Board Gender Diversity and Internal Control Weaknesses☆

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A R T I C L E   I N F O

A B S T R A C T

We investigate the role of gender diversity on corporate boards in mitigating internal control weaknesses (ICWs). We predict and find that firms with greater female board representation are less likely to have ICWs. The results are not driven by females sitting on the audit committee. Instead, it appears that females on corporate boards reduce ICWs, regardless of whether they sit on the audit committee or not. Our results are inconsistent with the critical mass theory, showing that even one female board member could reduce the likelihood of ICWs. Taken together, the evidence is consistent with female board members' typical characteristic tendency shown in prior literature (e.g., being more likely to discuss difficult issues, more fiscally conservative, better monitors, and less tolerant of opportunistic behaviors). Our results have implications for board member selection from a policy perspective as well as board member monitoring from an investor and regulator perspective.

1. Introduction

Section 404 of the Sarbanes–Oxley Act of 2002 (SOX, U.S. Congress, 2002) requires that the client's auditor issue an opinion on the effectiveness of the client's internal controls over financial reporting (ICFR). Internal controls over financial reporting are the firm's policies and procedures designed to ensure that the firm is producing reliable financial statements. The purpose of the ICFR report is to alert financial statement users to the possibility that the firm's reporting system is providing inaccurate financial statements (PCAOB, 2007). If an auditor deems the client's controls to be inadequate, an adverse opinion, often called a material weakness opinion is issued.[2] Audit researchers have identified a host of factors which affect the likelihood that the auditor issues a material weakness opinion. The literature generally concludes that smaller and younger firms, more financially distressed firms, and more complex firms are more likely to receive material weakness opinions (Ashbaugh-Skaife, Collins, & Kinney, 2007; Doyle, Ge, & McVay, 2007a; Ogneva, Subramanyam, & Raghunandan, 2007). In addition, certain aspects of a firm's corporate governance, including institutional ownership, auditor choice, and audit committee independence, are associated with the likelihood of receiving material weakness opinions (Ashbaugh-Skaife et al., 2007; Krishnan, 2005; Zhang, Zhou, & Zhou, 2007).

Absent from this literature is a consideration of the diversity of the firm's board of directors. This is somewhat surprising because the board of directors can be thought of as the apex of an organization's monitoring and control system (Fama & Jensen, 1983). It is therefore possible that certain observable characteristics of board members are associated with internal control quality. In this study, we focus on one observable board member characteristic—the gender of the board members, because the gender diversity literature has found considerable differences in behavioral characteristics between males and females. For example, recent research in economics finds that males prefer competition much more than their female counterparts, even after controlling for ability (Niederle & Vesterlund, 2007) and that males are overconfident in their investment decisions (Barber & Odean, 2001). Females have also been shown to be more risk averse (Beckmann & Menkhoff, 2008; Bellucci, Borisov, & Zazzaro, 2010). In the context of corporate boards of directors, Adams and Ferreira (2009) present evidence consistent with female board members being better monitors. Specifically related to the current study, the authors

find that female board members are more likely to serve on monitoring committees and CEO turnover is more sensitive to stock performance at firms with more female board members. Finally, there is considerable evidence that gender-diverse boards are more likely to discuss tough and sensitive issues than all-male boards (Clarke, 2005; Huse & Solberg, 2006; McInerney-Lacombe, Bilimoria, & Salipante, 2008; Stephenson, 2004). To the extent that females are more likely to discuss difficult issues, are more fiscally conservative, are better monitors, and are less tolerant of opportunistic behavior, it can be expected that firms with females on the board of directors will have fewer ICFR material weaknesses.

Our study is also motivated by the increasing trend of female members on board. Women held 9.6% of all Fortune 500 board seats in 1995, 13.6% in 2003, 14.7% in 2005, 15.7% in 2010, and 16.1% in 2011 (Catalyst, 2011; Konrad, Kramer, & Erkut, 2008). However, a concern is that firms might be adding females to the board just to assuage criticism: Female directors are just tokens. Alternatively, according to the critical mass theory, female directors are unable to effect any change unless the quantity reaches a threshold (e.g., three female directors). Our study attempts to explore the effect of female directors on ICFR material weaknesses and provides evidence of the validity of the critical mass theory in the setting of ICFR quality.

Using a sample of 4267 firm-year observations spanning the period of 2004 to 2013, we document a robust negative association between female board presence and the likelihood of receiving a material weakness opinion. We measure female board presence using two measures: (i) the percentage of board members who are female and (ii) an indicator variable equal to 1 if the board of directors has at least one female member, and 0 otherwise. The results are similar using either measure.

In additional analysis, we explore whether the results we document depend on whether females sit on the audit committee. Adams and Ferreira (2009) find that females are more likely to join monitoring committees, such as the audit committee. It could be argued that females could only impact ICFR material weaknesses via sitting on the audit committee. On the other hand, non-audit committee female board members may impact the reporting of ICFR material weaknesses by taking the audit committee findings more seriously (e.g., when they attend the full board meeting discussing the reporting by the audit committee). We find that females on corporate boards reduce the likelihood of internal control problems, regardless of whether they are also members of the audit committee.

This study contributes to the literature on internal controls in the following ways. While prior research has found that certain forms of corporate governance such as institutional ownership or the presence of a Big 4 auditor are negatively related to internal control weaknesses, this literature has not investigated how the gender diversity of the board of directors influences internal controls. This study fills this void in the literature by demonstrating that the gender diversity of the board of directors can influence the quality of internal controls at the firm. In addition, the evidence in this study is relevant for policymakers in the U.S. and elsewhere who are deciding whether or not to adopt legislation, which requires greater diversity on corporate boards. In fact, several European countries have recently adopted legislation which requires a certain percentage of board seats to be allocated to women. The proponents of board reform argue that gender diversity improves board performance (Higgs, 2003; Tyson, 2003). Understanding whether more diverse boards lead to fewer internal control problems would provide regulators in the U.S. and elsewhere with additional information to determine whether such legislation is desirable. Second, we shed light on the issue of tokenism and the critical mass theory. Our findings indicate that that female directors are not merely tokens. Rather, they bring real benefits to the firm in terms of better ICFR. Our results are also inconsistent with the critical mass theory in that we find that having even one female board member improves the ICFR quality. This is especially important because several prior papers support the critical mass theory in settings of firm performance and firm innovation (Joecks, Pull, & Vetter, 2013; Torchia, Calabrò, & Huse, 2011). The ICFR setting is

different because CEOs and CFOs must certify their assessment of ICFR and auditors need to attest to the quality of ICFR for accelerated filers. Hence, board members have more responsibility and emphasis on ICFR.

