firms where there is at least one woman director on board. Taken together, the overall results suggest that boards in which male directors are influenced by women both inside and outside of the board are more effective at monitoring and are associated with lower equity risk. The evidence found in this study is consistent with the view that male directors who are connected to women from outside of the board are more easily influenced by female directors inside the board. This also potentially explains why research so far has not found robust evidence on the risk-gender relationship. Women may only have an impact at the firm level when men on the board are receptive to their ideas. Thus, distinguishing firms where male directors are more likely to be influenced by women is potentially a key to assess the impact of women directors.

This study distinguishes "external influence" from "internal influence" – potential influence that comes from women within the current board under investigation – because of the endogenous nature of female boardroom representation. It is likely that firm characteristics and policies can influence female director appointments by that firm in its own board. However, it is less likely that these characteristics and policies would influence female director appointments on the boards of other firms. Thus, the presence of male directors who are externally connected to female directors is arguably less likely to be an endogenous choice compared to the presence of female directors on board used in other studies (e.g. Liu et al., 2014). Nonetheless, I perform several robustness tests to rule out a number of alternative possibilities and find that the results continue to hold. These include the possibilities that the results could be confounded by other unobserved factors, peer effects of other male directors, or the possibility that externally connected directors are more talented. Overall, I show that the presence of women in the boardroom can impact firm behavior even when they represent only a small proportion of the board of directors. My results also imply that gender diversity in the boardroom cannot be seen at the firm-level in isolation; director networks also have to be taken into account.

This study contributes to the existing literature in the following ways. First, to the best of my knowledge, this study is the first to document the spillover effect of female director behaviors to male directors across different boards and shows how both gender diversity inside and outside the firm affects the behavior of the firm. This study is most closely related to studies on the impact of female boardroom representation on corporate outcomes (e.g. Ahern and Dittmar, 2012; Matsa and Miller, 2013) as I extend the scope of gender diversity that is considered in these studies. Understanding whether and how gender diversity affects firm-level outcomes is important. In light of the growing pressure worldwide to increase female representation in the boardroom, the literature has investigated the impact of female directors on economic outcomes. Although existing empirical evidence shows a difference in behaviors between male and female directors[5], the literature finds mixed evidence when it comes to firm-level outcomes (e.g. Adams and Ferreira, 2009; Liu et al., 2014; Gregory-Smith et al., 2014). In particular, the literature finds little evidence that director gender affects firm-level risk outcomes[6]. Matsa and Miller (2013) look at the impact of gender quotas on Norwegian boards and conclude that "risk aversion may not be a distinctive part of women's approach to corporate

[5]Evidence shows that female directors tend to be more conscientious and better at monitoring (e.g. Izraeli, 2000; Huse and Solberg, 2006; Adams and Ferreira, 2009; Adams and Ragunathan, 2013).

[6]Only Berger et al. (2014) find the addition of female directors on bank boards to be positively related to risk. However, the authors attribute the differences in risk to the differences in age and experience.

decision making" (p. 161). Adams and Ragunathan (2013) find no strong evidence that gender diversity in the boardroom is related to any of the various firm-level risk measures. In this study, I find a strong relation between gender diversity and risk when I take into account female directors that are outside of the firm but are connected to the firm through male directors. Additionally, I extend the findings of Adams and Ferreira (2009) by showing that not only does the presence of female directors influence the behavior of male directors on that particular board, it also influences their behavior on other boards. I also show that the presence of these influenced male directors can is significantly related to the variation in firm-level outcomes.

Second, I contribute to the literature on governance mechanisms and firm-level risk. Prior literature has documented the relationships between performance variability and the corporate governance environment including CEO gender (Faccio et al., 2014), financial expertise (Minton et al., 2014), managerial ownership (Kim and Lu, 2011), managerial compensation (Coles et al., 2006) and institutional ownership (Wahal and McConnell, 2000). Gonzalez and André (2014) find a negative relation between director independence and equity risk. They argue that monitoring from directors who have no ties with the executive can reduce systematic risk in equity prices. I show that individuals whom directors know from their professional network, in particular female directors, also have an impact on equity risk. The evidence in this study suggests that this impact on risk is likely to be due to more effective monitoring.

Third, this study also contributes to the literature on the social networks of executives (e.g. Fracassi and Tate, 2012). Fracassi (2012) shows that social ties between two companies' executives and directors are positively related to similarities in firm policies. Shue (2013) documents similarities in behaviors of firms whose CEOs were randomly assigned into the same MBA class. I investigate professional connections at the director level and show that professional ties to female directors can influence male director behaviors.

Finally, this study contributes more generally to the literature on the hitherto inconclusive debate over director gender and firm value. Many studies use operating performance measures which are not risk-adjusted (e.g. ROA, ROE or other accounting variables)[7]. These studies can reveal only part of the story, because two firms with identical cash flows can exhibit different levels of risk. Even when operating performance is not affected, firm value may still be affected through risk (i.e. the discount rate)[8]. I contribute to this literature by showing that the presence of female directors in the professional network of male directors can influence firm-level risk outcomes.

[7] Some of these studies also examine Tobin's Q, which is measured as market-to-book ratio and is a proxy for a firm's growth opportunities. Although Tobin's Q is a risk-adjusted measure based on firm market value, Wintoki et al. (2012) argue that this measure is more likely to be a cause rather than a consequence of governance structure. This argument is supported by theoretical works such as Raheja (2005) and Harris and Raviv (2008). Various empirical works including Boone et al. (2007) and Linck et al. (2008) also find evidence that supports this argument.

[8] Other studies use risk-adjusted measures of performance changes, but reach conflicting conclusions. Ahern and Dittmar (2012) document a decline in equity prices following the introduction of a gender quota in Norway, while Adams et al. (2011) find that appointments of female directors result in higher stock market performance than male director appointments.

3.2 Literature and hypotheses

3.2.1 Influences of female directors

Serge Moscovici (1980, 1985) developed conversion theory to explain how influences are effected between individuals. Moscovici argues that any influence can lead to internal emotional conflict and that individuals are motivated to reduce this conflict. The process by which the conflict is reduced, however, depends on the source of the conflict. When the influence comes from the majority, individuals focus on the interpersonal relationship between themselves and members of the majority and the desire to conform tends to outweigh the consideration whether they agree with the opinion.

An extreme example of majority influence comes from Asch's (1951) conformity experiment where participants are asked to say aloud which line from three choices has the same length as the reference line. This example is illustrated in Figure 3.2. When the participants are grouped with others who are instructed to give the wrong answer (A or B), 75% of these participants also give the wrong answer to this simple question which has only one objectively correct answer (C). This evidence suggests that individuals primarily seek to comply with the majority members with little consideration to the validity of the actual decision.

In contrast to majority influence, when the sources of influence comes from the minority, individuals put greater focus on the message. Thus, the influence is believed to have a lasting impact on the influenced individuals. Many minority-influence studies employ a color perception task (e.g. Moscovici et al., 1969) and find that when a minority member of the group consistently calls a perceptively blue slide green, some of the subjects who are members of the

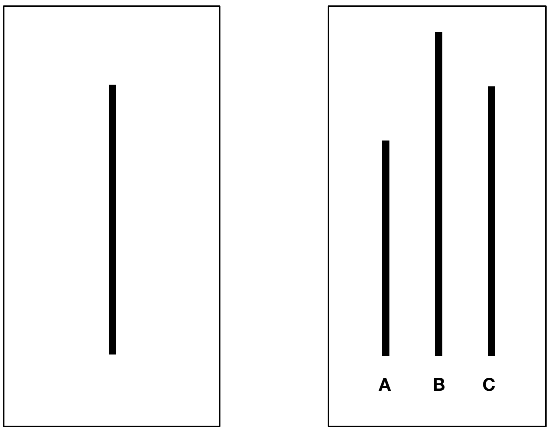

Figure 3.2: Line Matching Task from the Experiment of Asch (1951).

majority are also likely to call the same slide green. This effect is intensified when participants are asked to identify the color in private instead of publicly in front of the group.

The fact that the response is different when the question is asked in private is the key element that distinguishes influence from the minority to that from the majority. Majority influence can result in a public consensus without the individuals agreeing with the idea privately. On the other hand, minority influence can lead to the influenced individuals agreeing with the idea even when they may not express the agreement publicly. Only when a sufficient number of individuals privately agree with the minority's idea can the influence of the minority develop into public influence.

Moscovici (1980) argues further that the influence from minorities can lead to private validation by the majority when the influence comes from various sources that are consistent in their behavior. That is, the more the majority is exposed to consistent minority positions, the more likely they are to be influenced by them.

The documented effects of minority influence also extend beyond the color perception experiment to social issues such as homosexuality and gun control (Alvaro and Crano, 1997). Mugny (1975) documents similar results where the majority is exposed to extreme political ideologies. In addition, he finds that the influence is more powerful when the minority has a "flexible style of negotiation" i.e. they are willing to compromise. This finding carries particular relevance for this study as Adams and Funk (2012) find that female directors are less power-oriented (defined by Schwartz et al. (2001) as being less inclined to exert control or dominance over people) and hence are likely to take a collegiate approach in discussions.

Maass et al. (1987) identify four dimensions that are used in research to compare the effect of minority and majority influences: time, specificity, privacy, and awareness. Crano and Chen (1998) find that influence asserted by the majority induce a temporary change in attitude whereas influence asserted by the minority leads to more persistent impact. Additionally, minority influence is also found to have an indirect impact beyond the key message (Alvaro and Crano, 1997; Mugny and Perez, 1991) and those influenced are also less aware of this influence (Maass et al., 1987). Wood et al. (1994) conclude in their meta-analysis of 97 studies that minority influence "was most marked on measures of influence that were private from the source and indirectly related to the content of the appeal and less evident on direct private influence measures and on public measures" (p. 323).

Overall, conversion theory suggests that numerical minorities can make a broad impact by influencing individual members of the majority. Therefore, even when it appears that women as a minority tend to conform to the majority point of view, it is possible that these female directors can nevertheless exert influence on individual male directors, and as they influence more individual male directors, their impact can manifest itself in firm level outcomes.

3.2.2 Differences between male and female directors

The literature documents differences in behavior and attitudes between male and female directors[9]. Adams and Funk (2012) survey core values and attitudes[10] of directors and CEOs in Sweden and find that the women in their sample are more *benevolent*, more *universally concerned* and less *power oriented*

[9]This section only focuses on the literature on gender differences using samples of directors and top executives. Croson and Gneezy (2009) provide an excellent literature review on gender differences in the general population.

[10]Apart from *risk aversion*, the values and attitudes are based on the 10 value constructs of Schwartz et al. (2001).

than men. These women are also found to be slightly less *tradition-oriented* and less *risk averse*. Evidence shows that female directors are perceived to be more serious about their directorship and more conscientious at board meetings (Izraeli, 2000; Huse and Solberg, 2006). They also appear to be better at monitoring than their male counterparts (Adams and Ferreira, 2009; Adams and Ragunathan, 2013). Overall, the observable difference in behaviors between gender generally pertain to their monitoring intensity or conscientiousness[11].

3.2.3 Female influence and attendance behavior

I argue that female directors, as a minority, can influence male directors, who are members of the majority. I see “conscientiousness” as a “behavioral style” of female directors and investigate whether male directors change their behavior when exposed to female influence.

As there is no direct way to measure a director’s attitude towards monitoring, I look at the board meeting attendance problem as reported in SEC’s proxy statements. Board meetings provide the opportunity for directors to evaluate the performance of the executive team, and the information obtained from these meetings is crucial in strategic decision making. It follows that attendance at these meetings can be considered an observable outcome based on which a director’s attitude towards monitoring can be assessed. This is argued by Adams and Ferreira (2009), who find that female directors are less prone to absenteeism and see this as evidence of women being better monitors. These

[11] It is important to note that the difference in conscientiousness is not necessarily an intrinsic female directors trait. On the contrary, both Adams and Ferreira (2009) and Ferreira (2014) point out possible reasons why it is not. For example, women may be under higher performance pressure due to the visibility their token status confers (Kanter, 1977). Nonetheless, it is the visible differences in behavioral styles of female directors that can lead to influences on male directors.

authors also find that fewer male directors have attendance problems when there is a female presence in the boardroom. Their results support my narrative that women have some influence over the majority group i.e. male directors.

However, the evidence from Adams and Ferreira (2009) only suggests "internal influence" where both male and female directors sit on the same board. I seek to test the spillover effect of this influence on male directors' behaviors on their other boards – an "external influence". If there was a spillover effect of influence, there should be an observable relation between female connections of male directors from their other directorships (external connection) and their attendance behavior. Thus, my first hypothesis is as follows:

Hypothesis 1 *Male directors are less likely to exhibit absenteeism when they are externally connected to female directors.*

Additionally, if both external and internal female influences matter, one may expect both sources of influences to reinforce each other. That is, connected male directors may have better board attendance when working on a gender diverse board, compared to one which comprises exclusively male directors. Therefore, I add this as a sub-hypothesis below.

Hypothesis 1* *Male directors are less likely to exhibit absenteeism when they are both externally and internally connected to female directors.*

3.2.4 Female influence and firm-level outcomes

It is potentially more difficult for female directors to influence firm-level outcomes due to their minority status. Farrell and Hersch (2005) and Gregory-Smith et al. (2014) document some evidence of tokenism: female directors are more likely to be appointed after another female director's departure. Kanter (1977) finds that female directors are usually treated as tokens. Not only are tokens under higher performance pressure, their performance and achievements are less likely to be noticed by the majority. Thus, it is likely to be harder for female members of the board to exert influence on board-level decisions.

Although it may be challenging for female directors to exert influence, there remains the possibility that male directors can be privately influenced by female directors. This is illustrated in Figure 3.3. In this figure, the female director F1 exerts her influence on board decisions in a board meeting. Although she may not be able to influence board decisions (public influence – represented by solid lines) due to her token status, male directors may be intrigued by her different opinions such that she may be able to privately influence them (private influence – represented by dotted lines). Furthermore, conversion theory suggests that, as the difference in attitude of minority can intrigue the majorities, the minority influence can be more persistent. If so, the influence on male directors may not only be from female members on the board (internal private influence) but they can also be influenced by female directors they know from other directorships (external private influence).

One can also argue that the influence of female directors on M2 is stronger than the influence on M1, as M2 receives the influence from two different sources (F1 and F2), particularly if the influence received from both sources is consistent. As illustrated in this figure, it is possible that the male director

M2 may hold attitudes influenced by the female director F2, whom he knows from his other directorship, even when F2 is not present in the current meeting. It is possible that when there are a sufficient number of male directors who are influenced by female directors, female attitudes i.e. conscientiousness will be reflected in board level decisions. If this is the case, I should observe a relation between the proportion of men who are connected to women via other directorships and firm-level monitoring behavior.

One of the key responsibilities of the board is to monitor the CEO (Mace, 1971; Hermalin and Weisbach, 2003) and CEO turnover, particularly when the firm performs badly, can be considered an observable outcome of the board's monitoring ability. For example, Weisbach (1988) finds that CEO turnover is more sensitive to performance in an outsider-dominated board. CEO turnover also tends to be more sensitive to performance in firms with a smaller board (Yermack, 1996) and when the chair's position is separate from the CEO position (Goyal and Park, 2002). This suggests a positive relation between effective monitoring and CEO turnover sensitivity. Adams and Ferreira (2009) find that CEO turnover sensitivity is higher in firms with gender-diverse board and argue that it is potentially due to female directors being more effective monitors. If the board is more effective at monitoring due to the presence of externally-connected male directors (i.e. those who sit on other boards with women directors), then the CEO should be more likely to be dismissed when firm performance is low. Similar to board attendance, I also anticipate CEO turnover to be more sensitive to performance when there are both external and internal influences of female directors. Therefore, the hypotheses are as follows:-

Hypothesis 2 *When stock return is low, the probability of CEO turnover increases with the proportion of externally-connected male directors on board.*

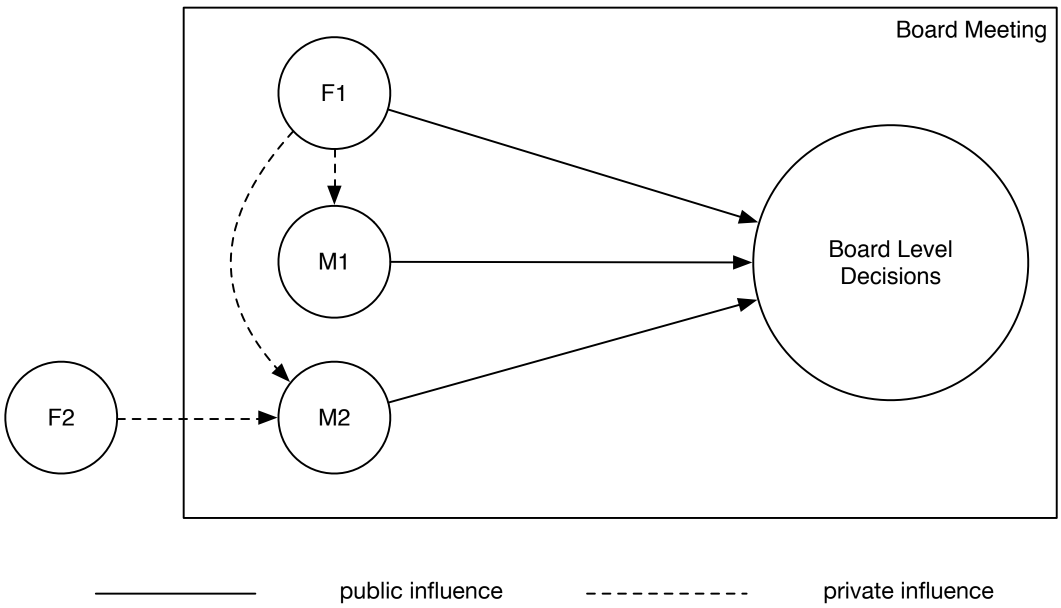

Figure 3.3: Public and Private Influence Between Directors in a Board Meeting

Hypothesis 2* *When stock return is low, the probability of CEO turnover increases more strongly with the proportion of externally connected male directors in firms with female directors.*

Next I look at the relation between externally-connected male directors and equity risk measures, which are proxies for performance variability. Sah and Stiglitz (1986, 1991) argue that centralized decision making can lead to outcomes that can be either very good or very bad; thus, without checks and balances, firms might be managed in ways that result in extreme performance outcomes i.e. higher performance variability. Adams et al. (2005) find that a powerful CEO is positively related to stock return standard deviation. Stronger monitoring from directors can be a factor that moderates extreme decision making. Cheng (2008) finds a negative association between board size and return volatility; he argues that decisions of larger boards are less extreme and therefore the performance of these firms tends to be less volatile. Gonzalez and André (2014) find firm systematic risk to be lower when the firm has an effective board. There is evidence that the CEO being female is associated with lower risk (Faccio et al., 2014)[12]; however, Adams and Ragunathan (2013) fail to find similar evidence for female directors[13]. It is possible that the influence of women on male directors inside the boardroom may need to be taken into consideration. Therefore, I postulate that as female-connected men become better at monitoring, their presence can decrease equity risk measures and potentially more so in firms with female directors. My third set of hypotheses are as follows:

[12]Faccio et al. (2014) find that firms run by female CEOs have lower leverage, lower ROA volatility and are more likely to survive over a 5-year period.

[13]Adams and Ragunathan (2013) analyze the relation between gender diversity of financial firms and stock return volatility, idiosyncratic volatility, Z-Score, estimated default frequency and tail risk.

Hypothesis 3 *Equity risk measures decreases with the proportion of externally-connected male directors on the board.*

Hypothesis 3* *The relation between equity risk measures and the proportion of externally-connected male directors is stronger in firms with female directors.*

3.3 Data

For this study, I obtain an unbalanced panel of director-level data for Standard & Poor's (S&P) 500, S&P MidCaps and S&P SmallCap firms for the period 1998–2012. The sample consists of 84,533 directorships (director-firm-years). I have information for 14,133 directors across 2,003 firms in this sample period. When I consolidate the director data into firm-level variables I end up with 16,289 observations.

3.3.1 Directorship-level data

In Table 3.2, I present summary statistics of the characteristics of all the directorships in my sample. Out of 84,533 directorships, 11,150 are held by women (13.19%). About 82% of the directorships are held by men. Out of these male directorships, 23,965 male directors are externally connected to women (about 28% of the full sample).

To determine whether a male director is externally connected, I investigate each male director in each firm year. If in a particular year a male director sits on at least one other board that has female directors, he is considered to be externally connected. This measure considers the contemporaneous influence of female directors on male directors.

As an illustration, I present an example of one director in the data set. In 2009, Peter J. Knights sits on the boards of Akamai Technologies Inc., Fiserv Inc. and Manhattan Associates (see Figure 3.4). Akamai Technologies has three female directors on its board; Fiserv has two female directors whereas the board of Manhattan Associates comprises exclusively male directors. From the perspective of Akamai Technologies, Peter has one external connection to

Table 3.1: Variable Definitions

Panel A: Director-level Variables	
D(Male Director)	= 1 if the director is a man, and 0 if the director is a women.
D(Connected with Women)	= 1 if the male director sits on the same board as at least one woman in his other directorships, and 0 otherwise.
D(Not Connected with Women)	= 1 if the male director does not know any female director from his other directorships, 0 and otherwise.
Director Age	Director's age (years).
Director Tenure	The number of years that the director has been on the board of directors.
Director Connectedness	Number of other directorships held by the director.
Absenteeism	= 1 if the proxy statement reports that the director misses more than 75% of board meetings, and 0 otherwise.
Panel B: Firm-level Variables	
Proportion of Connected Men	The number of male directors who sit on the same board as at least one women in his other directorships divided by the total number of directors.
Proportion of Women	The number of female directors divided by the total number of directors.
Average Director Age	The average age of all directors.
Average Director Tenure	The average tenure of all directors.
Board Connectedness	The total number of external directorships held by all directors.
Board Size	The total number of directors.
Board Independence	The number of directors who are non-executives and do not have any other affiliation with the managers divided by the total number of directors.
Ln(Total Assets)	Natural logarithm of total assets.
Market-to-Book	Stock price at fiscal year end times the number of common shares outstanding divided by the book value of equity.
Return on Assets	Return on assets, defined as net income divided by total assets.
R&D Expenditures	Research and development expenditures divided by total assets. Missing values are replaced by zero.
Capital Expenditures	Capital expenditures divided by total assets. Missing values are replaced by zero.
Leverage	Total long-term debt divided by total assets.
Total Risk	Natural logarithm of daily stock price volatility multiplied by a square root of 250.
Systematic Risk	The regression coefficient for market returns (using CRSP value-weighted index) from the single-factor market model.
Idiosyncratic Risk	Natural logarithm of the residuals from the single-factor market model multiplied by a square root of 250.
Diversification	The Herfindahl-Hirschman Index for for sales concentration across business segments.
Stock Return	Average daily stock return.
CEO Chair Duality	= 1 if the CEO is also the chairman of the board, and 0 otherwise.

women as he also sits on the board of Fiserv in which he works with Kim M Robak who is a female director. Similarly from the perspective of Fiserv, Peter also has one external connection to women. From the perspective of Manhattan Associates, Peter has two connections to women as there are female directors in both Akamai Technologies and Fiserv. Therefore, Peter is considered to be an externally connected man in all three boards.

Figure 3.5 shows the break down of male directors based on the number of external connections to women. About 21% of these men have only one connection and about 8% have two connections. Only a small proportion has more than two external board connection to women[14].

Panel A shows summary statistics for all directors in the sample. An average director is about 62 years old and has an average tenure of 9 years. I define *Director Connectedness* as the number of external board seats (in firms with and without any female directors) held by the director. This can be a proxy for director "busyness" – directors having many outside directorships may be less able to monitor (e.g. Fich and Shivdasani, 2007). It can also be seen as a signal of director ability as sitting on multiple boards might mean that his human capital is in high demand (e.g. Masulis and Mobbs, 2014). On average, a director holds 0.64 external directorships. The variable *Absenteeism* is a dummy variable which equals one when a director attends fewer than 75% of the sum of the total number of board meetings and the total number of meetings held by board committees on which they serve in each year[15]. Only 1.4% of the directorship-years in the sample are reported as exhibiting absenteeism. This is not surprising as directors who have attendance problems are reported in the proxy statement and this could be detrimental to the reputation of those

[14]The largest number of external connections to women is 9.

