Original Article

Impact of board gender composition on corporate debt maturity structures*

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Abstract

This paper examines the effect of female directors on corporate debt maturity structures. We find that firms with a higher ratio of female directors tend to have a larger proportion of short-maturity debt. This effect is more pronounced with female independent directors and is insignificant with female inside directors. These findings remain robust under propensity score matching and instrumental variable approaches to address potential endogeneity concerns. Furthermore, we find that our results are driven primarily by firms with weak governance quality and low financial constraints. We also find that the effect does not differ between high- and low-leveraged firms, and there is a negative relation between female directors and likelihood of overinvestment. This evidence suggests that female directors view short-term debt as a monitoring device.

1. Introduction

Gender diversity in corporate boardrooms was originally advocated as a matter of justice and human rights. However, whether it also gives rise to a range of positive economic outcomes remains unclear. There is a growing literature investigating the effects of gender-diverse boards since Norway first initiated mandatory requirements for gender diversity on boards, which has subsequently been adopted by many other countries. Insofar as this issue has been examined directly, the vast majority of studies focus on the ultimate effects on firm value or financial performance (see, e.g. Adams and Ferreira, 2009; Ahern and Dittmar, 2012; Carter, Simkins, and Simpson, 2003; Farrell and Hersch, 2005). However, since female directors may have different attitudes toward governance and bring a different kind of deliberation in discussions than their male counterparts, they could have particular influences on corporate policies in the process of decision making.

An emerging body of research investigates the monitoring role of female directors in such corporate decisions as dividend payout policy (see, e.g. Chen, Leung, & Goergen, 2017), executive compensation (see, e.g. Carter, Franco, & Gine, 2017), and mergers and acquisitions (see, e.g. Levi, Li, & Zhang, 2014). However, one type of important corporate policy, debt maturity structure, has remained largely unexplored.

Corporate debt maturity structure is not only one of the key elements of corporate financial policy, it is also believed to be an important corporate governance device. Barnea, Haugen, and Senbet (1980) argue that shorter-term debt can reduce managerial incentives to increase risk. Jensen (1986) notes the monitoring role of short-term debt in alleviating overinvestment behaviour. Short-term debt also has been shown to alleviate the agency costs stemming from managerial discretion by subjecting managers to more frequent monitoring from debtholders (Rajan and& Winton, 1995; Stulz, 2001). Therefore, it

is important to understand whether female directors influence corporate capital structure decisions by choosing a particular debt maturity structure and utilizing it as a monitoring device.

We aim to test the effect of gender diversity on corporate debt maturity by examining whether there are systematic differences in the choice of debt maturity in the presence of female directors. We argue that female directors place more emphasis on monitoring, and thus are more likely to use short-term debt as a governance mechanism to monitor managers' actions. First, empirical evidence suggests that female directors focus more on monitoring than male directors. Gender diversity in the boardroom thus has significant implications for board dynamics. The presence of female directors on boards brings not only different perspectives, skills, and knowledge, but also different values and norms (Gul, Srinidhi, & Ng, 2011; Miller & Triana, 2009). Moreover, gender-diverse boards are associated with more in-depth board deliberations and less conformity of attitudes (Adams, Gary, & Nowland, 2011; Clarke, 2005; Huse and Grethe Solberg, 2006; McInerney-Lacombe, Bilimoria, & Salipante, 2008). Gender diversity on boards thus encourages more competitive interaction in the boardroom as well as more effective board communication. In addition, recent studies indicate that female directors provide greater oversight and monitoring of managers' behaviour and actions. For example, Adams and Ferreira (2009) observe that female directors are more likely to undertake increased monitoring, attend more board meetings, and demand greater accountability for poor performance from managers.

Second, short-term debt can motivate managers to align their interests with shareholder interests more effectively by reducing the cash flow available to be spent at the discretion of managers. Short-term debt therefore serves as an effective monitoring instrument by avoiding the potential for inefficient investment by managers, consequently controlling managerial overinvestment behaviour. The threat caused by failure to make short-term debt payments also enhances manager incentives to improve the efficiency of fund utilization (Hart & Moore, 1994).

Given the characteristics of monitoring by female directors and of short-term debt, it is possible that female directors are more likely to use short-term debt to monitor managers than are male directors. We expect this effect to be weaker when overinvestment is less likely, i.e. when other corporate governance mechanisms are strong and managers are subject to financial constraints.

However, there are competing views that oppose this argument, and the influence of female directors on corporate governance is controversial. Corporations may use gender diversity only to convey the appearance that they are complying with social norms and expectations of how firms should behave, while in reality female directors might be marginalized and play no significant role in governance. If this were the case, we would not find an association between gender diversity and debt maturity. Moreover, some studies document unfavourable outcomes with regard to board gender diversity. For instance, Ahern and Dittmar (2012) find that mandatory female board representation causes a significant drop in firm value, mainly because boards became younger and less experienced. Again, if this were

the case, we would not be able to find systematic evidence of an association between gender diversity and debt maturity in situations where governance is critical.

We examine whether there is a positive relationship between female directors and short-term debt by using a sample taken from the S&P 1500 for the period 1997–2016. We show that firms with a greater proportion of female directors are more likely to adopt a shorter debt maturity structure than firms with a lower proportion of female directors. Our results are more pronounced when only independent female directors are examined. Our findings remain robust after implementing the propensity score matching (PSM) and instrumental variable (IV) approaches to control for firm and debt characteristics and other potential endogeneity issues.

Further, we find that our full sample results are driven by firms with weak governance quality and higher governance needs, as proxied by the managerial entrenchment index (E-index) (Bebchuk, Cohen, & Ferrell, 2009) and analyst coverage. This finding is consistent with our main argument that, compared with male directors, female directors are more likely to adopt shorter debt maturity structure as a monitoring and governance mechanism in firms with weak corporate governance quality and higher corporate governance needs. We also find that the positive relationship between female directors and short-term debt disappears for firms with financial constraints, since the overinvestment associated with a free cash flow agency problem decreases due to the decline in internal cash flow and financial constraints under such circumstances. We also address concerns over the confounding effects from debtholder monitoring by comparing different debtholders' power through classifying firms into high-leveraged and low-leveraged groups. Our results show that the association between female directors and debt maturity structure does not vary across high- and low-leveraged firms. More directly, we further present evidence that female directors reduce the likelihood of overinvestment. We also exclude the alternative explanation that women in general are more risk averse, and thereby more likely to choose less risky short-term debt, by comparing the effects from independent and inside female directors.

Taken together, our findings are consistent with our argument that female directors are more likely to use short-term debt as a corporate governance device, reducing the potential for managerial opportunism and self-serving overinvestment.

We make at least three contributions to the literature. First, to the best of our knowledge, this is the first study to investigate the corporate debt maturity consequences of having female directors on boards. Prior literature shows conflicting findings regarding the role that female directors play; we generate evidence that the presence of female directors is positively related to use of short-term debt. These findings concur with research that finds female directors play a significant role in a series of important corporate decisions (see, e.g. Carter, Franco, & Gine, 2017; Chen, Leung and Goergen, 2017; Levi, Li and Zhang, 2014).

Second, we contribute to a growing body of literature exploring various determinants of corporate debt maturity structure (e.g. Barclay & Smith, 1995; Billett, King, & Mauer, 2007; Brockman, Martin, & Unlu, 2010; Dang & Phan, 2016; Guedes & Opler, 1996; Johnson, 2003). We generate evidence that including female directors on boards is one factor that shapes corporate debt maturity policies.

Third, this study contributes to the literature that links gender diversity on boards to monitoring intensity (Adams & Ferreira, 2009; Chen, Leung, & Goergen, 2017; Gul, Srinidhi and Ng, 2011). We note that female directors undertake more monitoring than their male counterparts, as reflected by use of short-term debt as a monitoring device in firms with weak corporate governance quality and higher corporate governance needs.

This paper proceeds as follows. Section 2 discusses the related literature and develops our main hypotheses. In Section 3, we present data sources, sample selection, variable definitions, and summary statistics. Section 4 discusses our main regression results. Section 5 presents the sensitivity tests of our main results. Additional analysis is provided in Section 6. Finally, we set forth our conclusions in Section 7.

2. Related Literature and Hypotheses

Role of female directors

Over the past two decades, there has been both a voluntary and a mandatory increase in the proportion of women on corporate boards worldwide. However, since this is largely a result of the emergence of inclusion and gender equality to create a more balanced society, there has been a great deal of debate over whether boards with more female directors can be justified as a means toward better economic performance. Driven by such a direct motive for understanding female directors' role, many studies focus on the impact on firm value or financial performance. However, findings are mixed. For example Carter, Simkins, and Simpson (2003) find significant positive relationships between the proportion of female directors and firm value. In contrast, Ahern and Dittmar (2012) find that mandated female board representation leads to a deterioration in operating performance, since it results in younger and less experienced boards. Based on performance analysis but taking a more complex business environment into consideration, Farrell and Hersch (2005) suggest that gender diversity tends not to be a value-enhancing strategy, but rather a response to the demand for either internal or external calls for diversity. Adams and Ferreira (2009) show that female directors have a significant impact on firm outcomes, but the average effect of gender diversity on firm performance is negative, and this negative effect is driven by companies with fewer takeover defences, suggesting that mandating gender quotas for directors can reduce firm value for well-governed firms. Post and Byron (2015) conduct a meta-analysis and conclude that board diversity is neither wholly detrimental nor wholly beneficial to firm financial performance. These authors suggest that board diversity may be leveraged to improve firm performance, but this would depend on the particular corporate environment. Taken together, these

findings indicate that focusing purely on firm performance or value enhancement in investigating female directors' role may limit understanding of the impact of gender diversity on boards.

Recent research investigates the role of female directors through a broader scope, considering such factors as corporate strategy and a variety of corporate decisions. From the perspective of directors' monitoring role, Adams and Ferreira (2009) find that gender-diverse boards are associated with better attendance records and that CEO turnover is more sensitive to stock performance in such firms. Nielsen and Huse (2010) show that there is a positive relationship between female directors and board strategic control. Levi, Li, and Zhang (2014) show that firms with female directors decrease the likelihood of making acquisitions and such firms pay lower bid premia. Carter, Franco, and Gine (2017) produce evidence that greater gender diversity on boards reduces the compensation gap between male and female executives. Finally, Chen, Leung, and Goergen (2017) find that firms with a larger proportion of female directors on their boards implement higher dividend payouts. These findings suggest that female directors play a different monitoring role than their male counterparts in the process of corporate decision making. However, despite increasing attention to the effects of gender diversity on corporate decision making, debt maturity structure, as one type of important corporate policy, remains unexplored.