The remainder of this paper is organized as follows. Section 2 contains background information and the hypothesis, Section 3 outlines the research design, and Section 4 contains the sample selection and descriptive statistics. Section 5 contains the empirical results, and Section 6 concludes.

2. Background and hypothesis development

2.1. Internal control over financial reporting

As far back as 1941, the Securities and Exchange Commission (SEC) has required auditors to consider a firm's internal controls when conducting an audit (SEC, 1941). However, Section 404 of the Sarbanes–Oxley Act of 2002 (SOX) mandated that auditors attest to the effectiveness of internal control over financial reporting (ICFR) for their accelerated filing clients. The purpose of the ICFR report is to alert stakeholders to the possibility that the firm's accounting system is providing inaccurate financial information (PCAOB, 2007). ICFR is important because firms use financial reporting as a disclosure tool to communicate information to stakeholders such as investors and creditors to assist in their assessment of investment risk and resource allocation decisions, as well as evaluate the performance of top management (Beyer, Cohen, Lys, & Walther, 2010).

Accounting researchers have investigated the consequences of weak internal controls. Existing evidence suggests that internal control weaknesses lead to poor financial reporting quality (Ashbaugh-Skaife, Collins, Kinney, & LaFond, 2008; Doyle, Ge, & McVay, 2007b), less efficient investments (Cheng, Dhaliwal, & Zhang, 2013), and more severe insider trading (Skaife, Veenman, & Wangerin, 2013). Given these outcomes, it is important to understand the factors which lead to weak internal controls. The literature examining the determinants of internal control weaknesses identifies a host of client attributes associated with internal control weaknesses, including firm size, firm complexity, and the financial health of the firm (Ashbaugh-Skaife et al., 2007; Doyle et al., 2007a). This literature also finds that firms with higher quality auditors and firms with higher institutional ownership are more likely to report internal control weaknesses (Ashbaugh-Skaife et al., 2007). Finally, researchers have found that independent audit committees, audit committees with financial expertise, and larger audit committees are less likely to report internal control weaknesses (Hoitash, Hoitash, & Bedard, 2009; Krishnan, 2005; Zhang et al., 2007). However, the existing literature does not consider how the diversity of the board of directors may influence the likelihood of internal control weaknesses.

2.2. Female board members

The literature on gender diversity has found significant differences in behavioral characteristics of men and women. For example, in an experiment, Niederle and Vesterlund (2007) find that men prefer to engage in a competition much more than women, even after controlling for the ability of the participants. Similarly, there is considerable evidence that women are more risk averse in financial decision making than men (Beckmann & Menkhoff, 2008; Bellucci et al., 2010; Hinz, McCarthy, & Turner, 1997; Powell & Ansic, 1997; Riley & Chow, 1992; Sundén & Surette, 1998). Barber and Odean (2001) find that men trade 45% more than women and earn lower returns as a result, suggesting that men are overconfident. In addition, Huang & Kisgen (2013) find that female executives issue debt less frequently than male executives and that they place wider bounds on their earnings forecasts. Taken together, the literature has produced a wealth of evidence which suggests that females are more risk averse and less overconfident.

There is also considerable evidence which suggests that females make better monitors. For example, research has shown that women have a lower tolerance for opportunistic behavior (Ambrose & Schminke, 1999; Bernardi & Arnold, 1997; Krishnan & Parsons, 2008; Robinson, Lewicki, & Donahue, 2000; Schminke & Ambrose, 1997; Thorne, Massey, & Magnan, 2003). In the context of corporate boards of directors, Adams and Ferreira (2009) find evidence consistent with women being better monitors of top management. Specifically, the authors find that female board members have better attendance records than male directors and that female board members are more likely to join monitoring committees such as the audit committee or the compensation committee. Finally, Adams and Ferreira (2009) find that CEO turnover is more sensitive to stock performance when the board of directors contains more women. Collectively, the evidence in these papers indicates that women are more effective monitors. These differences between men and women suggest that the increasing trend of female directors on corporate boards (Catalyst, 2004; Rose, 2007) may have a significant influence on firms' decision-making processes.

Prior studies within the management literature find that gender-diverse boards lead to more informed discussions (Daily, Certo, & Dalton, 2000). Ray (2005) observes that in a more diverse corporate board, directors are more likely to both (i) critically examine the viewpoints of others because they bring different perspectives and (ii) consider counter-arguments and resolve differences via discussions. In addition, he argues that more diverse boards exhibit less overconfidence and directors on diverse boards are less likely to take extreme positions. Female directors differ in their decision-making styles (Bilimoria, 2000; Peterson & Philpot, 2007), which may lead them to demand different information from top management than male directors.[3]

In the context of financial reporting decisions, existing empirical evidence suggests that female board presence leads to higher accruals quality (Srinidhi, Gul, & Tsui, 2011) and fewer accounting restatements (Abbott, Parker, & Presley, 2012). This is consistent with female board members using higher quality disclosures as a monitoring mechanism to monitor top management (Gul, Srinidhi, & Ng, 2011). More evidence can be found in Gul, Hutchinson, and Lai (2013), who show that more gender-diverse boards are associated with greater analyst forecast accuracy and lower forecast dispersion. Taken together, the extant literature has provided evidence that female board presence results in higher accounting quality and, more generally, higher disclosure quality.[4]

Prior research has also examined the effect of female presence on audit committees since audit committees are critical in monitoring internal control and financial reporting process. Using a sample of S&P 500 firms covering 2006–2008, Ittonen, Miettinen, and Vahamaa (2010) find that firms with a female audit committee chair have significantly lower audit fees. Consistent with Ittonen et al. (2010), Harjoto, Laksmana, and Lee (2015) find that audit committees with female chairs are associated with lower audit fees based on a sample covering 2000 to 2010. They also find that firms with a higher percentage of female audit committee members have less audit delay and lower abnormal accruals, suggesting better earnings reporting quality. However, they do not find evidence that the presence of female audit committee members is associated with audit fees. In contrast to Harjoto et al. (2015), Sun, Liu, and Lan (2010) do not find an association between the proportion of female directors on audit committees and the extent of earnings management (proxied by discretionary accruals). Based on a sample of listed Australian companies in 2008, Chapple, Kent, and Routledge (2012) find that the presence of a female director is associated with a reduced likelihood of a going concern opinion, but they do not find evidence that a female audit committee member has such an effect.