[15]The firms are required to disclose in their proxy statement any director whose attendance is below the 75% threshold by the Securities and Exchange Act of 1934.

Akamai Technologies Inc. (AKAM)	Fiserv Inc. (FISV)	Manhattan Associates (MANH)
Conrades, George H.	Dillon, Donald F.	Cassidy, Brian
Coyne, Martin M. II	Kearney, Daniel P.	Goodwin, Paul R.
Goodwin, C. Kim	Knight, Peter J.	Huntz, John J. Jr.
Graham, Ronald L.	O'Leary, Denis J.	Knight, Peter J.
Greenthal, Jill A.	Levy, Gerald J.	Lautenbach, Dan J.
Kenny, David W.	Renwick, Glenn M.	Noonan, Thomas E.
Knight, Peter J.	**Robak, Kim M**	Raghavan, Deepak
Leighton, F. Thomson	Simons, Doyle R.	Sinisgalli, Peter F.
Moore, Geoffrey A.	Wertheimer, Thomas C.	
Sagan, Paul	Yabuki, Jeffery W.	
Salerno, Frederick V.		
Selighman, Naomi O.		

Figure 3.4: An Example of Director Internal and External Connections to Women

In 2009, Peter J. Knight holds 3 directorships in Akamai Technologies Incorporated (AKAM), Fiserv Incorporated (FISV) and Manhattan Associated (MANH). AKAM has 3 female directors on its board; FISV has 1 female directors on its board; while MANH has no female director on its board. Female directors are marked in bold. For AKAM and FISV, Peter is both externally and internally connected to women. For MANH, Peter is externally connected to women but is not internally connected to women.

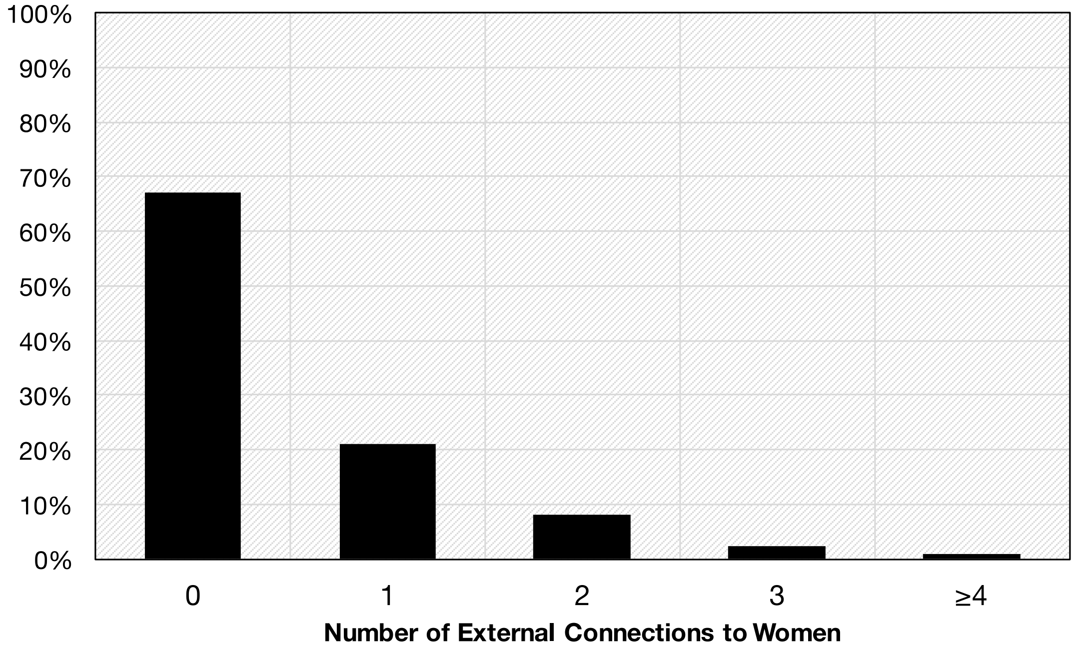

Figure 3.5: Proportion (%) of Male Directors by the Number of External Connections to Women

Table 3.2: Summary Statistics (Directorship-Years)

Panel A shows summary statistics for all directorship units (directorship-years) in the sample. Panel B shows summary statistics for male and female subsamples. Panel C shows summary statistics for the subsamples of male directors with and without external connections to female directors. A male director is considered to have external connections to female directors if he sit on at least one other board on which there is at least one female director. The sample covers the period between 1996–2012. Descriptions of all variables are provided in Table 3.1. Directors' information is from the RiskMetrics database. Accounting variables are obtained from the Compustat database. *Total Risk* is calculated using price data from Centre for Research in Security Prices.

		(B) Subsample by Gender			(C) Subsample by External Connection to Women		
	(A) All Directors	Women	Men	Difference ($\lvert t \rvert$)	Men Without External Connection	Men With External Connections	Difference ($\lvert t \rvert$)
Director Level Variables							
Age	61.774	57.271	62.459	68.703	62.459	62.831	9.414
Tenure	8.952	7.519	9.169	30.813	9.169	8.357	24.606
Director Connectedness	0.636	0.769	0.615	14.015	0.615	1.657	252.904
Absenteeism	0.014	0.012	0.015	2.351	0.014	0.016	1.308
Firm Level Variables							
Board Size	9.464	10.019	9.379	28.949	9.047	10.064	57.380
Board Independence	0.753	0.770	0.750	14.871	0.739	0.773	32.651
Total Assets	8133.128	11168.850	7671.872	13.381	5292.442	12578.47	36.984
Market-to-Book	1.965	1.975	1.964	0.800	1.968	1.955	1.311
Return on Assets	0.045	0.054	0.044	9.814	0.041	0.049	7.788
Total Risk	0.429	0.397	0.434	19.048	0.450	0.400	32.541
R&D Expenditure	0.066	0.039	0.070	5.221	0.077	0.057	1.536
Capital Expenditures	0.077	0.053	0.080	4.852	0.085	0.071	1.176
Leverage	0.220	0.230	0.218	7.228	0.208	0.239	23.273
Observations	84,533	11,150	73,383		49,418	23,965	

directors.

In Panel B, I split the sample into two groups based on director gender. I find that female directors are younger and have shorter tenure than men. The average age of female directors is about 57.27 years, as compared to 61.46 years for male directors. An average female director has spent 7.52 on the board whereas the average tenure is 9.17 years for male directors. The differences in age and tenure are significant at 1% level. The level of absenteeism is higher amongst male directors compared to female directors (significant at 5%). Women on average sit on larger and more independent boards; they also sit on boards of larger firms with higher growth opportunities. Additionally, we find that women are more similar amongst themselves in terms of age, tenure and attendance record compared to men[16]. This fact could lead to women behaving more consistently, a condition for minorities to be able to influence majorities within the minority influence literature.

In Panel C, I present the summary statistics for the subsamples of male directorships based on their external connection to women. Amongst male directors, those who are externally connected to women are slightly older and have shorter tenure. Amongst these directorships, men who are externally connected to women on average are 62.83 years old whereas those who are not connected to women are 62.46. The average tenure for directorships of men with external connections to female directors is 8.36 years whereas for directorships of men with no external female connection it is 9.17 years. Although the differences are not as big as the differences between men and women,

[16]For age, the standard deviations are 7.31 and 8.17 for female and male directors respectively. The standard deviations for tenure are 5.01 and 6.71 for female and male directors respectively. The Variance ratio tests indicate that the variances of these variables are statistically smaller for female directors than for male directors. The variance ratios are 1.247 for age and 1.792 for tenure (male divided by female). Both reject the null hypothesis that the variances of the two groups are equal against the alternative hypothesis that the variance for the male group is greater than the variance for the female group at 1% level.

these differences are statistically significant at 1% level and prior literature documents the relations between these variables and the outcome variables in this study. For example, Adams and Ferreira (2008) find director tenure to be associated with board meeting attendance and Berger et al. (2014) show evidence that younger directors are associated with higher risk taking. Therefore, these characteristics are included in the model, as not accounting for these differences may cause the results to be biased. Notably, the number of external board directorships are larger for externally connected men[17]. There is no statistical difference in term of absenteeism amongst these two groups, although the probability of externally connected men exhibiting absenteeism is slightly larger (1.6% compared to 1.4%). Men who have external connections to women also sit on larger and more independent boards in larger firms. The firms in which externally connected men work for are more profitable, have lower risk and higher leverage.

3.3.2 Firm-level data

I consolidate the directorship-level observations to firm-level and present the summary statistics in Table 3.3. In Panel A, I present the statistics for the full sample. An average board comprises nine directors, 70% of which can be classified as independent[18]. The average proportion of women on the board is 9%, which suggests that there is one woman director on an average board. Compared to the proportion of female directors, the proportion of men who are externally connected to women is much higher (27.7%). This means that

[17]I further account for the possibility that my results are confounded by external directorships of male directors in the robustness section (Section 3.5.4)

[18]I rely on RiskMetrics' definition of director independence. Independent directors are those directors who have no material connection to the company other than a board seat. "Material" is defined as a standard of relationship (financial, personal or otherwise) that a reasonable person might conclude could potentially influence one's objectivity in the boardroom in a manner that would have a meaningful impact on an individual's ability to satisfy requisite fiduciary standards on behalf of shareholders.

Table 3.3: Summary Statistics (Firm-Years)

Panel A shows summary statistics for all firm units (firm-years) in the sample. Panel B shows summary statistics subsample of firms with and without female directors on board. Panel C shows summary statistics for the subsamples of firms with and without connected men. Firms with connected men are those with male directors who are externally connected to female directors. The sample covers the period between 1996–2012. Descriptions of all variables are provided in Table 3.1. Board characteristics are constructed using the information from the RiskMetrics database. Accounting variables are obtained from the Compustat database. Stock return and equity risk measures are calculated using price data from Centre for Research in Security Prices.

	(A) All Firms				(B) Subsample by Female Directors			(C) Subsample by Connection with Women		
	Mean	S.D.	Min	Max	Firms Without Women	Firms With Women	Diff. ($\lvert t \rvert$)	Firms Without Connected Men	Firms With Connected Men	Diff. ($\lvert t \rvert$)
Board Characteristics										
Proportion of Women	0.098	0.095	0.000	0.667	0.000	0.158	222.438***	0.066	0.108	23.667***
Proportion of Connected Men	0.277	0.237	0.000	1.000	0.164	0.345	55.285***	0.000	0.360	194.011***
Board Connectedness	0.536	0.468	0.000	3.444	0.350	0.648	44.708***	0.101	0.666	117.982***
Board Size	8.956	2.305	2.000	23.000	7.609	9.769	68.527***	7.481	9.398	53.530***
Board Independence	0.699	0.170	0.000	1.000	0.650	0.728	27.907***	0.629	0.719	27.823***
Average Director Tenure	9.642	4.008	1.000	34.667	9.998	9.428	8.388***	10.481	9.392	12.997***
Average Director Age	60.015	4.390	27.833	77.875	59.711	60.199	6.443***	59.037	60.308	13.519***
CEO Characteristics										
Female CEO	0.024	0.152	0.000	1.000	0.000	0.037	19.031***	0.023	0.024	0.051
CEO Chair Duality	0.460	0.498	0.000	1.000	0.428	0.478	6.009***	0.443	0.465	2.316**
CEO Cash Compensation	1255.123	1656.382	0.000	77926.000	992.325	1405.194	14.004	975.854	1336.847	10.597***
CEO Turnover	0.074	0.262	0.000	1.000	0.070	0.077	1.723	0.072	0.075	0.509
Firm Characteristics										
Ln(Total Assets)	7.403	1.484	2.819	12.718	6.687	7.835	55.063***	6.454	7.686	56.202***
Market-to-Book	2.045	1.698	0.389	8.978	2.099	2.012	2.945***	2.149	2.014	4.143***
Return on Assets	0.036	0.187	−0.508	0.783	0.015	0.048	9.524***	0.025	0.039	3.649***
Total Risk	0.461	0.226	0.095	3.061	0.531	0.419	30.206***	0.527	0.441	19.367***
Systematic Risk	1.308	0.653	−0.555	5.202	1.482	1.203	25.359***	1.452	1.265	14.471***
Idiosyncratic Risk	0.396	0.207	0.082	3.041	0.462	0.356	30.840***	0.460	0.377	20.441***
Diversification	0.701	0.391	0.000	1.000	0.747	0.673	13.226***	0.792	0.673	21.024***
Stock Return	0.131	0.449	−0.590	0.840	0.150	0.119	3.983***	0.156	0.123	3.593***
Observations	16,289				6,130	10,159		3,750	12,539	

about a quarter of male directors on board have at least one external connection to women in their directorship network. Although not reported in the table, I find that more than 25% of the firms have at least four male members who interact with women through their external directorships. These members constitute a large proportion of the board. If the strength of influence depends on the absolute number of people exerting the influence (Asch, 1951), then it would seem that men who are externally connected to women would have a better chance of influencing board decisions than female board members in isolation.

Summary statistics for CEO characteristics and firm characteristics are also presented in this table. In the sample, 7.4% of the firm-years experience a CEO turnover event i.e. the CEO is being replaced. Only 2.4% of the firm-years in the sample have a female CEO; the CEOs in 46% of the firm-years also hold a position as the chairman of the board.

In Panel B, I split the sample into firms with and without women directors on board. The differences between these two groups are consistent with stylized facts shown in prior literature (Adams and Ferreira, 2009; Carter et al., 2010, e.g.). Women directors tend to sit on larger and more independent boards. Firms with women directors are larger, are more profitable, have higher growth opportunities, and have lower risk. They also have a higher proportion of connected men on average. This is consistent with Adams and Ferreira (2009) who argue that lack of access to the professional network could decrease the opportunities of women to be appointed as directors. Thus, firms in which male directors have professional connections to women directors are more likely to appoint women as directors.

Next, I split the sample into firms with and without externally connected men and present the summary statistics in Panel C. Connected male directors are more prevalent on larger and more independent boards. The differences in average tenure and age of directors on boards with and without connected men are small although univariate results show that these differences are statistically significant at 1%. The CEO characteristics are also similar in these two groups except for the level of cash compensation which is higher in firms with connected male directors. I also find that firms with connected men are larger and have lower risk.

3.4 Results

3.4.1 Spillover effect and board attendance

In this section, I test my first hypothesis. If there is any spillover effect of female influence, I would observe differences in behavior between male directors with and without outside female contacts. As the board meeting is an important mechanism whereby directors obtain the necessary information to perform their monitoring function, I argue that attendance at these meetings reflects the director's attitude regarding their monitoring duty. Thus, I investigate whether the variation in female contacts of male directors can explain their board attendance behavior. I estimate regressions using *Absenteeism*, a director-level dichotomous variable that equals 1 when the director attends less than 75% of all board meetings in that year as the dependent variable.

To eliminate the possibility that some directors start their directorship in the middle of the year, I remove the observations where tenure is equal to one year. All estimation models in this section include various director, board and firm characteristics. Director characteristics include director tenure and age. I also include director connectedness, which is the number of other board seats that each director holds. I anticipate the relation between number of external directorships and absenteeism to be positive as directors may face a higher opportunity cost as the number of directorships they hold increases (Ferris et al., 2003; Fich, 2005). As for board characteristics, I include board size and board independence. Board size may be positively related to absenteeism as directors in large boards may be plagued by free-riding problem (Lipton and Lorsch, 1992; Jensen, 1993) – failing to attend meetings may be less noticeable in larger boards. Independent directors may improve governance and as a result improve attendance behavior of directors; thus, board independence may be negatively related with absenteeism. Firm-level control variables include total assets (in log form), market-to-book ratio, return on assets and stock return volatility (in log form). These firm characteristics may be related to absenteeism as directors may care more about and are more likely to attend meetings in larger and more reputable firms due to their reputation concerns (Masulis and Mobbs, 2014). Additionally, directors may be more likely to attend board meetings when the firm is operating in a challenging or volatile environment such as when its performance is bad or when performance variability is high. Thus, I anticipate absenteeism to increase with return on assets and decrease with total risk.

The results for *Absenteeism* regressions (at directorship level) are displayed in Table 3.4. In Panel A, I report probit regressions including industry (based on two-digit standard industry classification code) and year dummy variables. The standard errors are corrected for heteroskedasticity and serial correlation within clusters (directorships). In Column 1, I regress *Absenteeism* on *D(Male Directors)*, a dummy variable which equals one when a director is male, and control variables. The coefficient for *D(Male Directors)* is positive and significant at 1% level, indicating that male directors are more likely to exhibit absenteeism compared to their female counterparts. The average marginal effect of *D(Male Directors)* is 0.004. Given that the fraction of attendance problems in my data is 0.014, this means that women are roughly 28% less likely to exhibit absenteeism than men. This is consistent with the results that Adams and Ferreira (2009) that female directors and male directors appear to behave differently in term of board attendance.

Next I evaluate whether external connections to women can explain the attendance behavior of male directors. To do this, I replace *D(Male Directors)*

Table 3.4: Regressions of Absenteeism on Director's Gender and Proportion of Women

This table reports director-level regressions of *Abseenteeism*, which is a dummy variable set to be equal to one when the proxy statement reports that the director attend less than 75% of board meetings and zero otherwise. *D(Male Director)* is equal to one for male directors and zero for female directors. *D(Connected with Women)* is dummy variable which equals one when a male director has at least one external connection to women and zero otherwise. *D(Not Connected with Women)* is dummy variable which equals one when a male director does not have any external connection to women and zero otherwise. A male director is considered to an external connection to women when he sits on other boards on which there is at least one female director. *Proportion of Women* is the number of female directors divided by the number of all directors on board. Other variables are defined in Table 3.1. Panel A present probit regression results with industry and year dummy variables. Panel B present results from firm-level fixed effects estimator with year dummy variables. Standard errors (in brackets) are robust to heteroskedasticity and serial correlations within director-level clusters. * , ** , *** denote statistical significance at 10%, 5% and 1% respectively.

Panel A: Probit Regressions with Industry and Year Fixed Effects
Dependent Variable = Absenteeism

	All Directors		Male Directors	
	(1)	(2)	(3)	(4)
D(Male Director)	0.117***			
	(0.042)			
D(Connected to Women)		0.099**	−0.040	0.062
		(0.046)	(0.047)	(0.057)
D(Not Connected to Women)		0.129***		
		(0.047)		
Proportion of Women			−0.271	0.043
			(0.192)	(0.219)
Propotion of Women ×				−1.007***
D(Connected to Women)				(0.386)
Director Tenure	−0.007***	−0.007***	−0.006**	−0.006**
	(0.003)	(0.003)	(0.003)	(0.003)
Director Age	−0.006***	−0.006***	−0.007***	−0.007***
	(0.002)	(0.002)	(0.002)	(0.002)
Director Connectedness	0.017	0.026	0.031	0.032
	(0.014)	(0.017)	(0.021)	(0.021)
Board Size	0.041***	0.041***	0.043***	0.043***
	(0.007)	(0.007)	(0.008)	(0.008)
Board Independence	−0.125	−0.121	−0.057	−0.053
	(0.112)	(0.113)	(0.118)	(0.119)
Ln(Total Assets)	−0.025*	−0.024*	−0.021	−0.020
	(0.014)	(0.014)	(0.015)	(0.015)
Market-to-Book	−0.008	−0.008	−0.012	−0.012
	(0.010)	(0.010)	(0.011)	(0.011)
Return on Assets	0.054	0.054	0.073	0.074
	(0.089)	(0.089)	(0.097)	(0.097)
Ln(Total Risk)	0.072	0.071	0.058	0.058
	(0.051)	(0.052)	(0.054)	(0.054)
Observations	84,533	84,533	73,383	73,383
Firms	2,003	2,003	2,002	2,002
Pseudo-R^2	0.052	0.052	0.051	0.052

Continued on next page

Table 3.4 – continued from previous page

Panel B: Linear Probability Models with Firm and Year Fixed Effects
Dependent Variable = Absenteeism

	All Directors		Male Directors	
	(1)	(2)	(3)	(4)
D(Male Director)	0.003**			
	(0.001)			
D(Connected with Women)		0.003*	−0.003	0.002
		(0.002)	(0.002)	(0.002)
D(Not Connected with Women)		0.004**		
		(0.002)		
Proportion of Women			−0.018	−0.003
			(0.012)	(0.013)
Propotion of Women × D(Connected with Women)				−0.040***
				(0.014)
Board Connectedness	0.001	0.001	0.002*	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)
Board Size	0.003***	0.003***	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Board Independence	0.017**	0.017**	0.019**	0.019**
	(0.007)	(0.007)	(0.008)	(0.008)
Director Tenure	−0.000**	−0.000**	−0.000*	−0.000*
	(0.000)	(0.000)	(0.000)	(0.000)
Director Age	−0.000**	−0.000**	−0.000***	−0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Ln(Total Assets)	−0.004**	−0.004**	−0.003	−0.003
	(0.002)	(0.002)	(0.002)	(0.002)
Market-to-Book	−0.001	−0.001	−0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Return on Assets	0.005	0.005	0.006	0.006
	(0.005)	(0.005)	(0.005)	(0.005)
Ln(Total Risk)	−0.000	−0.000	−0.001	−0.001
	(0.003)	(0.003)	(0.003)	(0.003)
Director Compensation	−0.000*	−0.000*	−0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	84,533	84,533	73,383	73,383
Firms	2,003	2,003	2,002	2,002
R^2	0.054	0.054	0.058	0.058

with *D(Connected to Women)* and *D(Not Connected to Women)*. The variable *D(Connected to Women)* is equal to 1 when the director is male and has at least one external connection to women. The variable *D(Not Connected to Women)* is equal to 1 when the director is male and has no external connection to women[19]. The results are reported in Column 2. I find that the coefficients for both *D(Connected to Women)* and *D(Not Connected to Women)* are negative and significant. The coefficient for *D(Connected to Women)* is economically smaller than that for *D(Not Connected to Women)*. Connected men are about 25% more likely to exhibit absenteeism whereas, for men with no external connection to women, it is 32%[20]. However, this difference is not statistically significant[21]. Thus, external connections to women alone does not appear to have any statistically significant impact on attendance behavior of male directors.

Next I look at the effect of both internal and external connections to women of male directors. To do this, I restrict the sample to only male directors. In Column 3, I still distinguish male directors based on their external connection to women[22] but I also introduce the proportion of women on board as a proxy for internal connection of male board members with women. The coefficient for D(Connected to Women) is negative but not significant, confirming our results in Column 2 that external connections alone is not a significant determinant. The coefficient for *Proportion of Women* is also not significant, suggesting that internal connections alone do not influence male directors' attendance behavior. However, the negative coefficient is consistent with the findings of

[19]The sum of *D(Connected to Women)* and *D(Not Connected to Women)* is equal to *D(Male Directors)*. For female directors, both *D(Connected to Women)* and *D(Not Connected to Women)* are equal to zero.

[20]The average marginal effects are 0.0034 for *D(Connected to Women)* and 0.0045 for *D(Not Connected to Women)*.

[21]The test statistic for the null hypothesis that the coefficients for *D(Connected to Women)* and *D(Not Connected to Women)* are statistically identical is 0.54 (χ^2 distributed with 1 degree of freedom, p-value = 0.46.

[22]The sample in Columns 3-4 comprises only male directors. Therefore, *D(Not Connected to Women)* is not included in these specifications to avoid perfect multicollinearity.

Adams and Ferreira (2009) who find that male directors have fewer attendance problems in gender-diversed boards. I then introduce the interaction between *Proportion of Women* and *D(Connected to Women)* to look at the multiplicative effect of internal and external connections to women. Based on the results in Column 4, I find that the coefficient for the interaction term *Proportion of Women* × *D(Connected to Women)* is negative. This suggests that when male directors have external connections to women, they are less likely to have attendance problems in boards that are gender diverse.

The control variables generally display the anticipated signs. I find that attendance problems decrease with director age and tenure. This is consistent with the idea that older directors are less likely to exhibit absenteeism as they have a lower opportunity cost of time[23] (Adams and Ferreira, 2008). Board size statistically significantly increases with absenteeism, supporting our prior expectation that large board is associated with free riding. I also find that firm size is negatively associated with absenteeism (at 10% level). This can be interpreted as directors are more attentive in larger firms due to their reputation incentives[24] (Masulis and Mobbs, 2014).