Debt maturity structure

Corporate debt maturity structure serves as an ideal setting to examine the behavioural traits of female directors versus their male counterparts, since it is argued that debt maturity structure is not only one of the key elements of corporate financial policy, it is also an important corporate governance monitoring device. Traditionally, debt maturity structure has been viewed as a mechanism of matching investment opportunities (Barclay & Smith, 1995; Myers, 1977), signalling information to the market (Diamond, 1991b; Flannery, 1986; Rajan, 1992), and influencing tax liabilities (Brick & Ravid, 1985). There is also evidence that corporate debt maturity influences choice of leverage and covenants (e.g. Billett, King, & Mauer, 2007) and long-term and short-term stock price performance and risk (Dang, Lee, Liu, & Zeng, 2018; Datta, Iskandar-Datta, & Raman, 2000).

Considering the governance aspect of debt maturity, since debt with short maturities requires more frequent renewal or refinancing, such debt exposes the firm to higher liquidity risk (Diamond, 1991a; Myers, 1977). Exposure to high liquidity risk thus induces short-term debt to serve as a corporate governance device in controlling for risky overinvestment behaviour (Barnea, Haugen, & Senbet, 1980; Smith and Warner, 1979). Childs, Mauer, and Ott (2005) further argue that short-term debt can mitigate both under- and overinvestment incentives by making the debt less sensitive to changes in firm value and by allowing for more frequent repricing of debt. Overall, to the extent that managers are subject to greater scrutiny and monitoring, short-term debt serves as a monitoring device for curbing managers' risk-seeking behaviour.

We argue that, given the monitoring capacity of short-term debt, it is likely that female directors may employ such debt as a monitoring device to alleviate agency cost. Although the arguments in the literature for the monitoring role of short-term debt derive mainly from the belief that it is debtholders' choice of debt maturity or other contractual devices that subjects managers to more frequent or enhanced monitoring (Rajan & Winton, 1995; Stulz, 2001), theories on determinants of debt maturity suggest that debt maturity structure largely depends on firm discretion (Diamond, 1993; Myers, 1977; Smith, 1986). Barclay and Smith (1995) empirically examine several theoretical hypotheses and generate evidence on the significant influence of firm discretion on the maturity structure of firm debt. Therefore, controlling for the factors that determine debtholder tendency to utilize short-term debt as a monitoring device, we aim to understand whether female directors are more likely than their male counterparts to use short-term debt as a monitoring device.

Female directors and debt maturity structure

Female directors bring particular monitoring features to boards. Research from a multidisciplinary perspective suggests that gender diversity in the boardroom has significant implications for board monitoring. From the perspective of demographic characteristics, female directors increase the demographic diversity of the board, leading to board demographic difference compared to management.[1] Westphal and Zajac (1995) show that powerful CEOs tend to appoint new directors who are demographically similar to themselves, thereby securing support from board members. Carter, Simkins and Simpson (2003) argue that board diversity increases board independence, because directors with a minority gender, ethnicity, or cultural background might bring up questions that would not be raised by directors with a more traditional background. Correspondingly, Hillman, Cannella, and Harris (2002) find female directors bring a variety of occupational expertise and knowledge, advanced education, and closer ties to other organizations. These characteristics may influence the strategic choices of the firm. Further, prior research finds female directors tend to exert greater diligence in monitoring managers, due to their demographic differences (Tsui, Egan and O'Reilly, 1992; Turner, 1982).

Social identity theory suggests that individuals possess a social identity based on their membership in distinct social groups or categories, e.g. gender (Turner, 1982). The corporate governance literature also suggests that formal and informal social ties between directors and the CEO impede the effective monitoring role of directors (Fracassi & Tate, 2012; Hwang and Kim, 2009, 2012; Schmidt, 2015). Ray (2005) argues that directors on a diverse corporate board are more likely to critically examine each others' viewpoints, consider counterarguments, resolve differences by discussion rather than by

[1] There has been a steady increase in executive gender diversity over the past 20 years, but male executives are still the majority in top management teams. For example, based on our analysis of data from S&P Capital IQ, only 24 female CEOs and 58 female CFOs served at Fortune 500 companies in 2015.

consensus, maintain the firm's conscience with regard to ethics and social responsibility, and display increased sensitivity to opportunities and threats to the firm from the external environment. Stephenson (2004) reports that boards with more women are found to surpass all-male boards in their attention to audit and risk oversight and control, and are more likely to ensure conflict of interest guidelines and a code of conduct for the organization. McInerney-Lacombe, Bilimoria and Salipante (2008) find that female directors are associated with better organizational outcomes, and improve and facilitate 'tough' decision making. These findings suggest that female directors are associated with higher-quality board deliberations and discussion of tough issues that could possibly constrain manager behaviour and actions.

In addition, Adams and Ferreira (2009) find that female directors have better attendance records than male directors and are more likely to join monitoring committees and demand greater accountability from managers for poor performance. However, these authors also find that the effect of gender diversity on firm performance depends on firm governance quality, i.e. gender diversity has a positive impact on performance in firms which have weak governance but a negative impact in firms with strong governance. These authors argue that a possible explanation for this is that greater gender diversity could lead to over-monitoring in firms with strong governance. Similarly, Gul, Srinidhi, and Ng (2011) show that the presence of female directors on boards improves the quality of public disclosure and informativeness of stock prices through better monitoring, and that this benefit is particularly high in firms which lack strong governance.

Taken together, empirical evidence from the literature suggests that the nature of female directors' deliberation when carrying out their monitoring roles differs from that of males; they also place more emphasis on monitoring. In turn, short-term debt has been argued to act as an effective monitoring device. On the one hand, such monitoring can reduce the cash flow available for managers to spend at their discretion, thereby avoiding the potential for inefficient investments by managers, consequently controlling managerial overinvestment behaviour (Barnea, Haugen, & Senbet, 1980; Childs, Mauer, & Ott, 2005; Smith & Warner, 1979). On the other hand, short-term debt can enhance managers' incentives to improve the efficiency of fund utilization, by avoiding failure to make frequent short-term debt payments (Hart & Moore, 1994; Rajan & Winton, 1995; Stulz, 2001).

Thus, based on prior empirical evidence that gender-diverse boards are associated with greater monitoring, we conjecture that, ceteris paribus, female directors are more likely than male directors to use a shorter debt maturity structure to monitor managers. Since the monitoring effects from female directors are subject to the quality of the corporate governance of companies whose boards they sit on (Adams & Ferreira, 2009; Chen, Leung, & Goergen, 2017; Gul, Srinidhi, & Ng, 2011), we further hypothesise that the association between female directors and short-term debt is weaker when other corporate governance mechanisms are stronger, and when overinvestment is less likely to occur.

3. Data Sources and Sample Selection

To examine the relationship between female directors and a firm's debt maturity structure, we use several databases to construct our main sample. Specifically, the gender information and corporate governance-related information are primarily from RiskMetrics, which provides director profiles for S&P 1500 companies. Our sample period ranges from 1997 to 2016. Data on debt maturity and firm characteristics are from COMPUSTAT. Following the literature (Barclay & Smith, 1995; Brockman, Martin, & Unlu, 2010; Datta, Iskandar-Datta, & Raman, 2005), we restrict our analysis to industrial firms with Standard Industrial Classification (SIC) codes from 2000 to 5999. We delete those observations for which debt maturity breached sensible bounds (less than zero percent or greater than 100 percent). All continuous variables are winsorized at the 1st and 99th percentiles to mitigate the impact of outliers. Our final sample contains 10,285 observations based on 1,379 unique firms.

Model specification

To examine the relationship between the proportion of female directors and a firm's debt maturity structure, we estimate the following cross-sectional regression model:

$$Debt\ maturity_{i,t} = \beta_0 + \beta_1 Fraction\ of\ Female\ Dire_{i,t} + \beta_2 Firm\ Size_{i,t} + \beta_3 (Firm\ Size)^2_{i,t} + \beta_4 MB_{i,t} + \beta_5 Leverage_{i,t} + \beta_6\ Abnormal\ Earnings_{i,t} + \beta_7 Asset\ Maturity_{i,t} + \beta_8 Z\text{-}score\ Dummy_{i,t} + \beta_9 Rating\ Dummy_{i,t} + \beta_{10} Term\ Structure_{i,t} + \beta_{11} Board\ Size_{i,t} + \beta_{12}\ Independent\ Ratio_{i,t} + \beta_{13} Dual\ Role_{i,t} + \beta_{14} CEO\ Age_{i,t} + \beta_{15} CEO\ Tenure_{i,t} + \varepsilon_{i,t} \quad (1)$$

All variables are explained in the following subsection and defined in Appendix A. We also include two-digit SIC industry dummies and year dummies in the model.

Variable definitions

Debt Maturity. The literature (e.g. Datta et al., 2005; Johnson, 2003) uses the proportion of debt due within three years as a proxy for debt maturity structure, while Brockman, Martin, and Unlu (2010) measure debt maturity structure using both the proportion of total debt maturing in three years or less and the proportion of total debt maturing in five years or less. There is no particular reason to prefer one to the other. Thus, we present our findings using all available measures which can be deemed as short-term debt. Specifically, we measure debt maturity structure using five proxies: proportion of debt maturing in 12 months or less divided by total debt (*ST1*); proportion of debt maturing in two years or less divided by total debt (*ST2*); proportion of debt maturing in three years or less divided by total debt (*ST3*); proportion of debt maturing in four years or less divided by total debt (*ST4*); and proportion of debt maturing in five years or less divided by total debt (*ST5*). This set of measures is also consistent with those employed in the literature (see, e.g. Huang, Tan, & Faff, 2016).

Gender Composition. Our main variable of interest is boardroom gender composition, which is proxied by the proportion of female directors on the board. Specifically presented as *Fraction of Female Dire* in our tables, gender composition is measured as the number of female directors divided by the total number of directors on the board.