2.3. Hypothesis development

There are several possible non-mutually exclusive mechanisms through which the gender diversity of the board of directors will affect the likelihood of a material weakness opinion. First, the literature has shown that women are less tolerant of opportunistic behavior (e.g. Ambrose & Schminke, 1999; Krishnan & Parsons, 2008; Schminke & Ambrose, 1997). For example, in an experiment, Kaplan, Pany, Samuels, and Zhang (2009) find that female participants were more likely to report fraud. Indeed, it was Cynthia Cooper, the former Vice President of Internal Audit at WorldCom, who revealed the fraud despite Scott Sullivan (former CFO at WorldCom) chiding her for snooping around (Farrell, 2008). The whistleblower at Enron, Sherron Watkins, is also female.

To the extent that weak internal controls give top management greater ability to engage in opportunistic behavior (Epps & Guthrie, 2010), we should expect that boards with greater gender diversity will be less willing to tolerate weak internal controls for concern of financial reporting quality. Second, women are generally more risk averse than men (e.g., Barber & Odean, 2001). Weak internal controls have been shown to be associated with negative market reactions (Beneish, Billings, & Hodder, 2008; Gupta & Nayar, 2007; Hammersley, Myers, & Shakespeare, 2008) and may expose the firm and its directors to greater investment risk (Cheng et al., 2013) and reputational risk. We should expect female directors to be more concerned with ICFR quality to avoid the negative effect of weak ICFR and impairment of personal reputation. Finally, prior literature has shown that female directors are better monitors. Adams and Ferreira (2009) find that female directors are more likely to join monitoring committees such as the audit committee and have better attendance records. Women are not afraid to ask tough questions (e.g., something that the management team has not fully explained), while men feel a gender obligation to behave as though they understand everything (Konrad et al., 2008). Hence, female directors may be more able to find clues of potential problems. In addition, the management literature finds that gender-diverse boards engage in better discussions because women are more willing to discuss issues which seem unpalatable to an all-male board (e.g.Clarke, 2005; Huse & Solberg, 2006; Stephenson, 2004). If one considers weak internal controls to be a demanding issue, this suggests that boards with a greater female presence will be more willing to discuss potential consequences of and corrections for weak internal controls, resulting in fewer ICFR weaknesses for the firm.

Our hypothesis, stated in alternate form, is therefore as follows:

Hypothesis. There is a negative relationship between the presence of females on the board of directors and the likelihood of an internal control weakness.

3. Research design

To test whether female board presence helps alleviate internal control issues, we estimate the following firm fixed effects logistic regression:

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\begin{aligned}
\Pr(\text{WEAK}_{it} = 1) = {}& \alpha_0 + \alpha_1 \text{FEM}_{it} + \alpha_2 \text{GEOSEG}_{it} + \alpha_3 \text{BUSSEG}_{it} \\
& + \alpha_3 \text{MERGER}_{it} + \alpha_4 \text{RESTR}_{it} + \alpha_5 \text{SG}_{it} + \alpha_6 \text{INVT}_{it} \\
& + \alpha_7 \text{SIZE}_{it} + \alpha_8 \text{LOSS}_{it} + \alpha_9 \text{ALTMAN}_{it} \\
& + \alpha_{10} \text{RESTATE}_{it-1} + \alpha_{11} \text{BIG4}_{it} + \alpha_{12} \text{MIDTIER}_{it} \\
& + \alpha_{13} \text{RESIGN}_{it} + \alpha_{14} \text{BDSIZE}_{it} + \alpha_{15} \text{ACSIZE}_{it} \\
& + \alpha_{16} \text{ACE}_{it} + \alpha_{17} \text{INSTOWN}_{it} + \alpha_{18} \text{AFEE}_{it} + \varepsilon_{it}
\end{aligned} \tag{1}
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Table 1 contains detailed variable definitions. Subscripts i and t denote firm and year, respectively. The dependent variable is WEAK, which equals 1 if a material weakness opinion is issued by the auditor for firm i for the ICFR audit of fiscal year t, and 0 otherwise. The variable of interest is FEM, which represents one of our four proxies of female

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[3] There are differing views on why females have different decision-making styles. See Ambrose and Schminke (1999).

[4] Additional evidence consistent with female board members being better monitors can be found in Carter, Simkins, and Simpson (2003, p. 37) who find that female board members are more likely to exhibit greater independence and activism than male members.

Table 1
Variable definitions with Compustat mnemonics (in alphabetical order).

Variable		Variable Definition
ACE	=	1 if all members of audit committee are independent, at least one member has financial expertise, and committee meets at least four times annually, 0 otherwise.
ALTMAN	=	Altman (1968) bankruptcy score as modified by Hillegeist, Keating, Cram, and Lundstedt (2004), calculated as $1000e^X/(1+e^X)$, where $X = -4.34 - 0.08 \times (WCAP/AT) + 0.04 \times (RE/AT) - 0.10 \times (PI + XINT - IDIT)/AT - 0.22 \times (PRCC\ F \times CSHO)/LT + 0.06 \times (SALE/AT)$
AFEE	=	Natural log of audit fees.
BDSIZE	=	The number of directors on the board.
BIG4	=	1 if client has a Big 4 auditor, 0 otherwise. The Big 4 includes Deloitte, Ernst & Young, PricewaterhouseCoopers, and KPMG.
BUSSEG	=	The number of business segments.
FEM_DUM	=	An indicator variable equal to 1 if the board contains at least one female member, 0 otherwise.
FEM_DUM2	=	An indicator variable equal to 1 if the board contains at least one female member who is not on the audit committee, 0 otherwise.
FEM_PCT	=	The percentage of board members who are female.
FEM_PCT2	=	The percentage of female board members who are not on the audit committee.
GEOSEG	=	The number of geographic segments.
INSTOWN	=	Percentage of the firm's shares held by institutional investors (Thomson Reuters).
INVT	=	Inventory (INVT) divided by total assets (AT).
LOSS	=	1 if the firm reports negative net income (NI), 0 otherwise.
MERGER	=	1 if firm is involved in a merger or acquisition (AQS) during the year, 0 otherwise.
MIDTIER	=	1 if firm is audited by a mid-tier auditor, 0 otherwise. Mid-tier auditors include Grant Thornton and BDO Seidman.
RESIGN	=	1 if auditor resigned from the audit during the year, 0 otherwise.
RESTATE	=	1 if firm disclosed an accounting restatement during the year, 0 otherwise.
RESTR	=	1 if firm underwent restructuring (RCA) during the year, 0 otherwise.
ROA	=	Return on assets, calculated as earnings (IB) scaled by average total assets (AT).
SG	=	The percentage change in annual sales (SALE) growth.
SIZE	=	The natural log of the client's total assets (AT).
WEAK	=	1 if the auditor reports an internal control weakness under Section 404 of the Sarbanes–Oxley Act for the ICFR audit of fiscal year t, 0 otherwise.