So far the external connections of male directors are being treated as exogenous. As such, the results can be interpreted as the effect of internal and external connections to women on male director attendance behavior. I argue that, compared to director gender, it is less obvious that firms would choose to appoint directors based on their external connections to women. Thus, male directors' external connection to women can potentially be treated as random.

[23]It is still possible however that these variables are jointly determined with absenteeism or it is attendance behavior that affects these variables. For example, directors with good attendance behavior are more likely to be reappointed and as a result have longer tenure than those who exhibit absenteeism.

[24]The relation between size and absenteeism is not statistically significant in the subsample of male directors. This can be interpreted as women directors care more about their reputation compared to male directors. However, the evidence found here is not strong.

However, the possibility of external connection of male directors being endogenous needs to be addressed. For instance, only those directors who have more than one directorship can be externally connected to female directors and multiple directorships can be considered a proxy for director ability and reputation[25] (Fich, 2005; Masulis and Mobbs, 2014). Therefore, the attendance behavior of these directors may reflect their monitoring ability or their tendency to build their reputation and not the influence of female directors from other directorships. Additionally, there could be other factors that are unobserved yet drive firm policies in regards to board meeting attendance as well as director hiring decisions. For example, firms that encourage better attendance may recruit directors from firms in which directors have good attendance record and these firms may be more likely to have female directors.

To address these concerns, I also estimate all *Absenteeism* regressions using a linear probability model with firm-level fixed effects (Panel B) and find that my results continue to hold. Additionally, the coefficients from the fixed effects regressions are similar in magnitude to the marginal effects from the probit regressions. This indicates that the factors that may be omitted are not likely to be strongly correlated with my proxies for female influence. Additionally, I also perform a number of robustness checks and find that the results continue to hold[26]

Overall I find evidence for the so-called spillover effect of female influence. Male directors are not identical in terms of their board attendance and this behavior can be explained by their exposure to female directors from their other directorships. This supports Hypothesis 1*: male directors who are externally connected to female directors behave differently, but only on boards

[25]It can also be seen as a proxy for director's "busyness" (e.g. Kaplan and Reishus, 1990) but the results that are consistent with this story would be the opposite to those presented here.

[26]The robustness checks are reported in Section 4.6.

where there is at least one female director. Based on the evidence from the absenteeism regression, I find that male directors act differently in the presence of women and the difference can be explained by their external connections to female directors. If a better attendance record suggests better monitoring, I should also find differences across firm outcomes pertaining to monitoring. This leads us to distinguish male directors based on their external female connections in my firm-level analysis.

3.4.2 The presence of men externally connected to female directors and CEO turnover

The results from the *Absenteeism* estimations show that male directors with external connections to female directors are less likely to miss board meetings, which suggests that they may be more conscientious with regards to monitoring. Although better attendance allows directors to obtain necessary information about the firm in order to perform their fiduciary duty, it does not necessarily imply improved decision making. There remains a possibility that directors may attend the meetings[27] but do not actively participate in board discussions nor decision making.

In this section, I investigate whether the presence of connected male directors affects firm decisions. As directors meet infrequently, the role of the board may not be obvious in day-to-day operations but may be more detectable in large and discrete corporate decisions (Levi et al., 2013). Therefore, I look at CEO turnover as a possible manifestation of director monitoring (Mace, 1971; Hermalin and Weisbach, 2003). I argue that a more effective board is likely to dismiss the CEO in bad times, thus I anticipate a positive relationship be-

[27]This may be due to compensation (such as meeting fees) or to avoid any damage to their reputation by being reported in the proxy statement as a director with attendance problems.

tween male directors with external female connections and the probability of the CEO being replaced when firm performance is low (Hypothesis 2).

To test this hypothesis, I conduct probit estimations of *CEO Turnover*, a dummy variable equal to one when the CEO is replaced in the following three years[28].

$$\begin{aligned} \Pr(\text{CEO Turnover}_{i,t+1\to t+3} = 1) = \Phi(\beta_0 + \\ \beta_1 \text{Proportion of Connected Men}_{i,t} \\ +\beta_2 \text{Proportion of Women}_{i,t} + \mathbf{X}_{i,t}\mathbf{\Gamma} + \varepsilon_{i,t}) \end{aligned} \tag{3.1}$$

The cumulative probability of CEO turnover (denoted by Φ) is explained by the proportion of men with external female connections (connected men), the proportion of women on board and a set of control variables ($\mathbf{X}_{i,t}$). I include CEO age. CEOs may be more likely to be replaced as they are closer to the retirement age while CEO tenure can capture the influence of the CEO on the firm. I also control for CEO gender and CEO/Chairman duality. I include board size and board independence to capture the board quality in terms of governance. Hermalin and Weisbach (1988) find that CEO turnover is more sensitive to performance when boards have a large proportion of outside directors. Firm characteristics include firm size (total assets in log form), profitability (stock returns) and risk (stock return volatility in log form). Industry and year dummies are also included in all specifications. I distinguish between the states where each firm has good and bad performances by calculating the median value of firm returns. Periods where returns are above (below) the median are regarded as periods of good (bad) performance.

Our probit regressions in Table 3.5 (Columns 1-3) show results for the peri-

[28]To do this, I require observations with data available for the following three years. The final sample for this test comprises 10,088 observations.

Table 3.5: Probit Regressions of CEO Turnover on the Proportion of Connected Men

This table reports probit regression results of CEO turnover on the proportion of male directors who sit on the same board as at least one female directors in their other directorships and control variables. The dependent variable (*CEO Turnover*) is a dummy variable set to one if the firm experience a change in CEO within the following three years and zero otherwise. Columns 1-3 (4-6) comprise firm-years where profitability (as proxied by return assets) is below (above) firm-level median. Industry and year dummy variables are included in all specifications. Other control variables are defined in Table 3.1. Standard errors (in brackets) are robust to heteroskedasticity and serial correlations within firm-level clusters. * , ** , *** denote statistical significance at 10%, 5% and 1% respectively.

	Bad Performance			Good Performance		
	All Firms (1)	With Women (2)	Without Women (3)	All Firms (4)	With Women (5)	Without Women (6)
Proportion of Connected Men	0.467**	0.546**	0.151	0.128	0.243	−0.131
	(0.212)	(0.233)	(0.413)	(0.195)	(0.236)	(0.338)
Proportion of Women	0.258	−0.014		0.255	−0.212	
	(0.309)	(0.474)		(0.308)	(0.489)	
Board Connectedness	−0.312***	−0.392***	−0.064	−0.164*	−0.214*	−0.033
	(0.107)	(0.122)	(0.195)	(0.098)	(0.120)	(0.165)
Board Size	−0.024*	−0.014	−0.042	−0.003	−0.008	−0.000
	(0.013)	(0.017)	(0.027)	(0.013)	(0.016)	(0.023)
Board Independence	0.242	0.558**	−0.096	0.242	0.281	0.217
	(0.174)	(0.230)	(0.271)	(0.167)	(0.227)	(0.253)
CEO Tenure	−0.008**	0.002	−0.021***	−0.006	−0.003	−0.008
	(0.004)	(0.005)	(0.006)	(0.004)	(0.005)	(0.006)
CEO Age	0.032***	0.033***	0.034***	0.024***	0.021***	0.034***
	(0.004)	(0.005)	(0.006)	(0.004)	(0.005)	(0.006)
Female CEO	0.236	0.280*		−0.042	−0.012	
	(0.158)	(0.165)		(0.164)	(0.166)	
CEO Chair Duality	−0.454***	−0.456***	−0.531***	−0.539***	−0.492***	−0.666***
	(0.055)	(0.067)	(0.096)	(0.053)	(0.067)	(0.086)
Ln(Total Assets)	0.065***	0.053*	0.082*	0.049**	0.033	0.057
	(0.024)	(0.029)	(0.046)	(0.024)	(0.030)	(0.044)
Ln(Total Risk)	0.163*	0.182*	0.225	0.173**	0.097	0.296**
	(0.087)	(0.106)	(0.142)	(0.088)	(0.113)	(0.134)
Diversification	−0.043	−0.025	−0.074	−0.049	−0.026	−0.090
	(0.041)	(0.052)	(0.066)	(0.039)	(0.049)	(0.063)
Stock Return	−0.174**	−0.187*	−0.120	−0.017	0.055	−0.162
	(0.087)	(0.111)	(0.139)	(0.075)	(0.103)	(0.117)
Observations	4,927	3,217	1,706	5,161	3,250	1,910
Firms	1,337	903	684	1,396	939	750
Pseudo-R^2	0.056	0.065	0.077	0.057	0.053	0.093

ods of bad performance. In Column 1, I employ the Probit model on the sample of all firms. The results show a positive and significant relation between *Proportion of Connected Men* and *CEO Turnover* at 5% level. The marginal effect of the coefficient for *Proportion of Connected Men* is 0.128. As CEO turnover events are in about 7.4% of the firm-years in my sample, a 10% increase in the proportion of connected men[29] is equal to about 17.2% increase in CEO turnover probability in bad times. The results in the sample where stock returns are high (Column 4) show no statistically significant relation between *Proportion of Connected Men* and *CEO Turnover*. The result in Column 1 appears to indicate that CEOs are more likely to be replaced in bad times when there are more male directors with external female connections (external connections to women), whether or not there is any female director on board.

However, when I divide my sample based on the presence of women on board (internal connections), the results again indicate the interaction effect between internal and external connections to women. In Column 2 where the sample comprises firm years where there is at least one female director on board, the coefficient for *Proportion of Connected Men* remain statistically significant. In contrast, when I use the sample comprising firm years without any female director on board, the coefficient is not statistically different from zero. The difference in the economic effects is also large. When there is at least one woman on board, a 10% increase in the proportion of connected men is associated with a 20% increase in the probability of CEO turnover whereas when there is no women on board it is only associated with a 5% increase[30]. Again, the coefficients are not significant when the firms have an above median stock performance. Overall, the results in this section suggest that CEOs in gender-

[29]This is approximately equivalent to an increase of one connected director on an average board of nine directors.

[30]The marginal effects for the proportion of connected men are 0.151 and 0.040 in Columns 2 and 3 respectively.

diverse firms are more likely to be replaced in bad times the more male directors in the firms are externally connected to women. This lends support to the interpretation that the interaction of male directors with women outside and inside a specific board leads to tougher monitoring via higher CEO turnover in bad times.

3.4.3 The presence of men externally connected to female directors and equity risk measures

We have shown that male directors behave differently when they are externally connected to women in their other directorships and that the presence of these female-connected male directors can explain firm-level monitoring when the firm has at least one woman in their board room. In this section, I relate the presence of externally-connected male director to equity risk measures. As firm performance is generally less volatile under effective monitoring (Sah and Stiglitz, 1986, 1991), I anticipate a negative relation between *Proportion of Connected Men* and equity risk measures (Hypothesis 3). I thus estimate the following equation:

$$\begin{aligned} \text{Risk Measure}_{i,t} = \beta_0 + \beta_1 &\text{Proportion of Connected Men}_{i,t} \\ &+\beta_2 \text{Proportion of Women} + \mathbf{X}_{i,t}\mathbf{\Gamma} + \varepsilon_{i,t} \end{aligned} \tag{3.2}$$

I employ three measures of equity risk (represented by *Risk Measure*$_{i,t}$) – total, systematic and idiosyncratic risk. Total risk is the standard deviation of the firm's daily stock returns (in log form); systematic risk is the stock return beta from a single factor market model; and, idiosyncratic risk the the standard deviation of the market model residuals.

I include various board characteristics as control variables ($\mathbf{X}_{i,t}$). I control for board size as decisions made by a large board can lead to compromises and, as a result, less risky outcomes (Sah and Stiglitz, 1986, 1991). I control for board independence as the presence of independent directors can result in a more shareholder-focused board (Fama and Jensen, 1983) which could lead to higher risk-taking. I also control for the level of director connectedness. On one hand, directors having many outside directorships may be less able to monitor (e.g. Fich and Shivdasani, 2007). On the other hand, having other directorships is a signal of director ability (e.g. Masulis and Mobbs, 2014). Both explanations suggest a relation between board connectedness and firm value and one channel through which this may affect value can be firm risk. I also control for CEO gender as Faccio et al. (2014) find that female CEOs are associated with lower risk. Additionally, I control for the average age and tenure of all directors as Berger et al. (2014) finds that these characteristics of directors can affect risk taking. Lastly, I control for a number of firm-level characteristics using financial accounting variables obtained from the Compustat database. Firms with larger investment opportunity set and growth options may take more risk (Guay, 1999); therefore, I include market-to-book ratio, research and development expenditures, capital expenditures and sales growth (in log form) as proxies for investment and growth opportunities. I include firm and year fixed effects in all specifications[31].

Table 3.6 presents the results. Again, the results indicate the interaction effect between internal and external connections of gender diversity. In Columns 1-2, I estimate Equation 3.2 on the full sample of all firms. I find the coeffi-

[31]This takes into account the possibility that there are other unobserved firm-level factors that can influences both firm risk and the choice of having externally connected male directors on the board. However, similar to the choice of having women in the boardroom, the choice of having externally connected men can be determined by risk. However, this causal link is far from obvious. Additionally, it is documented in Chapter 2 that, at least in this data set, there is no strong influence of risk on gender choice and this casual link does not have a large impact on the overall results.

Table 3.6: Fixed Effects Regressions of Equity Risk Measures on the Proportion of Connected Men

This table reports results from firm-level fixed effects estimations of equity risk measures on the proportion of connected men. The fixed effects estimations include year dummy variables as controls. Other variables are defined in Table 3.1. Standard errors (in brackets) are robust to heteroskedasticity and serial correlations within firm-level clusters. * , ** , *** denote statistical significance at 10%, 5% and 1% respectively.

	All firms (#Obs. = 16,310)			Firms with women directors (#Obs. = 10,175)			Firms without women directors (#Obs. = 6,135)		
	Total Risk (1)	Systematic Risk (2)	Idiosyncratic Risk (3)	Total Risk (4)	Systematic Risk (5)	Idiosyncratic Risk (6)	Total Risk (7)	Systematic Risk (8)	Idiosyncratic Risk (9)
Proportion of Connected Men	−0.072**	−0.118**	−0.071**	−0.098***	−0.119*	−0.093***	−0.056	−0.217	−0.055
	(0.030)	(0.058)	(0.030)	(0.035)	(0.061)	(0.035)	(0.054)	(0.133)	(0.053)
Proportion of Women	−0.029	−0.152	0.007	−0.002	−0.094	0.049			
	(0.065)	(0.120)	(0.065)	(0.090)	(0.153)	(0.090)			
Board Connectedness	0.028	0.037	0.035*	0.045**	0.032	0.051**	0.013	0.166**	0.011
	(0.018)	(0.033)	(0.018)	(0.022)	(0.036)	(0.022)	(0.033)	(0.073)	(0.032)
Board Size	−0.010***	−0.026***	−0.009***	−0.003	−0.012**	−0.002	−0.018***	−0.036***	−0.018***
	(0.003)	(0.005)	(0.003)	(0.003)	(0.005)	(0.003)	(0.005)	(0.011)	(0.005)
Board Independence	−0.060*	−0.072	−0.062*	−0.066	−0.028	−0.072*	−0.008	0.024	−0.023
	(0.033)	(0.066)	(0.032)	(0.041)	(0.074)	(0.041)	(0.053)	(0.115)	(0.052)
Female CEO	−0.017	0.020	−0.022	−0.017	0.012	−0.019			
	(0.032)	(0.050)	(0.034)	(0.029)	(0.049)	(0.030)			
Ln(Total Assets)	−0.093***	0.013	−0.115***	−0.103***	−0.048*	−0.118***	−0.055***	0.178***	−0.097***
	(0.012)	(0.023)	(0.012)	(0.016)	(0.028)	(0.016)	(0.017)	(0.036)	(0.017)
Market-to-Book	0.006**	0.048***	0.000	0.007*	0.054***	−0.001	0.004	0.040***	0.000
	(0.002)	(0.008)	(0.002)	(0.004)	(0.009)	(0.004)	(0.002)	(0.009)	(0.002)
Return on Assets	−0.217***	−0.404***	−0.212***	−0.422***	−0.522***	−0.434***	−0.160***	−0.327***	−0.153***
	(0.031)	(0.060)	(0.033)	(0.054)	(0.108)	(0.056)	(0.027)	(0.072)	(0.026)
R&D Expenditure	−0.008	−0.032**	−0.006	−0.015	−0.066**	−0.010	−0.009	−0.016	−0.010
	(0.005)	(0.016)	(0.006)	(0.013)	(0.027)	(0.011)	(0.007)	(0.023)	(0.008)
Capital Expenditure	0.010*	0.033**	0.008	0.084*	0.253*	0.038	0.011*	0.017	0.012
	(0.005)	(0.017)	(0.006)	(0.048)	(0.139)	(0.043)	(0.007)	(0.023)	(0.008)
Leverage	0.158***	0.049	0.201***	0.146***	0.032	0.187***	0.100*	−0.010	0.145**
	(0.036)	(0.073)	(0.036)	(0.044)	(0.082)	(0.045)	(0.060)	(0.120)	(0.060)
Average Director Age	−0.006***	−0.016***	−0.004**	−0.006*	−0.011**	−0.004	−0.008***	−0.021***	−0.006**
	(0.002)	(0.004)	(0.002)	(0.003)	(0.005)	(0.003)	(0.003)	(0.007)	(0.003)
Average Director Tenure	−0.003	−0.001	−0.003	−0.003	−0.003	−0.004	−0.002	0.003	−0.003
	(0.002)	(0.004)	(0.002)	(0.003)	(0.004)	(0.003)	(0.003)	(0.008)	(0.003)
Observations	16,289	16,289	16,289	10,159	10,159	10,159	6,130	6,130	6,130
Firms	2,170	2,170	2,170	1,357	1,357	1,357	1,370	1,370	1,370
R^2	0.586	0.156	0.589	0.617	0.189	0.603	0.558	0.161	0.566

cients for *Proportion of Connected Men* to be negative and statistically significant at the 5% level for all three equity risk measures, suggesting that the presence of externally-connected male directors is associated with lower firm-level performance variability. For firms with female board members, a 10% increase in the proportion of males with female external connections[32] is associated with an approximately 0.7% decrease in the standard deviation of returns, a 0.12 unit decrease in the market model beta and a 0.7% decrease in the idiosyncratic risk measure.

In Columns 4-6, I reestimate all three risk equations while restricting the sample to the firm-years where there is at least one female directors on board. The results indicate that the relationship between the proportion of connected men and all three risk measures are statistically significant. The coefficients are larger in magnitude compared to the results in Columns 1-3. In contrast, when I restrict the sample to the firm-years where there are no female directors, the coefficients remain negative although they are no longer statistically significant. The overall results suggest that external connections (i.e. the proportion of male directors who work with female directors on other boards) matter, but only when they are internally connected to female directors within the same board.

Overall, I find that male directors behave differently when they are connected to women in their other directorships. I argue, based on the theory of minority influence, that these men are influenced by female directors from their different directorships. Consequently, they become more conscientious, a documented trait of female directors. Individually, I find that they are less likely to exhibit absenteeism compared to male directors without any external female connection. At the firm-level I find that the presence of these men on

[32] A 10% increase is roughly equal to one director on an average board of 9 people.

the board is associated with firm-level outcomes associated with monitoring. Having these male directors on board increases the likelihood of CEO replacement under poor performance and lower firm-level performance variability. Similarly, I find that the presence of externally connected men is a statistically significant determinant of equity risk.

It is important to note that these results are only significant when there is at least one female director in the boardroom. This suggests that the influence of female directors only manifests when it is reinforced by the presence of female directors inside the board. It is possible that male directors with external female influence become more receptive to female directors' suggestions; that is, more conscientious firm-level decisions are initiated by female directors and are agreed by female-influenced male directors. Taken together, my results suggest that gender diversity in a single boardroom cannot be seen in isolation as female directors from the wide directorship network can influence firm-level outcomes.

3.5 Robustness checks and additional results

3.5.1 Difference-in-difference pairwise t-test for board attendance

To corroborate the findings on board meeting attendance, this section assesses the behavior of the *same* male director when he sits on *different* boards. Although the attendance results shown in Section 3.4.1 are robust to the inclusion of firm-level fixed effects, there remains a possibility that it is unobserved director characteristics that influence the results. In this section, I alleviate this concern by using a difference-in-difference pairwise t-test for each pair of the same director in two different directorships. The results are shown in Table 3.7. The sample of male directors are divided into two groups: men without any external female connection (Panel A) and men with at least one external female connection (Panel B). I find that on average men without external female connection behave similarly in terms of attendance in boards with and without female directors. On the other hand, male directors with external female connections are statistically less likely to be reported as absent directors when they sit on the same board as at least one female director (2.4% compared to 3.3%).

3.5.2 Gender effects or peer effects?

It is possible that externally-connected men attend more board meetings not because they have been exposed to female influence in their networks but because they are imitating their dutiful peers regardless of their gender. Adams and Ferreira (2008) show some evidence that newly appointed males, who may wish to impress their new colleagues, have better attendance records than male

Table 3.7: Board Attendance (Paired Two-Sample t-test)

This table shows the results from paired two-sample t-tests of director attendance behavior as proxied by *Absenteeism*. The sample in Panel A comprise male directors who sit on the same board as at least one female director on other boards whereas the sample in Panel B comprise male directors who are not externally connected with any female directors. Attendance behaviors of male directors on the boards without any female director (1 and 3) are compared with the behaviors of the sample directors when they are on the boards with at least one female director (2 and 4). * , ** , *** denote statistical significance at 10%, 5% and 1% respectively.

Panel A: Male Directors without External Female Connections		
Observations = 514	Mean	Standard Error
(1): Without Female Directors	0.028	0.006
(2): With Female Directors	0.029	0.007
(1) – (2):	−0.001	0.008
Panel B: Male Directors with External Female Connections		
Observations = 2,535	Mean	Standard Error
(3): Without Female Directors	0.033	0.004
(4): With Female Directors	0.024	0.003
(3) – (4):	0.009**	0.004

Table 3.8: Board Attendance Regressions (Controlling for Peer Effects)

The variable *D(New Director)* is a dummy variable set to one when a director is newly appointed in that year and zero otherwise. *Proportion of New Men* is the number of new male directors divided by the number of male directors. Standard errors (in brackets) are robust to heteroskedasticity and serial correlations within firm-level clusters. * , ** , *** denote statistical significance at 10%, 5% and 1% respectively.

Panel A: Probit Regressions with Industry and Year Fixed Effects
Dependent Variable = Absenteeism

	All Directors		Male Directors	
	(1)	(2)	(3)	(4)
D(Male Director)	0.107***			
	(0.042)			
D(Connected to Women)		0.087*	−0.037	0.070
		(0.047)	(0.048)	(0.057)
D(Not Connected to Women)		0.122***		
		(0.046)		
Proportion of Women			−0.273	0.033
			(0.193)	(0.234)
D(New Director)	−0.325***	−0.326***		
	(0.054)	(0.054)		
Proportion of New Men			0.030	−0.003
			(0.152)	(0.224)
Propotion of Women ×				−1.058***
D(Connected with Women)				(0.384)
Proportion of Women ×				0.495
Proportion of New Men				(1.852)
Other Controls	Yes	Yes	Yes	Yes
Observations	88,596	88,596	69,233	69,233
Firms	2,003	2,003	1,995	1,995
Pseudo-R^2	0.052	0.052	0.053	0.054

Panel B: Linear Probability Models with Firm and Year Fixed Effects
Dependent Variable = Absenteeism

	All Directors		Male Directors	
	(1)	(2)	(3)	(4)
D(Male Director)	0.003**			
	(0.001)			
D(Connected to Women)		0.003	−0.002	0.002
		(0.002)	(0.002)	(0.003)
D(Not Connected to Women)		0.004**		
		(0.002)		
Proportion of Women			−0.019	−0.004
			(0.013)	(0.015)
New Director	−0.006***	−0.006***		
	(0.002)	(0.002)		
Proportion of New Men			−0.004	−0.003
			(0.006)	(0.009)
Propotion of Women ×				−0.040***
D(Connected with Women)				(0.014)
Proportion of Women ×				−0.004
Proportion of New Men				(0.064)
Other Controls	Yes	Yes	Yes	Yes
Observations	2,003	2,003	1,994	1,994
R^2	0.054	0.054	0.060	0.061

directors with long tenures. In this analysis, I use the entire sample of directors (which includes the directors appointed in the current year). In Columns 1 and 2 of Table 3.8[33], I estimate the same regression as Columns 1 and 2 of Table 3.4 but include an additional dummy variable, *D(New Director)*. This variable is equal to one if the director is appointed in the current year and zero otherwise. I find that the coefficient for *D(New Director)* is negative and significant (at 1% level) in both models, suggesting that newly appointed directors are indeed less likely to have attendance problems. As the proportion of female directors is included in the model, this effect is not driven by the fact that new hires are predominantly women.