Control Variables. Drawing on the literature on debt maturity structures (e.g. Brockman, Martin, & Unlu, 2010; Custódio, Ferreira, & Laureano, 2013; Datta et al., 2005; Harford, Klasa, & Maxwell, 2014; Johnson, 2003), we control for variables for general and financial firm characteristics, factors identified as directly influencing debt maturity structure, and governance features. First, following Johnson (2003) and Custódio, Ferreira, and Laureano (2013), we control for both firm size and firm size squared. Firm size is correlated with debt maturity for several reasons, including economies of scale and information asymmetry. We measure firm size as the natural logarithm of market capitalization. We also include size squared as an additional control variable to capture the nonlinear relation between debt maturity and firm size as predicted by Diamond (1991b); we predict a negative coefficient. Firms with higher growth opportunities tend to use more short-term debt, since short-term debt can alleviate the underinvestment problems faced by firms with higher growth opportunities (Billett, King, & Mauer, 2007). Following Billett, King, and Mauer (2007), we measure growth opportunities using market-to-book ratio, defined as market value of the firm divided by book value of total assets. *Leverage* is the ratio of total debt to total assets. We predict a negative relationship between firm leverage and short-term debt, because firms with high leverage are more likely to employ long-term debt to mitigate refinancing and default risk. According to Flannery (1986), firms with higher abnormal earnings are more likely to issue short-term debt as a signalling device. We thus expect a positive association between abnormal earnings and short-term debt. We measure abnormal earnings as changes in income before extraordinary items from year t to year t+1 scaled by the market value of equity in year t. Following Barclay, Marx, and Smith (2003), we include asset maturity in the regressions. We expect a positive relationship between asset maturity and debt maturity, since firms tend to match their asset maturity with their debt maturity. We also follow Brockman, Martin, and Unlu (2010) to include an Altman (1968) Z-score dummy as a proxy for firm credit quality and default risk. The *Z-score Dummy* takes the value of unity if Z-score is greater than 1.81, and zero otherwise.[2] We expect a negative relationship between short-term debt and the *Z-score Dummy*, because firms with high credit quality are able to issue long-term debt. We also control for whether firms have credit ratings. Since unrated firms are more likely to be of lower credit quality than rated firms, unrated firms may be more likely to be issued short-term debt by debtholders. We measure *Rating Dummy* as an indicator variable, taking a value of 1 if the firm has an S&P credit rating on long-term debt, and zero otherwise. According to

[2] Z-score was developed to predict the probability that a firm will go into bankruptcy. Zones of discrimination according to Z-scores: $Z > 2.99$ – "Safe" Zone; $1.81 < Z < 2.99$ – "Gray" Zone; $Z < 1.81$ – "Distress" Zone (Altman, 1968).

Brick and Ravid (1991), when the term structure of interest is upward-sloping, firms should lengthen their debt maturity due to the greater tax advantages of long-term debt. Thus, we further control for term structure and expect a negative relationship between it and short-term debt. *Term Structure* is measured as the difference between the yield on 10-year government bonds and the yield on 6-month government bonds at fiscal year-end. To capture other boardroom characteristics, we include in our regressions both board size, measured as natural log of the total number of directors on the board, and independence ratio, measured as number of independent directors divided by the total number of directors on the board. We also include several CEO-specific characteristics to control for CEO power, which may constrain the monitoring roles that directors play. *Dual role* is a dummy variable that takes a value of 1 if the CEO is also the chairman of the board, and zero otherwise. CEO age and tenure are measured as age of the CEO and number of years the CEO has been in the position, respectively.

Detailed definitions of all variables are provided in Appendix A.

Descriptive statistics

Table 1 reports summary statistics for the variables used in our analysis. For gender composition, the mean and median values of our sample firms are 0.121 and 0.096, respectively. Our measurements for the dependent variable of short-term debt, *ST1*, *ST2*, *ST3*, *ST4*, and *ST5*, have mean values of 17.6 percent. 26.7 percent, 36.6 percent, 47 percent, and 58.2 percent, respectively. These statistics are consistent with the figures reported in the literature (Brockman, Martin, & Unlu, 2010; Dang & Phan, 2016; Datta et al., 2005). Most control variables in our sample show values similar to those presented in Datta, Iskandar-Datta, and Raman (2005), Brockman, Martin, and Unlu (2010), and Dang and Phan (2016).

[INSERT TABLE 1 HERE]

4. Empirical Results

Baseline regression results

Table 2 reports baseline regression results on how board gender composition affects corporate debt structure using multiple proxies for short-term debt maturity. In line with our hypothesis, the estimated coefficient on *Fraction of Female Dire* is positive and significant when we use *ST1*, *ST2*, or *ST3* as dependent variables, but insignificant when using ST4 and ST5 as dependent variables. In light of the similarity of the results across three proxies for the dependent variable (*ST1*, *ST2*, and *ST3*), we discuss the regression results using *ST1*, i.e. the proportion of debt due within 12 months.

In Table 2, Column (1), we present the results of estimating Eq. (1) using *ST1* as the dependent variable. Consistent with our expectations, we find a coefficient on *Fraction of Female Dire* of 0.109, statistically significant at the 10% level. This finding supports our hypothesis that firms with a higher proportion of female directors are more likely to issue short-term debt. In terms of economic significance, the

coefficient in Column (1) indicates that an increase of 10 percentage points in the proportion of female directors is associated with a 1.09 percentage point increase in firm short-term debt due within 12 months. Regarding control variables, consistent with earlier research and current theory (Brockman, Martin, & Unlu, 2010; Datta, Iskandar-Datta, & Raman, 2005; Huang, Tan, & Faff, 2016), we find that *ST1* is negatively associated with firm size but positively related to firm size squared. The estimated coefficients on leverage, Z-score dummy, rating dummy, and term structure are negative and statistically significant, consistent with the literature. The estimated coefficients on market-to-book ratio and abnormal earnings are positive and statistically significant, also in line with the literature (e.g. Brockman, Martin, & Unlu, 2010; Datta, Iskandar-Datta, & Raman, 2005; Huang, Tan, & Faff, 2016).

[INSERT TABLE 2 HERE]

An alternative explanation for our results shown in Table 2 relates to female directors' risk preference rather than their monitoring role. Levi, Li, and Zhang (2014) suggest that firms with a higher percentage of female directors are less likely to make acquisitions, due to risk aversion. Faccio, Marchica, and Mura (2016) find that firms run by female CEOs tend to be more risk averse. To the extent that the value of long-term debt varies more widely with unanticipated changes in interest rate than with the value of short-term debt, long-term debt is riskier than short-term debt.[3] As such, firms with more female directors might have a preference for short-term debt also because of a high propensity for risk avoidance. If this is the case, we would observe unambiguous effects among female directors regardless of their independence and monitoring incentives. However, we may observe differing effects due to a difference in their independence, because female inside directors do not exert similar monitoring efforts as do independent directors, should the positive association be due to the fact that female directors use debt maturity as a monitoring device.

To gain insight into the mechanisms behind increased short-term debt in the presence of female directors, we then break down female directors into two components, female independent directors and female inside directors. We posit that female independent directors, by undertaking more monitoring, encourage short-term debt more. Results are presented in Table 3. Panel A presents results where the test variable is the proportion of female independent directors, while Panel B presents results for the proportion of female inside directors. In line with our main regression, Panel A shows that female independent directors are more likely to use short-term debt, and the results for ST1 and ST2 remain statistically significant, though ST3 becomes statistically insignificant. Similar to the discussion in our main regression, we discuss the results with reference only to ST1, for purposes of brevity. In Panel A, Column (1), we find that the estimated coefficient of the proportion of female independent directors is positive and statistically significant at the 5% level, indicating that firms with a greater proportion of

[3] In the meantime, the literature discussed in this paper shows mainly that short-term debt exposes firms to high risk of refinancing, renegotiating and liquidity problems.

female directors are more likely to use short-maturity debt (ST1), and this relationship is driven by female independent directors. In Panel B, Column (1), we find that the estimated coefficient of the proportion of female insider directors is statistically insignificant, supporting the notion that the positive relationship between the proportion of female directors and short-term debt is due to female directors' monitoring intention rather than their risk preference.

[INSERT TABLE 3 HERE]

5. Sensitivity Test

In the baseline regressions reported in Table 2, we control for several observable firm characteristics shown to affect corporate debt maturity structures in the literature. However, we still face a challenge in identifying a causal effect of female board representation on corporate debt maturity structures. Female directors are not randomly assigned to firms; e.g. managers who are more likely to issue more short-term debt may also be more likely to call for greater diversity in the boardroom. We apply both IV and PSM approaches (e.g. Chen, Leung, & Goergen, 2017; Huang & Kisgen, 2013) to mitigate potential endogeneity issues.[4]

PSM results

In the first stage, we pool firms with female directors and firms without female directors, and predict the probability that a firm will appoint a female director. To run a logistic regression, we create a dummy variable as the dependent variable, *Female*, which takes the value 1 for firms with female directors and zero for firms without female directors. We predict the probability (i.e. the propensity score) from a logistic regression including various firm characteristics, such as firm size, profitability, leverage, credit quality, and growth opportunities. We also control for industry and year fixed effects in the logistic regression. In Panel A of Table 4, we present logistic regression results on the determinants of female directors. In line with prior literature (Adams & Ferreira, 2009; Chen, Leung, & Goergen, 2017), we find that firms with larger size and larger boards are more likely to have female directors on the board. The pseudo R-squared for the logistic regression is high, with a value of 0.330.

Next, we employ the propensity scores obtained from the logistic regression and perform a one-to-one nearest-neighbour match. Specifically, each firm with female directors on the board (i.e. the treatment sample) is matched to a firm with all-male directors (i.e. the control sample). To guarantee that the treatment sample and the matching sample are sufficiently similar in terms of major firm characteristics,

[4] We also employ the difference-in-difference (DID) approach as used in Chen et al. (2017) to further address potential endogeneity issues. However, applying DID procedure requires information for three consecutive years before year t and at least two consecutive years after year t. Given that our dependent variables including ST5 have a lot of missing values before applying this criterion, we do not obtain sufficient observations to conduct the tests. However, our results are all robust across PSM with different callipers and instrumental variable approaches.

we apply the calliper-matching method, and require that the maximum gap between the propensity score of each treatment firm and that of its matched control firm does not exceed 0.005 in absolute value.[5]

To ensure that there is no significant difference between the treatment sample and the matching sample in terms of observable characteristics, we adopt two diagnostic tests. The first consists of re-estimating the logistic regression for our post-match sample. The logistic regression results obtained using the post-match sample are reported in Column (2) of Panel A of Table 4. None of the estimated coefficients is statistically significant in the post-match sample, indicating that no factors that determine short-term debt maturity are significantly different after matching. The pseudo R-squared also decreases significantly from 0.330 for the pre-match sample to 0.006 for the post-match sample. This finding shows that through the PSM approach, we successfully remove the difference arising from all observable characteristics other than the difference in the presence of female directors.

Our second test compares the difference for each observable firm characteristic between the treated and control samples. In Panel B of Table 4, we report summary statistics, differences in means, and t-test results of the variables used in the matching process for both the treatment sample and the control sample. Indeed, none of the differences in means between the treatment sample and the control sample is statistically significant. In sum, both of our diagnostic tests indicate that we have successfully removed all observable differences other than the difference in the presence of female directors. This increases the likelihood that any difference in corporate debt maturity structure is attributable to the presence of female directors on boards.