board presence. Our first proxy is the percentage of board members who are female (FEM_PCT). The second proxy, used to test the critical mass theory, is an indicator variable which equals 1 if at least one of the board members is female, and 0 otherwise (FEM_DUM). Using either proxy, we expect to observe that $\alpha_1 < 0$, indicating that female board presence improves firms' internal controls. To examine whether the relation between female board presence and internal control weaknesses is driven by female audit committee members, we use a modified version of the aforementioned proxies (FEM_PCT2 and FEM_DUM2) which excludes female audit committee members in coding the female board presence measures.[5]

The model attempts to control for factors noted in the literature that are associated with the likelihood of receiving an adverse opinion on ICFR. One such factor is the complexity of the firm's operations. Doyle et al. (2007a) argue that firm complexity will be positively related to the incidence of internal control deficiencies. To this end, we include the number of geographic segments the firm reports (GEOSEG), the number of business segments the firm reports (BUSSEG), whether or not the firm was involved in a merger or acquisition during the year (MERGER), and whether or not the firm underwent restructuring (RESTR). We expect the coefficients on each of these variables to be positive.

The model also controls for certain operating characteristics which are expected to increase the likelihood of internal control weaknesses. To this end, the model controls for the sales growth of the firm (SG) as well as the level of inventory (INVT). Firms with higher levels of inventory may encounter problems with the proper measurement of inventory, employee theft of inventory, and the timely write downs of inventory (Ashbaugh-Skaife et al., 2007). We include a proxy for firm size (SIZE) because small firms tend to have more internal control issues (Ashbaugh-Skaife et al., 2007; Doyle et al., 2007a). One reason is that small firms are less likely to have enough employees to ensure proper segregation of duties. Another reason is that large firms tend to have greater economies of scale when implementing internal control systems,

which means they have more resources to invest in internal control systems. The model also controls for the financial condition of the client. Firms in poor financial condition may not have the time or resources to invest in an effective internal control system (Doyle et al., 2007a; Ogneva et al., 2007). Therefore, we control whether the firm reported a loss in the current year (LOSS), and include the firm's bankruptcy score (ALTMAN). Following Ashbaugh-Skaife et al. (2007), we include controls for auditor brand (BIG4 and MIDTIER),[6] prior restatement announcements (RESTATE), and whether the auditor resigned (RESIGN). BIG4 and MIDTIER are included because larger auditors are more likely to discover and report internal control weaknesses. An accounting restatement in the prior year or an auditor resignation in the current year are red flags that may signal a higher likelihood of internal control issues.

Within the model, we also control for board monitoring characteristics, including the size of the board of directors (BDSIZE) (e.g., Zhang et al., 2007), the size of the audit committee (ACSIZE) (Hoitash et al., 2009; Zhang et al., 2007), and audit committee effectiveness (ACE) (Abbott et al., 2012). We expect that firms with larger boards, larger audit committees, and more effective audit committees will be associated with stronger corporate governance, and therefore a lower likelihood of internal control problems. Finally, the model controls for institutional ownership (INSTOWN) and audit fees (AFEE).

4. Sample and descriptive statistics

We obtain financial data from Compustat, internal control weakness and auditor data from Audit Analytics, and board of director data from Board Ex. Our sample begins with all firm-year observations on Compustat with matching director data on Board Ex during the 2004 to 2013 time period. We begin the sample in 2004 because this is the first year internal control weaknesses were required to be disclosed under section 404 of SOX.[7] We delete 7706 financial services firm-

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[5] If a firm has a total of 9 board members, two of which are female with one of the females being a member of the audit committee, then FEM_PCT2 = 1/(9−1) = 12.5%. With this scenario, the FEM_DUM2 variable would be coded as 1. Alternatively, if there is only one female board member that serves on the audit committee, then FEM_PCT2 and FEM_DUM would both equal 0.

[6] We classify Grant Thornton and BDO Seidman as the Mid-tier auditors, following prior research (e.g., Boone, Khurana, & Raman, 2010; Eshleman & Guo, 2014a, 2014b).

[7] Section 404 went into effect for accelerated filer firms with fiscal years ending on or after November 15, 2004. Non-accelerated filers were still required to disclose any internal control weaknesses under Section 302. Before the Sarbanes–Oxley Act, firms were only required to disclose internal control deficiencies if there was a change in auditor (SEC, 1988).

years and 8382 firm-years without the necessary data to calculate the variables used in Eq. (1). This leaves us with a main sample of 18,593 firm-year observations. From this sample, we delete 14,326 observations because these firms do not exhibit variation in the dependent variable (WEAK) during the sample period. In other words, many firms have no material weaknesses (or all material weaknesses) for all sample years, which does not allow us to disentangle the effect of female board members from the firm effect in a firm fixed effects logistic regression. The final sample consists of 4267 firm-year observations spanning 2004 to 2013. Table 2A outlines the sample selection procedure. All variables are winsorized at the 1st and 99th percentiles to reduce the influence of outliers on the regression results.[8] We use the fixed effects model because Wooldridge (2001) shows that it can mitigate the omitted variable problem by capturing time-invariant unobservable firm idiosyncrasies. One disadvantage of the model is that it has restrictive assumptions (e.g., the lagged dependent variable cannot be an independent variable). Table 2B presents information on female representation on corporate boards and material weaknesses over our sample period. While female board representation has slowly but steadily risen over time, the incidence of material weaknesses exhibits no discernable pattern within our sample. While it spiked in the early years of the requirement, it dipped and then spiked again in the later years of the sample (2012–2013).[9]

Table 3 contains descriptive statistics for the sample for each variable used in the study.[10] The dependent variable, WEAK, has a mean of 0.194, indicating that over 19% of the sample firm-years had a material weakness. The presence of material weaknesses is considerably higher in our sample, as our firm fixed effects logistic regression requires each firm to exhibit variation in material weaknesses over time. As such, any firm with no material weaknesses during the 2004–2013 sample period is excluded. This means that the average firm size for our sample is smaller than that of related studies (e.g., Sun et al., 2010). The mean value of FEM_PCT is 0.079, indicating that females hold an average of 7.9% of the seats on corporate boards within the sample. The mean value of FEM_DUM is 0.488, which suggests that roughly half of firm-year observations within the sample have at least one female member. The mean value of LOSS is 0.341, indicating that approximately one-third of the firm-years in our sample are loss years. Approximately three-quarters of the sample firms are audited by a Big 4 auditor, 11% are audited by a mid-tier auditor, and the remaining firm-years (12.8%) are audited by a small auditor. The average firm has a board of approximately eight members and 3.5 audit committee members.