As new directors are also less likely to have attendance problems, it is possible that the influence on other male directors may come from these new directors rather than from female directors. This is particularly possible if new directors are predominantly women[34]. However, the results in Column 3 and 4 support my conjecture that the effect on attendance is more likely to be from the influence of female directors rather than peer effects. In these Columns, I exclude female directors from the sample and also include *Proportion of New Men* and *Proportion of Women times Proportion of New Men* into the model. If my prior findings were driven by peer effects rather than gender effects, the coefficients for these two additional variables should also be statistically significant. The results show no evidence of peer effects in this data set – neither coefficients are significant at any conventional level. In contrast, the interaction between *Proportion of Women* and *D(Connected to Women)* is still significant at 1% level. Thus, this alleviates the concern that the results are driven by peer effects and that it is external connections to women that affect male

[33]Similar to other sets of results, Panel A shows the results from Probit models whereas Panel B shows results from the linear probability model with firm and year fixed effects.

[34]There is some evidence that this is the case in the data. 16.82% of the new directors are women whereas for other directors the proportion is 12.94%. The two-sample t-test results reveal that the proportion of women are statistically different at 1% for these two groups.

director's behavior under the presence of women.

3.5.3 Alternative proxies for external female influence

I employ various alternative measures of male directors' connections to female directors to determine whether the results are sensitive to the way the variables are constructed. For the analysis of director attendance, I replace *D(Connected to Women)* which is a dummy variable with a new variable – *Number of Connections to Women*. This variable potentially captures the strength of female influence by accounting for the number of connections each male director has with women through his external directorships, instead of only capturing whether or not that male director knows any women through any of his other directorships.

The results using the number of connections to women are reported in Table 3.9. The estimation model and the control variables are the same as Column 4 of Table 3.4. The results for the probit model (with industry and year fixed effects) and the linear probability model (with firm and year fixed effects) are presented in Columns 1 and 2 respectively. Both results confirm my prior findings that the interaction between internal influence (the proportion of women on board) and external influence (number of connections to women) is a strong determinant of male directors' attendance behavior – the coefficient for *Proportion of Women* × *Number of Connections to Women* is negative and significant at 5% level in both specifications.

The results in Table 3.4 appear to suggest that the number of connections to women also matters. That is, male directors who have more connections to women may be less likely to exhibit absenteeism in the presence of female directors than those with fewer connections. I investigate this further with

Table 3.9: Board Attendance Regressions (Number of Connections to Women)

Number of Connections to Women is the number of male director's other boards on which there is at least one female directors. Standard errors (in brackets) are robust to heteroskedasticity and serial correlations within firm-level clusters. * , ** , *** denote statistical significance at 10%, 5% and 1% respectively.

Dependent Variable = Absenteeism	Probit (1)	Linear Probability Model (2)
Proportion of Women × Number of Connections to Women	−0.468**	−0.017**
	(0.212)	(0.008)
Proportion of Women	−0.036	−0.009
	(0.209)	(0.013)
Number of Connections to Women	−0.068*	−0.005**
	(0.039)	(0.002)
Board Connectedness	0.109***	0.006***
	(0.032)	(0.002)
Board Size	0.043***	0.003***
	(0.008)	(0.001)
Board Independence	−0.055	0.019**
	(0.118)	(0.008)
Director Tenure	−0.006**	−0.000*
	(0.003)	(0.000)
Director Age	−0.007***	−0.000***
	(0.002)	(0.000)
Ln(Total Assets)	−0.019	−0.003
	(0.015)	(0.002)
Market-to-Book	−0.012	−0.001
	(0.011)	(0.001)
Return on Assets	0.078	0.006
	(0.098)	(0.005)
Ln(Total Risk)	0.055	−0.001
	(0.054)	(0.003)
Director Compensation	−0.000	−0.000
	(0.000)	(0.000)
Fixed Effects	Industry, Year	Firm, Year
Observations	73,383	73,383
Firms	2,002	2,002
Pseudo-R^2 / R^2	0.053	0.059

an aim to quantify the incremental effect that each additional connection has on attendance behavior. To do this, I replace *Number of Connections to Women* with four dummy variables. These dummy variables, *D(Number of Connections to Women* $\geq$ *n)* are set as equal to one if the number of connections to women is greater than or equal to *n* and zero otherwise. These dummy variables allows me to measure the incremental effect of having an additional connection to women[35].

The results from both the probit and linear probability models are presented in Table 3.10. The same set of control variables as Column 4 of Table 3.4 are included but not reported for brevity. Overall, the only coefficient that is significant is *Proportion of Women* $\times$ *D(Number of Connections to Women* $\geq$ *1)*[36], suggesting that the reduction in absenteeism of male director is mainly attributed to the first connection a male director has with women whereas the additional connections do not significantly affect attendance behavior of male directors. Taken together, the results imply that it is whether a male director is connected to any female director in his network or not (rather than how many connections he has) that affect his behavior.

For the firm level results, I construct another variable, *Average Number of Connections to Women*, which is defined as the number of connections to women divided by the number of male directors on board. Similar to *Number of Connections to Women*, this variable does not only measure whether or not each male director is connected to women in his directorship network, but also measure the extent of his connections i.e. how many directorship connections does each male director has to women. The results for CEO turnover sensitiv-

[35]For example, for a male director with three external connections to women, *D(Number of Connections to Women* $\geq$ *3)* would capture the effect on attendance that *D(Number of Connections to Women* $\geq$ *1)* and *D(Number of Connections to Women* $\geq$ *2)* did not capture i.e. the effect of his connection to the third woman.

[36]The coefficient for *Proportion of Women* $\times$ *D(Number of Connections to Women* $\geq$ *1)* is also significant in the probit estimation, but only at 10% level.

Table 3.10: Board Attendance Regressions (Incremental Effect of the Number of Connections to Women)

The dummy variables *D(Number of Connections with Women ≥ n)* is set to one when the male director sit on more than *n* other boards on which there is at least one female director. Other control variables are the same as Table 3.10. Standard errors (in brackets) are robust to heteroskedasticity and serial correlations within firm-level clusters. * , ** , *** denote statistical significance at 10%, 5% and 1% respectively.

Dependent Variable = Absenteeism	Probit (1)	Linear Probability Model (2)
Proportion of Women	-1.084^{**}	-0.045^{***}
× D(Number of Connections to Women ≥ 1)	(0.443)	(0.015)
Proportion of Women	0.634	0.029
× D(Number of Connections to Women ≥ 2)	(0.630)	(0.022)
Proportion of Women	0.018	−0.010
× D(Number of Connections to Women ≥ 3)	(1.414)	(0.044)
Proportion of Women	-3.540^{*}	−0.092
× D(Number of Connections to Women ≥ 4)	(1.856)	(0.067)
Other Controls	Yes	Yes
Fixed Effects	Industry, Year	Firm, Year
Observations	73,383	73,383
Firms	2,002	2,002
Pseudo-R^2 / R^2	0.054	0.059

ity and equity risk are reported in Tables 3.11 and 3.12 respectively. I find that the results are similar to those from the baseline models in previous sections. Additionally, I also construct the connection measure by dividing the number of external connections of male directors with women by the total number of external connections and find that all results are qualitatively similar to the baseline results.

3.5.4 Female influence or talented directors?

In this study, I use external board connections to female directors as a proxy for female influence. This raises a concern with regards to its construction. In particular, only male directors with outside directorships can have external connections to women. As a result, my proxy for female influence are highly correlated with the measure of director connectedness[37]. This leads to a concern that the difference in behavior may be due to the fact that these directors have multiple directorships[38] and not because they are connected to female directors. The evidence shown in this study does not support this concern due to the following reasons.

First, in all of the analyses, I include more direct proxies for multiple directorships i.e. *Director Connectedness* and *Board Connectedness* and find that the main coefficients are statistically significant.

Second, the coefficients for my proxies for multiple directorships are largely insignificant[39] or if they are significant they usually yield the opposite sign. For example, in Table 3.5, I find that the coefficient for *Board Connectedness* is

[37]The correlation between *Number of Connections to Women* and *Director Connectedness* is 0.821.

[38]Having multiple directorships can be a proxy for director talent or the fact that they are busy directors.

[39]This may be due to multicollinearity.

Table 3.11: Probit Regressions of CEO Turnover on the Average Number of Connections to Women

This table reports probit regression results of CEO turnover on the proportion of male directors who sit on the same board as at least one female directors in their other directorships and control variables. Columns 1-3 (4-6) comprise firm-years where profitability (as proxied by return assets) is below (above) firm-level median. Year dummy variables are included in all specifications. Other control variables are defined in Table 3.1. Standard errors (in brackets) are robust to heteroskedasticity and serial correlations within firm-level clusters. * , ** , *** denote statistical significance at 10%, 5% and 1% respectively.

	Low Return			High Return		
	All Firms (1)	With Women (2)	Without Women (3)	All Firms (4)	With Women (5)	Without Women (6)
Average Number of Connections to Women	0.325**	0.334*	0.180	−0.013	−0.005	−0.105
	(0.160)	(0.181)	(0.324)	(0.151)	(0.180)	(0.271)
Proportion of Women	0.279			0.277	−0.190	0.000
	(0.308)	(0.474)		(0.307)	(0.487)	
Board Connectedness	−0.312***	−0.360***	−0.113	−0.113	−0.129	−0.019
	(0.111)	(0.128)	(0.222)	(0.107)	(0.128)	(0.188)
Board Size	−0.026*	−0.016	−0.043	−0.002	−0.007	−0.000
	(0.013)	(0.017)	(0.027)	(0.013)	(0.016)	(0.023)
Board Independence	0.258	0.581**	−0.094	0.258	0.323	0.213
	(0.174)	(0.231)	(0.270)	(0.166)	(0.225)	(0.253)
Ln(Total Assets)	0.067***	0.055*	0.082*	0.051**	0.037	0.056
	(0.024)	(0.029)	(0.046)	(0.024)	(0.030)	(0.044)
Ln(Total Risk)	0.162*	0.175*	0.230	0.168*	0.086	0.295**
	(0.087)	(0.106)	(0.144)	(0.088)	(0.113)	(0.135)
CEO Tenure	−0.008**	0.002	−0.021***	−0.006	−0.004	−0.008
	(0.004)	(0.005)	(0.006)	(0.004)	(0.005)	(0.006)
CEO Age	0.032***	0.033***	0.034***	0.024***	0.021***	0.034***
	(0.004)	(0.005)	(0.006)	(0.004)	(0.005)	(0.006)
Female CEO	0.235	0.277*		−0.047	−0.020	0.000
	(0.158)	(0.165)		(0.163)	(0.165)	(.)
Diversification	−0.043	−0.026	−0.074	−0.047	−0.023	−0.090
	(0.041)	(0.052)	(0.066)	(0.039)	(0.050)	(0.063)
CEO Chair Duality	−0.457***	−0.457***	−0.534***	−0.538***	−0.490***	−0.665***
	(0.055)	(0.066)	(0.096)	(0.053)	(0.067)	(0.086)
Stock Return	−0.173**	−0.188*	−0.120	−0.016	0.056	−0.163
	(0.087)	(0.111)	(0.140)	(0.075)	(0.103)	(0.117)
Observations	4,927	3,217	1,706	5,161	3,250	1,910
Firms	1,337	903	684	1,396	939	750
Pseudo-R^2	0.056	0.065	0.078	0.057	0.052	0.093

Table 3.12: Fixed Effects Regressions of Equity Risk Measures on the Average Number of Connected Men

This table reports results from firm-level fixed effects estimations of equity risk measures on the proportion of connected men. The fixed effects estimations include year dummy variables as controls. Other variables are defined in Table 3.1. Standard errors (in brackets) are robust to heteroskedasticity and serial correlations within firm-level clusters. * , ** , *** denote statistical significance at 10%, 5% and 1% respectively.

	All firms			Firms with women directors			Firms without women directors		
	Total Risk	Systematic Risk	Idiosyncratic Risk	Total Risk	Systematic Risk	Idiosyncratic Risk	Total Risk	Systematic Risk	Idiosyncratic Risk
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Average Number of Connections to Women	−0.086***	−0.178***	−0.077***	−0.101***	−0.120**	−0.094***	−0.148***	−0.436***	−0.126***
	(0.024)	(0.048)	(0.023)	(0.028)	(0.051)	(0.028)	(0.044)	(0.111)	(0.044)
Proportion of Women	−0.033	−0.161	0.004	−0.005	−0.098	0.047			
	(0.065)	(0.120)	(0.065)	(0.090)	(0.153)	(0.090)			
Board Connectedness	0.068***	0.131***	0.069***	0.093***	0.089*	0.095***	0.080**	0.347***	0.065*
	(0.022)	(0.047)	(0.021)	(0.027)	(0.052)	(0.027)	(0.038)	(0.089)	(0.037)
Board Size	−0.010***	−0.026***	−0.009***	−0.003	−0.011**	−0.002	−0.018***	−0.035***	−0.018***
	(0.003)	(0.005)	(0.003)	(0.003)	(0.005)	(0.003)	(0.005)	(0.011)	(0.005)
Board Independence	−0.061*	−0.072	−0.062*	−0.067	−0.029	−0.073*	−0.008	0.021	−0.024
	(0.033)	(0.066)	(0.032)	(0.041)	(0.074)	(0.041)	(0.053)	(0.114)	(0.051)
Female CEO	−0.017	0.020	−0.022	−0.017	0.012	−0.019			
	(0.032)	(0.050)	(0.034)	(0.029)	(0.049)	(0.030)			
Ln(Total Assets)	−0.092***	0.015	−0.114***	−0.102***	−0.046*	−0.117***	−0.054***	0.181***	−0.096***
	(0.012)	(0.023)	(0.012)	(0.016)	(0.028)	(0.016)	(0.017)	(0.036)	(0.017)
Market-to-Book	0.006**	0.048***	0.000	0.006*	0.054***	−0.001	0.004	0.040***	0.000
	(0.002)	(0.008)	(0.002)	(0.004)	(0.009)	(0.004)	(0.002)	(0.009)	(0.002)
Return on Assets	−0.218***	−0.405***	−0.213***	−0.422***	−0.523***	−0.435***	−0.161***	−0.331***	−0.154***
	(0.031)	(0.060)	(0.033)	(0.054)	(0.107)	(0.056)	(0.027)	(0.072)	(0.026)
R&D Expenditure	−0.009	−0.033**	−0.006	−0.015	−0.066**	−0.010	−0.010	−0.019	−0.011
	(0.005)	(0.016)	(0.006)	(0.013)	(0.027)	(0.011)	(0.007)	(0.023)	(0.008)
Capital Expenditure	0.010*	0.033**	0.008	0.083*	0.252*	0.038	0.012*	0.019	0.012
	(0.005)	(0.016)	(0.006)	(0.048)	(0.139)	(0.043)	(0.007)	(0.023)	(0.008)
Leverage	0.157***	0.048	0.200***	0.145***	0.031	0.187***	0.099*	−0.014	0.144**
	(0.036)	(0.073)	(0.036)	(0.044)	(0.082)	(0.045)	(0.059)	(0.119)	(0.059)
Average Director Age	−0.006***	−0.016***	−0.004**	−0.006*	−0.011**	−0.004	−0.008***	−0.020***	−0.006**
	(0.002)	(0.004)	(0.002)	(0.003)	(0.005)	(0.003)	(0.003)	(0.007)	(0.003)
Average Director Tenure	−0.003	−0.001	−0.003	−0.003	−0.002	−0.003	−0.003	0.003	−0.003
	(0.002)	(0.004)	(0.002)	(0.003)	(0.004)	(0.003)	(0.003)	(0.008)	(0.003)
	(0.141)	(0.277)	(0.141)	(0.207)	(0.349)	(0.209)	(0.216)	(0.463)	(0.208)
Observations	16,289	16,289	16,289	10,159	10,159	10,159	6,130	6,130	6,130
Firms	2,170	2,170	2,170	1,357	1,357	1,357	1,370	1,370	1,370
R^2	0.586	0.158	0.589	0.617	0.190	0.603	0.560	0.166	0.567

negative and significant. This suggests that as more directors have more external directorships, the firm's CEO is more likely to be dismissed when the firm performs badly. In contrast, when more directors hold other directorships in firms with female directors, the probability of CEO dismissal increases.

Lastly, to further alleviate the concern that the results are driven by the effect of directors having multiple directorships rather than the influence of female directors, I repeat the analysis on a subsample of male directors with only one additional directorship[40]. The results (Table 3.13) show that the proportion of female directors on the current board only significantly explains attendance behavior of the male director when there is at least one female director on his other board. The extent of director connectedness can be considered as being held constant as all male directors in this sample have only one other director. Therefore, we reduce the likelihood that the results are driven by the fact that these male directors behave differently because they are talented rather than due to the female influence.

[40]I choose to restrict my sample to only male directors with one directorship as this simplifies the empirical design. Male directors with one directorship either have no external connection to women (if his other board comprises exclusively male directors) or has one external connection to women (if there are female directors in his other board). Additionally, prior results show that the difference in behavior is the largest between with and without any external connection to women. In addition to these results, I also remove male directors without any external connection from the sample and reestimate the models. The results (unreported for brevity) still lead to the same conclusion.

Table 3.13: Board Attendance Regressions (Sample Restricted to Male Directors with One External Connection)

This table reports director-level regressions of *Absenteeism* using a subsample of male directors with one external board seats. The number of observations employed in this table is 17,825 directorship-years. Male directors in 4,034 of these directorship-years sit on one other board which comprises exclusively male directors; male director on the rest of these directorship-years sit on one other board on which there is at least one female director. Standard errors (in brackets) are robust to heteroskedasticity and serial correlations within firm-level clusters. * , ** , *** denote statistical significance at 10%, 5% and 1% respectively.

Dependent Variable = Absenteeism	Probit		Linear Probability Model	
	(1)	(2)	(3)	(4)
Connected to Women	No	Yes	No	Yes
Proportion of Women	−0.866	−0.947**	−0.074	−0.056**
	(0.716)	(0.447)	(0.068)	(0.028)
Board Size	0.054*	0.046***	−0.002	0.002*
	(0.029)	(0.017)	(0.003)	(0.001)
Board Independence	0.220	0.129	−0.021	0.033**
	(0.388)	(0.269)	(0.045)	(0.016)
Director Tenure	0.001	0.003	0.000	0.000
	(0.010)	(0.006)	(0.001)	(0.000)
Director Age	−0.015*	−0.008	−0.001	−0.000
	(0.008)	(0.005)	(0.001)	(0.000)
Ln(total Assets)	0.026	−0.069**	0.009	−0.002
	(0.049)	(0.028)	(0.010)	(0.005)
Market-to-Book	−0.104*	−0.037	−0.005	−0.005*
	(0.062)	(0.043)	(0.005)	(0.003)
Return on Assets	0.313	−0.036	0.018	0.032
	(0.925)	(0.699)	(0.042)	(0.028)
Ln(Total Risk)	0.093	−0.058	−0.021	−0.003
	(0.197)	(0.134)	(0.014)	(0.006)
Fixed Effects	Industry, Year	Industry, Year	Firm, Year	Firm, Year
Observations	4,034	13,791	4,034	13,791
Firms	1,031	1,476	1,031	1,476
Pseudo-R^2 / R^2	0.087	0.066	0.348	0.171

3.6 Conclusion

In this chapter, I propose an alternative way of looking at gender diversity. By looking at the external influences of female directors in other boards who are connected with male directors inside the board, as well as the internal influences of female directors inside the board, I find that gender diversity can affect firm monitoring as well as equity risk. Based on conversion theory (Moscovici et al., 1969), I argue that male directors' connection to female directors is a proxy for female minority influence. Thus the men who are connected to female directors become more conscientious, a trait of female directors as documented by prior literature (Izraeli, 2000; Adams and Ferreira, 2009). I find that individual male directors who are connected to female directors are less likely to exhibit attendance problems when working on a gender diverse board. The proportion of male directors who are connected to women increases CEO turnover sensitivity of firms that have female directors. Finally, I find that equity risk also decreases with the proportion of connected male directors when they work on the boards that are gender diverse. The findings are robust to the presence of other unobserved firm-level factors, alternative variable constructions and various other robustness checks.

Previous research has largely concentrated on the impact of women within boardrooms. These results add to the existing literature by showing that the wider professional connections of externally-connected male directors are also important to the gender debate and provide a mechanism by which female directors can make an impact on firm-level risk outcomes. The key implication of this paper is that female directors can have an impact on firm-level outcomes even when they are a minority on most boards. What I find, however, is not a direct impact. The proportion of women on boards does not explain firm-level outcomes in a statistically significant way; rather, it is the proportion of male directors who have more interactions with female directors in their directorship networks that can explain these outcomes. Thus, this paper suggests a new way in which gender diversity in the boardroom can be viewed. Given that female representation in the boardroom is increasing due to both regulatory and social pressure, their impact on firm behavior may be more significant than previously documented.

CHAPTER 4

Independent director reputation incentives and stock price informativeness

4.1 Introduction

This chapter examines whether the reputation incentives of independent directors are related to firm stock price informativeness. The empirical evidence, presented by Masulis and Mobbs (2014, 2015) on reputation incentives, shows that boards in which independent directors are incentivized to protect their reputation are associated with better governance. I argue that reputation incentives can also facilitate firm-specific information disclosure to the market and ultimately leads to higher stock price informativeness.

One of the functions of financial markets is to produce and aggregate information via the trading process, which transmits information produced by traders into market prices (Grossman and Stiglitz, 1980). Managers can learn about the firm's prospect from this information (Dow and Gorton, 1997; Subrahmanyam and Titman, 1999) and can use this information to guide them in decision making with regards to capital structure, cash holding and investment expenditure (see, e.g. Durnev et al., 2004; Chen et al., 2007; Foucault and Gehrig, 2008; Fresard, 2012).

The extent to which firm-specific information is incorporated into stock prices is broadly influenced by two factors. The first factor is the degree of investor protection. Better investor protection can encourage incorporation of information into stock prices, because it can deter managerial expropriation and enhance the gain of information-based trading to outside investors (e.g. Morck et al., 2000; Ferreira and Laux, 2007). The second factor is the firm's information environment. The quality of firm financial information and the extent to which firm discloses information to the public can affect the level of firm specific information in stock prices (Gelb and Zarowin, 2002). The evidence in this study suggests that reputation incentives of directors are linked to stock price informativeness through this second factor.

In this chapter, I hypothesize that monitoring from independent directors can increase stock price informativeness through better disclosure of information to the public[1]. As outsiders to the firm, independent directors require firm-specific information in order to perform their monitoring and advising functions effectively (Adams and Ferreira, 2007). It is unlikely that these directors rely solely on private sources of information such as internal financial reports and private discussions with managers (Armstrong et al., 2010). Information from private sources are supplied by the managers who may not be willing to disclose information that is detrimental to their own interests (Jensen, 1993). Jin and Myers (2006) argue that managers may withhold firm-

[1]Monitoring from independent directors can also reduce managerial expropriation (Fama and Jensen, 1983). This can enhance the benefits of gathering and trading private information and, as a result, lead to more information being incorporated into stock prices.

specific information in order to capture private benefits. In contrast, information from public sources can carry greater credibility as it is subject to regulatory rules and enforcement, auditor oversight, and scrutiny by security analysts (Bushman et al., 2004a). Therefore, in the process of obtaining the information about the firm, independent directors can increase stock price informativeness through enhanced firm transparency and greater level of disclosure.