Panel C of Table 4 presents the difference in the means of short-term debt between the treated and the control samples. The results suggest that there are significant differences in short-term debt due within 12 months, at the 5% level. The results also indicate that there is no significant difference in short-term debt maturing in two years, three years, four years, and five years between firms with female directors and firms with only male directors. Thus, the findings from applying the PSM mitigate the concern regarding self-selection bias and further confirm our hypothesis.

[INSERT TABLE 4 HERE]

IV results

To further account for the endogeneity problem, following Huang and Kisgen (2013), we use an IV approach to extract the exogenous component from gender composition in the boardroom, and employ it to explain corporate debt maturity structure. We adopt an IV that captures the likelihood of a firm hiring female directors, while remaining unrelated to the corporate debt maturity structure, except through our control variables. Our IV for a firm having female directors is a state-level gender status

[5] We also apply 0.01 and 0.001 as callipers for our matching, and the results (untabulated) remain robust and largely similar.

equality calibrated by Sugarman and Straus (1988). A higher state-level gender status equality value suggests more favourable gender equality in a state. This IV is also used by Huang and Kisgen (2013). The logic of using this instrument is that the more positive a state is toward women's equality in general, the more likely a firm located in that state is to hire female directors. We assign each firm a state-level gender status equality value based on the firm's headquarters location. Thus, we argue that the higher the level of state-level gender status equality, the greater should be the proportion of female board directors.

Table 5 exhibits the two-stage least squares results. Panel A reports the first-stage regression, where the proportion of female board directors is the dependent variable. The explanatory variables include the IV (state-level gender status equality value) and the same control variables used in the baseline model. For brevity, we do not tabulate the coefficient estimates of the explanatory variables, except for our main variable of interest. The coefficient on the IV carries a positive coefficient and is statistically significant at the 1% level. Consistent with the rationale behind the IV (Huang & Kisgen, 2013), the state-level gender status equality value significantly explains the gender composition of the board. We also report the F-statistic, which is very high for the first-stage regression, indicating that our IV is not weak. Moreover, to ensure that our IV is acceptable, we perform Cragg–Donald's Wald F weak-instrument test. The *p*-value of the Cragg–Donald Wald F weak-instrument test statistic is <0.001, rejecting the null hypothesis that the instrument is weak (Cragg & Donald, 1993; Stock & Yogo, 2005) and suggesting that our IV is valid.

Panel B of Table 5 shows the second-stage regressions, where the dependent variables are alternative proxies for short-term debt, namely ST1, ST2, ST3, ST4, and ST5. We replace the *Fraction of Female Dire* with the predicted value of the proportion of female board directors. The coefficients on the predicted values of the proportion of female board directors are positive and statistically significant at the 1%, 5%, and 10% levels when we use ST1, ST2, and ST3 as the dependent variables, respectively, echoing the results from our main results in Table 2. Again, our findings on the control variables are largely in line with the literature (Brockman, Martin, & Unlu, 2010; Datta, Iskandar-Datta, & Raman, 2005). This is consistent with our main hypothesis, and indicates that our key result is not unduly influenced by endogeneity.

Overall, after subjecting the results to a battery of tests to account for both self-selection bias and endogeneity, our results still hold; i.e. firms with female board directors tend to adopt a short-term debt maturity structure. The results from sensitivity tests in this section enhance our argument that the gender composition of boards affects corporate debt maturity structure.

[INSERT TABLE 5 HERE]

6. Additional Tests

Role of corporate governance

Thus far, we include a limited number of corporate governance characteristics which may influence the relationship between board gender composition and corporate debt maturity structure. If firms with female directors are more likely to employ short-term debt as a corporate governance device, then we conjecture that the positive impact of female directors on short-term debt should be more prominent in firms with weak corporate governance and/or high need for corporate governance. We use the entrenchment index of Bebchuk, Cohen, and Ferrell (2009) (E-index) and analyst coverage as proxies for governance monitoring mechanisms.

The E-index is based on six anti-takeover provisions and is formed by calculating the indicator variables for each of the six provisions (staggered boards, limits to shareholder bylaw amendments, poison pills, golden parachutes, supermajority requirements for mergers, and charter amendments) for each firm. A higher E-index value suggests that a firm is less shareholder-friendly, has greater managerial entrenchment, and is more insulated from the external market for corporate control, indicating lower corporate governance quality. Analyst coverage is the natural logarithm of 1 plus the number of analysts who issue earnings forecasts for the firm. Higher analyst coverage suggests a lower level of information asymmetry between managers and outside investors, indicating stronger external monitoring and better governance quality.

Column (1) and Column (2) of Table 6 present the subsample results for weak governance firms and strong governance firms, respectively, based on their E-index median values. The dependent variable in these columns is short-term debt due within 12 months. Note that the numbers of observations for these subsamples are smaller than those in the baseline model because E-index scores are not available for all firms in our sample. The coefficients on the proportion of female directors are positive for both subsamples, but significant only for firms with weak corporate governance, where managerial entrenchment effects are stronger. In a similar fashion, by splitting the sample by above- and below-median values of *Analyst Coverage*, Column (3) and Column (4) of Table 6 estimate high analyst coverage and low analyst coverage respectively. The estimated coefficients on the proportion of female directors are positive and significant only for the low analyst coverage group ($t = 1.883$). Overall, our findings suggest that corporate governance quality and the need for corporate governance affect the impact of female directors on corporate debt maturity structure. The results provide further support to our main argument that female directors, by undertaking more monitoring, are more likely to use short-term debt as a corporate governance device than their male counterparts.

[INSERT TABLE 6 HERE]

Role of financial constraints

Since we argue that short-term debt may be utilized by female directors as a monitoring device to minimize the likelihood of managers overinvesting, we conjecture that the association between the proportion of female directors and short-term debt is stronger when firms have fewer financial constraints, but weaker when firms are more likely to be subject to financial constraints. Following prior studies, we employ three proxies for financial constraints. The first is dividend, measured as an indicator variable with a value of 1 if the firm pays a dividend during fiscal year *t*, and zero otherwise. Fazzari, Hubbard, and Petersen (1988) suggest that financially constrained firms tend to pay lower or no dividends to decrease the necessity of raising external funds in the future. Accordingly, we classify dividend-paying firm–year observations into the financially unconstrained subsample; in contrast, non-dividend-paying firm–year observations are classified into the financially constrained subsample. Column (1) and Column (2) of Table 7 present the subsample results of estimating Eq. (1) for zero-dividend and positive-dividend groups. We conjecture that female directors, by undertaking more monitoring, will promote more short-term debt in financially unconstrained firms. Consistent with our conjecture, we find that the estimated coefficient on the proportion of female directors is positive and significant only for financially unconstrained firms (positive dividend–paying firms).

Our second measure of financial constraint is based on firm bankruptcy risk or financial distress. The rationale for using this measure is as follows. When firms face high probability of financial distress, they have a high likelihood of facing more severe financial constraints. We employ the Z-score developed by Altman (1968) to proxy the probability of firm financial distress, which also influences firms' access to credit, and consequently might limit firm investment. We divide our sample into two groups based on Z-score. High-Z is for firm–year observations with Z-score > 2.99 and Low-Z is for firm–year observations with Z-score < 1.81.[6] Column (3) and Column (4) of Table 7 present the subsample results of estimating Eq. (1) for high-Z and low-Z groups. Our third measure of financial constraint, following the literature (Carpenter, Fazzari, & Petersen, 1994; Faulkender & Wang, 2006; Liu & Mauer, 2011), is firm size. We measure firm size based on a firm's net assets, i.e. total assets minus cash and short-term investments. Given that small firms are generally younger and less well known, they are more vulnerable to capital market imperfections and, hence, will be more financially constrained. Thus, we assign firm–year observations to the financially constrained (unconstrained) group if they have size below (above) the sample median. Columns (5) and (6) of Table 7 present the subsample results of estimating Eq. (1) for the large and small groups.

[6] As noted in footnote 2, Z-score was developed to predict the probability that a firm will go into bankruptcy. Zones of discrimination according to Z-scores: Z > 2.99 – "Safe" Zone; 1.81 < Z < 2.99 – "Gray" Zone; Z < 1.81 – "Distress" Zone (Altman, 1968). Algorithm of Z-score is provided in Appendix A.

As predicted, the positive association between female directors and short-term debt is statistically significant only for the financially unconstrained observations. In contrast, the coefficient on the proportion of female directors is not significant for financially constrained firms, where managers are less likely to undertake self-serving overinvestment.[7] Taken together, our results are robust across all these different measures of financial constraint, suggesting that the positive impact of female directors on short-term debt is significant only for financially unconstrained firms, because difficulties in gaining access to capital markets prevent managers from undertaking non–value-maximizing investment.

[INSERT TABLE 7 HERE]

Role of leverage

To rule out the alternative explanation that debtholders are the party that determines corporate debt maturity structure, in addition to the variables controlling for debtholder influence, we further examine whether the relationship between the proportion of female directors and corporate debt maturity structures is affected by firm leverage levels. We use the median value of leverage for our sample to classify firm–year observations into high leverage and low leverage, and re-estimate Eq. (1) for the two subsamples. Column (1) and Column (2) of Table 8 present the subsample results of estimating Eq. (1) for high-leverage and low-leverage observations, respectively. We then conduct seemingly unrelated estimations to check the equality of the estimated coefficients between the low-leverage group and the high-leverage group. We find no difference between the effects of the proportion of female directors on firm debt maturity structures for firms with low leverage levels and firms with high leverage levels, suggesting that the impact of the proportion of female directors on debt maturity structures is not conditional on the power of debtholders.