Table 4 contains Pearson correlation coefficients for the sample for each of the variables used in the study. As expected, all our proxies for female board presence (FEM_PCT, FEM_DUM, FEM_PCT2, FEM_DUM2) are significantly positively correlated, indicating that they measure a common underlying construct. Consistent with our hypothesis, the incidence of internal control weaknesses (WEAK) is significantly negatively correlated with three of the four proxies for female board presence at the 5% level. SIZE is significantly positively correlated with all of our proxies for female presence, suggesting that larger firms tend to have more gender-diverse boards. None of the correlations within our independent variables are high enough to cause concerns

of multicollinearity, with the exception of SIZE and AFEE (0.75). We note, however, that the high correlation between firm size and audit fees will not affect the inferences we draw on the coefficient on our female board presence variable.

5. Empirical results

In this section, we investigate whether female presence on corporate boards of directors affects the likelihood of having internal control weaknesses. Following prior research (e.g., Johnson, Ryan, & Tian, 2009; Zhang et al., 2007), we use firm fixed effects logistic regressions to control for firm fixed effects which are likely unobservable.

5.1. Female board presence test

Table 5 presents the main empirical results.[11] The first column presents results when using the percentage of female directors (FEM_PCT) to measure female board presence. The coefficient is negative and significant at the 5% level (P-value = 0.031), consistent with female board presence reducing the likelihood of internal control issues. Column (2) reports the results when using an indicator variable (i.e., FEM_DUM) to measure female board presence. The coefficient on FEM_DUM is significantly negative at the 1% level (P-value = 0.002). It is worth noting that some prior papers argue that the board needs to have a critical mass of women for them to make real impact on the firm. For example, using a data set of 151 listed German firms, Joecks et al. (2013) find that gender diversity of the board is positively associated with firm performance only after the board is composed of approximately 30% female members. Torchia et al. (2011) find that attaining critical mass (i.e., three women directors) significantly enhances firm innovation. However, our results do not support the critical mass theory and show that having even one female director is associated with a reduced likelihood of internal control weaknesses. The ICFR setting is different because CEOs and CFOs have to certify their assessment of ICFR quality and auditors need to attest to ICFR quality. Hence, in a highly regulated area such as ICFR quality and in a litigious market like the U.S., board members are more careful in scrutinizing internal control issues. Our results are consistent with prior gender diversity literature in accounting that shows no support for the critical mass theory (e.g., Abbott et al., 2012; Srinidhi et al., 2011).

Table 2
Sample selection and sample composition.

Panel A—Sample selection	
All firm-years on Compustat with matching data in Board Ex during 2004–2013	34,681
Less financial services firms (SIC codes 6000–6999)	(7706)
Less observations with missing data	(8382)
Less firms with no variation in WEAK within the sample period	(14,326)
Main sample for female board test	**4267**

Panel B—Female directors and internal control weaknesses over time

Year	% Female directors	% Firms with at least one female	% firms with WEAK = 1
2004	6.33	39.91	37.82
2005	6.80	43.56	36.27
2006	7.11	43.61	23.83
2007	7.55	45.99	22.78
2008	8.08	49.78	11.57
2009	8.43	51.46	6.74
2010	8.60	52.12	7.31
2011	8.53	52.35	10.62
2012	8.84	54.31	15.93
2013	10.03	60.20	13.49

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[8] Results are qualitatively similar if we do not winsorize the variables (untabulated).

[9] This pattern of material weaknesses can also be observed in the larger population of firms not in our sample.

[10] Our sample differs from that of Abbott et al. (2012). First, the pre-SOX sample of Abbott et al. (2012) is based on GAO report 03-138, which includes US firms with reporting restatements from January 1, 1997, to June 30, 2002. For their post-SOX sample, they randomly select 75 restatement firms drawn from GAO report 06-678, which includes restatements from July 1, 2002, to September 30, 2005. Therefore, the sample of Abbott et al. (2012) is primarily pre-SOX. Our sample spans 2004 to 2013, so it is post-SOX. Second, Abbott et al. (2012) match each restatement firm with a control firm based on firm size, auditor (Big N/non-Big N auditor) and industry. We do not use a matched sample, and our sample size is much larger.

[11] Note that there is no intercept term when using the firm fixed effects logistic regressions.

Table 3
Descriptive statistics.

Variable	N	Mean	Q1	Median	Q3	Min	Max	SD
WEAK	4267	0.194	0.000	0.000	0.000	0.000	1.000	0.395
FEM_PCT	4267	0.079	0.000	0.000	0.143	0.000	0.375	0.094
FEM_PCT2	4267	0.040	0.000	0.000	0.100	0.000	0.429	0.069
FEM_DUM	4267	0.488	0.000	0.000	1.000	0.000	1.000	0.500
FEM_DUM2	4267	0.292	0.000	0.000	1.000	0.000	1.000	0.455
BUSSEG	4267	2.538	1.000	2.000	4.000	1.000	8.000	1.858
GEOSEG	4267	3.420	1.000	3.000	5.000	1.000	13.000	2.787
MERGER	4267	0.122	0.000	0.000	0.000	0.000	1.000	0.327
RESTR	4267	0.361	0.000	0.000	1.000	0.000	1.000	0.480
SG	4267	0.136	−0.024	0.077	0.209	−0.607	2.327	0.368
INVT	4267	0.117	0.006	0.085	0.180	0.000	0.579	0.129
Total assets	4267	1534.250	168.867	409.978	1171.980	7.326	34,812.090	3433.410
LOSS	4267	0.341	0.000	0.000	1.000	0.000	1.000	0.474
ALTMAN	4267	−5.473	−5.673	−4.877	−4.539	−15.936	−4.240	1.724
RESTATE	4267	0.159	0.000	0.000	0.000	0.000	1.000	0.365
BIG4	4267	0.762	1.000	1.000	1.000	0.000	1.000	0.426
MIDTIER	4267	0.110	0.000	0.000	0.000	0.000	1.000	0.313
RESIGN	4267	0.075	0.000	0.000	0.000	0.000	1.000	0.264
BDSIZE	4267	7.897	7.000	8.000	9.000	4.000	13.000	1.860
ACSIZE	4267	3.498	3.000	3.000	4.000	2.000	6.000	0.766
ACE	4267	0.859	1.000	1.000	1.000	0.000	1.000	0.348
INSTOWN	4267	0.618	0.392	0.694	0.866	0.000	1.679	0.316
Audit fees	4267	1983.647	593.000	1078.350	2029.550	5.500	82,249.000	3571.923

Note: This table contains the number of observations (N), the mean, first quartile (Q1), median, third quartile (Q3), minimum (Min), maximum (Max), and standard deviation (SD) for all variables used in the study. All variables are winsorized at the 1st and 99th percentile. See Table 1 for variable definitions.

The coefficients on the control variables are largely consistent with our expectations. For example, firms that recently announced an accounting restatement (RESTATE), firms with Big 4 auditors (BIG4), and firms with auditor resignations (RESIGN) are more likely to have internal control weaknesses. It is worth noting that because we estimate Eq. (1) using firm fixed effects logistic regressions, it is unlikely that the result is being driven by unobservable firm characteristics. The results are also economically significant. Using an ordinary logistic regression (untabulated) in lieu of our firm fixed effects logit regression and holding all independent variables constant at their mean values, a firm with a female director (FEM_DUM = 1) is 1.7% less likely to report an internal control weakness compared with a firm with no female directors

Table 4
Pearson correlation matrix.

Variable	WEAK	FEM_PCT	FEM_PCT2	FEM_DUM	FEM_DUM2	BUSSEG	GEOSEG	MERGER	RESTR	SG	INVT	SIZE	LOSS	ALTMAN
FEM_PCT	−0.03													
FEM_PCT2	**−0.04**	**0.70**												
FEM_DUM	−0.03	**0.86**	**0.60**											
FEM_DUM2	**−0.04**	**0.66**	**0.91**	**0.66**										
BUSSEG	−0.01	**0.08**	**0.07**	**0.11**	**0.11**									
GEOSEG	−0.01	**−0.11**	**−0.08**	**−0.09**	**−0.07**	**0.12**								
MERGER	0.03	**−0.05**	−0.01	**−0.04**	−0.02	0.02	0.03							
RESTR	−0.00	**0.09**	**0.07**	**0.10**	**0.09**	**0.13**	**0.20**	**0.14**						
SG	**0.04**	**−0.08**	**−0.06**	**−0.09**	**−0.07**	**−0.07**	−0.02	**0.14**	**−0.15**					
INVT	−0.03	**0.08**	0.02	**0.06**	0.02	0.01	**0.08**	**−0.06**	**−0.06**	**−0.07**				
SIZE	−0.02	**0.17**	**0.15**	**0.26**	**0.23**	**0.33**	**0.13**	0.03	**0.19**	**−0.09**	0.01			
LOSS	**0.08**	**−0.05**	**−0.06**	**−0.06**	**−0.07**	**−0.13**	−0.02	**−0.04**	**0.12**	**−0.04**	**−0.07**	**−0.29**		
ALTMAN	0.01	**0.10**	**0.07**	**0.14**	**0.11**	**0.22**	0.01	**0.05**	**0.17**	**−0.23**	**0.15**	**0.40**	−0.02	
RESTATE	**0.15**	0.02	0.00	0.02	0.01	0.01	−0.02	−0.02	0.02	0.00	−0.01	0.03	**0.06**	0.01
BIG4	0.01	**0.11**	**0.10**	**0.16**	**0.15**	**0.11**	0.03	0.00	**0.14**	**−0.06**	−0.01	**0.42**	**−0.11**	**0.15**
MIDTIER	0.01	**−0.10**	**−0.08**	**−0.10**	**−0.09**	**−0.05**	0.05	0.02	−0.04	0.00	0.01	**−0.19**	**0.06**	**−0.06**
RESIGN	**0.09**	−0.04	−0.03	**−0.05**	**−0.05**	−0.02	−0.02	−0.03	**−0.05**	0.05	0.00	**−0.12**	0.04	**−0.05**
BDSIZE	**−0.04**	**0.27**	**0.24**	**0.40**	**0.36**	**0.29**	0.03	−0.04	**0.10**	**−0.08**	**0.06**	**0.54**	**−0.15**	**0.23**
ACSIZE	−0.03	**0.16**	0.01	**0.20**	**0.08**	**0.23**	0.04	**−0.05**	0.04	**−0.09**	**0.10**	**0.33**	**−0.13**	**0.14**
ACE	**−0.14**	0.04	0.01	**0.07**	0.04	0.05	0.05	−0.02	0.00	**−0.06**	0.01	**0.14**	**−0.13**	0.04
INSTOWN	**−0.04**	**0.07**	**0.06**	**0.11**	**0.09**	**0.10**	**0.06**	0.02	**0.12**	**−0.12**	0.03	**0.49**	**−0.25**	**0.23**
AFEE	**0.10**	**0.15**	**0.13**	**0.22**	**0.20**	**0.32**	**0.26**	**0.05**	**0.31**	**−0.11**	−0.02	**0.75**	**−0.13**	**0.34**

Variable	RESTATE	BIG4	MIDTIER	RESIGN	BDSIZE	ACSIZE	ACE	INSTOWN
BIG4	0.03							
MIDTIER	−0.01	−0.63						
RESIGN	0.08	−0.19	0.10					
BDSIZE	0.02	0.29	−0.11	−0.07				
ACSIZE	0.01	0.11	−0.04	−0.05	0.45			
ACE	−0.07	0.10	−0.02	−0.07	0.11	0.08		
INSTOWN	0.00	0.34	−0.12	−0.11	0.18	0.16		
AFEE	0.07	0.44	−0.16	−0.18	0.44	0.26	0.07	0.39

Note: This table contains Pearson correlation coefficients below the diagonal. Correlations significant at the 5% level are in **bold**. See Table 1 for variable definitions.

Table 5
Results on whether firms with more gender-diverse boards are less likely to have material weaknesses.