The ability of a board to monitor the managers is traditionally associated with the proportion of outside or independent directors. Hence, regulations and exchange listing rules require firms to have an independent majority board. However, the literature provides mixed evidence regarding the influence of board independence on information asymmetry between managers and shareholders. Some studies find that the presence of outside directors can deter earnings management, reduce the likelihood of financial fraud, and increase the frequency as well as the accuracy of management earnings forecasts (e.g. Dechow et al., 1996; Beasley, 1996; Ajinkya et al., 2005). In contrast, other studies find no relation between director independence and information asymmetry (e.g. Agrawal and Chadha, 2005; Larcker et al., 2007). These conflicting results could possibly be explained by the fact that independent directors cannot be treated as if each of them was identical. Recent literature explores the heterogeneity of independent directors in terms of demographics, connection, firm ownership and expertise (see e.g. Adams and Ferreira, 2009; Knyazeva et al., 2009; Coles et al., 2014). In particular, Masulis and Mobbs (2014) present evidence that independent directors are more effective at monitoring when working in firms that provide them with higher visibility.

In this chapter, I focus on independent directors who are arguably more affected by the level of firm transparency i.e. those directors who have higher incentives to protect their reputation in the directorship labor market. The literature has long recognized the incentive for directors to build and maintain their reputation (Fama, 1980; Fama and Jensen, 1983). Adams and Ferreira (2008) argue that it is prestige, reputation and career concerns rather than financial remuneration that motivate directors to perform their board functions. Thus, it is logical that directors would focus their effort on the directorships that give them the highest visibility. Masulis and Mobbs (2014) find that directors with multiple directorships do not allocate their time and effort uniformly across their different directorships. Instead, they are more attentive in boards of larger firms, which are deemed more prestigious (Shivdasani, 1993; Ryan and Wiggins, 2004).

This chapter investigates the relation between director reputation incentives and stock price informativeness. I employ the reputation incentive measures from Masulis and Mobbs (2014, 2015). For each independent director with multiple directorships, I sort all the directorships by market capitalization. A directorship is considered the most (least) important to the director when it is for the largest (smallest) firm of all directorships. Figure 4.1 presents an example of a director in the data set employed in this chapter. In 2012, Geraldine Laybourne was an independent director for three companies – Symantec, Electronics Arts and JC Penny. Symantec has a market capitalization of 17.22 billion dollars and is the largest amongst the three firms. Based on the reputation incentive measures employed, Laybourne is assumed to consider Symantec as the most important directorship. Correspondingly, JC Penny is Laybourne's smallest directorship and is considered to be the least important directorship.

I then construct two board-level measures that capture the reputation incentives of independent directors: the proportion of independent directors

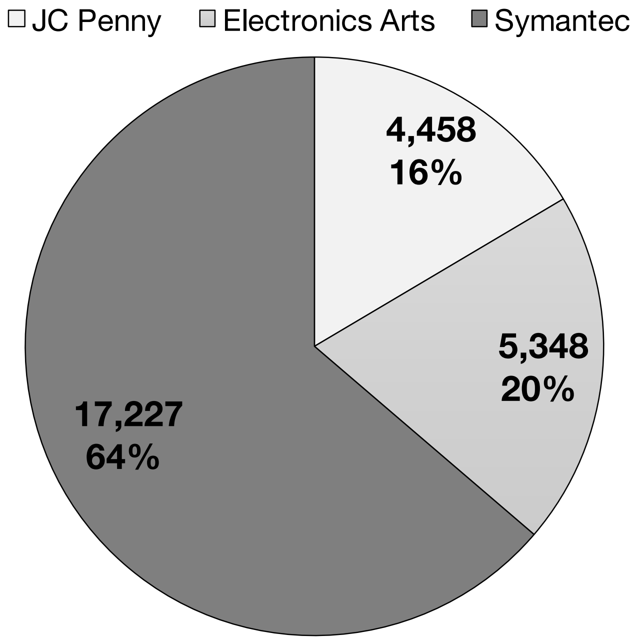

Figure 4.1: Example of directorship ranking

that deem the directorship to be the most and least important. Masulis and Mobbs (2014, 2015) suggest that these directors are more motivated due to higher visibility of the directorship and find that boards in which more directors rank the firm highly are associated with more effective monitoring and fewer adverse outcomes such as lucky CEO option grants, dividend cuts and debt covenant violations. Moreover, these boards are associated with better financial information environment i.e. the firms are less likely to engage in earnings management and have their financial reports restated. Thus, I hypothesize that the proportion of directors to whom the directorship is the largest is positively associated with stock prices informativeness.

To measure stock price informativeness, I follow Morck et al. (2000) and use firm-specific stock return variation. This measure is employed as a proxy of the rate of information flow into stock prices in various studies (e.g. Ferreira and Laux, 2007; Fernandes and Ferreira, 2008, 2009; Gul et al., 2011). I find that stock price informativeness increases with the proportion of the directors for whom the director is highly ranked. This suggests that firms where directors are motivated due to their reputation incentives can increase the firm-specific information in stock prices. The relation is robust to the inclusion of various other board characteristics (board size, board independence, the presence of "busy" directors and directors who only hold one directorship) and many other firm-level controls. This evidence is consistent with the hypothesis that directors with high reputation incentives can increase stock price informativeness.

I further characterize the results and show evidence supporting the hypothesis that independent director reputation incentives and stock price informativeness are related to monitoring. Informativeness of stock prices can also be influenced by monitoring activities of those outside of the firm. For instance, stock analysts can facilitate dissemination of information about the firm (e.g. Piotroski and Roulstone, 2004). Similarly, the openness of the firm to the corporate control market also encourages investors to collect firm-specific information (Ferreira and Laux, 2007). Therefore, I include as additional controls two proxies for external monitoring – analyst coverage and an entrenchment index (Bebchuk et al., 2009). I find that my results continue to hold. Moreover, I find that the relationship between the reputation measures and stock price informativeness is stronger when external monitoring is weak. These results suggest that directors act as substitutes to these other monitoring mechanisms in term of information. Additionally, I find that the relation is robust to the inclusion of various measures for financial report quality, which suggests that director incentives induce the firm to become more transparent through other channels in addition to better financial report quality.

Based on the empirical results, I argue that the relation between the reputation incentive measures and stock price informativeness is because independent director who see the directorship as important encourage more firm-specific information to be released to the public. However, there are some alternative explanations to my results. First, the statistically significant relation may be due to other factors that are not controlled for in the model. Second, the choice of independent director appointments can be influenced by the firm information environment (e.g. Coles et al., 2008; Linck et al., 2008; Lehn et al., 2009). It is possible that when appointed to a larger firm, independent directors may prefer firms that are more transparent. These explanations can also lead to the significant relation between the reputation incentive measures and stock price informativeness as observed in the data.

To address these possible endogeneity concerns, I analyze the effect of exogenous shocks to directorship ranking on stock price informativeness. Specifically, I look at the effect of increases in directorship ranking that are caused by large decreases in market capitalization in other firms. To do this, I identify a group of treatment firms in which at least one director experiences an exogenous increase in directorship ranking due to a large decrease in the size of other firms in their directorship portfolio. These change in ranking can be considered exogenous because the changes are caused by the decrease in size of other firms apart from those I investigate. The decrease in size can be due to a number of reasons such as poor performance or divestiture. These reasons are specific to other firms and thus can be considered as exogenous to the firm currently under investigation. However, the decrease in size of these other firms leads to the change in ranking that allow us to identify the causal effect of the change in directorship importance on stock price informativeness. I match these treatment firms with a group of control firms by industry and size and perform a difference-in-difference analysis. I find that after the increase in directorship ranking of at least one independent director in the firm, the level of price informativeness increases for treatment firms in relation to the control firms. This result is consistent with my hypothesis that it is the reputation incentives of independent directors that influences stock price informativeness. As the difference-in-difference setting only exploits the change in stock price informativeness and reputation incentives within the firm, it also reduces the possibility that the relation between the two variables are driven by other unobserved factors.

As my results indicate that independent directors induce the firm to become more transparent through other channels in addition to better financial report quality, I next provide evidence that voluntary disclosure is a mechanism through which independent directors can influence stock price informativeness. I analyze Form 8-K filings as one possible channel for firms to voluntarily disclose information to the market. The Securities and Exchange

Commission requires firms to disclose information deemed to be material to investors on a continuous basis. These disclosures are mostly triggered by certain corporate events such as when new directors are nominated or when the company is conducting an acquisition. One exception is category #8 ("other events") where a firm can choose to disclose any information it deems material. I use the frequency of category #8 disclosures relative to other disclosures as a proxy for the extent to which firms voluntarily disclose information. I find that, after the exogenous shock in directorship ranking, firms disclose more Category #8 items but only when there are more disagreements amongst analysts in terms of earnings forecasts. This result suggests that high ranked directors try to reduce the firm's information risk, i.e. disagreements about future prospects of the firm, by voluntarily disclosing more firm-specific information to the public. Additionally, I also observe the reduction in extreme negative outcomes (crash risk) in a firm's stock. The overall evidence suggests that firms which are seen by directors as relatively important for their reputation tend to be more transparent.

This study makes two main contributions to the existing literature. First, I document a capital market effect of director reputation incentives. In particular, I show that the presence of directors with high reputation incentives can increase the firm-specific information content in stock price. This evidence helps further the understanding of board of directors as a monitoring mechanism through a variable that is directly relevant to investors i.e. firm-specific risk. There is documented evidence of the relationship between idiosyncratic volatility and equity returns (e.g. Ang et al., 2006; Fu, 2009). Jiang et al. (2009) find that idiosyncratic volatility is negatively related to future earning shocks. Additionally, information in stock prices is also relevant to firm decision making. Durnev et al. (2004) argue that stock price informativeness can facilitate more efficient capital budgeting decisions as managers can obtain feedback from the market regarding their decisions.

Secondly, I contribute to the studies that link corporate governance to return volatility. Prior literature documents the relationship between idiosyncratic risk and shareholder rights, ownership structure, and board structure (Ferreira and Laux, 2007; Ferreira et al., 2011; Panousi and Papanikolaou, 2012). The findings in this study are consistent with the view that independent directors alter the firm information environment to accommodate their demand for information (Armstrong et al., 2014). This study also contributes to the literature that links characteristics of directors to stock price informativeness (e.g. Gul et al., 2011). Masulis and Mobbs (2014, 2015) find that reputation incentives lead independent directors to be more motivated and the presence of these directors are associated with better board monitoring. I extend these results by showing that the presence of these directors are also associated with higher stock price informativeness, greater level of voluntary disclosure by the firm, and lower stock price crash risk.

4.2 Literature review and hypothesis development

4.2.1 Firm-specific information and stock returns

Under the efficient market hypothesis, stock prices reflect the information set available to the market participants. This information set can either be market-wide information or information specific to the firm. Roll (1988) uses R^2 from the market model regression to measure the extent to which stock price movement can be explained by market-related information. A high R^2 means that market returns can explain a large portion of return variation. A low R^2, on the other hand, suggests that a higher proportion of stock return volatility can be attributed to firm-specific information. Thus, a high proportion of idiosyncratic volatility can be considered a proxy for the level of firm-specific information being released to the market by the firm.

The extent to which firm-specific information is incorporated into stock returns is broadly influenced by two factors. The first factor is the incentive for investors to collect firm-specific information. Morck et al. (2000) find R^2 to be high in economies with low property rights. They argue that low property rights reduce the benefits of informed arbitrage; thus, investors are discouraged from collecting firm-specific information. Similarly, Ferreira and Laux (2007) argue that fewer takeover restrictions can induce more private information collection. They document a negative relation between the number of anti-takeover provisions, a proxy for managerial entrenchment, and idiosyncratic volatility. Capital market liberalization and stronger investor protection such as the enactment of insider trading laws also leads to greater informativeness of stock prices (Li et al., 2004; Fernandes and Ferreira, 2009). Overall, evidence shows that the ability to use information to make a profitable trade is linked to informativeness in stock prices.

The second factor is the information environment of the firm. One of the barriers preventing information from being incorporated into stock price is the cost of obtaining that information (Grossman and Stiglitz, 1980). Veldkamp (2006) suggests that, because firm-specific information has a higher per-unit cost than market information, the firm's market-model R^2 is on average higher than what the comovement of firm fundamentals would suggest. When the cost of obtaining firm-specific information is high, rational investors rely on market-level information to infer firm cash flows. Jin and Myers (2006) show that the lack of a firm's information transparency can lead to an increase in R^2. In their model, investors cannot observe firm's true cash flows. To extract wealth from the company, the manager captures part of the firm's cash flow and, in the process, reduces firm-specific variance. Fox et al. (2003) find the introduction of enhanced disclosure rules leads to more firm-specific information in stock prices. Bushman et al. (2004b) find R^2's to be lower in countries with higher levels of financial transparency i.e. the availability of financial information to those outside the firm. At the firm level, stock prices of companies with a higher level of analyst coverage tend to have a higher proportion of firm-specific information content in their stock prices (Chan and Hameed, 2006). Fernandes and Ferreira (2008) find a rise in stock price informativeness when developed market firms are cross-listed in the US, and attribute this increase to the increase in analyst coverage. Rajgopal and Venkatachalam (2011) find a negative relationship between idiosyncratic volatility and the quality of firm accounting information. The overall findings from these studies suggest that the more widely available firm information is to investors, the lower the market-model R^2.

4.2.2 Director reputation incentives and board monitoring.

Fama and Jensen (1983) argue that directors have incentives to maintain and increase their reputation as monitors. In the labour market of directors, signalling that they are effective monitors can increase the value of their human capital and the opportunity for additional directorships (Fama, 1980). Outside directorships can reflect the demand of that director's service in the directorship market and, ultimately, their ability. Shivdasani (1993) argues that the number of outside directorships serves as a measure for that director's reputation – a proxy for ability[2].

In addition to the positive signaling effect of outside directorships, sitting on multiple boards may allow directors to increase their ability to perform board functions. Directors who have more connections tend to have better access to information that can be useful in decision making (Coles et al., 2012). For example, Field et al. (2013) finds that younger firms can benefit from having well-connected directors on their boards.

Despite these positive evidence, many studies see directors with multiple directorships as "busy directors" and associate them with poor monitoring (e.g. Kaplan and Reishus, 1990; Beasley, 1996; Core et al., 1999; Fich and Shivdasani, 2006)[3]. These studies usually classify busy directors as those who hold three or more board seats or use the total number of external board seats as a proxy for overall board "busyness". An implicit assumption of this measure is that the time and efforts of these directors are distributed uniformly across directorships. Recent literature shows that this is not the case.

[2] As the CEO may have a considerable influence in the director appointment process, directors may also be appointed to multiple boards because they have a reputation of having a tendency to agree with the CEO. While this is the possibility, the predictions based on this 'yes-man' rationale would be opposite to the 'high-ability' rationale.

[3] Perry and Peyer (2005) find that executives accepting an additional outside directorship decreases firm value, but only when the firm has greater agency problems. In firms with fewer agency concerns, additional directorships are related to increased firm value.

Masulis and Mobbs (2014, 2015) show evidence that directors do not allocate their time and effort equally among their multiple directorships. Instead, they allocate more of their limited human capital on firms they deem most desirable. Directors are more incentivized to preserve their reputation in large firms because the higher visibility, provided by these firm, can increase the likelihood of obtaining additional directorships (Shivdasani, 1993). Ryan and Wiggins (2004) find that director pay is generally higher in large firms, although Adams and Ferreira (2008) argue that directors do not care so much about monetary compensation: they are more motivated by prestige and reputation. Masulis and Mobbs (2014) rank directorships by firm size and find that directors who view their board seat as being more prestigious are more likely to attend meetings more regularly and serve on more committees. Their results are consistent with the view that directors who have high incentives to monitor are more active monitors. Linking this to firm-level outcomes, Masulis and Mobbs (2015) find that firms have a lower level of discretionary accruals in the presence of directors who deem their directorship to be relatively important. They also find that these firms are less likely to restate their earnings. Thus, it is possible that reputation incentives can induce better monitoring and as a result increase firm-related information in the stock market.

4.2.3 Hypotheses

Existing empirical evidence suggests that independent directors are incentivized to monitor when they believe their performance is more likely to be observed by the labor market. They require information about the company in order to be effective at monitoring. Although independent directors may have access to firm-specific information via private channels e.g. internal financial reports and informal communications with the managers, they arguably prefer information from public channels. Information from private channels mainly come from managers, who have incentives to withhold information that is detrimental to their interest (Jensen, 1993; Jin and Myers, 2006). Additionally, the information can be distorted in a way that reduces effectiveness of monitoring from independent directors (Bushman et al., 2004a).

The increased level of monitoring would then lead to a higher level of firm-specific information content in a firm's stock price. Therefore, I should observe a positive relation between reputation incentives and stock price informativeness. Therefore, my first hypothesis is as follows.

Hypothesis 1 *Stock price informativeness increases with the proportion of directors to whom the directorship is the highest ranked.*

The literature also documents the impact of monitoring by parties outside of the firm on firm-specific information content in stock price. Ferreira and Laux (2007) find a link between openness of the firm to the market for corporate control and stock price informativeness. They postulate that investors are more incentivized to collect information about firms that are more likely to become takeover targets. Similarly, Piotroski and Roulstone (2004), amongst others, find firm-specific information content in stock price to be higher among firms that are extensively covered by analysts.

I investigate whether monitoring by external parties is a complement or substitute to monitoring by directors. If internal and external monitoring mechanisms are complements, I should find the relationship between reputation incentives and stock price informativeness to be stronger when outside monitoring is strong.

Hypothesis 2 *The strength of the relation between the proportion of directors for whom the directorship is the highest ranked and stock price informativeness is stronger in firms covered by* ***more*** *financial analysts.*

Hypothesis 3 *The strength of the relation between the proportion of directors for whom the directorship is the highest ranked and stock price informativeness is stronger in firms with* ***fewer*** *takeover defenses.*

On the other hand, if these mechanisms are substitutes, I would find the relationship to be stronger when outside monitoring mechanisms are weak.

Hypothesis 2* *The strength of the relation between the proportion of directors for whom the directorship is the highest ranked and stock price informativeness is stronger in firms covered by* ***fewer*** *financial analysts.*

Hypothesis 3* *The strength of the relation between the proportion of directors for whom the directorship is the highest ranked and stock price informativeness is stronger in firms with* ***more*** *takeover defenses.*

Prior literature shows some evidence that price informativeness is positively linked to financial report quality (e.g. Hutton et al., 2009) whilst Masulis and Mobbs (2015) document a positive relation between earnings quality and reputation incentives. To assess whether director reputation incentives can increase firm-specific information in stock price through other channels, I need to take into account the effect of earnings quality in the model. If the link between reputation incentives and stock price informativeness occurs through channels other than better financial reporting, I would observe a statistically significant relationship between the two variables even when I control for quality of earnings.

Hypothesis 4: The positive association between the proportion of directors for whom the directorship is the highest ranked and stock price informativeness occurs via other channels in addition to the quality of financial reports.

4.3 Data

This study employs 18,538 observations (firm-years) of 2,463 firms between 1996-2012 from the following data sources. The information of each directors and firm's anti-takeover provisions are obtained from the RiskMetrics database, which covers Standard and Poor's (S&P) 500, S&P MidCaps and S&P SmallCap firms.

I obtain information of each director and firm-level anti-takeover provisions from the RiskMetrics database, which covers Standard & Poor's (S&P) 500, S&P MidCaps and S&P SmallCap firms. Financial accounting variables are constructed using the information from the S&P Capital IQ Compustat database. The stock price informativeness measure is calculated using daily stock price information from the Centre for Research in Security Prices (CRSP). I use CRSP NYSE/Amex/NASDAQ Value-Weighted Market Index as my proxy for the market portfolio. Analyst coverage data is obtained from the I/B/E/S database. Following prior literature, I exclude financial service (SIC code 4900-4999) and utility firms (SIC code 6000-6999) from the sample. All variable definitions are provided in Table 4.1.

4.3.1 Stock price informativeness

This study follows Morck et al. (2000) and employs idiosyncratic volatility as the key proxy for stock price informativeness. For each firm-year, I estimate the following single-factor market model:-

$$r_{id} = \alpha_i + \beta_i \times r_{md} + e_{id} \tag{4.1}$$

Table 4.1: Variable Definitions

Variable	*Definition*
Price Informativeness	Annual logistic transformed relative idiosyncratic volatility estimated from the market model.
% Independent Directors - High	Proportion of board members who are independent outside directors and this directorship is at least 10% larger than their smallest directorship based on the firm market capitalization.
% Independent Directors - Highest	Proportion of board members who are independent outside directors and this directorship is their largest directorship based on the firm market capitalization.
% Independent Directors - Low	Proportion of board members who are independent outside directors and this directorship is at least 10% smaller than their largest directorship based on the firm market capitalization.
% Independent Directors - Lowest	Proportion of board members who are independent outside directors and this directorship is their smallest directorship based on the firm market capitalization.
Busy Board	An indicator variable that equals one if the majority of the board is populated by directors who hold three or more additional directorship and zero otherwise.
Sole Directors	An indicator variable that equals one if the majority of the board is populated by directors whose directorship is their only directorship and zero otherwise.
Board Size	Number of directors on board.
Board Independence	An indicator variable that equals one if the majority of the board is populated by independent directors. Directors are classified as independent when they are not executives (formerly or presently) and do not have any other affiliation to the company.
Return on Equity	Net income divided by total common equity.
S.D.(ROE)	Standard deviation of the firm's return on equity in the current year and the previous two years.
Leverage	Total long-term debt divided by total assets. Market-to-book ratio, defined as the product of number of common shares outstanding and share price at the end of fiscal year divided by total common equity.
Market-to-Book	Stock price at fiscal year end times the number of common shares outstanding divided by the book value of equity and winsorized at 1%.
Firm Size	Log firm size based on the firms market capitalization.
Dividend	An indicator variable that equals one if the firm pays dividends and zero otherwise.
Firm Age	Logarithm of one plus firm age measured as the number of years since the firms inclusion in the Compustat database.
Diversification	An indicator variable that equals one if the firm operates in more than one business segments and zero otherwise.
Earning Quality	Measures of earning quality, defined as the absolute values of the residuals from cross-section regression ($\|\varepsilon_t\|$) of the following earning quality models: Jones (1991), modified-Jones (Dechow et al., 1996), Dechow and Dichev (2002), and McNichols (2002).
E-Index	The number of governance provisions adopted by firm that reduce shareholder rights and takeover threats (Bebchuk et al., 2009).
Analyst Coverage	The number of forecasts made by stock analysts.

where r_{id} is the daily return for stock i on day d and r_{md} is the value-weighed market return on day d.

The residuals e_{id} have mean of zero and are orthogonal to the market return: $E(e_{id}) = cov(r_{md}, e_{id}) = 0$. Thus return volatility of stock i (σ_i^2) can be divided into two components.

$$\sigma_i^2 = \beta_i^2 \times \sigma_m^2 + \sigma_{ie}^2 \tag{4.2}$$

Here, idiosyncratic volatility ($\sigma_{ie}^2 = \sigma_i^2 - \beta_i^2 \times \sigma_m^2$) is the variance of the component of the stock return that cannot be explained by the market return. I measure stock price informativeness as the variance of firm-specific returns scaled by the variance of total return ($\sigma_{ie}^2/\sigma_i^2 = 1 - \beta_i^2 \times \sigma_m^2/\sigma_i^2$), which is equivalent to $1 - R_{i,t}^2$ from the market model regression (Equation 4.1).

As $1 - R_{i,t}^2$ only has possible values between zero and one, I follow prior literature (e.g. Ferreira and Laux, 2007) and construct my measure of stock price informativeness as a logistic transformation of $1 - R_{i,t}^2$. Formally,

$$\text{Price Informativeness}_{i,t} = \ln\left(\frac{\sigma_{ie,t}^2}{\sigma_{i,t}^2 - \sigma_{ie,t}^2}\right) = \ln\left(\frac{1 - R_{i,t}^2}{R_{i,t}^2}\right) \tag{4.3}$$

A high (low) level of stock price informativeness can be interpreted as stock price having a greater (smaller) level of firm-specific information content because the market return can explain a smaller (greater) portion of the stock total volatility.

4.3.2 Independent director reputation incentives

The measures for independent director reputation incentives follow Masulis and Mobbs (2014, 2015). I collect director information from the universe of S&P 1500 firms between 1996-2012. I focus on independent directors with multiple directorships because their human capital is in high demand, signaling that they have higher ability[4]. Executive directors or directors with any other affiliation with the firm are not considered when constructing these measures as potential conflicts of interest may inhibit their willingness to reveal firm-specific information to the public[5]. For each independent director, I rank all directorships in his/her portfolio by firm market capitalization. I assume that the firm that is highest ranked based on size is the most important firm for that director and correspondingly the lowest ranked is the least important.