[INSERT TABLE 8 HERE]

Investment efficiency

Since we argue that short-term debt serves as a monitoring device used by female directors to reduce the risk of management overinvestment, we further directly test the association between female director and investment inefficiency. Following Richardson (2006) and Stoughton, Wong, & Yi (2017), we derive our measures of investment inefficiency from the following regression model:

$$INEW_{i,t} = \beta_0 + \beta_1 V/P_{i,t-1} + \beta_2 Leverage_{i,t-1} + \beta_3 Cash_{i,t-1} + \beta_4 Age_{i,t-1} + \beta_5 Size_{i,t-1} + \beta_6 Return_{i,t-1} + \beta_7 INEW_{i,t-1} + \delta + \mu_t + \varepsilon_{i,t} \quad (2)$$

[7] We also follow Campello, Graham and Harvey (2010) and Duchin, Ozbas and Sensoy (2010) to use financial crisis as a proxy for financial constraints, and the results are consistent with our conjecture that the positive association between female directors and short-term debt is statistically significant only for the financially unconstrained observations (non-crisis period). Results are not tabulated.

where $INEW_{i,t}$ is the measure of new investment level for firm *i* in fiscal year *t*, consisting of total investment expenditure ($ITotal_{i,t}$) minus the investment expenditure necessary to maintain assets in place ($IMaintenance_{i,t}$). *V/P* is a proxy for growth opportunities. *Leverage* and *Cash* are measures of financial constraint. *Age* is the natural log of (1 + the number of years the firm has been covered by CRSP). *Return* is the change in market value of the firm from *t*-1 to *t*. *Size* is the natural log of firm total assets at the beginning of year *t*. To control for the effects of market movement and unobservable firm characteristics, we also include year and firm fixed effects in our regression model.

We define the absolute value of residuals of the above regression model as our overall, $Overall_{i,t}$, measure of firm-level investment inefficiency. We further define overinvestment proxy and underinvestment proxy as $Under_{i,t}$ = |ε| if ε < 0 and $Over_{i,t}$ = |ε| if ε > 0, respectively. Separation of investment inefficiency into overinvestment and underinvestment helps to distinguish the roles female independent directors play in mitigating investment inefficiency. Panel A of Table 9 presents the regression results of estimating Eq. (2). The negative coefficient on *V/P* suggests that firms with high growth opportunities are associated with higher investment. The positive (negative) coefficient on *Cash* (*Leverage*) shows that firms with less stringent financial constraints are associated with higher investment. Further, the negative coefficient on *Size* is consistent with the firm life cycle view on firm investment.

We now examine the role of female independent directors with respect to investment inefficiency using the following baseline model:

$$INF_{i,t} = \beta_0 + \beta_1 Fraction\ of\ Female\ Dire_{\ i,t-1} + \beta' X_{i,t-1} + \varepsilon_{i,t} \quad (3)$$

where the dependent variable $INF_{i,t}$ represents our three empirical measures of firm-level investment inefficiency, i.e. $Overall_{i,t}$, $Under_{i,t}$ and $Over_{i,t}$, respectively. Our test variable is the proportion of female independent directors. Controls in Eq. (3) refer to the following two sets of control variables. The first set includes proxies for economic determinants of investment inefficiency adopted by Richardson (2006) and Stoughton et al. (2017): *MTB*, *Leverage*, *Cash*, *Size*, *Tangibility*, and *Age*. Our second set of controls captures corporate governance characteristics: *Board Size* and *Independence Ratio*. We also include year and industry (based on two-digit SIC codes) fixed effects.

Panel B of Table 9 presents the results from estimating Eq. (3). The dependent variables are three measures of investment inefficiency: $Overall_{i,t}$, $Over_{i,t}$, and $Under_{i,t}$. The estimated coefficients on female independent directors are negative and statistically significant across Column (1) and Column (2), suggesting that female independent directors are negatively associated with total investment inefficiency and overinvestment. Meanwhile, the estimated coefficient on female independent directors is statistically insignificant in Column (3), where the dependent variable is underinvestment, suggesting that female independent directors have no impact on underinvestment.

[INSET TABLE 9 HERE]

7. Conclusion

Incorporating female directors on boards has been emphasized by regulators, social activists, and the media over the past two decades, and companies have responded to the call. However, investigation of female directors' impact remains limited. Adding to the main stream of research which explores female directors' direct effect on firm performance and firm value, we extend the emerging literature on female directors' monitoring role by examining whether gender composition of boards affects corporate debt maturity structures. Prior literature suggests that female directors have a different kind of deliberation in board discussions and greater monitoring intensity than their male counterparts. Meanwhile, the literature on debt maturity structure suggests that short-term debt can serve as a governance monitoring device by subjecting managers to greater scrutiny, exposing them to higher liquidity risk and reducing cash flow available for overinvestment. Therefore, we hypothesise that boards with more female directors are more likely to use short-term debt as a monitoring device, and the effect is weaker when other corporate governance mechanisms are strong and overinvestment is less likely to occur.

Our findings consistently support our hypothesis across several research methods and a variety of robustness and additional tests. Specifically, we find that firms with a higher proportion of female directors tend to issue more short-term debt than firms with only male directors. This finding is robust after considering unobservable heterogeneity, using the PSM and IV approaches. Further analysis shows that our full sample results are driven by firms with weak governance quality and higher governance needs, suggesting that female directors view short-term debt as a corporate governance mechanism in firms with weak corporate governance and higher governance needs. In addition, we find that the positive relationship between the proportion of female directors and short-term debt disappears when firms have financial constraints, proxied by non-dividend payout, low Z-score, small firm size, and during financial crisis, since overinvestment associated with the free cash flow agency problem decreases due to the decline in internal cash flow and financial constraints. Finally, a more direct test on the association between female independent directors and firm investment inefficiency shows that female directors are negatively associated with total investment inefficiency and overinvestment, but not with underinvestment, suggesting that our underlying hypothesis that female directors utilize short-term debt to minimize the likelihood of overinvestment is more likely to be true.

Overall, our findings contribute to three streams of literature and have practical implications. First, we generate evidence that the presence of female directors is positively associated with use of short-term debt, adding to existing research that finds female directors play a significant role in a series of important corporate decisions. Second, we contribute to the literature that explores various determinants of corporate debt maturity structure and provide evidence that the presence of female directors on boards is one factor that shapes corporate debt maturity policies. Third, we highlight that female directors

undertake more monitoring than their male counterparts by using short-term debt as a monitoring device, especially when firms have weak corporate governance quality and higher corporate governance needs. This contributes to the literature that links gender diversity on boards to monitoring intensity. From the perspective of governance practice, our findings suggest that including female directors on boards could be a substitute governance mechanism that would, without them, be much needed.

Appendix A. Variable Definitions

Variable	Definition
ST1	Proportion of debt maturing in 12 months or less divided by total debt.
ST2	Proportion of debt maturing in two years or less divided by total debt.
ST3	Proportion of debt maturing in three years or less divided by total debt.
ST4	Proportion of debt maturing in four years or less divided by total debt.
ST5	Proportion of debt maturing in five years or less divided by total debt.
Fraction of Female Dire	Number of female directors on the board divided by board size.
Firm Size	Natural logarithm of firm market value.
$(\text{Firm Size})^2$	Square of firm size.
MB	Market-to-book ratio. Ratio of market value of assets to book value of assets.
Leverage	Sum of short-term and long-term debts divided by total assets.
Abnormal Earnings	Ratio of change between income before extraordinary items adjusted for common or ordinary stock equivalents from year *t* to *t*+1 and the market value of equity in year *t*.
Asset Maturity	Ratio of property, plant and equipment to depreciation times the proportion of property, plant and equipment in total assets, plus the ratio of current assets to cost of goods sold times the proportion of current assets in total assets.
Z-score Dummy	Equals 1 if Altman's Z-score is greater than 1.81, and zero otherwise. Following the algorithm in Brockman, Martin, and Unlu (2010), Altman's Z-score is measured as 3.3*OIADP/AT+ 1.2*(ACT-LCT)/AT+SALE/AT+ 0.6*PRCC*CSHO/(DLTT+DLC) +1.4*RE/AT (Data source: COMPUSTAT Annual Industrial file).
Rating Dummy	Equals 1 if the firm has an S&P credit rating on long-term debt, and zero otherwise.

Term Structure	Difference between yield on 10-year government bonds and yield on 6-month government bonds.
Board Size	Natural log of total number of directors on the board.
Independent Ratio	Number of independent directors divided by total number of directors.
Dual Role	Dummy variable that equals 1 if CEO is also chairman of the board, and zero otherwise.
CEO Age	Age of current CEO.
CEO Tenure	Number of years the current CEO has held the position.
ROA	Ratio of operating income before depreciation to total assets.
State-level gender status equality	Assignment of state-level gender status equality value to each firm based on where the firm is headquartered.
E-index	An index, used in Bebchuk, Cohen, and Ferrell (2009), and formed by cumulating the indicator variables for each of six anti-takeover provisions for each firm.
Size	Natural log of total assets at the start of year.
Age	Natural log of (1 + number of years the firm has been listed on the CRSP).
Cash	Cash and short-term investment divided by total assets at the start of year.
Return	Change in market value of the firm.
INEW	Investment measured by the sum of capital expenditure, research and development expenditure, research expenditure, acquisition and sale of property, plant, and equipment (Itotal) minus amortization and depreciation (IMaintenance) divided by total assets at the start of the year.
V/P	Growth opportunities of the firm proxied by assets in place over firm market value, where assets in place are measured as $(1-\alpha\gamma)BV+\alpha(1+\gamma)X-\alpha\gamma d$, $\alpha = \omega/1+\gamma-\omega$, $\gamma = 12\%$, $\omega = 0.62$; BV is book value of assets, d is annual dividend, X is operating income after depreciation (Richardson, 2006).

Overall	Our empirical measure of overall investment inefficiency, which is the absolute value of residuals derived from regression model Eq. (2).
Over	Our empirical measure of overinvestment, which is the negative residual derived from regression model Eq. (2).
Under	Our empirical measure of underinvestment, which is the positive residual derived from regression model Eq. (2).

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Table 1. Descriptive statistics

This table presents summary statistics for our main variables, including observation numbers, mean, standard deviation, 25th percentile, median, and 75th percentile. Our sample contains 10,285 firm–year observations during the period 1997 to 2016. Variable definitions are presented in Appendix A. All continuous variables are winsorized at the 1st and 99th percentiles.