Variable	Predicted sign	(1)		(2)	
		Coefficient	P-value	Coefficient	P-value
FEM_PCT_t	−	−1.789**	[0.031]		
FEM_DUM_t	−			−0.503***	[0.002]
$BUSSEG_t$	+	0.075*	[0.084]	0.075*	[0.084]
$GEOSEG_t$	+	−0.075**	[0.046]	−0.079**	[0.040]
$MERGER_t$	+	0.142	[0.150]	0.148	[0.140]
$RESTR_t$	+	−0.185*	[0.065]	−0.180*	[0.070]
SG_t	+	0.230**	[0.032]	0.223**	[0.037]
$INVT_t$	+	−1.191	[0.189]	−1.068	[0.215]
$SIZE_t$	−	−0.328***	[0.007]	−0.321***	[0.008]
$LOSS_t$	+	0.188*	[0.051]	0.192**	[0.047]
$ALTMAN_t$	+	−0.005	[0.457]	−0.003	[0.475]
$RESTATE_{t-1}$	+	0.461***	[0.000]	0.463***	[0.000]
$BIG4_t$	+	1.415***	[0.000]	1.424***	[0.000]
$MIDTIER_t$	+	0.327	[0.148]	0.346	[0.135]
$RESIGN_t$	+	0.939***	[0.000]	0.952***	[0.000]
$BDSIZE_t$	−	−0.059	[0.133]	−0.038	[0.240]
$ACSIZE_t$	−	0.001	[0.494]	0.006	[0.475]
ACE_t	−	−0.511***	[0.000]	−0.502***	[0.000]
$INSTOWN_t$	+	−0.820***	[0.003]	−0.823***	[0.003]
$AFEE_t$	+	1.517***	[0.000]	1.525***	[0.000]
N		4267		4267	
Likelihood ratio		347.51		352.53	

Note: This table contains estimated coefficients from the firm fixed effects logistic regressions in which the dependent variable is WEAK, which equals 1 if the firm receives a material weakness opinion, and 0 otherwise. P-values are displayed in brackets below the coefficient estimates. See Table 1 for variable definitions. All tests of significance are based on two-tailed tests unless a prediction is given, in which case they are based on one-tailed tests.
 * Statistical significance at the 10% level.
 ** Statistical significance at the 5% level.
 *** Statistical significance at the 1% level.

Table 6
Results on whether the gender effect is driven by females on the audit committee.

Variable	Predicted sign	(1)		(2)	
		Coefficient	P-value	Coefficient	P-value
FEM_PCT2_t	−	−2.809***	[0.009]		
FEM_DUM2_t	−			−0.285**	[0.045]
$BUSSEG_t$	+	0.077*	[0.079]	0.077*	[0.077]
$GEOSEG_t$	+	−0.077**	[0.043]	−0.077**	[0.043]
$MERGER_t$	+	0.144	[0.147]	0.149	[0.139]
$RESTR_t$	+	−0.190*	[0.060]	−0.191*	[0.059]
SG_t	+	0.233**	[0.031]	0.230**	[0.032]
$INVT_t$	+	−1.189	[0.190]	−1.193	[0.189]
$SIZE_t$	−	−0.330***	[0.007]	−0.335***	[0.006]
$LOSS_t$	+	0.189**	[0.050]	0.187*	[0.051]
$ALTMAN_t$	+	−0.008	[0.429]	−0.008	[0.428]
$RESTATE_{t-1}$	+	0.453***	[0.000]	0.457***	[0.000]
$BIG4_t$	+	1.413***	[0.000]	1.419***	[0.000]
$MIDTIER_t$	+	0.318	[0.155]	0.321	[0.152]
$RESIGN_t$	+	0.939***	[0.000]	0.940***	[0.000]
$BDSIZE_t$	−	−0.046	[0.196]	−0.040	[0.231]
$ACSIZE_t$	−	−0.031	[0.367]	−0.025	[0.393]
ACE_t	−	−0.520***	[0.000]	−0.513***	[0.000]
$INSTOWN_t$	+	−0.824***	[0.003]	−0.837***	[0.002]
$AFEE_t$	+	1.515***	[0.000]	1.525***	[0.000]
N		4259		4267	
Likelihood ratio		346.44		346.87	

Note: This table contains estimated coefficients from the firm fixed effects logistic regressions in which the dependent variable is WEAK, which equals 1 if the firm receives a material weakness opinion, and 0 otherwise. P-values are displayed in brackets below the coefficient estimates. See Table 1 for variable definitions. All tests of significance are based on two-tailed tests unless a prediction is given, in which case they are based on one-tailed tests.
 * Statistical significance at the 10% level.
 ** Statistical significance at the 5% level.
 *** Statistical significance at the 1% level.

(FEM_DUM = 0). Given that the baseline likelihood of reporting an internal control weakness is only 17.1%, this translates into a relative decrease in probability of approximately 9.7%.[12]

To summarize, the evidence in Table 5 suggests that female board presence reduces the likelihood of material weaknesses of internal controls.

5.2. Audit committee test

Prior research documents that females are more likely to join the monitoring committees such as audit committees (Adams & Ferreira, 2009). Therefore, it is interesting to examine whether the effects we document are driven by female board presence on the audit committee. In other words, although we find that females on corporate boards deter internal control weaknesses, it may be the case that this is only true if these females join the audit committee. In order to test this conjecture, we re-estimate Eq. (1) using proxies for female presence that exclude audit committee members. Specifically, we code FEM_PCT2 as the percentage of female board members who are not on the audit committee and code FEM_DUM2 as equal to 1 if the board contains at least one female member who is not on the audit committee, and 0 otherwise.[13]

Table 6 reports the results of this analysis. The first column reports results when using the percentage of female board members who are not on audit committees (FEM_PCT2). The coefficient on FEM_PCT2 is

−2.809 and is statistically significant at the 1% level (P-value = 0.009). The second column reports results using an indicator variable to measure non-audit committee female board presence (FEM_DUM2). Again, the coefficient is statistically negative at the 5% level (P-value = 0.045). Overall, Table 6 provides evidence that the effect we document is not solely attributable to females serving on the audit committee. Rather, the evidence suggests that females on corporate boards deter material weaknesses, regardless of whether or not they serve on the audit committee.

5.3. Endogeneity and reverse causality

As with any study that documents an association between two constructs, there is a concern that the results we document could be endogenous. In other words, there could be some firm characteristic that simultaneously leads to a higher proportion of female board members and a lower likelihood of internal control weaknesses. We believe this is unlikely to be the case because all of our regressions are estimated using the firm fixed effects logistic approach. The use of firm fixed effects eliminates the possibility that any time-invariant firm characteristic causes firms to both hire more female board members and have better internal controls.

Another concern is that the relationship we document is due to firms with fewer ICFR deficiencies retaining more female directors, and not vice versa. That is, a reverse causality may exist. To mitigate this concern, we regress WEAK on the lagged value of FEM_PCT, FEM_DUM, FEM_PCT2, and FEM_DUM2, respectively. Table 7 reports the results of this analysis. For three of the four regressions, the coefficient on the lagged female board presence variable is significantly negative. For the other regression (Column 1), the coefficient is negative but not quite significant (P-value = 0.107). Therefore, it seems that reverse causality is not an issue in this study.

[12] Calculated as (1.66%)/(17.1%) = 9.7%.
[13] If we instead estimate Equation (1) by adding an indicator variable for female audit committee presence, we find that the correlation between our original female board presence variables and the indicator variable for female audit committee presence is extremely high, averaging about 0.67. This is not surprising because a female audit committee member is necessarily a board member. Therefore, multicollinearity is likely to bias our results using this method.

Table 7
Results on whether the gender effect is driven by reverse causality.

Variable	Predicted sign	(1)		(2)		(3)		(4)	
		Coefficient	P-value	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
FEM_PCT_{t-1}	−	−1.353	[0.107]						
FEM_DUM_{t-1}	−			−0.490***	[0.009]				
FEM_PCT2_{t-1}	−					−2.150*	[0.052]		
FEM_DUM2_{t-1}	−							−0.347**	[0.032]
$BUSSEG_t$	+	0.088*	[0.067]	0.087*	[0.072]	0.091*	[0.062]	0.090*	[0.065]
$GEOSEG_t$	+	−0.088**	[0.043]	−0.089**	[0.042]	−0.089**	[0.041]	−0.089**	[0.041]
$MERGER_t$	+	0.148	[0.166]	0.147	[0.168]	0.150	[0.163]	0.149	[0.165]
$RESTR_t$	+	−0.184*	[0.088]	−0.179*	[0.095]	−0.177*	[0.097]	−0.177*	[0.097]
SG_t	+	0.346***	[0.007]	0.342***	[0.007]	0.350***	[0.006]	0.345***	[0.007]
$INVT_t$	+	−1.121	[0.230]	−1.111	[0.232]	−1.014	[0.256]	−1.139	[0.227]
$SIZE_t$	−	−0.405***	[0.003]	−0.388***	[0.005]	−0.412***	[0.003]	−0.409***	[0.003]
$LOSS_t$	+	0.207**	[0.049]	0.211**	[0.046]	0.209**	[0.047]	0.206**	[0.049]
$ALTMAN_t$	+	0.001	[0.493]	0.000	[0.499]	−0.002	[0.482]	−0.001	[0.490]
$RESTATE_{t-1}$	+	0.359***	[0.001]	0.361***	[0.001]	0.355***	[0.001]	0.357***	[0.001]
$BIG4_t$	+	1.269***	[0.000]	1.274***	[0.000]	1.257***	[0.000]	1.264***	[0.000]
$MIDTIER_t$	+	0.211	[0.276]	0.210	[0.277]	0.201	[0.285]	0.202	[0.284]
$RESIGN_t$	+	0.883***	[0.000]	0.887***	[0.000]	0.887***	[0.000]	0.892***	[0.000]
$BDSIZE_t$	−	−0.076	[0.104]	−0.070	[0.125]	−0.069	[0.127]	−0.064	[0.146]
$ACSIZE_t$	−	0.060	[0.276]	0.064	[0.262]	0.053	[0.298]	0.049	[0.314]
ACE_t	−	−0.548***	[0.001]	−0.537***	[0.001]	−0.548***	[0.001]	−0.543***	[0.001]
$INSTOWN_t$	+	−0.832***	[0.005]	−0.832***	[0.005]	−0.831**	[0.005]	−0.845***	[0.005]
$AFEE_t$	+	1.497***	[0.000]	1.504***	[0.000]	1.504***	[0.000]	1.510***	[0.000]
N		3421		3421		3419		3421	
Likelihood ratio		272.89		277.10		273.55		274.79	

Note: This table contains estimated coefficients from the firm fixed effects logistic regressions in which the dependent variable is WEAK, which equals 1 if the firm receives a material weakness opinion, and 0 otherwise. P-values are displayed in brackets below the coefficient estimates. See Table 1 for variable definitions. All tests of significance are based on two-tailed tests unless a prediction is given, in which case they are based on one-tailed tests.

*   Statistical significance at the 10% level.
**   Statistical significance at the 5% level.
***   Statistical significance at the 1% level.

6. Conclusion

We investigate whether female presence on a firm's board of directors influences the firm's internal controls. Based on the gender diversity literature (Krishnan & Parsons, 2008), we predict and find that firms with a greater presence of female board members are less likely to report having weak internal controls. Additional analyses reveal that the results are not driven by females on the audit committee. Rather, females on the board of directors are associated with a lower likelihood of internal control issues, regardless of whether they sit on the audit committee. Our results are robust to alternate definitions of female board presence and are inconsistent with the critical mass theory, suggesting that female directors are not merely tokens: even one female director may lead to reduced likelihood of material weaknesses.

The results add to the internal control literature by showing that certain characteristics of the firm's board of directors can have a substantial effect on the strength of the firm's internal controls. The study also extends prior literature on gender diversity of corporate boards. While prior literature has shown that gender-diverse boards are associated with higher earnings quality (Srinidhi et al., 2011) and lower likelihood of restatements (Abbott et al., 2012), our findings suggest that this relationship may exist because female board members help reduce internal control weaknesses, and prior literature has established a negative relationship between internal control weaknesses and earnings quality (Ashbaugh-Skaife et al., 2008; Doyle et al., 2007b).

One limitation of our study is that our measure of the quality of a firm's internal controls is dichotomous, which does not allow us to capture all variation in the quality of firms' internal control systems.[14] Also, although our findings suggest that female directors are associated with a reduced likelihood of material ICFR weaknesses, the quality of internal controls is only one of many factors to consider when hiring a board member. It would be interesting to see whether male board members have advantages for any specific areas and whether there is an optimal mix of male and female board members. Another question is whether other types of diversity, including racial, ethnic, or age diversity, affect the decisions of corporate boards. We leave these considerations to future research.

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[14]   Only 19.4% of firm-years in our sample report an internal control weakness. We are unable to capture variation in the quality of the internal controls of the remaining 80.6%.

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