I then consolidate the director data into firm-level variables. The main board-level reputation incentive of directors, *% Independent Directors - Highest*, is the proportion of directors for whom this directorship is the *highest* ranked i.e. the *largest* firm. Correspondingly, I define *% Independent Directors - Lowest* as the proportion of directors for whom the directorship is the *lowest* ranked i.e. the *smallest* firm.

To capture the relative importance of the directorships in independent directors' directorship portfolio, I construct two additional variables *% Independent Directors - High* and *% Independent Directors - Low*. The variable % Independent Directors - High (Low) is the proportion of directors for whom this directorship is at least 10% *larger* (*smaller*) than their *smallest* (*largest*) directorship. These two variables recognize that directors may not only deem

[4]I note that directors with only one directorship may also have strong incentives to retain their directorship. Thus, I also include the presence of sole directors in the model as a control variable.

[5]I account for the impact of executive and affiliated directors in the model by controlling for the level of board independence.

their largest directorship to be important but may also pay more attention to their directorships of relatively larger firms. Referring back to the example in Figure 4.1, Laybourne would consider her directorship for Symantec to be of high rank whereas both JC Penny and Electronic Art would be considered low ranked. These two measures exploit greater variability in the data and are also able to capture the relative reputation incentives for independent directors with more than two directorships.

4.3.3 Summary statistics

The summary statistics are presented in Table 4.2. On average, 24% of stock price movements can be explained by market returns (Panel A). This leaves 76% of unexplained variation that can be attributed to the incorporation of firm-specific information. The key dependent variable, *Price Informativeness*, which is a logistic transformation of $1 - R^2_{i,t}$ has a mean of 1.53.

Panel B shows the summary statistics of the board of directors in the sample. On average a board comprises nine directors. About 69% of directors on an average board are considered independent by RiskMetrics. Independent directors are those who are neither executives not affiliated with the company[6]. In more than 80% of the observations, independent directors represent a majority of the board.

Although unreported in this table, I find that more than half of these independent directors hold at least one additional directorship in other RiskMetrics firms[7]. This implies that a large proportion of the directors may have

[6]RiskMetrics classify directors as affiliated if they are a former employee; an employee of or is a service provider, supplier, customer; a recipient of charitable funds; are considered an interlocking or designated director; or are a family member of a director or executive of the firm.

[7]About 38% as a percentage of all directors.

Table 4.2: Summary Statistics

The full sample comprises 18,538 S&P 1500 firms from 1996-2012. R^2 and the measure of stock price informativeness are computed using daily stock price data from the Center of Research in Security Prices. NYSE/Amex/NASDAQ value-weighted market index (inclusive of dividends) is the proxy for stock market portfolio. Director data and E-Index are obtained from the RiskMetrics database. Firm characteristics are obtained from S&P Capital IQ Compustat database. Analyst coverage data is obtained from the I/B/E/S database. Variable definitions are provided in Table 4.1.

Variable	#Obs.	Mean	S.D.	Min	p25	p50	p75	Max
Panel A: Stock Price Informativeness								
R^2	18,538	0.24	0.17	0.00	0.10	0.21	0.35	0.84
Price Informativeness	18,538	1.53	1.43	-1.65	0.60	1.30	2.18	15.34
Panel B: Board Characteristics								
Board Size	18,538	9.02	2.38	3.00	7.00	9.00	10.00	23.00
Board Independence	18,538	0.69	0.17	0.00	0.57	0.71	0.83	1.00
Independent Director Majority	18,538	0.82	0.38	0.00	1.00	1.00	1.00	1.00
Sole Director Majority	18,538	0.63	0.48	0.00	0.00	1.00	1.00	1.00
Busy Board	18,538	0.01	0.08	0.00	0.00	0.00	0.00	1.00
% Independent Directors – Highest	18,538	0.10	0.14	0.00	0.00	0.00	0.15	0.91
% Independent Directors – Lowest	18,538	0.13	0.14	0.00	0.00	0.10	0.20	0.88
% Independent Directors – High	18,538	0.11	0.15	0.00	0.00	0.00	0.18	0.91
% Independent Directors – Low	18,538	0.15	0.15	0.00	0.00	0.13	0.25	0.89
Panel C: Firm Characteristics								
Return on Equity	18,538	0.06	6.57	-0.30	0.05	0.12	0.19	0.38
Variance(ROE)	18,538	0.36	6.35	0.01	0.02	0.05	0.11	0.60
Leverage	18,538	0.19	0.17	0.00	0.02	0.17	0.29	0.49
Market-to-Book	18,538	3.56	44.55	0.68	1.47	2.28	3.65	8.75
Firm Size	18,538	7.44	1.60	5.04	6.35	7.29	8.42	10.33
Firm Age	18,538	3.08	0.68	2.56	2.56	3.09	3.69	4.02
Dividends	18,538	0.52	0.50	0.00	0.00	1.00	1.00	1.00
Diversification	18,538	0.61	0.49	0.00	0.00	1.00	1.00	1.00
Panel D: External monitoring measures								
E-Index	12,900	2.14	1.35	0.00	1.00	2.00	3.00	5.00
Analyst Coverage	12,242	10.85	7.79	0.00	5.00	9.00	15.00	56.00
Panel E: Earnings quality measures								
Jones (1991)	18,442	0.12	0.16	0.01	0.03	0.08	0.14	0.35
Modified-Jones (Dechow et al., 1996)	18,442	0.12	0.16	0.01	0.03	0.07	0.14	0.35
Dechow and Dichev (2002)	7,138	0.13	0.30	0.00	0.02	0.05	0.12	0.54
McNichols (2002)	7,138	0.18	0.68	0.00	0.02	0.05	0.14	0.69

different reputation incentives across their directorships. It also implies that, within each firm, different directors may also have different reputation incentives. Only a small fraction (about 1%) of firms in my sample have busy boards i.e. those where the majority of directors hold more than three directorships.

The means of the key independent variables[8] *% Independent Directors - Highest* and *% Independent Directors - Lowest* are 10% and 13% respectively. This means that, on an average board, about 10% of directors are independent and for them this firm is the largest in their directorship portfolio, whereas for about 13% this firm is the smallest in their directorship portfolio. The relative measures *% Independent Directors - High* and *% Independent Directors - Low* have slightly higher means – 11% and 15% respectively[9]. Because the relative size of the directorships are also taken into account, the standard deviations for these two measures are slightly higher.

Panel C displays summary statistics for a number of firm characteristics. The average return on equity of the sample firms are 6% with a five-year rolling standard deviation of 36%. An average firm has a leverage of 19% and the market value of the firm is 3.6 times larger than the book value. Firm size and firm age are reported in log form. An average firm has a market capitalization of 1.7 billion dollars and is about 20 years old. About 52% of the firms in the sample pay dividends and 61% operate in more than one industry.

In Panel D, I report two measures that proxy for monitoring by parties outside of the firm. First is the entrenchment index from Bebchuk et al. (2009) which counts the number of entrenchment provisions adopted by the firm. Out of six provisions[10], the sample firms on average adopt two provisions that

[8] All independent variables are scaled by the number of all directors.

[9] These measures have a similar (albeit slightly higher) mean compared to those reported in Masulis and Mobbs (2015).

[10] Staggered boards, limits to shareholder bylaw amendments, poison pills, golden parachutes, and supermajority requirements for mergers and charter amendments.

can be considered anti-takeover. These provisions can decrease the probability of the firm being taken over. As a result, they can also discourage market participants from collecting firm-specific information (Ferreira and Laux, 2007). Another measure is analyst coverage which is the number of earnings forecast made by security analysts for each firm-year. On average, a firm has 11 earnings forecasts made by analysts in each year.

Lastly, I report the summary statistics for earnings quality measures from Jones (1991), Dechow et al. (1996), Dechow and Dichev (2002) and McNichols (2002). These measures capture the level of discretionary accruals i.e. the part of accounting accruals that cannot be captured by assumed theoretical models. The ways these measures are computed are discussed further in Section 4.4.3. High values of these measures suggest that the firm's accounting accruals cannot be explained by economic conditions and as such the quality of the firm's earnings is low. Low values of these earnings quality measures on the other hand suggests that the quality of the firm's earnings is high.

4.4 Results

4.4.1 Stock price informativeness and reputation incentives

I first test the hypothesis that the proportion of directors to whom the directorship is the highest ranked is positively related to stock price informativeness (Hypothesis 1). To estimate the relation between stock price informativeness and the reputation incentive measures, I estimate the following model:

$$\begin{aligned}\text{Price Informativeness}_{i,t} = \beta_0 + \beta_1 \times (\text{\% Independent Directors - Highest})_{i,t} \\ +\beta_2 \times (\text{\% Independent Directors - Lowest})_{i,t} \\ +\mathbf{X}_{i,t}\mathbf{\Pi} + \varepsilon_{i,t}\end{aligned} \tag{4.4}$$

Having multiple directorships can severely constrain directors' time and attention and may inhibit them from performing their functions effectively. If they see the directorship as less important, they may allocate less monitoring effort and the lack of monitoring may allow the managers to withhold firm-specific information from the public. Independent directors to whom the directorship is the highest ranked are assumed to be incentivized to decrease information asymmetry between managers and shareholders. Therefore, I expect price informativeness to increase with the proportion of directors for whom this directorship is highly ranked. On the other hand, independent directors to whom this directorship is the least important may not be incentivized to reduce firm information asymmetry. Therefore, I also expect price informativeness to decrease with the proportion of directors for whom the directorship is of low rank.

Following prior literature, I include a number of board and firm characteristics are included in the matrix $\mathbf{X}_{i,t}$. I include board size and board independence as Ferreira and Laux (2007) suggest that stock market and board of directors can be substitutes in terms of monitoring and advising functions.

A number of control variables are included in all specifications. I include net return on the book value of equity to proxy for profitability. I also include profit variability as measured by the variance of the firm's return on equity. Chan and Hameed (2006) argue that firms with volatile returns produce more firm-specific information and their prices are less affected by industry- and market-wide information. I include leverage as higher levered firms may have high idiosyncratic volatility (Rajgopal and Venkatachalam, 2011). I include firm size as Roll (1988) finds that larger firm tend to incorporate more market-wide information compared to small firms. Firm size is measured as the logarithm of total market capitalization. I also include firm age (in log form) and a dummy variable indicating whether the firm is diversified i.e. operating in more than one industry. Diversified firms may be less sensitive to macroeconomic shocks, and thus their stock prices may better reflect firm-specific information (Piotroski and Roulstone, 2004). However, diversified firms can also be seen as diversified portfolios and thus the movement of their stock prices may resemble that of the market (Roll, 1988). Finally, I proxy for liquidity using stock turnover, which is defined as the number of trades divided by the number of shares outstanding. Stock liquidity facilitates informed trading and thus can be a determinant of stock price informativeness (Chordia et al., 2008). Finally, I include industry (2-digit SIC code) and year dummies in all specifications to control for the possibility of differences in levels of stock price informativeness across industries and years. Standard errors are robust to heteroskedasticity and serial correlation within firm-level clusters.

Table 4.3 reports the regression results. Consistent with Hypothesis 1, I find a positive and statistically significant relationship between stock price informativeness and the proportion of directors to whom the directorship is the highest ranked. Price informativeness is also negatively related with the proportion of directors to whom the directorship is the lowest ranked.

Considering Model 1, an 11% increase in *% Independent Directors - Highest* (equivalent to one additional director on a nine-person board perceiving their directorship to be the most important) is associated with a 0.0573 unit increase in stock price informativeness. In contrast, the relation between stock price informativeness and *% Independent Directors - Lowest* is also negative and significant although the relation is weaker in both economic magnitude and statistical significance.

In Model 2, I introduce two additional control variables – *Busy Board* and *Sole Director Majority*. As the reputation measures only exploit the variation of independent directors who hold multiple directorships, controlling for busy boards may further isolate the effect of reputation incentives from the effect of having multiple directorships. The variable *Busy Board* is a dummy variable that takes the value of one when the majority of directors hold three or more directorships. The results show that a busy board has lower stock price informativeness although the coefficient is not statistically significant. By controlling for *Sole Directorship Majority*, I recognize directors to which the firm is their only directorship may also be incentivized to protect their only directorship and thus the board where the majority of directors have sole directorship may also be effective at monitoring. The results however indicate that *Sole Directorship Majority* is not statistically related to price informativeness and the coefficient is close to zero. In this model, the coefficient for both *% Independent Directors - Highest* and *% Independent Directors - Lowest* remain statistically significant.

Table 4.3: Price Informativeness on Reputation Incentives Measures

This table presents coefficient estimates and cluster-robust standard errors from multivariate OLS regression analysis of stock price informativeness on director reputation incentives. The dependent variable is the logistic transformation of $1 - R^2$ from market model regression. % Independent Directors – Highest (Lowest) is the proportion of directors who are independent and for whom this directorship the largest (smallest) directorship. % Independent Directors – High (Low) is the proportion of directors who are independent and for whom this directorship is at least 10% larger (smaller) than their smallest (largest) directorship. Other control variables are defined in Table 4.1. Industry and fiscal year dummy variables are included in all specifications. * , ** and *** indicate significance at the 10%, 5% and 1% levels respectively.

	Dependent Variable = Price Informativeness			
	(1)	(2)	(3)	(4)
% Independent Directors – Highest	0.573***	0.569***		
	(0.102)	(0.112)		
% Independent Directors – Lowest	−0.181**	−0.182**		
	(0.075)	(0.088)		
% Independent Directors – High			0.605***	0.584***
			(0.098)	(0.105)
% Independent Directors – Low			−0.253***	−0.273***
			(0.068)	(0.078)
Busy Board		−0.156		−0.159
		(0.110)		(0.109)
Sole Director Majority		−0.002		−0.016
		(0.026)		(0.025)
Board Size	0.021***	0.021***	0.022***	0.022***
	(0.006)	(0.006)	(0.006)	(0.006)
Board Independence	−0.068**	−0.068**	−0.065**	−0.063**
	(0.029)	(0.029)	(0.029)	(0.029)
Return on Equity	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
S.D.(ROE)	−0.000	−0.000	−0.000	−0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Leverage	0.216***	0.216***	0.220***	0.220***
	(0.066)	(0.066)	(0.066)	(0.065)
Market-to-Book	−0.003	−0.003	−0.003	−0.003
	(0.003)	(0.003)	(0.003)	(0.003)
Firm Size	−0.322***	−0.321***	−0.328***	−0.328***
	(0.012)	(0.012)	(0.013)	(0.013)
Dividend	−0.023	−0.023	−0.021	−0.021
	(0.026)	(0.026)	(0.026)	(0.026)
Firm Age	−0.053**	−0.053**	−0.054***	−0.054***
	(0.021)	(0.021)	(0.021)	(0.021)
Diversification	−0.065***	−0.064***	−0.065***	−0.064***
	(0.024)	(0.024)	(0.024)	(0.024)
Stock Turnover	−0.017**	−0.017**	−0.016**	−0.016**
	(0.007)	(0.007)	(0.007)	(0.007)
Observations	18,538	18,538	18,538	18,538
Firms	2,463	2,463	2,463	2,463
R^2	0.569	0.569	0.570	0.570

In Models 3 and 4, I replace the key independent variables with the relative measures of reputation incentives – *% Independent Directors - High* and *% Independent Directors - Low*. The results are consistent with those using the absolute measures. The overall results in this table suggest that directorship ranking of directors matters in term of stock price informativeness. This is consistent with Hypothesis 1 – directors who see the firm as important can deter managers from withholding firm specific information and as such are associated with a higher level of stock price informativeness.

4.4.2 Controlling for external monitoring mechanisms

The argument I put forward in this study is that director reputation incentives are related to stock price informativeness through monitoring of directors that see the firm as important. In this section, I look at the interaction between monitoring of these directors and other monitoring mechanisms from outside parties that can also affect stock price informativeness as documented by prior literature.

The first monitoring mechanism is firm coverage by security analysts. Prior literature has documented the relationship between analyst coverage and information asymmetry (Piotroski and Roulstone, 2004; Chan and Hameed, 2006; Yu, 2008; Derrien and Kecskés, 2013). The presence of financial analysts may lead to more price informativeness as firm-specific information is disseminated. However, analysts may not have access to firm-level information; therefore, they may focus on producing market- and industry-wide information which could then lead to a lower level of firm specific information (Piotroski and Roulstone, 2004).

The second mechanism is monitoring by outside investors. Ferreira and

Laux (2007) argue that the openness of a firm to the market for corporate control encourages investors to collect firm-specific information and ultimately leads to more informative stock price. Both these external monitoring mechanisms may be correlated with the reputation incentive measures.

Additionally, the relation between reputation incentives and stock price informativeness may be conditional on the activities of parties outside of the firm. On one hand, directors may respond to informational demand of outside parties (i.e., analysts and the corporate control market) by encouraging more firm-specific information to be released into the market. On the other hand, directors may act as a substitute to information collection from outside parties and release more information to decrease information asymmetry between insiders and outsiders.

I first confirm that my results hold after controlling for external monitoring mechanisms. To do this, I introduce two additional control variables to the models in Table 4.3. The first variable, *Analyst Coverage*, is defined as the number of earnings forecast made by analysts in each financial year. The analyst forecast data is obtained from the Institutional Brokers' Estimate System (I/B/E/S). For the firm-years where there is no information in the database, I follow prior literature and set this variable to zero. The second variable is *Entrenchment Index*, which is the index based on six anti-takeover provisions from Bebchuk et al. (2000). This variable takes values between 0 and 6. Higher values mean the firm has put more anti-takeover provisions in place. Thus, firms with high *Entrenchment Index* are considered to be more hostile to takeover attempts.

In Columns 1-4 of Table 4.4, I introduce *Analyst Coverage* and *Entrenchment Index* to the model separately. In Columns 1-2, *Analyst Coverage* enters the model with a positive and statistically significant coefficient ($p < 0.01$).

Table 4.4: Price informativeness, reputation incentives & monitoring

This table presents coefficient estimates and cluster-robust standard errors from multivariate OLS regression analysis of stock price informativeness on director reputation incentives. Analyst coverage is the number of earnings forecasts made by security analysts. E-Index is the number of governance provisions adopted by firm that reduce shareholder rights and takeover threats as constructed by Bebchuk et al. (2009). Other variables are defined in Table 4.1. Industry and fiscal year dummy variables are included in all specifications. * , ** and *** indicate significance at the 10%, 5% and 1% levels respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
% Independent Directors – Highest	0.543***		0.362***		0.359***	
	(0.111)		(0.122)		(0.121)	
% Independent Directors – Lowest	−0.171**		−0.128		−0.125	
	(0.087)		(0.097)		(0.097)	
% Independent Directors – High		0.572***		0.367***		0.367***
		(0.105)		(0.114)		(0.113)
% Independent Directors – Low		−0.247***		−0.194**		−0.184**
		(0.078)		(0.088)		(0.088)
Busy Board	−0.140	−0.146	−0.329***	−0.331***	−0.322***	−0.325***
	(0.109)	(0.108)	(0.114)	(0.110)	(0.112)	(0.109)
Sole Director Majority	−0.002	−0.012	−0.031	−0.042	−0.032	−0.041
	(0.026)	(0.025)	(0.030)	(0.029)	(0.029)	(0.029)
Board Size	0.020***	0.020***	0.018**	0.018***	0.017**	0.017**
	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)
Board Independence	−0.071**	−0.068**	−0.057	−0.054	−0.060	−0.058
	(0.029)	(0.029)	(0.040)	(0.039)	(0.040)	(0.040)
Return on Equity	0.001	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
S.D.(ROE)	−0.000	−0.000	0.001	0.001	0.000	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Leverage	0.237***	0.240***	0.197**	0.202***	0.209***	0.213***
	(0.065)	(0.065)	(0.078)	(0.078)	(0.078)	(0.077)
Market-to-Book	−0.003	−0.003	−0.002	−0.002	−0.001	−0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)

(Continued on next page...)

(Table 4.4 Continued)

Firm Size	−0.353***	−0.360***	−0.249***	−0.254***	−0.283***	−0.287***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.017)	(0.017)
Dividend	−0.024	−0.022	−0.029	−0.027	−0.030	−0.029
	(0.026)	(0.025)	(0.027)	(0.027)	(0.027)	(0.027)
Firm Age	−0.049**	−0.050**	−0.067***	−0.067***	−0.058**	−0.059***
	(0.021)	(0.021)	(0.023)	(0.023)	(0.023)	(0.023)
Diversification	−0.056**	−0.056**	−0.114***	−0.114***	−0.104***	−0.104***
	(0.023)	(0.023)	(0.027)	(0.027)	(0.027)	(0.027)
Stock Turnover	−0.020***	−0.019***	0.008	0.008	0.004	0.004
	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)
Analyst Coverage	0.011***	0.011***			0.010***	0.010***
	(0.002)	(0.002)			(0.002)	(0.002)
E-Index			−0.027**	−0.026**	−0.026**	−0.026**
			(0.011)	(0.011)	(0.011)	(0.011)
Observations	12,204	12,204	12,813	12,813	10,778	10,778
Firms	1,181	1,181	1,357	1,357	1,111	1,111
R^2	0.572	0.572	0.564	0.564	0.565	0.566

The results indicate that analyst coverage facilitates the incorporation of firm-specific information rather than market- and/or industry-wide information into stock prices. Columns 3-4 show that results with *Entrenchment Index* as a control variable. I find *Entrenchment Index* to be negatively related to stock price informativeness. Consistent with Ferreira and Laux (2007), the evidence suggests that less entrenched firms encourage more firm-specific information collection.

In Columns 5-6, both variables are included in the model. The coefficients for *Analyst Coverage* and *Entrenchment Index* remain similar in terms of sign, magnitude and statistical significance. The proportion of directors to whom the firm is highest ranked remains statistically significant determinants of stock price informativeness. Both the coefficients for *% Independent Directors - Highest* and *% Independent Directors - High* are statistically significant at 1% level. There are also some evidence that directors to whom the directorship is of low rank are associated with low price informativeness. However, the coefficient for *% Independent Directors - Lowest* becomes statistically insignificant whereas the coefficient for *% Independent Directors - Low* are significant at 5% level. Overall, the results suggest that reputation incentives of independent directors are significantly related to stock price informativeness even after controlling for other monitoring mechanisms that can affect the firm information environment.

I then look at the interaction between the reputation incentive measures and these two external monitoring mechanisms. In Panel A of Table 4.5, I split the sample into two groups based on the number of earnings forecasts made by financial analysts. The low (high) analyst coverage group comprises firm-years where the analyst coverage is below (above) the median of 5. I have 5,062 and 7,751 observations in the low and high analyst coverage groups respectively.

Table 4.5: Subsample Analysis

This table presents coefficient estimates and cluster-robust standard errors from multivariate OLS regression analysis of stock price informativeness on director reputation incentives. Firms are classified as having a high (low) level of Entrenchment Index when the number of anti-takeover provisions is above (below) the median, which is 2. Firms are classified as having a high (low) lever of analyst coverage when they earnings are forecasted by greater (lower) number of financial analyst than the median value (10.85). Other control variables from Models 5-6 of Table 4.4 are included. Definitions of variables are provided in Table 4.1. Dummy variables for industries (as defined by 2-digit SIC codes) and fiscal years are included in all specifications. *, ** and *** indicate significance at the 10%, 5% and 1% levels respectively.