	(1)	(2)	(3)	(6)	(7)	(8)
VARIABLES	N	Mean	SD	p25	p50	p75
ST1	10,285	0.176	0.245	0.016	0.084	0.216
ST2	10,285	0.267	0.281	0.056	0.178	0.366
ST3	10,285	0.366	0.305	0.128	0.291	0.521
ST4	10,285	0.470	0.316	0.226	0.413	0.710
ST5	10,285	0.582	0.308	0.349	0.551	0.900
Fraction of Female Dire	10,285	0.121	0.096	0.000	0.111	0.182
Fraction of Female Indep Dire	10,285	0.110	0.091	0.000	0.111	0.167
Fraction of Female Insider Dire	10,285	0.006	0.026	0.000	0.000	0.000
Firm Size	10,285	8.436	1.556	7.274	8.308	9.495
(Firm Size)2	10,285	73.590	27.120	52.910	69.030	90.150
MB	10,285	1.811	0.974	1.194	1.497	2.080
Leverage	10,285	0.183	0.131	0.082	0.161	0.264
Abnormal Earnings	10,285	0.005	0.116	-0.013	0.004	0.019
Asset Maturity	10,285	11.560	10.370	4.027	7.904	15.820
Z-score Dummy	10,285	0.881	0.324	1.000	1.000	1.000
Rating Dummy	10,285	0.659	0.474	0.000	1.000	1.000
Term Structure	10,285	0.017	0.012	0.006	0.018	0.027
Board Size	10,285	2.243	0.234	2.079	2.303	2.398
Independent Ratio	10,285	0.737	0.154	0.667	0.778	0.875
Dual Role	10,285	0.458	0.498	0.000	0.000	1.000
CEO Age	10,285	54.630	11.500	51.000	56.000	60.000
CEO Tenure	10,285	7.737	6.653	3.000	6.000	10.000
Analyst Coverage	10,285	1.664	1.143	0.000	1.946	2.639
E-index	6,127	3.004	1.354	2.000	3.000	4.000
Dividend	10,285	0.669	0.470	0.000	1.000	1.000
Inew	9,838	0.059	0.085	0.009	0.036	0.085
Cash	9,838	0.117	0.146	0.019	0.059	0.156
Age	9,838	3.253	0.733	2.773	3.367	3.784
Size	9,838	7.874	1.505	6.727	7.745	8.899
V/P	9,838	0.570	0.340	0.345	0.506	0.716
Return	9,838	0.126	0.437	-0.137	0.077	0.301
Tangibility	9,838	0.322	0.219	0.145	0.265	0.470

Table 2. Female directors and debt maturity structures

This table presents estimation results from pooled cross-sectional regressions of debt maturity on the proportion of female directors and control variables. The dependent variable is alternative measures of short-term debt, namely, ST1 (short-term debt due within 12 months), ST2 (short-term debt due within two years), ST3 (short-term debt due within three years), ST4 (short-term debt due within four years) and ST5 (short-term debt due within five years). The sample contains 10,285 firm–year observations for the period 1997–2016. All variables are defined in Appendix A. We control for industry and year fixed effects in all specifications. Standard errors are clustered at the firm level. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
VARIABLES	ST1	ST2	ST3	ST4	ST5
Fraction of Female Dire	0.109*	0.115**	0.102*	0.068	0.033
	(1.911)	(2.023)	(1.801)	(1.212)	(0.565)
Firm Size	-0.156***	-0.202***	-0.234***	-0.197***	-0.138***
	(-4.554)	(-6.010)	(-6.975)	(-6.026)	(-4.176)
(Firm Size)2	0.009***	0.011***	0.013***	0.010***	0.007***
	(4.639)	(6.087)	(6.912)	(5.750)	(3.666)
MB	0.012*	0.007	0.002	-0.003	-0.001
	(1.810)	(1.073)	(0.283)	(-0.434)	(-0.196)
Leverage	-0.444***	-0.507***	-0.498***	-0.420***	-0.283***
	(-8.656)	(-9.088)	(-8.972)	(-7.572)	(-5.146)
Abnormal Earnings	0.043**	0.032	0.035	0.024	0.051**
	(2.409)	(1.633)	(1.586)	(1.137)	(2.491)
Asset Maturity	-0.000	-0.000	-0.001	-0.001**	-0.002***
	(-0.800)	(-0.847)	(-1.363)	(-2.194)	(-3.127)
Z-Score Dummy	-0.069***	-0.080***	-0.077***	-0.058***	-0.045***
	(-6.316)	(-6.400)	(-5.882)	(-4.336)	(-3.249)
Rating Dummy	-0.066***	-0.096***	-0.116***	-0.148***	-0.163***
	(-5.422)	(-7.220)	(-8.208)	(-9.745)	(-10.160)
Term Structure	-1.401	-2.020**	-2.423**	-2.929***	-1.480
	(-1.559)	(-2.062)	(-2.293)	(-2.782)	(-1.471)
Board Size	-0.013	-0.005	0.002	0.006	-0.002
	(-0.619)	(-0.220)	(0.067)	(0.246)	(-0.065)
Independent Ratio	-0.040	-0.047	-0.035	-0.028	-0.010
	(-1.235)	(-1.407)	(-0.990)	(-0.766)	(-0.280)
Dual Role	0.015*	0.010	0.007	0.011	0.006
	(1.716)	(1.080)	(0.769)	(1.112)	(0.618)
CEO Age	-0.000	-0.000	-0.000	-0.000	-0.000
	(-0.450)	(-0.760)	(-0.088)	(-0.180)	(-0.369)
CEO Tenure	0.001	0.001	0.000	0.000	0.000
	(1.021)	(1.268)	(0.561)	(0.060)	(0.183)
Constant	1.120***	1.442***	1.684***	1.648***	1.514***
	(7.024)	(9.374)	(11.101)	(11.239)	(10.222)
Observations	10,285	10,285	10,285	10,285	10,285
Adjusted R-squared	0.160	0.173	0.180	0.194	0.225
Industry dummy	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes

Table 3. Board gender composition and debt maturity structures

This table presents estimation results from pooled cross-sectional regressions of short-term debt on the proportion of female independent directors (Panel A) and the proportion of female insider directors (Panel B). For each panel, the dependent variable is alternative measures of short-term debt, namely, ST1 (short-term debt due within 12 months), ST2 (short-term debt due within two years), ST3 (short-term debt due within three years), ST4 (short-term debt due within four years), and ST5 (short-term debt due within five years). The sample contains 10,285 firm–year observations for the period 1997–2016. All variables are defined in Appendix A. We control for industry and year fixed effects in all specifications. Standard errors are clustered at the firm level. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Panel A

VARIABLES	(1) ST1	(2) ST2	(3) ST3	(4) ST4	(5) ST5
Fraction of Female Indep Dire	0.115**	0.114*	0.085	0.052	0.024
	(2.021)	(1.948)	(1.433)	(0.863)	(0.381)
Firm Size	-0.156***	-0.202***	-0.234***	-0.197***	-0.138***
	(-4.552)	(-6.011)	(-6.983)	(-6.035)	(-4.181)
$(\text{Firm Size})^2$	0.009***	0.011***	0.013***	0.010***	0.007***
	(4.632)	(6.086)	(6.921)	(5.762)	(3.672)
MB	0.012*	0.007	0.002	-0.003	-0.001
	(1.809)	(1.070)	(0.276)	(-0.441)	(-0.199)
Leverage	-0.444***	-0.508***	-0.500***	-0.421***	-0.284***
	(-8.642)	(-9.089)	(-8.995)	(-7.596)	(-5.160)
Abnormal Earnings	0.043**	0.032	0.035	0.024	0.052**
	(2.399)	(1.627)	(1.589)	(1.141)	(2.493)
Asset Maturity	-0.000	-0.000	-0.001	-0.001**	-0.002***
	(-0.781)	(-0.819)	(-1.318)	(-2.161)	(-3.114)
Z-Score Dummy	-0.069***	-0.080***	-0.077***	-0.058***	-0.045***
	(-6.285)	(-6.378)	(-5.873)	(-4.333)	(-3.250)
Rating Dummy	-0.065***	-0.096***	-0.115***	-0.147***	-0.163***
	(-5.372)	(-7.168)	(-8.156)	(-9.715)	(-10.150)
Term Structure	-1.419	-2.040**	-2.441**	-2.941***	-1.485
	(-1.579)	(-2.081)	(-2.308)	(-2.791)	(-1.476)
Board Size	-0.012	-0.004	0.003	0.008	-0.001
	(-0.581)	(-0.165)	(0.145)	(0.305)	(-0.038)
Independence Ratio	-0.048	-0.055	-0.039	-0.030	-0.011
	(-1.478)	(-1.612)	(-1.091)	(-0.803)	(-0.294)
Dual Role	0.014*	0.010	0.007	0.011	0.007
	(1.697)	(1.076)	(0.796)	(1.139)	(0.633)
CEO Age	-0.000	-0.000	-0.000	-0.000	-0.000
	(-0.428)	(-0.740)	(-0.077)	(-0.174)	(-0.367)
CEO Tenure	0.001	0.001	0.000	0.000	0.000
	(1.029)	(1.264)	(0.534)	(0.036)	(0.170)
Constant	1.125***	1.447***	1.687***	1.649***	1.514***
	(7.047)	(9.391)	(11.108)	(11.247)	(10.224)
Observations	10,285	10,285	10,285	10,285	10,285
Adjusted R-squared	0.160	0.173	0.180	0.194	0.225

Industry dummy	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes

Panel B

	(1)	(2)	(3)	(4)	(5)
VARIABLES	ST1	ST2	ST3	ST4	ST5
Fraction of Female Insider Dire	-0.041	0.087	0.222	0.184	0.167
	(-0.294)	(0.559)	(1.341)	(1.083)	(0.962)
Firm Size	-0.157***	-0.203***	-0.235***	-0.198***	-0.139***
	(-4.571)	(-6.051)	(-7.039)	(-6.073)	(-4.203)
$(\text{Firm Size})^2$	0.009***	0.011***	0.013***	0.011***	0.007***
	(4.685)	(6.163)	(7.008)	(5.818)	(3.703)
MB	0.012*	0.007	0.002	-0.003	-0.001
	(1.782)	(1.047)	(0.265)	(-0.443)	(-0.198)
Leverage	-0.449***	-0.512***	-0.502***	-0.422***	-0.284***
	(-8.726)	(-9.163)	(-9.043)	(-7.624)	(-5.167)
Abnormal Earnings	0.044**	0.033*	0.036	0.025	0.052**
	(2.455)	(1.686)	(1.635)	(1.172)	(2.514)
Asset Maturity	-0.000	-0.000	-0.001	-0.001**	-0.002***
	(-0.632)	(-0.687)	(-1.240)	(-2.122)	(-3.099)
Z-Score Dummy	-0.069***	-0.081***	-0.078***	-0.059***	-0.045***
	(-6.313)	(-6.422)	(-5.933)	(-4.383)	(-3.281)
Rating Dummy	-0.064***	-0.095***	-0.115***	-0.147***	-0.163***
	(-5.295)	(-7.124)	(-8.169)	(-9.738)	(-10.180)
Term Structure	-1.421	-2.036**	-2.431**	-2.933***	-1.478
	(-1.582)	(-2.077)	(-2.297)	(-2.784)	(-1.470)
Board Size	-0.007	0.001	0.007	0.010	-0.000
	(-0.342)	(0.052)	(0.295)	(0.389)	(-0.006)
Independence Ratio	-0.031	-0.034	-0.019	-0.016	-0.002
	(-0.960)	(-1.012)	(-0.541)	(-0.448)	(-0.065)
Dual Role	0.016**	0.012	0.009	0.012	0.007
	(1.975)	(1.323)	(0.983)	(1.252)	(0.684)
CEO Age	-0.000	-0.000	-0.000	-0.000	-0.000
	(-0.464)	(-0.785)	(-0.121)	(-0.204)	(-0.387)
CEO Tenure	0.000	0.001	0.000	-0.000	0.000
	(0.817)	(1.079)	(0.416)	(-0.032)	(0.146)
Constant	1.116***	1.436***	1.677***	1.643***	1.510***
	(6.975)	(9.305)	(11.045)	(11.194)	(10.183)
Observations	10,285	10,285	10,285	10,285	10,285
Adjusted R-squared	0.159	0.172	0.180	0.194	0.225
Industry dummy	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes

Table 4. Propensity score matching estimator

This table presents propensity score matching estimation results. Panel A reports the results from logit regression of the likelihood of the presence of female board members. The dependent variable is a dummy variable set to 1 if there are female directors on the board in a given year, and zero otherwise. Panel A presents the pre-match logit regression on the choice of having female directors and the post-match diagnostic regression. Panel B presents the univariate comparison between the treatment group (firms with female directors) and the control sample (firms with only male directors). Panel C presents estimates of the average treatment effects. The dependent variables include alternative measures of short-term debt, namely, ST1 (short-term debt due within one year), ST2 (short-term debt due within two years), ST3 (short-term debt due within three years), ST4 (short-term debt due within four years) and ST5 (short-term debt due within five years). All variables are defined in Appendix A. We control for industry and year fixed effects in all specifications. Values of heteroscedasticity-robust t-statistics are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Panel A

	(1)	(2)
VARIABLES	Pre-match	Post-match
Firm Size	0.336***	-0.018
	(5.332)	(-0.247)
MB	-0.114	0.017
	(-1.476)	(0.209)
Leverage	-2.115***	0.169
	(-3.744)	(0.291)
Abnormal Earnings	0.545***	0.148
	(2.681)	(0.658)
Asset Maturity	0.030***	0.000
	(2.820)	(0.033)
Z-Score Dummy	-0.471**	0.005
	(-2.430)	(0.026)
Rating Dummy	0.103	0.031
	(0.643)	(0.180)
Term Structure	-8.881	6.666
	(-1.018)	(0.628)
ROA	0.215	-0.557
	(0.235)	(-0.610)
Board Size	4.311***	-0.183
	(13.708)	(-0.546)
Independence Ratio	2.975***	-0.086
	(6.833)	(-0.196)
Dual Role	0.462***	0.071

	(3.907)	(0.546)
CEO Age	-0.002	0.001
	(-0.582)	(0.222)
CEO Tenure	-0.024***	-0.008
	(-2.987)	(-0.945)
Constant	-11.377***	0.650
	(-12.236)	(0.639)
Pseudo-R-squared	0.330	0.006
Observations	10,282	3,598
Industry dummy	Yes	Yes
Year dummy	Yes	Yes

Panel B: Differences in firm characteristics

	Firm–year obs. with female dirs. (N = 1799)	Firm–year obs. without female dirs. (N = 1799)	Difference	T-stat
Firm Size	7.623	7.653	0.031	0.762
(Firm Size)^2	59.700	59.887	0.187	0.294
MB	1.746	1.759	0.012	0.378
Leverage	0.186	0.184	-0.002	-0.356
Abnormal Earnings	0.008	0.004	-0.004	-0.841
Asset Maturity	9.379	9.429	0.050	0.170
Z-score Dummy	0.911	0.913	0.002	0.176
Rating Dummy	0.497	0.495	-0.002	-0.133
Term Structure	0.016	0.016	-0.000	-0.909
Board Size	2.124	2.128	0.004	0.626
Independence Ratio	0.704	0.703	-0.001	-0.151
Dual Role	0.396	0.388	-0.008	-0.478
CEO Age	54.450	54.575	0.125	0.318
CEO Tenure	8.439	8.718	0.279	1.138

Panel C: PSM estimator

	Firm–year obs. with female dirs. (N = 1799)	Firm–year obs. without female dirs. (N = 1799)	Difference	T-stat
ST1	0.205	0.185	-0.020**	-2.092
ST2	0.303	0.288	-0.015	-1.353
ST3	0.413	0.398	-0.015	-1.306
ST4	0.525	0.511	-0.015	-1.247
ST5	0.641	0.639	-0.002	-0.195

Table 5. Instrumental variable estimator

This table presents two-stage least squares regression results from Eq. (1). The instrumental variable is the state-level gender status equality value. Panel A reports the results from the first-stage OLS regressions with the proportion of female directors as the dependent variable as well as several instrument validity tests, including F-statistics for excluded instruments and Cragg–Donald's Wald statistic for weak instrument. Panel B presents the second-stage regression results, where the dependent variable is an alternative proxy for short-term debt, namely ST1 (short-term debt due within one year), ST2 (short-term debt due within two years), ST3 (short-term debt due within three years), ST4 (short-term debt due within four years) and ST5 (short-term debt due within five years). All variables are defined in Appendix A. We control for industry and year fixed effects in all specifications. Values of heteroscedasticity-robust t-statistics are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Panel A: First-stage regression	**Dependent variable: Fraction of female directors**
Variable	
State-level gender status equality value	0.001***
	(3.212)
Controls	Yes
Industry Dummy	Yes
Year Dummy	Yes
Observations	10,188
F-statistics	22.710
p-Value	0.000

Cragg–Donald Wald F-statistics	77.299
Stock-Yogo (2005) weak IV test critical value	16.380

Panel B: Second-stage regression

VARIABLES	(1) ST1	(2) ST2	(3) ST3	(4) ST4	(5) ST5
Fraction of Female Dire	2.012***	1.828**	1.305*	0.972	0.307
	(2.590)	(2.323)	(1.683)	(1.217)	(0.364)
Firm Size	-0.141***	-0.188***	-0.223***	-0.189***	-0.134***
	(-3.330)	(-4.611)	(-5.920)	(-5.313)	(-3.994)
$(\text{Firm Size})^2$	0.007***	0.010***	0.012***	0.010***	0.006***
	(2.930)	(4.175)	(5.407)	(4.688)	(3.322)
MB	0.016**	0.011	0.005	-0.001	-0.001
	(2.019)	(1.396)	(0.627)	(-0.155)	(-0.179)
Leverage	-0.340***	-0.413***	-0.430***	-0.368***	-0.266***
	(-4.705)	(-5.546)	(-6.100)	(-5.208)	(-3.715)
Abnormal Earnings	0.024	0.015	0.020	0.013	0.047**
	(1.105)	(0.672)	(0.815)	(0.589)	(2.158)
Asset Maturity	-0.002**	-0.002**	-0.002*	-0.002**	-0.002**
	(-2.126)	(-2.017)	(-1.954)	(-2.257)	(-2.414)
Z-Score Dummy	-0.051***	-0.064***	-0.065***	-0.049***	-0.042***
	(-3.114)	(-3.753)	(-4.061)	(-3.079)	(-2.655)
Rating Dummy	-0.096***	-0.124***	-0.137***	-0.164***	-0.170***
	(-4.671)	(-6.000)	(-6.943)	(-8.232)	(-8.309)
Term Structure	-1.104	-1.676	-2.210**	-2.739**	-1.368
	(-1.065)	(-1.533)	(-1.977)	(-2.515)	(-1.327)
Board Size	-0.113**	-0.095*	-0.060	-0.041	-0.015
	(-2.169)	(-1.810)	(-1.204)	(-0.802)	(-0.283)
Independence Ratio	-0.221***	-0.212***	-0.152*	-0.117	-0.039
	(-2.726)	(-2.587)	(-1.886)	(-1.423)	(-0.468)
Dual Role	-0.017	-0.019	-0.013	-0.005	0.001

	(-0.981)	(-1.039)	(-0.749)	(-0.260)	(0.054)
CEO Age	-0.000	-0.000	0.000	0.000	-0.000
	(-0.165)	(-0.396)	(0.121)	(0.015)	(-0.228)
CEO Tenure	0.003**	0.002**	0.001	0.001	0.000
	(2.258)	(2.127)	(1.244)	(0.650)	(0.154)
Constant	1.177***	1.491***	1.714***	1.669***	1.513***
	(6.418)	(8.481)	(10.432)	(10.680)	(9.954)
Observations	10,188	10,188	10,188	10,188	10,188
Adjusted R-squared	-0.226	-0.065	0.080	0.142	0.221
Industry dummy	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes

Table 6. Board gender diversity, debt maturity structures and monitoring

This table reports subsample analyses of the impact of governance monitoring mechanisms on the relationship between short-term debt and the proportion of female directors. The subsample period is from 1997 to 2016. We use managerial entrenchment index (E-index) and analyst coverage (number of analyst following) to proxy for governance monitoring mechanisms. A low E-index indicates a below-median level of managerial entrenchment index and a high E-index indicates an above-median level of managerial entrenchment index. Low analyst coverage indicates a below-median level of analyst following, and a high analyst coverage indicates an above-median level of analyst following. The dependent variable is short-term debt, namely ST1 (short-term debt due within one year). All variables are defined in Appendix A. We control for industry and year fixed effects in all specifications. Standard errors are clustered at the firm level. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

VARIABLES	(1) High-E	(2) Low-E	(3) High-ANA	(4) Low-ANA
Fraction of Female Dire	0.147**	0.065	0.082	0.183*
	(2.294)	(0.569)	(1.201)	(1.883)
Firm Size	-0.100**	-0.170***	-0.063	-0.256***
	(-2.010)	(-3.594)	(-0.877)	(-3.599)
$(\text{Firm Size})^2$	0.005**	0.009***	0.004	0.014***
	(2.004)	(3.640)	(1.133)	(3.399)
MB	0.012	0.013	0.000	0.035**
	(1.177)	(1.339)	(0.033)	(2.493)
Leverage	-0.377***	-0.522***	-0.370***	-0.561***
	(-6.097)	(-5.514)	(-5.149)	(-7.063)
Abnormal Earnings	0.010	0.098**	0.031	0.024
	(0.284)	(2.284)	(0.860)	(0.642)
Asset Maturity	-0.001**	0.000	0.000	-0.001