Panel A: Split by Analyst Coverage				
Analyst Coverage =	Low		High	
	(1)	(2)	(3)	(4)
% Independent Directors – Highest	0.459**		0.101	
	(0.206)		(0.133)	
% Independent Directors – Lowest	−0.109		−0.085	
	(0.147)		(0.119)	
% Independent Directors – High		0.556***		0.127
		(0.204)		(0.120)
% Independent Directors – Low		−0.141		−0.051
		(0.138)		(0.108)
Other Controls	Yes	Yes	Yes	Yes
Observations	5,062	5,062	7,751	7,751
Firms	846	846	959	959
R^2	0.520	0.519	0.593	0.594

Panel B: Split by Entrenchment Index (Bebchuk et al., 2009)				
E-Index	Low		High	
	(1)	(2)	(3)	(4)
% Independent Directors – Highest	0.388*		0.329*	
	(0.202)		(0.172)	
% Independent Directors – Lowest	0.057		−0.152	
	(0.196)		(0.137)	
% Independent Directors – High		0.320		0.430***
		(0.196)		(0.153)
% Independent Directors – Low		−0.026		−0.207*
		(0.171)		(0.125)
Other Controls	Yes	Yes	Yes	Yes
Observations	4,162	4,162	4,770	4,770
Firms	741	741	1,046	1,046
R^2	0.520	0.519	0.593	0.594

I estimate the same equation as Columns 5-6 of Table 4.4 using these two subsamples. The results indicate that the higher proportion of directors with reputation incentives is associated with more firm-specific information in the stock price when firms lack monitoring from financial analysts: the coefficients for both *% Independent Directors - Highest* and *% Independent Directors - High* are larger in magnitude in the subsample where analyst coverage is below the median.The coefficients for *Highest* and *High* are 0.459 and 0.556 respectively in the low coverage subsample compared to 0.101 and 0.127 for the high coverage subsample. This evidence suggests that monitoring from analysts and director reputation incentives are substitutes in term of information (Hypothesis 2*); that is, when firms are well-covered by analysts, directors may not need to encourage more information disclosure even when they see the directorship as important.

The results for the monitoring from the market for corporate control (Hypothesis 3) is less conclusive; nonetheless, the evidence also suggests the substitution effect between monitoring from the market for corporate control and director reputation incentives. In Panel B, I estimate the same model on subsamples of firm-years with low and high levels of *Entrenchment Index*. A firm is considered to have low (high) Entrenchment Index when it adopts 0-1 (3-6) anti-takeover provisions in that financial year. The low (high) Entrenchment Index subsample comprises 3,454 (3,955) observations[11]. I find that the coefficient of *% Independent Directors - Highest* (0.388) in the low Entrenchment Index group is similar in magnitude compared to the coefficient in the high Entrenchment Index group (0.329). Statistical significance for both coefficients

[11]The median firm-years in my sample adopts two anti-takeover provisions. The number of observations with *Entrenchment Index* equal to 2 is 3,903, which comprises approximately 21% of the sample in which earnings quality data is available (18,442). To ensure similar numbers of observations across the two subsamples, I only include those observations where *Entrenchment Index* is above (below) the median in the high (low) subsample. The results are qualitatively similar when the median firms are included in the high or low group.

are also at the same level ($p < 0.10$). However, the relationship between *% Independent Directors - High* and stock price informativeness is stronger when Entrenchment Index is high. This is suggestive of a substitution effect (Hypothesis 3*): a director whose directorship ranking is relatively high compared to their other directorships appears to be associated with a higher level of information release to the market when the corporate control market is made ineffective by takeover provisions.

4.4.3 Controlling for earnings quality

Masulis and Mobbs (2015) show that the presence of directors who view the board as highly ranked is negatively associated with the level of discretionary accrual and earnings restatements. This suggests that monitoring from directors with high reputation incentives discourages managers from earnings management. Accounting information quality is one channel through which reputation incentives can affect stock price informativeness (e.g. Hutton et al., 2009; Chen et al., 2012). However, not only can directors affect the firm information environment by improving the quality of mandatory disclosures such as financial reports, they can also release firm-specific information through other channels including voluntary information disclosures. To test this hypothesis (Hypothesis 4), I introduce measures of accounting information quality into the model. If the impact of reputation incentives on idiosyncratic volatility also occur through other channels, the coefficient for the proportion of directors with high reputation incentives should remain significant.

In this section, I employ four measures of *Earnings Quality*. The first measure is the measure of earnings management through the use of discretionary accruals from Jones (1991). Intuitively, Jones (1991) hypothesizes that a firm's total accruals can be explained by changes in the firm's economic conditions. Therefore, the component of total accruals that come from managerial discretion would be captured by the residuals (ε_t) in the following equation:

$$TA_t = b_0 + b_1 \Delta REV_t + b_2 PPE_t + \varepsilon_t \tag{4.5}$$

where TA_t is the level of total accruals, ΔREV_t is the change in revenue and PPE_t is the value of property, plant and equipment. The level of discretionary accruals is the component of total accruals that cannot be explained by any of the independent variables in the model. Thus, it is estimated as the fitted value of the error term ($\hat{\varepsilon}_t$). Earnings quality is deemed to be high when $\hat{\varepsilon}_t$ is close to zero. As I am only interested in the magnitude of the discretionary accruals but not in whether the earnings are overstated or understated, I use the absolute value of the residuals as the proxy for earnings quality (i.e. *Earnings Quality* = $|\hat{\varepsilon}_t|$). Higher values of *Earnings Quality* suggest that much of the accruals cannot be explained by the changes in revenue and the value of property, plant and equipment.

The second measure is the absolute value of the residuals from the modified–Jones model of Dechow et al. (1995):

$$TA_t = b_0 + b_1(\Delta REV_t - \Delta REC_t) + b_2 PPE_t + \varepsilon_t \tag{4.6}$$

This model relaxes the implicit assumption of Jones's model and allows for earnings to be manipulated through discretionary adjustments of firm revenue. Assuming that changes in credit sales come from earnings management, this model adjusts the change in revenue by the change in account receivables (ΔREC_t) which is easier to manipulate compared to cash sales.

The third earnings quality model is that of Dechow and Dichev (2002):

$$\Delta WC_t = b_0 + b_1 CFO_{i-1} + b_2 CFO_t + b_3 CFO_{t+1} + \varepsilon_t \tag{4.7}$$

Instead of directly looking at total accruals, Dechow and Dichev (2002) look at how well the change in working capital accruals can be explained by operating cash flow realization. Similar to the models above, I use the absolute values of the residuals as the proxy for earnings quality.

The fourth measure (McNichols, 2002) comes from a modification of Dechow and Dichev's model:

$$\Delta WC_t = b_0 + b_1 CFO_{i-1} + b_2 CFO_t + b_3 CFO_{t+1} + b_4 \Delta REV_t + b_5 PPE_t + \varepsilon_t \tag{4.8}$$

McNichols (2002) extends the model of Dechow and Dichev (2002) by introducing factors from Jones (1991) – the change in revenue and the value of property, plant and equipment. Overall, these four measures are used as proxies for quality of a firm's financial statements. If the relationship between director reputation incentives and idiosyncratic volatility occurs through channels besides accounting information quality, I should observe significant coefficients for the main independent variables, particularly for *% Independent Directors - Highest* and *% Independent Directors - High*, when any of these four measures is included in the model.

In Table 4.6, I report the results where these measures of earnings quality are introduced to the estimation model. I lose some observations from the sample due to the inclusion of the earning quality measure. For the measures calculated using Jones (1991) and modified-Jones models (Columns 1-4), 18,442 observations are included in the estimation. The loss of observations

Table 4.6: Controlling for Earnings Quality Measures

This table presents coefficient estimates and cluster-robust standard errors from multivariate OLS regression analysis of stock price informativeness on director reputation incentives. All control variables in model 2 and 4 of Table 4.3 are included. Four proxies of earnings quality are employed: Jones (1991), Modified-Jones (Dechow et al., 1995), Dechow and Dichev (2002) and McNichols (2002). The construction of these earnings quality measures and other variables are provided in Table 4.1. Industry and fiscal year dummy variables are included in all specifications. * , ** and *** indicate significance at the 10%, 5% and 1% levels respectively.

Earnings Quality Model =	Jones (1991)		Modified-Jones	
	(1)	(2)	(3)	(4)
% Independent Directors – Highest	0.565***		0.566***	
	(0.113)		(0.113)	
% Independent Directors – Lowest	−0.179**		−0.178**	
	(0.087)		(0.087)	
% Independent Directors – High		0.588***		0.588***
		(0.106)		(0.106)
% Independent Directors – Low		−0.266***		−0.265***
		(0.078)		(0.078)
Earnings Quality	−0.150**	−0.151**	−0.159**	−0.159**
	(0.063)	(0.062)	(0.062)	(0.062)
Other Controls	Yes	Yes	Yes	Yes
Observations	18,442	18,442	18,442	18,442
Firms	2,454	2,454	2,454	2,454
R^2	0.569	0.570	0.569	0.570
Earnings Quality Model =	Dechow and Dichev (2002)		McNichols (2002)	
	(5)	(6)	(7)	(8)
% Independent Directors – Highest	0.616***		0.614***	
	(0.174)		(0.174)	
% Independent Directors – Lowest	−0.093		−0.093	
	(0.146)		(0.146)	
% Independent Directors – High		0.583***		0.581***
		(0.162)		(0.162)
% Independent Directors – Low		−0.269**		−0.269**
		(0.129)		(0.129)
Earnings Quality	0.012	0.012	−0.027**	−0.026**
	(0.046)	(0.047)	(0.011)	(0.011)
Other Controls	Yes	Yes	Yes	Yes
Observations	7,138	7,138	7,138	7,138
Firms	1,348	1,348	1,348	1,348
R^2	0.588	0.589	0.588	0.589

is more severe for the models of Dechow and Dichev (2002) and McNichols (2002) (only 7,138 observations remain) as I require both lead and lag values of operating cash flows in order to estimate their measures of accrual quality. Except for the model of Dechow and Dichev (2002), *Earnings Quality* enters the equation significantly at the 5% level with a negative sign, suggesting that firms with noisy accruals tend to have lower firm-specific information content in their stock prices. More importantly, I find that the coefficients for director reputation incentive measures remain significant in all eight specifications. These results indicate that, in addition to better accounting information quality, the presence of directors with high reputation incentives is associated with a high level of firm-specific information being released to the market (Hypothesis 4).

4.5 Robustness checks

4.5.1 Alternative measure of stock price informativeness

As robustness checks, I employ several measures of stock price informativeness. First, I use weekly data instead of daily data and find that my results continue to hold. In addition to the the single-factor market model in Equation 4.1, I employ the residuals from the three-factor Fama and French (1993) model and find similar results. Additionally, I follow Dimson (1979) and employ the following expanded market model:

$$r_{i,d} = \alpha_i + \beta_1 r_{m,d-2} + \beta_2 r_{m,d-1} + \beta_3 r_{m,d} + \beta_4 r_{m,d+1} + \beta_5 r_{m,d+2} + \varepsilon_{i,d} \tag{4.9}$$

where $r_{i,d}$ is the return of stock i on day d and $r_{m,d}$ is the return of the CRSP value-weighted market index on day d. The dependent variable in this section is the log ratio of $1 - R^2$ from the model above. The lead-lag terms are included to allow for nonsynchronous trading. Dimson (1979) argues that parameter estimates can be severely biased if stocks are not frequently traded. This could affect my measure of idiosyncratic volatility as it is calculated from the estimated values of the residuals. Dimson finds the inclusion of the lead and lag terms eliminates most of the bias[12]. The results are similar to those using my original measure of idiosyncratic volatility.

There is a debate in literature whether firm-specific stock returns are associated with noise rather than firm-specific information (see e.g. Dasgupta et al., 2010; Gassen et al., 2015). Therefore, I employ the illiquidity ratio of

[12]This is identical to the measure used in Kim et al. (2011) amongst others. Some studies e.g. Jin and Myers (2006) and Hutton et al. (2009) also include value-weighted industry indices in the model. I control for industry variation by including industry dummy variables in all of my estimations.

Amihud (2002). This measure is defined as the annual average of absolute daily returns scaled by the stock's daily volume (in dollars):

$$\text{Iliquidity Ratio} = \frac{1}{D_i} \sum_{t=1}^{D_i} \frac{r_{i,t}}{vold_{i,t}} \tag{4.10}$$

where D_i is the number of valid observation days for stock i in that fiscal year and $\text{vold}_{i,t}$ is the dollar volume of stock i on day t. This measure gives the absolute price change per dollar (in percent) of daily trading volume and proxies for the price impact of order flow. The magnitude of price impact can be seen as the amount of informed trade on a stock (Kyle, 1985). I also find that my results hold using this measure.

4.5.2 Endogeneity

In this chapter, I posit that directors are more effective as monitors when the firm has the highest visibility and, as a result, more firm specific information is being released to investors. This is consistent with the argument that corporate information environment can be altered to suit the informational demand of independent directors (Armstrong et al., 2014) and that the presence of independent directors can influence the firm information environment (e.g. Gul and Leung, 2004; Ajinkya et al., 2005). However, it is recognized in the literature that the corporate information environment may influence attributes of a firm's board structure (e.g. Coles et al., 2008; Linck et al., 2008; Lehn et al., 2009). Specific to this case, the first explanation is that both sets of variables are jointly determined. This is in line with the adverse selection model and empirical results of Ferreira et al. (2011) that price informativeness and board monitoring are substitutes. Information embedded in stock prices enables more efficient monitoring from external players such as the corporate

Table 4.7: Alternative Proxy for Stock Price Informativeness

This table presents coefficient estimates and cluster-robust standard errors from firm-level fixed effects regression analysis of stock price informativeness on director reputation incentives. Other boards and firms characteristics are included in all models. Fiscal year fixed effects are included in all specifications. Definitions of variables are provided in Table 4.1. * , ** and *** indicate significance at the 10%, 5% and 1% levels respectively.

Dependent Variable = Illiquidity Ratio	(1)	(2)	(3)	(4)	(5)	(6)
% Independent Director - Highest	0.013***	0.011***	0.008**	0.014***	0.011***	0.011***
	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)
% Independent Director - Lowest	−0.005**	−0.007**	−0.006**	−0.007**	−0.006**	−0.005**
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Busy Board		0.010***	0.012***	0.008**	0.011***	0.011***
		(0.003)	(0.004)	(0.003)	(0.003)	(0.003)
Sole Directorship Majority		−0.001	−0.001	−0.001	−0.001	−0.001
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Analyst Coverage			0.000		0.000***	0.000***
			(0.000)		(0.000)	(0.000)
Entrenchment Index				−0.001***	−0.001***	−0.001***
				(0.000)	(0.000)	(0.000)
Observations	8,570	8,570	6,870	7,590	6,388	6,351
Firms	1,139	1,139	912	1,009	842	844
R^2	0.151	0.151	0.140	0.196	0.212	0.216

Dependent Variable = Illiquidity Ratio	(1)	(2)	(3)	(4)	(5)	(6)
% Independent Director - High	0.016***	0.015***	0.012***	0.018***	0.015***	0.015***
	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)
% Independent Director - Low	−0.005**	−0.006**	−0.005**	−0.006**	−0.005**	−0.005**
	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)
Busy Board		0.008*	0.011**	0.005	0.009**	0.010**
		(0.004)	(0.005)	(0.004)	(0.004)	(0.005)
Sole Directorship Majority		−0.000	−0.000	−0.001	−0.000	−0.000
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Analyst Coverage			0.000		0.000***	0.000***
			(0.000)		(0.000)	(0.000)
Entrenchment Index				−0.001***	−0.001***	−0.001***
				(0.000)	(0.000)	(0.000)
Observations	8,570	8,570	6,870	7,590	6,388	6,351
Firms	1,139	1,139	912	1,009	842	844
R^2	0.153	0.153	0.141	0.198	0.214	0.218

control market. As a result, firms with higher price informativeness may not require directors with a strong monitoring experience. These directors may come from smaller firms. Another explanation is self-selection by the directors. If directors are appointed into a new directorship that is larger than their other directorships, they may be more inclined to work for a more transparent firm which she can monitor more effectively. Both these explanations can lead to the documented positive (negative) relation between the proportion of directors that view the board as of high (low) rank and stock price informativeness.

To circumvent these possibilities, I exploit the exogenous shock in directorship ranking and conduct a difference-in-difference analysis similar to Masulis and Mobbs (2014, 2015). Specifically, I identify treatment firms in which at least one independent director experiences an exogenous increase in their directorship ranking as other firms in their directorship portfolio decrease in market capitalization. I exclude firms that experience significant size change (greater than 10%) and firms where the change in their own market capitalization lead to any change in directorship ranking. I identify 392 treatment firms through these criteria. I then match each treatment firm with a control firm, which is in the same industry and is closest in size, but does not have any treatment director. Firms that change significantly in size or cause directorship ranking to change are also excluded from the control group. For each firm, I include three years prior to the shock and three years after the shock in the analysis. The estimation model is as follows:

$$\begin{aligned}\text{Price Informativeness}_{i,t} = \alpha_0 + \alpha_1(\text{Ranking Increase}_{i,t} \times \text{Post Period}_{i,t}) \\ + \alpha_2\text{Ranking Increase}_{i,t} + \alpha_3\text{Post Period}_{i,t} \\ + \mathbf{X}_{i,t}\mathbf{\Pi} + \varepsilon_{i,t} \quad (4.11)\end{aligned}$$

The variable *Ranking Increase* equals one for treatment firms and zero for control firms. The variable *post* equals one for the three years after the exogenous shock in director ranking and zero for the three years before. The coefficient of interest is the interaction between *Ranking Increase* and *Post Period* (α_1). If monitoring from directors in directorships with relatively high ranking leads to more firm-specific information in stock price, I expect a higher level of idiosyncratic volatility in treatment firms after the exogenous shock in ranking.

The difference-in-difference results in Table 4.8 shows that the coefficients for *Ranking Increase* × *Post Period* are positive and significant. In Column 1, the average idiosyncratic volatility of the treatment firms is 10% higher than after the shock in directorship ranking. In Column 2, I introduce board and firm control variables and find that the coefficient remain statistically significant ($p < 0.10$) and the magnitude remains similar to Column 1. The results in this section indicate that the exogenous change in directorship ranking leads firm-specific information to increase.

Another concern in my analysis is that the relation may be driven by market capitalization; that is, larger firms are more likely to have more independent directors that rank them as their most important directorship. In this analysis, the average market capitalization of firms in the treatment and control groups are similar to each other[13].

[13] The average market capitalization of the treatment group is 11,032 million dollars whereas the average market capitalization of the control group is 9,556 million dollars. I conduct a two-sample t test (with unequal variances) and obtain a test statistic of 1.93 ($p < 0.1$).

Table 4.8: Difference-in-Difference

This table reports parameter estimates and cluster-robust standard errors from difference-in-difference estimations. The dependent variable is *Price Informativeness*. The treatment firms (indicated by the dummy variable *Post Period*) are firms that have at least one treatment director. Treatment directors are independent directors who have multiple directorships; at least one of his other directorships is in a firm that decreased in size; and, the decrease in size of this other firm led to an increase in ranking in the current firm. Control firms are those which are in the same industry and are nearest in size (market capitalization) to the treatment firms but have no treatment director. The dummy variable *post* equals zero (one) in the three years before (after) the change in ranking. Dummy variables for industries (as defined by 2-digit SIC codes) and fiscal years are included in all specifications. * , ** and *** indicate significance at the 10%, 5% and 1% levels respectively.

Dependent Variable = Price Informativeness	(1)	(2)
Ranking Increase × Post Period	0.103**	0.101*
	(0.047)	(0.058)
Ranking Increase	−0.064	−0.061
	(0.045)	(0.057)
Post Period	−0.012	−0.071*
	(0.043)	(0.042)
Board Size		0.024**
		(0.012)
Board Independence		−0.061
		(0.074)
Busy Board		−0.532**
		(0.260)
Sole Director Majority		−0.061
		(0.044)
Return on Equity		−0.006
		(0.008)
S.D.(ROE)		0.011
		(0.011)
Leverage		0.413**
		(0.194)
Market-to-Book		0.012
		(0.010)
Firm Size		−0.201***
		(0.030)
Dividend		0.071
		(0.048)
Firm Age		−0.013
		(0.046)
Diversification		−0.107**
		(0.047)
Stock Turnover		−0.011
		(0.017)
Earnings Quality		−0.263
		(0.166)
Analyst Coverage		0.012**
		(0.005)
E-Index		−0.022
		(0.021)
Observations	5,094	3,763
Firms	383	356
R^2	0.500	0.517

4.6 Additional results

4.6.1 Voluntary disclosures

I find that the relation between reputation incentive measures and stock price informativeness holds after controlling for proxies for earnings quality. This suggests that there are other ways that motivated directors can shape a firm's information environment besides the quality of financial reports. In this section, I explore a particular channel where a firm could disclose information to the public. Following prior literature (e.g. Pastena, 1979; Carter and Soo, 1999), I examine Form 8-K filings as a channel where companies can voluntarily disclose information. The Securities and Exchange Commission requires firms to report certain corporate events on a continuous basis. Companies must file Form 8-K to disclose major events to shareholders within four days after the event. The events that trigger the filing of 8-K reports can be grouped into 9 categories (see Table 4.9). I focus on category #8 of 8-K filing ("other events") and use this as my proxy for voluntary disclosures. Unlike other categories of 8-K filing, category #8 allows the firm to disclose any information that they deem material to investors. There is no clear definition of what constitutes materiality (Debreceny and Rahman, 2005); therefore, the disclosure decisions for this category are, to an extent, left with the managers and directors. For each firm-year, I identify the number of disclosures under category #8 and construct a variable $\textit{Voluntary Disclosures}_{i,t}$ as a natural logarithm of one plus the number of category #8 events in 8-K reports of firm i in fiscal year t.

Firms may decide to file category #8 events in 8-K filings as additional disclosures to other events that trigger 8-K report; therefore, I follow Gul et al.

Table 4.9: Disclosure Items in Form 8-K

Section 1: Registrant's Business and Operations	
Item 1.01	Entry into a Material Definitive Agreement
Item 1.02	Termination of a Material Definitive Agreement
Item 1.03	Bankruptcy or Receivership
Item 1.04	Mine Safety - Reporting of Shutdowns and Patterns of Violations
Section 2: Financial Information	
Item 2.01	Completion of Acquisition or Disposition of Assets
Item 2.02	Results of Operations and Financial Condition
Item 2.03	Creation of a Direct Financial Obligation or an Obligation under an Off-Balance Sheet Arrangement of a Registrant
Item 2.04	Triggering Events That Accelerate or Increase a Direct Financial Obligation or an Obligation under an Off-Balance Sheet Arrangement
Item 2.05	Costs Associated with Exit or Disposal Activities
Item 2.06	Material Impairments
Section 3: Securities and Trading Markets	
Item 3.01	Notice of Delisting or Failure to Satisfy a Continued Listing Rule or Standard; Transfer of Listing
Item 3.02	Unregistered Sales of Equity Securities
Item 3.03	Material Modification to Rights of Security Holders
Section 4: Matters Related to Accountants and Financial Statements	
Item 4.01	Changes in Registrant's Certifying Accountant
Item 4.02	Non-Reliance on Previously Issued Financial Statements or a Related Audit Report or Completed Interim Review
Section 5: Corporate Governance and Management	
Item 5.01	Changes in Control of Registrant
Item 5.02	Departure of Directors or Certain Officers; Election of Directors; Appointment of Certain Officers; Compensatory Arrangements of Certain Officers
Item 5.03	Amendments to Articles of Incorporation or Bylaws; Change in Fiscal Year
Item 5.04	Temporary Suspension of Trading Under Registrant's Employee Benefit Plans
Item 5.05	Amendment to Registrant's Code of Ethics, or Waiver of a Provision of the Code of Ethics
Item 5.06	Change in Shell Company Status
Item 5.07	Submission of Matters to a Vote of Security Holders
Item 5.08	Shareholder Director Nominations
Section 6: Asset-Backed Securities	
Item 6.01	ABS Informational and Computational Material
Item 6.02	Change of Servicer or Trustee
Item 6.03	Change in Credit Enhancement or Other External Support
Item 6.04	Failure to Make a Required Distribution
Item 6.05	Securities Act Updating Disclosure
Section 7: Regulation FD	
Item 7.01	Regulation FD Disclosure
Section 8: Other Events	
Item 8.01	Other Events (The registrant can use this Item to report events that are not specifically called for by Form 8-K, that the registrant considers to be of importance to security holders.)
Section 9: Financial Statements and Exhibits	
Item 9.01	Financial Statements and Exhibits

(2011) and include filings in other categories as an additional control variable. The variable *Other Disclosures*$_{i,t}$ is defined as a natural logarithm of one plus the number of events in other categories in firm *i*'s 8-K reports in fiscal year *t*.

I conduct a difference-in-differnce estimation to evaluate the effect of the exogenous shock in director ranking on voluntary disclosures. The model is similar to Equation 4.11 but with *Voluntary Disclosures*$_{i,t}$ as the dependent variable.

$$\begin{aligned}\text{Voluntary Disclosures}_{i,t} = \alpha_0 + \alpha_1(\text{Ranking Increase}_{i,t} \times \text{Post Period}_{i,t}) \\ +\alpha_2\text{Ranking Increase}_{i,t} + \alpha_3\text{Post Period}_{i,t} \\ +\text{Other Disclosures}_{i,t} + \mathbf{X}_{i,t}\mathbf{\Pi} + \varepsilon_{i,t}\end{aligned} \tag{4.12}$$

I also estimate an extended difference-in-difference analysis which incorporates analyst disagreements into the model. The most important motivation for voluntary disclosures is to reduce uncertainty about the firm's future prospects. Specifically, voluntary disclosures can reduce the "information risk" of the firm and "tightens the distribution of perceived cash flows" (Graham et al., 2005). I anticipate the relation between the exogenous change in reputation incentives and voluntary disclosures to be more pronounced when the market-wide beliefs of the firm's prospect are dispersed and incorporate the dispersion of analyst forecasts in to the extended model:

$$
\begin{aligned}
&\text{Voluntary Disclosures}_{i,t} \\
&= \alpha_0 + \alpha_1(\text{Ranking Increase}_{i,t} \times \text{Post Period}_{i,t} \times \text{Disagreement}_{i,t}) \\
&+\alpha_2(\text{Ranking Increase}_{i,t} \times \text{Disagreement}_{i,t}) \\
&+\alpha_3(\text{Post Period}_{i,t} \times \text{Disagreement}_{i,t}) \\
&+\alpha_4(\text{Ranking Increase}_{i,t} \times \text{Post Period}_{i,t}) \\
&+\alpha_5\text{Ranking Increase}_{i,t} + \alpha_6\text{Post Period}_{i,t} + \alpha_7\text{Disagreement}_{i,t} \\
&+\text{Other Disclosures}_{i,t} + \mathbf{X}_{i,t}\mathbf{\Pi} + \varepsilon_{i,t}
\end{aligned}
\tag{4.13}
$$

The dummy variable *Disagreement* equals one when EPS forecast dispersion is above the industry median and zero otherwise. I use two measures of EPS forecast dispersion. One is forecasted EPS standard deviation adjusted by the mean and the other is the range of forecasted EPS (maximum less minimum) adjusted by the median.

The results are displayed in Table 4.10. In Columns 1-2, I do not find an increase in category #8 filings in 8-K reports after the exogenous increase in directorship ranking (the coefficients for *Ranking Increase* × *Post Period* are not statistically significant).

However, I find that when there is high disagreement amongst analysts in regards to earnings (as proxied by EPS forecasts), treated firms increase their voluntary disclosures by about 20% after the shock. The results are consistent regardless of the measures of analyst disagreement employed and the coefficients for *Ranking Increase* × *Post Period* × *Disagreement* remain statistically significant after controlling for other disclosure items in 8-K reports as well as other board and firm characteristics. The coefficients for *Disagreement* are significant and positive, supporting the findings of Graham et al. (2005) that firms use voluntary disclosures in response to information risk. Overall, the results indicate that the exogenous increase in directorship ranking is associated with a higher level of voluntary disclosures in 8-K filings when analyst forecasts are dispersed. This suggests that voluntary disclosure is one channel where directors can release firm specific information to public.

4.6.2 Crash risk

The results so far in this chapter suggest that the presence of independent directors who rank the directorship highly is associated with greater transparency in the firm information environment. In this section, I test the association between independent director reputation incentives and a negative outcome from the lack of transparency, stock price crash risk. There is a wide range of incentives that can motivate managers to conceal bad news from the stock market such as compensation and career concerns (Ball, 2009; Kothari et al., 2009). When the amount of bad news reaches a tipping point after an extended period of accumulation and the news are released to the market, the stock market would respond in a form of a large negative firm-specific shock (Jin and Myers, 2006). Recent research suggests that information asymmetry increases future crash risk by allowing managers to hide and accumulate bad news (Jin and Myers, 2006; Hutton et al., 2009; Kim et al., 2011). Consistent with these arguments, I anticipate a negative association between independent director reputation incentives and crash risk measures.

To construct my crash risk measures, I collect firm-specific daily returns ($R_{i,d}$), which is defined as the natural log of one plus the residual return from the expanded market model regression; that is, $R_{i,d} = \ln(1 + \hat{\varepsilon}_{i,d})$ where $\hat{\varepsilon}_{i,t}$ is

Table 4.10: Voluntary Disclosures

This table reports parameter estimates and cluster-robust standard errors from difference-in-difference estimations. The dependent variables is logarithm of one plus the number of voluntary disclosures (Item 8) in the firm's 8-K reports within each fiscal year. Treatment firms (indicated by the dummy variable *Ranking Increase*) are firms that have at least one treatment director. Treatment directors are independent directors who have multiple directorships; at least one of his other directorships is in a firm that decreased in size; and, the decrease in size of this other firm led to an increase in ranking in the current firm. Control firms are those which are in the same industry and are nearest in size (market capitalization) to the treatment firms but have no treatment director. The dummy variable *Post Period* equals zero (one) in the three years before (after) the change in ranking. Disagreement amongst analysts is measured by the standard deviation of forecasted EPS (Columns 3-4) and the difference between maximum and minimum forecasted EPS (Columns 5-6). The variable "Other Disclosures" is logarithm of one plus the number of other disclosure items in 8-K reports. Other control variables in Columns 2, 4 and 6 are the same as those in Column 2 of Table 4.8. Dummy variables for industries (as defined by 2-digit SIC codes) and fiscal years are included in all specifications. * , ** and *** indicate significance at the 10%, 5% and 1% levels respectively.

Dependent Variable = Voluntary Disclosures			Forecasted EPS disagreement			
			Standard Deviation		Range	
	(1)	(2)	(3)	(4)	(5)	(6)
Ranking Increase × Post Period × Disagreement			0.233**	0.209**	0.195**	0.176*
			(0.092)	(0.091)	(0.091)	(0.090)
Ranking Increase × Post Period	−0.023	−0.016	−0.111*	−0.097*	−0.102*	−0.087
	(0.044)	(0.043)	(0.059)	(0.058)	(0.061)	(0.060)
Ranking Increase × Disagreement			−0.126*	−0.118*	−0.133**	−0.147**
			(0.067)	(0.066)	(0.066)	(0.066)
Post Period × Disagreement			−0.071	−0.068	−0.059	−0.063
			(0.065)	(0.064)	(0.064)	(0.063)
Ranking Increase	0.036	−0.012	0.081*	0.039	0.090**	0.057
	(0.032)	(0.032)	(0.042)	(0.042)	(0.044)	(0.044)
Post Period	0.001	−0.014	0.019	0.000	0.017	0.002
	(0.033)	(0.032)	(0.041)	(0.040)	(0.043)	(0.042)
Disagreement			0.116**	0.141***	0.111**	0.131***
			(0.047)	(0.047)	(0.046)	(0.046)
Other Disclosures	0.512***	0.464***	0.517***	0.474***	0.517***	0.474***
	(0.025)	(0.025)	(0.026)	(0.026)	(0.026)	(0.026)
Other Controls	No	Yes	No	Yes	No	Yes
Observations	4,018	4,018	4,018	4,018	4,018	4,018
Firms	374	374	374	374	374	374
R^2	0.177	0.214	0.191	0.225	0.190	0.223

estimated using Equation 4.9.

I then use the firm-specific daily returns to compute the following measures of stock price crash. I define a crash incidence as an event where the firm experiences firm-specific daily returns 3.2 standard deviations below the mean over each fiscal year. I choose 3.2 because it corresponds to a 0.1% probability of occurrence under the normal distribution. Four measures of firm-specific stock price crash are employed[14]. The first measure, *COUNT*, is the difference between the number of crash incidences (downside extreme returns) and the number of jumps (upside extreme returns) for each firm in each fiscal year. The jump incidents are when the firm experiences firm-specific daily returns 3.2 standard deviations above the mean over each fiscal year. A high value of *COUNT* indicates that stock price crashes occur more frequently than sharp increases in returns.

The second measure, *CRASH*, is a dummy variable which equals one for firms that experiences one or more crash events during the fiscal year period.

The third measure is the negative coefficient of skewness, *NCSKEW*, which measures the magnitude of stock price losses comparative to the gain[15]. This is computed as the negative value of the third moment of firm-specific daily returns for each firm year divided by the standard deviation of firm-specific daily returns raised to the third power. Specifically, *NCSKEW* is calculated as:

$$NCSKEW_{i,t} = -\frac{n(n-1)^{\frac{3}{2}} \sum_{d\in t} R_{i,d}^{3}}{(n-1)(n-2)(\sum_{d\in t} R_{i,d}^{2})^{\frac{3}{2}}} \tag{4.14}$$

[14]These measures are widely-used in the crash-risk literature e.g. Chen et al. (2001); Hutton et al. (2009); Kim et al. (2011); Callen and Fang (2013).

[15]If a stock tends to experience large losses compared to the increase in price, its return distribution would be negatively skewed. I use the negative value of the coefficient of skewness so that higher positive values represents a higher crash risk.

The last measure, *DUVOL*, is the natural log ratio of volatility in the "down" sample to volatility in the "up" sample. For each stock i over a fiscal year period, I separate the days with firm-specific daily returns above (below) the mean of the period and put them in an "up" ("down") sample. I then calculate the sample standard deviations and compute the natural log of the ratio of the variance in the "down" sample to the variance of the "up" sample. More specifically, I calculate the measure as follows.

$$DUVOL_{i,t} = \ln\left\{\frac{(n_u - 1)\sum\limits_{down} R_{i,d}^2}{(n_d - 1)\sum\limits_{up} R_{i,d}^2}\right\} \tag{4.15}$$

where n_u and n_d are the number of up and down days over the fiscal year t respectively. A higher value of *DUVOL* means that stock returns for that particular firm-year are more volatile on the down side compared to the up side and thus the firm is more prone to crash in that particular financial year.

In Table 4.11, I employ the difference-in-difference estimator to analyze the relation between stock price crash risk and reputation incentives. The coefficient *Ranking Increase* × *Post Period* measures the difference in the change in crash risk measures for the treatment group, which experience an exogenous shock in directorship ranking, after the shock period compared to the change in crash risk measures of the control group. The sample period comprises three years before and after the shock in directorship ranking. I find evidence that crash risk decreases in the post shock period for treatment firms. The coefficients for *Ranking Increase* × *Post Period* are negative and significant for all crash risk measures except for *CRASH* where the coefficient is still negative.

In Columns 5-8, I include in the analysis control variables for the presence of busy directors and sole directors. Additionally, I include other variables

Table 4.11: Crash Risk

This table reports parameter estimates and cluster-robust standard errors from difference-in-difference estimations. The dependent variables are *COUNT* (the number of stock price crashes minus the number of jumps), *CRASH* (a dummy variable which equals one when the firm experiences one or more crash and zero otherwise), *NCSKEW* (negative coefficient of skewness) and *DUVOL* (the log ratio of volatility in the down sample to volatility in the up sample). The treatment firms (indicated by the dummy variable *Ranking Increase*) are firms that have at least one treatment director. Treatment directors are independent directors who have multiple directorships; at least one of his other directorships is in a firm that decreased in size; and, the decrease in size of this other firm led to an increase in ranking in the current firm. Control firms are those which are in the same industry and are nearest in size (market capitalization) to the treatment firms but have no treatment director. The dummy variable *Post Period* equals zero (one) in the three years before (after) the change in ranking. Dummy variables for industries (as defined by 2-digit SIC codes) and fiscal years are included in all specifications. * , ** and *** indicate significance at the 10%, 5% and 1% levels respectively.

	COUNT (1)	CRASH (2)	NCSKEW (3)	DUVOL (4)
Ranking Increase × Post Period	−0.240***	−0.020	−0.217***	−0.058***
	(0.071)	(0.013)	(0.072)	(0.016)
Ranking Increase	0.157***	0.019*	0.180***	0.047***
	(0.050)	(0.010)	(0.048)	(0.011)
Post Period	0.043	0.004	−0.012	−0.005
	(0.052)	(0.010)	(0.058)	(0.013)
Other Controls	No	No	No	No
Observations	5,094	5,094	5,094	5,094
Firms	592	592	592	592
R^2	0.036	0.039	0.030	0.060
	COUNT (5)	CRASH (6)	NCSKEW (7)	DUVOL (8)
Ranking Increase × Post Period	−0.260***	−0.018	−0.278***	−0.072***
	(0.075)	(0.013)	(0.078)	(0.018)
Ranking Increase	0.181***	0.011	0.227***	0.062***
	(0.056)	(0.010)	(0.059)	(0.013)
Post Period	0.011	0.008	−0.002	−0.003
	(0.053)	(0.009)	(0.060)	(0.013)
Other Controls	Yes	Yes	Yes	Yes
Observations	4,454	4,454	4,454	4,454
Firms	517	517	517	517
R^2	0.055	0.284	0.065	0.085

that are found to affect stock price crash risk. I include annual stock return and standard deviation of daily returns as Chen et al. (2001) postulate that firms with high and volatile past returns are more likely to crash. To control for persistence in stock return skewness, I introduce the lag value of the negative coefficient of skewness into all my models. I also control for earnings quality (based on the model of Jones (1991)) and standard firm characteristics i.e. firm size, market-to-book ratio, leverage and return on equity. The results are similar in these specifications.

The overall evidence is consistent with my hypothesis that the presence of directors with high reputation incentives is negatively associated with stock price crash risk. Although I do not find any statistical evidence that the presence of high reputation incentive directors reduce the probability of crash, those firms on average experience fewer crash incidents in each financial year. Returns of the firms in which directors have high reputation incentives are less negatively skewed and their negative returns are less volatile.

4.7 Conclusion

In this chapter, I find that the proportion of directors on board who perceive their directorship to be the most important is positively associated with the level of firm-specific information content in stock price. The evidence is consistent with the hypothesis that directors want to preserve their reputation in the director labour market; thus, they serve as a monitoring mechanism that prevents the managers from withholding firm-specific information from the shareholders. The results are robust to the inclusion of factors that can explain the firm-specific component of stock returns including various measures of financial report quality, anti-takeover provisions and the presence of financial analyst coverage.

I also find that the link between reputation incentives and firm-specific return volatility is stronger when monitoring from the market for corporate control and financial analysts are weak, suggesting that director reputation incentives may act as a substitute for these other monitoring mechanisms. My findings are robust to alternative proxies for firm-specific information content and a treatment for endogeneity. I find that voluntary disclosures through 8-K report is a channel where directors may choose to disclose information to the public when there is a high uncertainty regarding a firm's future prospects. Finally, I document some evidence that director reputation incentives are linked to lower incidents of firm-specific stock price crash.

This study extends the literature by establishing a link between the incentives of directors to preserve their reputation and capital market outcomes. It also adds to the vast literature on director characteristics by showing that not all independent directors can be considered identical as they do not have equal incentives to perform their monitoring function.

CHAPTER 5

Conclusion

This thesis investigates whether the characteristics of directors have any impact on the firm. It comprises three empirical studies. The first study (Chapter 2) looks at the effect of gender diversity on firm risk. I find no evidence that gender diversity in the boardroom has any causal impact on equity risk, after controlling for the possibility of a reverse causal relation and other unobserved heterogeneity in the data. The results in this study suggest that the negative relation between gender diversity and risk (usually documented in the data) is a cross-sectional phenomenon; that is, the more gender-diverse firms have lower equity risk because of other factors that cannot be readily observed in the data, and not because of the causal relationship between the two. While the first study fails to establish any causal evidence of gender diversity on risk, the second study (Chapter 3) expands the view of boardroom gender diversity to include those female directors that are outside the board, but are connected to the board through male directors, and finds that gender diversity is related to risk. Firm equity risk significantly decreases with the proportion of male directors that are connected to women in other firms, but only in firms with female directors. This suggests that not only does gender diversity inside the boardroom matter in terms of risk, but overall gender diversity in other firms also matters. Finally, in the third study (Chapter 4), I investigate the heterogeneity in reputation incentives of independent directors. I find that the proportion of independent directors that see the firm as important (i.e. larger firms which is more visible and thus more beneficial to their reputation) is positively related to firm stock price informativeness (i.e. the firm-specific information content derived from stock price volatility). All these studies indicate that, beyond being inside and outside directors, other characteristics of directors also matter and they can lead to differences in how firms behave.

Contributions

This thesis contributes to the existing literature by adding to the vast literature that empirically documents the relation between characteristics of directors and firm-level outcomes. Examples of such characteristics include directors' gender (Adams and Ferreira, 2009; Levi et al., 2013), nationality (Masulis et al., 2012), education (Nguyen et al., 2014), whether or not the director is appointed by the current CEO (Coles et al., 2014), social ties to the CEO (Westphal, 1999), board connections to other firms (Coles et al., 2013b), professional experience (Fich, 2005) and other board employments (Ferris et al., 2003; Masulis and Mobbs, 2014). The findings in this thesis add to this mounting evidence of the impact of director characteristics beyond the salient classification of directors into insiders and outsiders that is often assumed by theoretical models (Hermalin and Weisbach, 1998; Raheja, 2005; Adams and Ferreira, 2007; Harris and Raviv, 2008).

Chapters 2 and 3 examine the relation between boardroom gender diversity and firm risk. Specifically, I show that boardroom gender diversity matters in terms of firm risk, although not in an obvious way. When considering only gender diversity within individual firms, there is no significant relation between gender diversity and risk; however, when looking at the overall gender diversity including the potential influence of other female directors from other boards, I find that gender diversity is negatively related to equity risk. Both chapters therefore contribute to studies that examine the link between gender diversity and risk in banks (Berger et al., 2014; Adams and Ragunathan, 2013) by establishing the gender-risk link for a sample of firms in non-banking industries. Additionally, they also contribute to studies that document the relations between firm risk and other corporate governance characteristics such as CEO gender, financial expertise, ownership, compensation and the presence of institutional investors (e.g. Faccio et al., 2014; Wahal and McConnell, 2000; Minton et al., 2014; Coles et al., 2006; Kim and Lu, 2011).

These two chapters also contribute more generally to the literature on the hitherto inconclusive debate over director gender and firm value (e.g. Adams and Ferreira, 2009; Ahern and Dittmar, 2012; Matsa and Miller, 2013). While female board representation is linked to a range of arguably desirable firm outcomes such as board attendance, lower M&A bid premiums and less risky business decisions (e.g. Levi et al., 2013; Adams and Ragunathan, 2013), evidence linking gender diversity to firm performance is less conclusive (e.g. Adams and Ferreira, 2009; Liu et al., 2014). Many studies that examine the gender-performance link use operating performance measures which are not risk-adjusted (e.g. ROA, ROE or other accounting variables). I show that risk is potentially a channel through which gender diversity can affect firm value.

Chapter 3 add further contributions to the literature on boardroom gender diversity by suggesting an alternative way of examining boardroom gender diversity. To the best of my knowledge, this chapter provides the first evidence of the spillover effect of female director behavior to male directors across different boards and shows how both gender diversity inside and outside the firm affects decisions in the firm. In particular, the evidence presented in this thesis suggests that gender diversity can have a firm-level influence without the proportion of women on board reaching a critical mass. Additionally, it contributes to the literature on the social networks of executives (e.g. Fracassi and Tate, 2012; Fracassi, 2012; Shue, 2013). This chapter shows that behaviors of male directors can be influenced by their professional ties to female directors.

Chapter 4 shows that reputation incentives of independent directors have an impact on the capital market. In particular, I find evidence that reputation incentives of independent directors affect the informative of the firm stock price and firm-specific crash risk. Both outcomes are relevant to investors as stock price informativeness is found to be a priced risk factor by Ang et al. (2006) and Fu (2009). Jiang et al. (2009) also find that idiosyncratic volatility is negatively related to future earning shocks. These findings can also be relevant to the firms as information in stock prices is found to be useful to managers in terms of capital structure, cash holding and investment decisions (Chen et al., 2007; Durnev et al., 2004; Foucault and Gehrig, 2008; Fresard, 2012). Additionally, this study adds to the literature that documents the relation between firm transparency and governance characteristics (Ferreira and Laux, 2007; Ferreira et al., 2011; Gul et al., 2011; Panousi and Papanikolaou, 2012; Armstrong et al., 2014).

Limitations of the thesis

Based on the analyses conducted in the three preceding empitrical chapters, a number of shortcomings of this thesis can be identified.

This thesis is limited in its scope and focuses only on the monitoring function of the board. However, it is well recognized in both academia and practice that advising is also another major function of the board (e.g. Linck et al., 2008; Coles et al., 2013a). In particular, Adams and Ferreira (2007) stress the importance of the balance between monitoring and advising fuctions of the board. Faleye et al. (2011) find that too much oversight can adversely affect innovation. Therefore, it is interesting to see whether the increase in mornitoring is at the expense of reduced advising capability of the board.

In Chapter 2, the key results rely on all the assumptions of the dynamic panel system GMM estimator being fulfilled. One particular assumption that may be violated is that all time-variant factors that are related to both gender diversity and risk are included in the estimation model. This is because the first differencing conducted in the system GMM estimator only removes the influence of unobserved time-invariant factors from the residuals. If there remains any time-variant factors that are strongly related to both risk and boardroom gender diversity, the estimated relation between the proportion of women and risk will be asymptotically biased. Although the estimation model in this chapter carefully includes many risk determinants as indicated by the literature, it is likely that there are many other factors that are time-variant and cannot be observed. As such this limitation should be taken into consideration when interpreting the results in this chapter.

Due to data limitation, the analyses in Chapter 3 only consider contemporaneous influence of female directors. This does not negate the possibility that male directors are also influended by female directors they have worked with in the past. Also, due to the small number of female CEOs in the sample, this study does not consider the influence of female CEOs on male directors, which can potentially be stronger than the influence amongst directors.

More generally, whether and how the results in these two chapters can inform the discussion on gender diversity policy need to be discussed. This thesis uncovers some evidence that gender diversity in the boardroom is positively related to board monitoring and is negatively related to risk. Assuming that greater board monitoring is always desirable, the evidence in this thesis would appear to support the enacment of gender diversity quota. However, as argued by Ferreira (2014), using evidence that gender diversity increases firm value as a case for women in the boardroom means that any evidence suggesting a negative impact of gender diversity will also become a case against women in the boardroom. Equality in the workplace, including in the top management, is desirable in and of itself. The results in these two studies only show a new potential way how gender diversity can affect firm value.

Chapter 4 looks at reputation incentives, which is an intangible concept and thus cannot be easily captured. This study follows Masulis and Mobbs (2014, 2015) and construct the measure of reputation incentives based on firm size (market capitalization). As size is a "portmanteau" variable, the results may capture other things besides reputation incentives. The robustness checks in this chapter may alleviate some concerns that the results are purely driven by the "size effect". In particular, the treatment and control firms in the difference-in-difference estimation are matched by size; therefore, the average market capitalization of these two groups are very similar. However, they are still statistically different (at 10%) and thus the size effect cannot be completely ruled out. It could be fruitful to test whether he results hold under alternative proxies of reputation incentives, when they become available.

Directions for future research

There are various avenues for future research based on the findings in this thesis.

Firstly, future studies may look at boardroom diversity in a broader sense. For example, one may look at racial diversity of board members. Some work has already been done around this issue; for example, Carter et al. (2010) investigate the relation between boardroom racial diversity and profitability. Still, it is possible that racial diversity in the boardroom may affect other firm outcomes. Additionally, diversity in the boardroom needs not be confined to characteristics that are visible. For instance, one may look at diversity in terms of skill sets or cultural heritage. Some studies start moving into this direction (see e.g. Adams et al., 2015; Nguyen et al., 2015).

Another potentially interesting aspect is to investigate the interaction effect between diversity of the management team (the C-suite) and diversity of the board. For example, it is possible that female CEOs can better add value to the firm when working with a gender-diverse board, or vice versa.

Finally, more research is needed to analyze whether the impact of director characteristics on firm outcomes varies from one culture to another. Culture in this case could be at both the firm level (organizational culture) and the societal level (national culture). Guiso et al. (forthcoming) see corporates as micro socities and look at the effect of culture at the firm level can help explaining the link between culture and formal institutions. At the national level, it is conceivable that the role of women or inter-race relation in the society can influence the impact of boardroom diversity on the firm. Not only can adding culture as a dimension to board studies enhance understanding of how board works, but it can also advance the knowledge around culture in economics and finance.

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