	(-2.046)	(0.212)	(0.220)	(-1.229)
Z-Score Dummy	-0.068***	-0.063***	-0.039**	-0.095***
	(-4.888)	(-2.901)	(-2.568)	(-5.377)
Rating Dummy	-0.077***	-0.078***	-0.100***	-0.038**
	(-4.601)	(-3.703)	(-4.367)	(-2.305)
Term Structure	0.044	-5.927**	-2.565*	0.524
	(0.032)	(-2.305)	(-1.670)	(0.411)
Board Size	0.002	0.007	0.006	-0.032
	(0.061)	(0.187)	(0.176)	(-0.876)
Independence Ratio	-0.001	-0.022	0.067	-0.175***
	(-0.023)	(-0.352)	(1.544)	(-3.372)
Dual Role	0.007	0.041***	-0.012	0.036**
	(0.611)	(2.799)	(-1.044)	(2.384)
CEO Age	0.000	-0.000	0.000	0.000
	(0.622)	(-0.294)	(0.042)	(0.041)
CEO Tenure	-0.001	0.000	0.000	0.001
	(-0.850)	(0.327)	(0.305)	(0.689)
Constant	0.816***	1.202***	0.609*	1.592***
	(3.641)	(5.275)	(1.812)	(5.365)
Observations	3,988	2,155	3,758	3,894
Adjusted R-squared	0.149	0.194	0.160	0.207
Industry dummy	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes

Table 7. Board gender diversity, debt maturity structures and financial constraints

This table reports subsample analyses of the impact of financial constraints on the relationship between short-term debt and the proportion of female directors. The subsample period is from 1997 to 2016. To study the impact of financial constraints on the association between short-term debt and the proportion of female directors, we separate firms according to the likelihood that firms suffer from financial constraints. In Columns (1) and (2), we classify firm–year observations based on the presence of dividend-paying. In Columns (3) and (4), we divide our sample into two groups based on Z-scores. High-Z is for firm–year observations with Z-score > 2.99 and Low-Z is for firm–year observations with Z-score < 1.81. In Columns (5) and (6), we divide our sample into two groups based on firm size measured as net assets. 'Large' is for firm–year observations with size above the sample median and 'Small' is for firm–year observations with size below the sample median. The dependent variable is short-term debt, namely ST1 (short-term debt due within one year). All variables are defined in Appendix A. We control for industry and year fixed effects in all specifications. Standard errors are clustered at the firm level. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

VARIABLES	(1) Div	(2) Non-div	(3) High-Z	(4) Low-Z	(5) Large	(6) Small
Fraction of Female Dire	0.158**	0.005	0.135*	0.062	0.121**	0.100
	(2.177)	(0.065)	(1.795)	(1.085)	(2.405)	(1.133)
Firm Size	-0.161***	-0.120**	-0.163***	-0.086*	-0.178**	-0.265***
	(-3.856)	(-2.080)	(-3.980)	(-1.931)	(-2.559)	(-2.775)
$(\text{Firm Size})^2$	0.009***	0.007**	0.009***	0.004*	0.010***	0.015**
	(3.930)	(2.114)	(4.125)	(1.700)	(2.685)	(2.294)
MB	0.028***	-0.006	0.003	-0.023	0.013	0.019*
	(3.291)	(-0.600)	(0.414)	(-1.553)	(1.520)	(1.791)
Leverage	-0.354***	-0.511***	-0.766***	-0.209***	-0.159***	-0.675***
	(-5.328)	(-7.159)	(-9.168)	(-3.530)	(-2.843)	(-9.140)
Abnormal Earnings	-0.017	0.087***	0.006	0.087***	0.006	0.069**
	(-0.721)	(3.215)	(0.159)	(3.131)	(0.298)	(2.364)
Asset Maturity	-0.000	-0.001	-0.001	-0.000	0.000	-0.001
	(-0.493)	(-0.683)	(-0.803)	(-0.448)	(0.540)	(-1.190)
Z-Score Dummy	-0.058***	-0.083***	-	-	-0.020*	-0.113***
	(-4.716)	(-4.190)			(-1.720)	(-5.590)
Rating Dummy	-0.049***	-0.112***	-0.073***	-0.009	-0.069***	-0.055***
	(-3.556)	(-5.624)	(-4.938)	(-0.470)	(-2.718)	(-4.100)

Term Structure	-0.939	-1.866	-1.178	-7.269**	-0.178	-1.808
	(-0.938)	(-1.184)	(-1.147)	(-2.308)	(-0.151)	(-1.415)
Board Size	0.016	-0.082**	-0.030	0.029	0.023	-0.032
	(0.606)	(-2.466)	(-1.156)	(1.119)	(0.945)	(-1.020)
Independence Ratio	-0.093**	0.005	-0.037	0.047	0.027	-0.110**
	(-2.259)	(0.103)	(-0.893)	(1.349)	(0.857)	(-2.206)
Dual Role	0.015*	0.024	0.012	-0.001	0.009	0.018
	(1.654)	(1.544)	(1.164)	(-0.108)	(1.236)	(1.252)
CEO Age	0.000	-0.001	-0.000	0.000	0.000	-0.000
	(0.292)	(-1.054)	(-0.776)	(1.338)	(0.071)	(-0.574)
CEO Tenure	0.001	0.000	0.001	0.001	0.000	0.001
	(1.124)	(0.366)	(1.359)	(1.442)	(0.424)	(0.907)
Constant	1.069***	1.033***	1.200***	0.535***	1.046***	1.635***
	(5.278)	(4.080)	(6.393)	(2.692)	(3.071)	(4.415)
Observations	6,885	3,400	7,379	1,226	5,269	5,016
Adjusted R-squared	0.171	0.178	0.168	0.250	0.137	0.190
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes

Table 8. Board gender diversity, debt maturity structures and financial leverage

This table reports subsample analyses of the impact of financial leverage on the relationship between short-term debt and the proportion of female directors. The subsample period is from 1997 to 2016. To study the impact of financial leverage on the association between short-term debt and the proportion of female directors, we separate firms according to leverage level. A low-leverage sample includes firm–years with below-median leverage level. A high-leverage sample includes firm–years with above-median leverage level. The dependent variable is short-term debt, namely ST1 (short-term debt due within one year). We conduct seemingly unrelated estimations to test the equality of estimated coefficients between two subsamples (Chi-square and *p*-value reported). All variables are defined in Appendix A. We control for industry and year fixed effects in all specifications. Standard errors are clustered at the firm level. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)
VARIABLES	Low-leverage	High-leverage
Fraction of Female Dire	0.169***	0.082***
	(3.522)	(3.237)
Firm Size	-0.158***	-0.081***
	(-6.928)	(-5.356)
(Firm Size)^2	0.009***	0.005***
	(7.048)	(5.568)
MB	-0.012***	-0.003
	(-2.699)	(-0.490)
Leverage	-1.871***	0.011
	(-20.556)	(0.388)
Abnormal Earnings	0.044	0.043***
	(0.901)	(3.115)
Asset Maturity	0.001	-0.001**
	(0.970)	(-2.218)
Z-score Dummy	-0.050	0.000
	(-0.878)	(0.011)
Rating Dummy	-0.079***	-0.018***
	(-6.961)	(-2.869)
Term Structure	-1.721	-2.010**
	(-1.343)	(-2.407)
Board Size	0.004	0.027**
	(0.219)	(2.416)
Independence Ratio	-0.018	-0.007
	(-0.588)	(-0.413)
Dual Role	0.011	0.020***
	(1.212)	(4.012)
CEO Age	-0.001	0.000
	(-1.488)	(0.130)
CEO Tenure	0.001	0.000
	(1.118)	(0.342)
Constant	1.274***	0.451***
	(10.643)	(6.462)
Observations	5,171	5,114

Adjusted R-squared	0.195	0.170
Industry dummy	Yes	Yes
Year dummy	Yes	Yes
Subsample comparison of coefficients on female director ratio	Chi-square = 0.79 (P-value = 0.375)	

Table 9. Board gender diversity and investment efficiency

This table presents the regression results of firm inefficient investments on the ratio of female independent directors.

Panel A of this table reports regression results of optimal investment expenditure. The determinants of investment include proxies for growth opportunities, leverage, firm age, size, cash, and firm and year fixed effects. We use the absolute value of residuals as the proxy for investment inefficiency. The sample period is from 1998 to 2016. All variables are defined in Appendix A. Robust t-statistics are reported in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Panel B reports regression results of investment inefficiency on the ratio of female independent directors, i.e. Eq. (3). The dependent variables are the investment inefficiency proxy variables: *Overall*, *Over* and *Under*, derived from Eq. (2). The sample period is from 1998 to 2016. All variables are defined in Appendix A. We control for industry and year fixed effects in all specifications. Standard errors are clustered at the firm level. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Panel A

VARIABLES	$INEW_{i,t}$
Leverage	-0.098***
	(-16.692)
Cash	0.147***
	(14.951)
Age	0.002
	(0.479)
Size	-0.015***
	(-6.581)
V/P	-0.043***
	(-11.943)
Return	-0.008***
	(-3.944)
INew	-0.001
	(-0.101)
Constant	0.229***
	(10.811)
Observations	9,838
Adjusted R-squared	11.54
Firm dummy	Yes
Year dummy	Yes

Panel B

VARIABLES	(1) Overall	(2) Over	(3) Under
Fraction of Female Indep Dire	-0.015*	-0.022*	-0.008
	(-1.874)	(-1.735)	(-1.226)
MB	0.002**	0.004**	0.001
	(2.282)	(2.252)	(1.080)
Leverage	0.005	0.001	0.007**
	(1.324)	(0.109)	(2.048)
Cash	0.040***	0.056***	0.032***
	(5.060)	(3.858)	(5.304)
Tangibility	-0.009*	-0.013*	-0.008
	(-1.731)	(-1.951)	(-1.575)
Age	-0.001	0.001	-0.002***
	(-1.300)	(0.586)	(-2.607)
Size	-0.003***	-0.004***	-0.003***
	(-5.472)	(-4.605)	(-4.774)
Board Size	-0.001	-0.001	-0.002
	(-0.263)	(-0.110)	(-0.706)
Independence Ratio	0.004	0.006	0.003
	(0.738)	(0.703)	(0.653)
Dual Role	-0.002	-0.002	-0.002*
	(-1.324)	(-0.749)	(-1.662)
CEO Age	-0.000**	-0.000	-0.000*
	(-2.029)	(-1.446)	(-1.855)
CEO Tenure	-0.000	-0.000	-0.000
	(-0.222)	(-0.337)	(-0.074)
Constant	0.090***	0.104***	0.082***
	(8.219)	(6.361)	(8.031)
Observations	9,641	4,073	5,568
Adjusted R-squared	0.072	0.078	0.094
Industry dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes