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# The impact of board gender composition on loan covenant violations

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## Abstract

**Research Question/Issue:** We examine the role of board gender diversity in attenuating loan covenant violations. We also investigate whether the relationship is influenced by female independent directors. Finally, we examine the channels of this relationship.

**Research Findings/Insights:** Drawing on gender socialization and diversity theories, our findings show that firms with gender-diverse boards are less likely to violate loan covenants. We also find that boards with more female directors have a stronger impact on loan covenant violations than those with fewer female directors, consistent with critical mass theory. Our results also suggest that the negative relationship stems from female independent directors rather than from female executive directors. Our channel analyses indicate that the relationship is routed through covenant strictness, the financial performance of firms, and better corporate governance. Our further analysis demonstrates that the relationship is pronounced in female-dominated industries and financially distressed firms, as well as in firms whose directors have greater experience. Our results are robust across a series of sensitivity and endogeneity tests.

**Theoretical/Academic Implications:** We contribute to an emerging strand of literature that examines the link between board gender diversity and loan covenants. We fill a gap in this stream of literature by providing the first empirical evidence that female directors in the boardroom reduce loan covenant violations through their greater integrative bargaining skills during loan deals, improving firm financial performance, and ensuring good corporate governance. Our study also contributes to the growing literature on the differential effects on corporate policies of female directors (independent and executive) and critical mass.

**Practitioner/Policy Implications:** This finding offers significant policy implications for managers, investors, and policymakers. Given the growing frequency of loan covenant violations, the presence of a gender-diverse board should serve as a potent indicator to creditors who have a concern regarding loans. In addition, our study adds to the ongoing debate regarding the business case of board gender diversity.

KEYWORDS
corporate governance, board gender diversity, covenant violations

## 1 | INTRODUCTION

Loan covenants are used by lenders as tools in loan contracts to monitor borrowers (Chava & Roberts, 2008). The violation of such covenants over the course of a loan is a technical default for firms that grant lenders temporary control rights over borrowers (Garleanu & Zwiebel, 2009; Roberts & Sufi, 2009). The violation of loan covenants indicates that firms require intense monitoring, incur additional costs in renegotiating loan contracts, and face issues in future loans (Nini et al., 2012). These violations further translate into pronounced costs in terms of value destruction to shareholders (Beneish & Press, 1993; Chava & Roberts, 2008; Falato & Liang, 2016). Extant literature concurs that board characteristics affect loan pricing and non-pricing provisions, including loan maturity, size, and covenant requirements (Lin et al., 2016). An extensive part of this literature suggests that a gender-diverse board is conducive for shareholders and other stakeholders of firms due to its monitoring effects (Adhikari et al., 2019; Atif et al., 2021; Casu et al., 2023; Cumming et al., 2015; De Amicis & Falconieri, 2023; Dimungu-Hewage & Poletti-Hughes, 2023; Falconieri & Akter, 2023) and that female leaders exhibit less vague corporate communications (De Amicis et al., 2021; De Amicis & Falconieri, 2023). Understanding what benefits gender-diverse boards can provide with respect to covenant violations is a vital concern, given the higher costs associated with these violations. This study helps to reduce the scarcity of research in the area by investigating whether board gender diversity attenuates loan covenant violations.

While there may be some overlap between financial misconduct and covenant violations, we argue that there are definite differences between them. Financial misconduct indicates any unethical and illegal behavior regarding financial matters, including embezzlement, fraud, insider trading, money laundering, and other forms of financial mismanagement (Koch-Bayram & Wernicke, 2018; Raghunandan, 2021). Financial misconduct may lead to fines, criminal charges, and imprisonment. It can also have severe consequences for a company's reputation and the trust of its investors and stakeholders (Zaman et al., 2022). On the other hand, loan covenant violations refer to breaches of the terms and conditions outlined in a contractual loan agreement between lenders and borrowers. These covenants include both financial and non-financial requirements and limitations regarding payment terms, maintenance and operation obligations, and performance benchmarks (Demiroglu & James, 2010; Lim et al., 2020).

While covenant violations may not largely involve illegal behavior, they could result in profound consequences for both parties. Unlike financial misconduct, covenant violations may have an immediate impact on a firm's capital reserves as such breaches may cause loan contract termination, which could result in urgent loan repayment, collateral seizing, and legal action against the borrower (Beneish & Press, 1993; Chava & Roberts, 2008). Moreover, the consequences of violating loan covenants can vary depending on the type of covenant and the severity of the violation (Dyreng et al., 2022). For example, if a borrower triggers an event of default, the lender may accelerate the repayment of the loan, demand immediate repayment of the outstanding balance, and take legal action to recover the outstanding debt. However, if a borrower fails to disclose the required information by the loan agreement, the lender may ask the borrower to provide additional information and comply with the loan agreement. Overall, financial misconduct and covenant violations are significantly different in nature as they have distinct implications and consequences.

We draw arguments based on negotiation skills and monitoring perspectives to postulate that board gender diversity reduces loan covenant violations. More specifically, we refer to gender behavior theory that emphasizes female directors are significantly different from their male peers in terms of their behavior and cognition. For example, female directors spend more time in preparation to understand and analyze information involved in financial transactions and dealings. In addition, female directors are more collaborative, cooperative, and trustworthy (Liu et al., 2014; Perrault, 2015; Strøm et al., 2023), which can be crucial during the negotiation of a loan deal, thereby lowering the covenant restriction and probability of loan covenant violations. Second, gender socialization theory implies that women are less overconfident (Larkin et al., 2013; Levi et al., 2014; Matsa & Miller, 2013) and prudent risk takers (Chen et al., 2017) compared with their male counterparts. Thus, female directors may prioritize financial security and stability, leading to more equitable and inclusive loan dealings. Finally, the agency theory postulates that female directors put more emphasis on monitoring through frequently organizing board meetings and ensuring better attendance to them (Adams & Ferreira, 2009; Goergen & Renneboog, 2014). Enhanced board monitoring increases corporate governance and, thus, its ability to reduce loan covenant violations.

The follow-up question is how board gender diversity influences covenant violations. We argue that board gender diversity is likely to influence covenant violations both directly and indirectly. From a direct perspective, women have superior communication skills and spend more time preparing and analyzing deal information, leading to greater integrative bargaining skills in financial dealings (Kray et al., 2001; Mazei et al., 2015). Hence, firms with more female directors may be better able to negotiate loan deals with less strict covenants, which, in turn, results in less likelihood of covenant violations.

However, one may argue that female directors indirectly influence covenant violations through the firms' financial policies (i.e., improving financial performance and reducing financial risk). Prior studies provide considerable evidence that board gender diversity is positively associated with firm financial performance (Brahma et al., 2021; Liu et al., 2014), which, in turn, assists financially improved firms in meeting

loan covenants. Similarly, Sila et al. (2016) and Sattar et al. (2022) show that gender-diverse boards lower firm risk and enhance risk management, as diversity brings a range of benefits to decision-making, risk assessment, and reputation management. A low-risk firm has less likelihood of covenant violations, as the firm is better able to meet its financial obligations and maintain operations. Finally, board gender diversity improves corporate governance by eliciting higher meeting attendance (Adams & Ferreira, 2009), creating a collaborative decision-making style, and reducing information asymmetry. By implementing best practices in corporate governance, firms with a greater number of female directors are likely to have greater financial and operational controls, reducing the likelihood of covenant violations.

We empirically examine the relationship between board gender diversity and loan covenant violations in US firms for the period 1999–2019. Our results show that firms with greater female board representation experience significantly fewer loan covenant violations. In terms of economic significance, an increase in female directors by 1 (sample) standard deviation decreases the level of loan covenant violation by approximately 9.9%. The negative relationship is more pronounced if more women are on the board, supporting the critical mass theory. In addition, we further subdivide female directors into independent and executive directors and examine their influences on loan covenant violations separately. Our results indicate that female independent directors play a more crucial role in reducing loan covenant violations than female executive directors. This result is intuitive, given the monitoring and advisory roles of independent directors. Moreover, we test the potential channels of the relationship between board gender diversity and loan covenant violations using covenant strictness, the financial performance of firms, and the strength of corporate governance. Our analyses indicate that the relationship is influenced by the level of loan covenant strictness, the financial performance of firms, and better corporate governance. Our further analysis shows that the relationship is pronounced in female-dominated industries and financially distressed firms; also, the level of a director's experience influences this relationship. The empirical results are robust to a series of sensitivity tests: subsample analyses, alternative variables and model specifications, and industry controls and adjustments.

One may argue that firms endogenously choose directors to suit their operating and contracting environments (Adams, 2016; Coles et al., 2008; Harris & Raviv, 2008); thus, our baseline regressions could be endogenously biased. However, our research design allows us to alleviate these endogeneity concerns significantly. First, we employ propensity score matching (PSM) to construct a matched subsample based on firm characteristics. Using a matched subsample, we find that board gender diversity is negatively associated with loan covenant violations. Second, we conduct a difference-in-differences (DID) analysis to examine the change in loan covenant violations. We consider female directors' appointments replacing male directors in the treatment group and male directors' appointments replacing incumbent male directors in the control group. We then use PSM to match the observations in both the treatment and control groups. Our results show that loan covenant violations are lower after appointing a female director than after appointing a male director. Third, we employ the instrumental variable (IV) approach to isolate the exogenous elements from female directors. Following the extant literature (e.g., Atif et al., 2021; Chen et al., 2017), we utilize the female-to-male workforce participation ratio (*FMR*) as an IV for female directors. The first-stage regression shows that *FMR* is positively related to female directors, which indicates the validity of the IV. After endogenous effects are controlled for, there is a negative and significant association between female directors and loan covenant violations.

This study contributes to the extant literature and policy debate in three respects: First, we extend the covenant violations literature. The extant literature examines the cost of covenant violations on firms' financial performances (Chava & Roberts, 2008; Nini et al., 2012; Roberts & Sufi, 2009). Surprisingly, beyond the studies of Fields et al. (2012) and Lim et al. (2020), there appears to be a lack of research on the factors affecting covenant violations. Fields et al. (2012) investigate the impact of board quality on price and non-price loan terms, while Lim et al. (2020) examine how board co-option affects covenant intensity. Our study goes above and beyond and contributes to this thin stream of literature by demonstrating that female directorship is an important determinant affecting loan covenants in the United States. Our study shows that gender-diverse boards should serve as a potent indicator to creditors who have a concern regarding loans.

Second, female independent directors are expected to affect corporate policies through their better capacity for monitoring power due to their independent position. On the contrary, female executive directors have greater executive power and management skills to influence and execute firm policies. In this study, we explore which effect drives the negative relationship between board gender diversity and loan covenant violations. Our findings suggest that the monitoring effect outweighs the executive effect. We also provide empirical evidence that the negative relationship is stronger as the number of female directors increases on the board, consistent with critical mass theory. Hence, our study contributes to a growing stream of literature examining the differential effect of independent and executive female directors on corporate policies and decisions (e.g., Atif et al., 2021; Chen et al., 2017; Liu et al., 2014).

Finally, in our channel analysis, we show that the presence of more female directors on the board reduces covenant strictness, and firms with less stringent loan covenants are less likely to violate them. Hence, our study contributes to a stream of literature that determines the factors of covenant intensity (Lim et al., 2020). Further, we use firm financial performance and corporate governance as indirect channels through which board gender diversity can influence a firm's covenant violations. Hence, our study provides new insights by empirically examining these mechanisms through which female directors influence firm decision-making, including covenant violations. Our study offers significant policy implications for managers, investors, and policymakers by presenting empirical evidence on the ongoing debate regarding the business case for board gender diversity.

The remainder of our study is structured in five sections. Section 2 develops hypotheses based on reviewing the extant literature and relevant theories. Section 3 presents the research design, including data, descriptive statistics, and empirical models. Section 4 discusses the

empirical results, and Section 5 includes a battery of robustness checks, identification, and channel analysis. Section 6 concludes the study.

## 2 | LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

### 2.1 | Theoretical arguments: women and covenant violations

We develop theoretical arguments based on gender behavior, gender socialization, and agency theories to hypothesize why and how board gender diversity could act as a catalyst in reducing covenant violations.

The gender behavior theory postulates that the behavior of men and women is different, largely as a result of socialization and cultural norms and not their innate biological differences. For example, females are encouraged to be nurturing and emotional in the social and cultural spheres, while men are taught to be assertive and competitive (Claes, 1999). Accordingly, female directors could exhibit different behaviors and decision-making styles compared with their male counterparts. For instance, Charness and Gneezy (2012) claim that women are more risk averse and cautious than men, which may lead them to spend more time carefully assessing the relative terms and conditions for available financing options. In a similar vein, Broihanne et al. (2016) contend that adequate preparation helps female directors make robust financial decisions as it scales down risk, boosts confidence, and invigorates relationships with lenders.

Female directors are more likely to be collaborative and inclusive when they make decisions. They frequently ask questions, get advice from others, and encourage other members to share their opinions in team meetings (Adams & Ferreira, 2009). In their survey, McKinsey and Company (2022) find that firms with a higher number of female directors tend to demonstrate collaborative behaviors, such as sharing ideas, fostering constructive criticism, and acknowledging the skills and creativity of others. In a loan dealing, collaborative behaviors led by a more gender-diverse board may facilitate better outcomes, as collaboration helps to negotiate the terms of loan agreements that work for both sides (Trzebiatowski et al., 2022). Moreover, firms with more female directors have a favorable image and reputation in the market (Glass & Cook, 2018). Such a positive image and reputation may help to build a perception of trustworthiness among major stakeholders (Adams & Xu, 2023). Indeed, in the lending decisions of commercial banks, trust and reputation are crucial as they reduce information asymmetry and transaction costs (Gounopoulos et al., 2019; Greenberg, 1980).

Finally, from an agency theory perspective, we argue that board gender diversity helps to reduce covenant violations through improved monitoring. For example, Adams and Ferreira (2009) report that female independent directors are more likely to be appointed for monitoring roles in various board committees to enhance efficiency. This enhanced monitoring role appears to stem from more active participation in strategic decisions of female directors compared with male directors (Dowling & Aribi, 2013). In addition, female directors challenge assumptions, have more enquiries, and bring diverse perspectives to discussions, which enhances the scope of effective monitoring and eventually leads to good governance. In the context of our study, the extant literature shows that firms with active monitoring and improved corporate governance can detect and prevent financial mismanagement (Cumming et al., 2015; Dimungu-Hewage & Poletti-Hughes, 2023; Wang et al., 2022). Thus, we expect that board gender diversity reduces covenant violations via effective monitoring.

### 2.2 | Board gender diversity and corporate malpractices

Recent research shows that greater female representation on boards is linked to decreased corporate malpractice and other misconduct that negatively affect firms' reputations. For instance, Cumming et al. (2015), who investigate the impact of boardroom gender diversity on securities fraud, document that board diversity lowers the incidence and severity of corporate fraud. Female directors are associated with decreased corporate tax aggressiveness (Lanis et al., 2017) and constrained earnings management (García-Lara et al., 2017). Similarly, Wahid (2019) documents that board gender diversity decreases the likelihood of financial misconduct and lowers the propensity of receiving environmental-related sanctions (Liu, 2018). Arnaboldi et al. (2021) report that more female representation on boards substantially decreases the frequency of misconduct fines.

The extant literature argues that the negative relationship between female directors and corporate malpractice is due to monitoring effectiveness. In the context of this study, we argue that firms with more effective board monitoring have less probability of developing severe problems related to loan covenant violations. Because higher female representation on the board is expected to improve board monitoring quality, we anticipate that female directors are more likely to have fewer loan covenant violations. Thus, we propose the following hypothesis:

> **H1.** Firms with female directors experience fewer loan covenant violations, ceteris paribus.

The role of executive versus independent directors in shaping corporate policies is well documented in the literature. Executive directors may impact corporate policies through the executive channel because they devote their invaluable human capital to the firm and have a strong motivation to improve firm performance (Liu et al., 2014). However, they may also have incentives to carry out corporate operations, which may raise a firm's financial performance in the short run (Srinidhi et al., 2011). Unlike executive directors, independent directors do not invest their human capital in the firm but have a strong motivation to sustain their reputation by undertaking effective corporate policies through exercising their monitoring and advisory roles (García-Lara et al., 2017; Srinidhi et al., 2011). Prior studies (e.g., Arun et al., 2015; Atif et al., 2021; García-Lara et al., 2017; Nadeem, 2020) support this argument. For example, Arun et al. (2015) and García-Lara et al. (2017) find that female independent directors ensure better financial reporting

quality, while Atif et al. (2019) show that female independent directors decrease cash holdings. Further, Atif et al. (2021), who find that firms with a greater percentage of female independent directors have better environmental performance through higher renewable consumption, do not find such a link for female executive directors. Considering the positive impact of female independent directors on efficient decision-making, we also expect that female independent directors will reduce loan covenant violations compared with their executive counterparts. Therefore, we postulate the hypothesis below:

> **H2.** Having more female independent directors rather than more female executive directors reduces loan covenant violations.

## 3 | RESEARCH DESIGN

### 3.1 | Sample and data

Our data come from four sources. We use BoardEx for board gender diversity and Thomson Reuters' Loan Pricing Corporation's DealScan database for loan characteristics. We obtain data on the probability of loan covenant violations from Peter Demerjian's website, and our control variables come from the Compustat quarterly file. Borrowers usually obtain multiple "facilities" or "tranches" at the same time, and they are grouped into one "package" of loans or as a "deal" (denominated in US dollars). We use the facility start and end dates of a particular loan package from DealScan for the quarterly distribution of data for reported firms. For this research, we exclude regulated industries due to stringent regulations and require the sample loans to have non-missing information on financial covenants, loan size, and maturity. We obtain control variables for borrower characteristics by matching each loan contract with the quarterly Compustat database based on the DealScan–Compustat link file from Chava and Roberts (2008). We finally merged BoardEx data with the database, which includes 6648 unique loan packages (1089 unique firms) from 1999 to 2019.[1] Our final sample contains 72,966 firm-quarter observations.[2]

### 3.2 | Empirical model and variables

We estimate the following baseline model to examine the effect of board gender diversity on loan covenant violations:

$$CV_{i,t} = \alpha + \beta_1 (FOB)_{i,t} + \beta_2 (\text{controls})_{i,t} + \beta_3 \sum (\text{industry effects})_i + \beta_4 \sum (\text{period effects})_t + \varepsilon_{it}. \quad (1)$$

Following extant literature (e.g., Christensen & Nikolaev, 2012; Demerjian & Owens, 2016), the dependent variable, *CV*, is measured as the aggregate probability of loan covenant violations across all covenants in the loan (*PVIOL*) and is calculated non-parametrically.[3] The data cover all DealScan loan packages. *PVIOL* is the aggregate probability of covenant violations at the loan inception date across all covenants included on a given loan package from the total set of 15 covenant categories, which are divided into two covenant subsets: performance covenants (*PPVIOL*) and capital covenants (*PCVIOL*). We use *PPVIOL* and *PCVIOL* as alternative measures of covenant violation, calculated following the same nonparametric approach as for *PVIOL*, except with aggregated violation probability only across the covenant category subsets of interest rather than across all 15 covenant categories. On a given loan package, the performance covenants (*PPVIOL*) include (1) minimum cash interest coverage, (2) minimum debt service coverage, (3) minimum EBITDA, (4) minimum fixed charge coverage, (5) minimum interest coverage, (6) maximum debt-to-EBITDA, and (7) maximum senior debt-to-EBITDA. On a given loan package, the capital covenants (*PCVIOL*) include (1) minimum quick ratio, (2) minimum current ratio, (3) maximum debt-to-equity, (4) maximum debt-to-tangible net worth, (5) maximum leverage, (6) maximum senior leverage, (7) minimum net worth, and (8) minimum tangible net worth.

The independent variable of interest in this study is female on the board (*FOB*). We measure *FOB* by the fraction of female directors on the board expressed as a percentage of total board size and, alternatively, by the number of female directors on the board (*NFOB*), following extant literature (e.g., Atif et al., 2021; Chen et al., 2017; Gull et al., 2023). We also use three dummy variables, *W1*, *W2*, and *W3*, to measure board gender diversity, more specifically, when testing the validity of critical mass. Dummy variable *W1* is equal to 1 if a firm has one female director on the board and 0 otherwise; dummy variable *W2* is equal to 1 if a firm has two female directors on the board and 0 otherwise; and dummy variable *W3* is equal to 1 if the firm has three or more female directors on the board and 0 otherwise. To empirically examine our H2, we employ female independent directors (*FOBIND*) and female executive directors on the board (*FOBEXE*). *FOBIND* is measured as the number of female independent directors divided by board size, while *FOBEXE* is calculated as the number of female executive directors divided by board size.

The vector *Controls* in the equation represents three types of control variables: corporate governance characteristics, firm characteristics, and loan characteristics consistent with prior studies (e.g., Atif et al., 2021; Lim et al., 2020). For corporate governance characteristics, we control for board size (*BSIZE*) (measured as the total number of directors on a firm board), board tenure (*BTEN*) (measured as the average number of years of directors on the board), board independence (*BIND*) (measured as the number of independent directors divided by the board size), and CEO duality (*DUAL*) (a dummy variable equal to 1 if the CEO is also the chairman of the board and 0 otherwise).

For firm characteristics, we control for a range of attributes, including return on assets (*ROA*), tangibility (*TANG*), distance to default (*DTD*),[4] income volatility (*INCVOL*),[5] capital expenditure (*CAPEX*), leverage (*LEV*), current ratio (*CRATIO*), interest coverage ratio (*INTCOV*), and firm size (*FSIZE*), all of which may impact loan covenant violations. For loan characteristics, we consider the Standard and Poor (S&P) rating of firms (*RATE*), loan maturity (*LMAT*), and the type of facility; for instance, revolving (*REV*), syndicate loan (*SYND*), and the rating by S&P (*SPRATE*). In our analysis, we also use additional variables, such as the global financial crises (*GFC*), the Sarbanes–Oxley

**TABLE 1** Definitions of variables.

| Notation | Variable name | Measure |
|---|---|---|
| Panel A: Loan violation | | |
| *PVIOL* | Probability of covenant violation | Aggregate probability of loan covenant violation across all covenants in the loan. *PVIOL* is based on 15 covenant categories, namely, (1) minimum interest coverage, (2) minimum cash interest coverage, (3) minimum fixed charge coverage, (4) minimum debt service coverage, (5) maximum debt-to-EBITDA, (6) maximum senior debt-to-EBITDA, (7) maximum leverage, (8) maximum senior leverage, (9) maximum debt-to-tangible net worth, (10) maximum debt-to-equity, (11) minimum current ratio, (12) minimum quick ratio, (13) minimum EBITDA, (14) minimum net worth, and (15) minimum tangible net worth |
| *PPVIOL* | Probability of performance covenant violation | (1) Minimum cash interest coverage, (2) minimum debt service coverage, (3) minimum EBITDA, (4) minimum fixed charge coverage, (5) minimum interest coverage, (6) maximum debt-to-EBITDA, and (7) maximum senior debt-to-EBITDA |
| *PCVIOL* | Probability of capital covenant violation | (1) Minimum quick ratio, (2) minimum current ratio, (3) maximum debt-to-equity, (4) maximum debt-to-tangible net worth, (5) maximum leverage, (6) maximum senior leverage, (7) minimum net worth, and (8) minimum tangible net worth |
| Panel B: Gender diversity | | |
| *FOB* | Female on the board | The fraction of female directors on the board expressed as a percentage of the total board size |
| *NFOB* | Number of females on the board | The number of female directors on the board |
| *W1* | Female Dummy 1 | A dummy variable equal to 1 if a firm has one female director on the board and 0 otherwise |
| *W2* | Female Dummy 2 | A dummy variable equal to 1 if a firm has two female directors on the board and 0 otherwise |
| *W3* | Female Dummy 3 | A dummy variable equal to 1 if a firm has three or more female directors on the board and 0 otherwise |
| *FOBIND* | Female independent directors | The number of female independent directors divided by board size |
| *FOBEXE* | Female executive directors | The number of female executive directors divided by board size |
| Panel C: Corporate governance | | |
| *BSIZE* | Board size | The total number of directors on the firm board |
| *BTEN* | Board tenure | The average number of years directors are on the board |
| *BIND* | Board independence | The number of independent directors divided by board size |
| *DUAL* | CEO duality | A dummy variable equal to 1 if the CEO is also the chairman of the board and 0 otherwise |
| Panel D: Firm characteristics | | |
| *ROA* | Return on assets | Firm net income divided by total assets |
| *TANG* | Tangibility | The ratio of property, plant, and equipment of the borrower to total assets |
| *DTD* | Distance to default | Distance to default in year *t*, defined as the annual average of the distance to default for gauging how far a limited-liability firm is away from default |
| *INCVOL* | Income volatility | The operating income variability in year $t-1$ is defined as the coefficient of variation of operating income over a 3-year period |
| *CAPEX* | Capital expenditure | Capital expenditure to total assets |
| *LEV* | Leverage | The sum of short- and long-term debt divided by total assets |
| *CRATIO* | Current ratio | Total current assets to total current liabilities |
| *INTCOV* | Interest coverage ratio | The ratio of EBITDA to interest expense |
| *FSIZE* | Firm size | Natural log of total assets |
| Panel E: Loan characteristics | | |
| *RATE* | Rating of the firm | A dummy variable equal to 1 if the firm is not rated by Standard and Poor and 0 otherwise |
| *LMAT* | Loan maturity | Natural log of loan maturity in months |
| *REV* | Revolving | A dummy variable equal to 1 if a loan is a revolving facility and 0 otherwise |
| *SYND* | Syndicate loan | A dummy variable equal to 1 if a loan is a syndicated facility and 0 otherwise |
| *SPRATE* | Standard and Poor rating | A dummy variable equal to 1 if a loan is rated by Standard and Poor and 0 otherwise |
| Panel F: Additional variables | | |
| *GFC* | Global financial crises | A dummy variable equal to 1 for the sample period 2007–2009 and 0 otherwise |
| *PSOX* | Post-SOX | A dummy variable equal to 1 if the loan was initiated after SOX and 0 otherwise |

**TABLE 1** (Continued)

| Notation | Variable name | Measure |
|---|---|---|
| *W0* | Female dummy 0 | A dummy variable equal to 1 if a firm has at least one female director on the board and 0 otherwise |
| *FCEO* | Female CEO | A dummy variable equal to 1 if a female is CEO and 0 otherwise |
| *CEOCONF* | CEO overconfidence | (Estimated value of in-the-money unexercised exercisable options/fiscal year-end stock price)/ unexercised exercisable options for CEO in year *t* |
| *CB* | Co-opted board | Number of co-opted directors scaled by board size |
| *CEOT* | CEO tenure | Number of average years in the role |
| *CIND* | Co-opted independent director | Number of co-opted independent directors scaled by board size |
| *NIND* | Non-co-opted independent director | Number of independent directors who were on the board before the CEO appointment |
| *DTIME* | Director time in the role | A dummy variable equal to 1 if the director's time in the role is above average and 0 otherwise |
| *DTINCO* | Director time in the firm | A dummy variable equal to 1 if the director's time in the firm is above average and 0 otherwise |
| *STRICT* | Covenant strictness | The variable calculated based on Murfin (2012) |
| *TOBINSQ* | Tobin's *Q* | The ratio of the sum of market capitalization and total assets minus the book value of shareholders' equity divided by total assets |
| *GOV* | Corporate governance score | Corporate governance score as provided in ASSET4 |

Act (*PSOX*), no presence of female directors (*W0*), CEO tenure (*CEOT*), co-opted board characteristics (i.e., *CB*, *CIND*, and *NIND*), CEO overconfidence (*CEOCONF*), female CEO (*FCEO*), a director's experience in the role and in the firm (*DTIME* and *DTINCO*), covenant strictness (*STRICT*), financial performance (*TOBINSQ*), and corporate governance strength (*GOV*). The definitions of all variables are provided in Table 1. To test our empirical model, we use ordinary least squares (OLS) as the baseline method while controlling for industry (using two-digit Global Industry Classification Standards) and period effects in the regressions. The standard errors are corrected for clustering at the firm level to control for heteroskedasticity and within-firm correlation in the residuals (Petersen, 2008). To address the concern related to potential omitted firm-level variables bias, we use firm fixed effects as an alternative specification.

## 3.3 | Descriptive statistics

Table 2 reports summary statistics based on the whole sample. The mean for the aggregate probability of loan covenant violation (*PVIOL*) is .297, with a range between .004 for the 25th percentile and .723 for the 75th percentile. These statistics indicate that there is adequate variation in covenant violations. Similarly, the average values of the probability of capital covenant violation and the probability of performance covenant violation are .055 and .265, respectively. For females on the board, the average for the sample is .126, while the mean values for independent and executive directors are .895 and .009, respectively. Interestingly, these statistics indicate that the sample firms tend to appoint women as independent rather than executive directors. Regarding the gender balance of the corporate boards, nearly 33%, 22%, and 12% of observations have one woman, two women, and three or more women on the board, respectively. These statistics are consistent with Chen et al. (2017) and Atif et al. (2021). Table A1 provides industry distributions of the sample. Figure A1 compares the probability of loan covenant violations with female directors. For each year, the loan covenant violations decrease as the female director's average increases over time.

Regarding corporate governance characteristics, Table 2 shows that the mean board size (*BSIZE*) is 9.072, the average board tenure (*BTEN*) is 9.285, and the average level of board independence (*BIND*) is 89%. On average, the board chair is the CEO in 25% of the firms. In terms of firm characteristics, the mean value of *ROA* is 0.008, the tangibility (*TANG*) average value is 0.458, the distance to default (*DTD*) stands at 5.304, and income volatility (*INCVOL*) and capital expenditure (*CAPEX*) show 0.193 and 0.033 mean values, respectively. On average, 31% of the assets are financed by debt (*LEV*): The current ratio (*CRATIO*) and interest coverage (*INTCOV*) ratios are 1.918 and 20.546, respectively. On average, the firm size (*FSIZE*) is 3.236, and the average value of *RATE* is 0.448, with an average maturity (*LMAT*) of 1.721. On average, 71% of loans are revolving (*REV*), 97% are financed by syndicates (*SYND*), and only 12% of facilities are rated by S&P (*SPRATE*).

Table A2 shows the correlations among the variables used in our regression analysis. As expected, the highest correlation is between *PVIOL* and *PPVIOL* (.932). As a rule of thumb, a correlation coefficient higher than .5 may indicate a multicollinearity issue. However, we use these variables in separate regressions rather than simultaneously. To further explore this issue, we calculate variance inflation factors (VIFs) for all variables. The unreported VIF values for all the variables are within acceptable limits. Overall, multicollinearity is unlikely to be an issue for our regressions because the correlation coefficients of the other variables are less than .50 (Coeff. < .50).

**TABLE 2** Descriptive statistics.

| Variable | N | Mean | SD | p25 | Median | p75 |
|---|---|---|---|---|---|---|
| Panel A: Loan violation | | | | | | |
| *PVIOL* | 72,966 | 0.297 | 0.394 | 0.004 | 0.053 | 0.723 |
| *PCVIOL* | 72,966 | 0.055 | 0.193 | 0.000 | 0.000 | 0.007 |
| *PPVIOL* | 72,966 | 0.265 | 0.382 | 0.000 | 0.030 | 0.521 |
| Panel B: Gender diversity | | | | | | |
| *FOB* | 72,966 | 0.126 | 0.122 | 0.000 | 0.111 | 0.200 |
| *NFOB* | 72,966 | 1.216 | 1.193 | 0.000 | 1.000 | 2.000 |
| *W1* | 72,966 | 0.329 | 0.470 | 0.000 | 0.000 | 1.000 |
| *W2* | 72,966 | 0.223 | 0.417 | 0.000 | 0.000 | 0.000 |
| *W3* | 72,966 | 0.124 | 0.330 | 0.000 | 0.000 | 0.000 |
| *FOBIND* | 72,966 | 0.895 | 0.304 | 0.800 | 0.875 | 0.900 |
| *FOBEXE* | 72,966 | 0.009 | 0.285 | 0.001 | 0.005 | 0.007 |
| Panel C: Corporate governance | | | | | | |
| *BSIZE* | 72,966 | 9.072 | 2.303 | 7.000 | 9.000 | 11.000 |
| *BTEN* | 72,966 | 9.285 | 8.711 | 3.000 | 6.500 | 12.800 |
| *BIND* | 72,966 | 0.895 | 0.304 | 0.800 | 0.875 | 0.900 |
| *DUAL* | 72,966 | 0.253 | 0.435 | 0.000 | 0.000 | 1.000 |
| Panel D: Firm characteristics | | | | | | |
| *ROA* | 72,966 | 0.008 | 0.048 | 0.002 | 0.011 | 0.020 |
| *TANG* | 72,966 | 0.458 | 0.512 | 0.000 | 0.326 | 0.774 |
| *DTD* | 72,966 | 5.304 | 3.432 | 3.501 | 5.145 | 7.626 |
| *INCVOL* | 72,966 | 0.193 | 0.215 | 0.073 | 0.130 | 0.327 |
| *CAPEX* | 72,966 | 0.033 | 0.046 | 0.009 | 0.019 | 0.040 |
| *LEV* | 72,966 | 0.310 | 0.208 | 0.174 | 0.285 | 0.408 |
| *CRATIO* | 72,966 | 1.918 | 1.236 | 1.153 | 1.657 | 2.350 |
| *INTCOV* | 72,966 | 20.546 | 27.691 | 0.631 | 3.718 | 10.520 |
| *FSIZE* | 72,966 | 3.236 | 0.707 | 2.777 | 3.225 | 3.699 |
| Panel E: Loan characteristics | | | | | | |
| *RATE* | 72,966 | 0.448 | 0.500 | 0.000 | 0.000 | 0.1000 |
| *LMAT* | 72,966 | 1.721 | 0.181 | 1.681 | 1.778 | 1.778 |
| *REV* | 72,966 | 0.707 | 0.455 | 0.000 | 1.000 | 1.000 |
| *SYND* | 72,966 | 0.966 | 0.181 | 1.000 | 1.000 | 1.000 |
| *SPRATE* | 72,966 | 0.117 | 0.321 | 0.000 | 0.000 | 0.000 |

*Note*: This table presents the summary statistics for all variables based on the whole sample in five panels (A–E). All the variables are defined in Table 1.

## 4 | EMPIRICAL RESULTS

### 4.1 | Baseline

#### 4.1.1 | Board gender diversity and loan covenant violations

We start our analysis by analyzing the effect of board gender diversity, measured by the fraction of female directors on the board (*FOB*), on loan covenant violations (*PVIOL*). Table 3 illustrates the results of the OLS regressions by estimating Equation (1). Columns 1–3 present the results using *PVIOL* as dependent variable running OLS and fixed effects (FE) regressions, respectively. Columns 1 and 2 show results using OLS without and with control variables, respectively; column 3 uses FE regression while including all the variables. As expected, the coefficient on board gender diversity (*FOB*) is negative and significant at the 1% level in columns 1–3, suggesting that female directors reduce the probability of loan covenant violations. Specifically, a one-percentage-point increase in the proportion of female directors on the board is associated with a 0.233-percentage-point (column 2) decrease in loan covenant violations.[6] The economic significance of the results is also important. For example, an increase in *FOB* by

**TABLE 3** Females on the board and loan covenant violations.

| Variable | OLS (1) | OLS (2) | FE (3) | OLS (4) | OLS (5) | FE (6) | OLS (7) | OLS (8) | FE (9) |
|---|---|---|---|---|---|---|---|---|---|
| | | *PVIOL* | | | *PPVIOL* | | | *PCVIOL* | |
| *FOB* | −0.417*** | −0.233*** | −0.232*** | −0.381*** | −0.192*** | −0.165*** | −0.081*** | −0.038*** | −0.078** |
| | (−8.541) | (−4.235) | (−6.134) | (−5.923) | (−4.132) | (−4.190) | (−4.379) | (−3.112) | (−2.190) |
| *BSIZE* | - | −0.008*** | −0.010*** | - | −0.012*** | −0.010*** | - | 0.009 | −0.002* |
| | - | (−2.635) | (−3.001) | - | (−3.153) | (−3.212) | - | (0.151) | (−1.883) |
| *BTEN* | - | −0.003** | −0.002*** | - | −0.004*** | −0.003*** | - | 0.001** | 0.001** |
| | - | (−2.146) | (−3.055) | - | (−3.462) | (−5.345) | - | (2.069) | (2.135) |
| *BIND* | - | 0.005 | −0.004 | - | 0.009 | −0.007 | - | −0.006 | −0.002 |
| | - | (0.341) | (−1.188) | - | (0.413) | (−1.431) | - | (−0.302) | (−0.080) |
| *DUAL* | - | 0.023** | 0.031** | - | 0.011 | 0.023** | - | 0.010* | 0.010* |
| | - | (2.163) | (2.134) | - | (1.503) | (2.019) | - | (1.889) | (1.892) |
| *ROA* | - | −0.540*** | −0.347*** | - | −0.434*** | −0.336*** | - | −0.165*** | −0.168*** |
| | - | (−7.264) | (−5.119) | - | (−4.072) | (−4.982) | - | (−4.430) | (−3.752) |
| *TANG* | - | −0.032 | −0.021* | - | −0.032** | −0.035*** | - | 0.018* | 0.023*** |
| | - | (−1.511) | (−1.910) | - | (−2.161) | (−3.334) | - | (1.819) | (4.795) |
| *DTD* | - | −0.012*** | −0.010*** | - | −0.006*** | −0.003*** | - | −0.006* | −0.003** |
| | - | (−3.123) | (−4.151) | - | (−4.153) | (−4.076) | - | (−1.833) | (−2.129) |
| *INCVOL* | - | 0.103** | 0.091** | - | 0.041*** | 0.002** | - | −0.001 | 0.000 |
| | - | (2.171) | (2.152) | - | (4.155) | (−2.070) | - | (−0.231) | (0.129) |
| *CAPEX* | - | 0.005 | 0.280*** | - | −0.262*** | −0.292*** | - | 0.552*** | 0.701*** |
| | - | (0.058) | (5.991) | - | (−3.194) | (−6.249) | - | (3.322) | (5.184) |
| *LEV* | - | 0.318*** | 0.320*** | - | 0.320*** | 0.340*** | - | 0.031** | 0.011*** |
| | - | (7.682) | (3.164) | - | (4.745) | (4.335) | - | (2.169) | (3.849) |
| *CRATIO* | - | −0.020*** | −0.026*** | - | −0.022*** | −0.025*** | - | −0.003** | −0.003*** |
| | - | (−5.461) | (−4.143) | - | (−3.182) | (−3.143) | - | (−2.201) | (−4.165) |
| *INTCOV* | - | −0.001 | −0.002 | - | −0.002 | −0.011 | - | 0.000 | 0.004 |
| | - | (−0.771) | (−1.621) | - | (−0.202) | (−0.032) | - | (0.247) | (1.322) |
| *FSIZE* | - | −0.036*** | −0.051*** | - | −0.032*** | −0.053*** | - | −0.004 | −0.007* |
| | - | (−2.726) | (−5.147) | - | (−2.593) | (−3.178) | - | (−0.721) | (−1.935) |
| *RATE* | - | −0.113*** | −0.091*** | - | −0.108*** | −0.092*** | - | −0.023*** | −0.017*** |
| | - | (−4.142) | (−3.557) | - | (−4.272) | (−6.154) | - | (−3.176) | (−3.022) |
| *LMAT* | - | −0.072*** | −0.062*** | - | −0.038* | −0.026*** | - | −0.062*** | −0.062*** |
| | - | (−3.051) | (−3.585) | - | (−1.893) | (−3.052) | - | (−4.888) | (−6.948) |
| *REV* | - | 0.004 | 0.003 | - | −0.004 | −0.005 | - | 0.012*** | 0.012*** |
| | - | (0.246) | (0.282) | - | (−1.072) | (−1.652) | - | (2.838) | (4.844) |
| *SYND* | - | 0.071*** | 0.081*** | - | 0.091*** | 0.096*** | - | −0.053*** | −0.056*** |
| | - | (2.732) | (2.769) | - | (2.809) | (3.136) | - | (−3.140) | (−5.467) |
| *SPRATE* | - | 0.022** | 0.024*** | - | 0.015* | 0.018*** | - | 0.008* | 0.012*** |
| | - | (2.133) | (3.818) | - | (1.857) | (3.986) | - | (1.885) | (4.051) |
| *CONSTANT* | 0.212*** | 1.461*** | 1.374*** | 0.065*** | 1.232*** | 1.266*** | 0.164*** | 0.481*** | 0.355*** |
| | (3.754) | (8.162) | (4.224) | (3.147) | (5.147) | (4.128) | (3.223) | (4.133) | (3.101) |
| *INDUSTRY* | Y | Y | N | Y | Y | N | Y | Y | N |
| *PERIOD* | Y | Y | Y | Y | Y | Y | Y | Y | Y |

(Continues)

**TABLE 3** (Continued)

| Variable | OLS (1) | OLS (2) | FE (3) | OLS (4) | OLS (5) | FE (6) | OLS (7) | OLS (8) | FE (9) |
|---|---|---|---|---|---|---|---|---|---|
| | | *PVIOL* | | | *PPVIOL* | | | *PCVIOL* | |
| *N* | 72,966 | 72,966 | 72,966 | 72,966 | 72,966 | 72,966 | 72,966 | 72,966 | 72,966 |
| Adj. $R^2$ | .073 | .169 | .142 | .068 | .159 | .123 | .068 | .108 | .127 |

*Note*: This table presents regression results for the relationship between board gender diversity and the probability of loan covenant violations (columns 1–3), as well as the alternative measures of loan covenant violations, namely, *PPVIOL* (columns 4–6) and *PCVIOL* (columns 7–9). Robust *t*-statistics are presented in parentheses. All the variables are defined in Table 1.

***Statistically significant at the 1% level.

**Statistically significant at the 5% level.

*Statistically significant at the 10% level.

1 (sample) standard deviation (e.g., using Table 2) decreases the level of loan covenant violations by approximately 9.80%, *FOB*(0.126) × −0.233/*PVIOL*(0.297) = −0.098. Thus, the economic significance is also high.

Further, we check the robustness of our main finding by re-estimating Equation (1) using alternative measures, performance covenant (*PPVIOL*) and capital covenant violations (*PCVIOL*). The results of this analysis are reported in Table 3: columns 4–6 for *PPVIOL* and columns 7–9 for *PCVIOL* using equivalent regressions (as in columns 1–3). Our findings indicate that the coefficient on *FOB* is negative and statistically significant at the 5% or better level of significance. The coefficient on *PPVIOL* is pronounced compared with *PCVIOL*. The plausible explanation may lie in the fact that, on average, firms commit more violations of performance-related covenants than capital covenants (0.055 vs. 0.265). Moreover, performance covenants are more stringent (15 covenant categories) in nature compared with capital covenants (seven covenant categories), resulting in more violations. In addition to board gender diversity, *BSIZE*, *ROA*, *DTD*, *CRATIO*, *FSIZE*, *RATE*, and *LMAT* have a significantly negative relationship with loan covenant violations. In contrast, *DUAL*, *LEV*, and *SPRATE* each have a positive relationship with loan covenant violations. Overall, these results lend strong support to H1.

### 4.1.2 | Critical mass of female directors and loan covenant violations

While having female directors helps reduce loan covenant violations, the critical mass theory posits that the impact of female directors on corporate policies can be significant when they reach a certain threshold level. This theory developed based on the argument of the gender role stereotype (Block, 1973; Sherrick, 2021) and token status (Kanter, 1977). According to this theory, female directors tend to be more influential in decision-making if there are two or more because women feel more comfortable and less constrained (Terjesen et al., 2009) when working in collaboration. An emerging strand of empirical literature supports the fundamental arguments of critical mass theory. For example, Liu (2018) and Arnaboldi et al. (2021) show that female directors become more influential in reducing corporate wrongdoings when their numbers reach a critical mass. Following prior literature, we examine the effect of board gender diversity using an alternative measure (*NFOB*) in Table 4. Columns 1 and 2 present results using OLS without and with control variables, and column 3 shows results using FE regression. Our findings are consistent with the main results in Table 3. Further, we examine the effect of the critical mass of female directors, measured by dummy variables indicating one female director (*W1*), two female directors (*W2*), and three or more female directors (*W3*), on the probability of loan covenant violations. Columns 4–6 of this analysis present the results, which intend to examine whether the influence of female directors on loan covenant violations increases with an increase in their representation on the board of directors.

The results reported in columns 4–6 of Table 4 show that *W1*, *W2*, and *W3* are negatively and significantly (at the 1% level) associated with loan covenant violations. However, the magnitude of the coefficient on *W3* (−0.185) is larger than the coefficient on *W2* (−0.155), while the coefficient on *W2* is larger than the coefficient on *W1* (−0.077) in column 4. This suggests that the magnitude of the negative relationship between board gender diversity and loan covenant violations increases with an increase in the number of female directors on the board. We then perform the Wald test to examine the difference in the coefficients, and the unreported results indicate that the coefficients on *W1*, *W2*, and *W3* are significantly different.

Consistent with prior studies (Atif et al., 2019; Torchia et al., 2011), these findings lend support to Kristie's (2011, p. 22) review of critical mass theory by showing that "one is token, two is presence, and three is a voice." Taken together, these results support prior studies: The impact of board gender diversity on loan covenant violations is more pronounced in firms that have attained a critical mass.

### 4.1.3 | Which female director type influences loan covenant violations more?

So far, we have established that female directors are negatively linked to the probability of loan covenant violations. One may raise a follow-up question of whether all female directors behave similarly. Put differently, we attempt to examine the channel via which female directors influence the relationship. To do so, we follow the existing literature and explore the monitoring and executive power channels

**TABLE 4** Number of women on the board and loan covenant violations.

| Variable | OLS (1) | OLS (2) | FE (3) | OLS (4) | OLS (5) | FE (6) |
|---|---|---|---|---|---|---|
| | | | *PVIOL* | | | |
| *NFOB* | −0.050*** | −0.023*** | −0.025*** | - | - | - |
| | (−7.770) | (−3.831) | (−22.033) | - | - | - |
| *W1* | - | - | - | −0.077*** | −0.037*** | −0.047*** |
| | - | - | - | (−4.259) | (−2.857) | (−3.147) |
| *W2* | - | - | - | −0.155*** | −0.083*** | −0.094*** |
| | - | - | - | (−6.474) | (−4.028) | (−4.117) |
| *W3* | - | - | - | −0.185*** | −0.097*** | −0.106*** |
| | - | - | - | (−3.651) | (−4.581) | (−6.236) |
| *BSIZE* | - | −0.005* | −0.007*** | - | −0.005 | −0.005*** |
| | - | (−1.860) | (−5.741) | - | (−1.386) | (−5.866) |
| *BTEN* | - | −0.003*** | −0.002*** | - | −0.003*** | −0.002*** |
| | - | (−2.692) | (−7.155) | - | (−2.552) | (−3.550) |
| *BIND* | - | −0.003 | −0.015*** | - | −0.008 | −0.019*** |
| | - | (−0.223) | (−3.495) | - | (−0.487) | (−5.866) |
| *DUAL* | - | 0.023* | 0.030*** | - | 0.024* | 0.029*** |
| | - | (1.958) | (2.973) | - | (1.952) | (4.737) |
| *ROA* | - | −0.542*** | −0.348*** | - | −0.533*** | −0.542*** |
| | - | (−4.467) | (−7.153) | - | (−4.458) | (−6.130) |
| *TANG* | - | −0.021 | −0.022*** | - | −0.022 | −0.022*** |
| | - | (−1.622) | (−3.830) | - | (−1.387) | (−4.783) |
| *DTD* | - | −0.006** | −0.014** | - | −0.015** | −0.004*** |
| | - | (−2.180) | (−2.134) | - | (−2.159) | (−4.168) |
| *INCVOL* | - | 0.105** | 0.119** | - | 0.002*** | 0.018*** |
| | - | (2.180) | (2.139) | - | (2.199) | (4.178) |
| *CAPEX* | - | 0.011 | 0.283*** | - | 0.002 | 0.261** |
| | - | (0.074) | (4.044) | - | (0.019) | (2.165) |
| *LEV* | - | 0.223*** | 0.332*** | - | 0.319*** | 0.327*** |
| | - | (4.189) | (3.121) | - | (4.601) | (3.525) |
| *CRATIO* | - | −0.027*** | −0.026*** | - | −0.024*** | −0.026*** |
| | - | (−4.478) | (−5.014) | - | (−4.563) | (−4.120) |
| *INTCOV* | - | −0.001 | −0.002 | - | −0.004 | −0.007 |
| | - | (−0.549) | (−0.381) | - | (−0.833) | (−0.551) |
| *RATE* | - | −0.036*** | −0.052*** | - | −0.034** | −0.052*** |
| | - | (−2.819) | (−3.590) | - | (−2.173) | (−5.452) |
| *LSIZE* | - | −0.114*** | −0.093*** | - | −0.112*** | −0.092*** |
| | - | (−6.588) | (−4.521) | - | (−6.472) | (−6.453) |
| *LMAT* | - | −0.073*** | −0.068*** | - | −0.073*** | −0.067*** |
| | - | (−3.121) | (−4.089) | - | (−3.164) | (−6.158) |
| *REV* | - | 0.002 | 0.001 | - | 0.003 | 0.002 |
| | - | (0.255) | (0.289) | - | (1.313) | (0.456) |
| *SYND* | - | 0.071*** | 0.070*** | - | 0.071*** | 0.070*** |
| | - | (2.793) | (4.505) | - | (2.799) | (4.650) |
| *SPRATE* | - | 0.022** | 0.027*** | - | 0.021** | 0.027*** |
| | - | (2.105) | (4.770) | - | (2.127) | (4.718) |

(Continues)

**TABLE 4** (Continued)

| Variable | OLS (1) | OLS (2) | FE (3) | OLS (4) | OLS (5) | FE (6) |
|---|---|---|---|---|---|---|
| | *PVIOL* | | | | | |
| *CONSTANT* | 0.222*** | 1.445*** | 1.354*** | 0.247*** | 1.430*** | 1.349*** |
| | (4.150) | (7.199) | (5.962) | (4.421) | (5.441) | (5.120) |
| *INDUSTRY* | Y | Y | N | Y | Y | N |
| *PERIOD* | Y | Y | Y | Y | Y | Y |
| *N* | 72,966 | 72,966 | 72,966 | 72,966 | 72,966 | 72,966 |
| Adj. $R^2$ | .101 | .166 | .126 | .094 | .169 | .164 |

*Note*: This table presents regression results for the relationship between board gender diversity and the probability of loan covenant violations using alternative measures (columns 1–3), as well as the dummy variables of *W1*, *W2*, and *W3* (columns 4–6). Robust *t*-statistics are presented in parentheses. All the variables are defined in Table 1.

***Statistically significant at the 1% level.

**Statistically significant at the 5% level.

*Statistically significant at the 10% level.

(i.e., independent vs. female executive directors). Female independent directors are expected to impact strategic decisions, such as relationships with creditors and stakeholders via the monitoring channel, because of their independent status and advisory role; female executive directors may influence strategic decisions as they are directly involved in management and policy implementation (Atif et al., 2019, 2020; Chen et al., 2017; Do et al., 2023). We report the results of this analysis in Table 5 (columns 1–3), finding that female independent directors (*FOBIND*) have a significantly negative impact on the probability of loan covenant violations. However, female executive directors (*FOBEXE*) have a less significant impact, using OLS only. As expected, the impact of board gender diversity on the probability of loan covenant violations is mainly driven by female independent directors, supporting H2. These findings are consistent with extant literature (e.g., Atif et al., 2019; Chen et al., 2017).

## 5 | ROBUSTNESS, IDENTIFICATION, CHANNEL ANALYSIS, AND ADDITIONAL ANALYSIS

### 5.1 | Robustness checks

In this section, we re-examine the main findings using several robustness tests, including alternative measures of board gender diversity and the probability of loan covenant violations (i.e., the industry-adjusted [*PVIOL-INDADJ*] probability and the mean-adjusted [*PVIOL-MEANADJ*] probability of loan covenant violations); excluding dominating industry sectors from the sample; controlling for additional loan characteristics, additional board characteristics, and additional CEO characteristics; and using a subsample excluding the global financial crisis (GFC) period.

First, to check whether our results are sensitive to the choice of board gender diversity measures, we conduct the following check using the industry-adjusted percentage of female directors (*FOBINDADJ*) in panel A.

Second, as our main findings may be driven by the Industrial and Consumer Discretionary sectors due to their dominating number of observations in the sample, we address this concern by excluding such dominating sectors from the regression in panel B.

Third, loan covenant violations may have been impacted by the implementation of the Sarbanes–Oxley Act 2002 (SOX) due to its rigid regulations and monitoring. In addition, the extent and severity of loan covenants are impacted by the performance pricing grid. To address these concerns, we control for additional loan characteristics: *PSOX*, a dummy variable equal to 1 if a loan is initiated post-SOX and 0 otherwise; *performance pricing*, a dummy variable equal to 1 if the loan contains performance pricing grid and 0 otherwise. See panel C.

Fourth, one may argue that board characteristics such as board co-option may influence covenant violations, given the weaker governance mechanism associated with such boards (Lim et al., 2020). To address this concern, we control for board co-option (*CB*, measured as the number of co-opted directors scaled by board size), co-opted independence (*CIND*, measured as the co-opted independent directors scaled by board size), and non-co-opted independent directors (*NIND*, measured as the number of independent directors who were on the board before the CEO appointment) in panel D.

Fifth, GFC may impact the loan covenant violations due to the liquidity crunch; therefore, we exclude the GFC period in panel E. Finally, we examine if a male-dominated board is more likely to appoint an overconfident CEO than a gender-diverse board, which may have a different impact on the probability of loan covenant violations. We control for additional CEO characteristics, including CEO tenure (*CEOT*, measured as the average number of years in the role), female CEO (*FCEO*, a dummy variable equal to 1 if the CEO is female and 0 otherwise), and CEO overconfidence in panel F. Table 6 reports the regression results for these sensitivity tests including the control variables, industry, and period effects. In line with our main results, we find that board gender diversity decreases the probability of loan covenant violations across panels A to F.

**TABLE 5** Women on the board and loan covenant violations.

| Variable | OLS (1) | OLS (2) | FE (3) |
|---|---|---|---|
| | | *PVIOL* | |
| *FOBIND* | −0.418*** | −0.233*** | −0.251*** |
| | (−7.184) | (−4.422) | (−3.538) |
| *FOBEXE* | −0.031* | −0.008* | −0.004 |
| | (−1.978) | (−1.815) | (−1.133) |
| *BSIZE* | - | −0.008*** | −0.010*** |
| | - | (−2.835) | (−3.011) |
| *BTEN* | - | −0.003** | −0.006*** |
| | - | (−2.646) | (−3.155) |
| *BIND* | - | 0.007 | −0.004 |
| | - | (1.340) | (−1.199) |
| *DUAL* | - | 0.023** | 0.031*** |
| | - | (1.982) | (3.124) |
| *ROA* | - | −0.540*** | −0.543*** |
| | - | (−5.464) | (−4.149) |
| *TANG* | - | −0.022 | −0.012*** |
| | - | (−1.416) | (−3.814) |
| *DTD* | - | −0.018*** | −0.023*** |
| | - | (−4.336) | (−3.251) |
| *INCVOL* | - | 0.092** | 0.064*** |
| | - | (2.136) | (2.892) |
| *CAPEX* | - | 0.004 | 0.222 |
| | - | (0.050) | (0.092) |
| *LEV* | - | 0.321*** | 0.331*** |
| | - | (9.622) | (3.365) |
| *CRATIO* | - | −0.023*** | −0.026*** |
| | - | (−5.468) | (−9.143) |
| *INTCOV* | - | −0.001* | −0.002 |
| | - | (−1.871) | (−1.311) |
| *FSIZE* | - | −0.033*** | −0.051*** |
| | - | (−2.748) | (−3.847) |
| *RATE* | - | −0.114*** | −0.083*** |
| | - | (−8.440) | (−6.667) |
| *LMAT* | - | −0.073*** | −0.067*** |
| | - | (−3.043) | (−3.105) |
| *REV* | - | 0.002 | 0.004 |
| | - | (0.246) | (0.282) |
| *SYND* | - | 0.072*** | 0.072** |
| | - | (2.639) | (2.169) |
| *SPRATE* | - | 0.022** | 0.019*** |
| | - | (2.136) | (3.138) |
| *CONSTANT* | 0.202*** | 1.462*** | 1.270*** |
| | (3.561) | (3.322) | (5.424) |
| *INDUSTRY* | Y | Y | N |
| *PERIOD* | Y | Y | Y |
| *N* | 72,966 | 72,966 | 72,966 |
| Adj. $R^2$ | .076 | .166 | .159 |

*Note*: This table presents regression results for the relationship between female independent directors and female executive directors and the probability of loan covenant violations (columns 1–3). Robust *t*-statistics are presented in parentheses. All the variables are defined in Table 1.
***Statistically significant at the 1% level.
**Statistically significant at the 5% level.
*Statistically significant at the 10% level.

## 5.2 | Identification strategies

We acknowledge that our main findings might be subject to endogeneity concerns due to female board representation. For instance, one may argue that the boards of directors are endogenously chosen by firms to suit their operations. Hence, our results may suggest correlation rather than causation. In addition, given the shortage of a qualified pool of women, female directors enjoy the freedom to self-select boards of firms with better debt management, including fewer covenant violations. Therefore, our independent variable (*FOB*) may suffer from a self-selection bias and, as a result, may not be systematically associated with the dependent variable (*PVIOL*). To address this potential endogeneity concern, we use three identification strategies: PSM, DID, and two-stage least squares (2SLS).

### 5.2.1 | PSM

We use PSM following prior studies (e.g., Ahmed et al., 2021; Lennox et al., 2011) in two steps to control for firm characteristics that may influence loan covenant violations.[7] In the first step, we generate a dummy variable (*W0*), which takes the value of 1 if the firm has at least one woman on the board and 0 otherwise. We then define the treatment and control groups based on firm years with and without female directors. After that, we estimate a probit regression to explain *W0* (i.e., the probability that a firm has female directors) with similar control variables employed in Equation (1), including industry and period effects. As presented in the results in panel A (column 1) of Table 7, we find that most of the control variables are significant, and the pseudo-$R^2$ is reasonably high (.292). We then perform one-to-one matching without replacement at the 1% level caliper distance to make sure that firms in both treatment and control groups are adequately identical and indistinguishable. Based on these criteria, we received 27,228 matched observations and formed two similar subsamples from the treatment and control groups.[8]

Following Chen et al. (2017) and Atif et al. (2019), we run two diagnostic tests to confirm that the firm-year observations in both groups are identical regarding observable characteristics. The first test re-estimates the probit regression for the post-match sample. The

**TABLE 6** Robustness analysis.

| Variable | *PVIOL* | *PVIOL-INDADJ* | *PVIOL-MEANADJ* | *PPVIOL* | *PCVIOL* |
|---|---|---|---|---|---|
| Panel A: OLS regression ($N = 72{,}966$) | | | | | |
| *FOB-INDADJ* | −0.199** | −0.157*** | −0.204** | −0.134*** | −0.024*** |
| | (−4.165) | (−3.225) | (−2.132) | (−3.130) | (−2.783) |
| *CONTROLS* | Yes | Yes | Yes | Yes | Yes |
| *INDUSTRY* | Yes | Yes | Yes | Yes | Yes |
| *YEAR* | Yes | Yes | Yes | Yes | Yes |
| Panel B: Excluding industrial and consumer discretionary sectors ($N = 43{,}070$) | | | | | |
| *FOB* | −0.224** | −0.287*** | −0.243** | −0.125** | −0.068** |
| | (−2.173) | (−3.321) | (−2.111) | (−2.197) | (−2.132) |
| *CONTROLS* | Yes | Yes | Yes | Yes | Yes |
| *INDUSTRY* | Yes | Yes | Yes | Yes | Yes |
| *YEAR* | Yes | Yes | Yes | Yes | Yes |
| Panel C: Controlling for additional loan characteristics post-SOX, performance pricing ($N = 14{,}568$) | | | | | |
| *FOB* | −0.212** | −0.178*** | −0.138** | −0.195** | −0.053* |
| | (−2.203) | (−3.341) | (−2.147) | (−2.057) | (−1.904) |
| *CONTROLS* | Yes | Yes | Yes | Yes | Yes |
| *INDUSTRY* | Yes | Yes | Yes | Yes | Yes |
| *YEAR* | Yes | Yes | Yes | Yes | Yes |
| Panel D: Controlling for additional board characteristics co-opted board, co-opted independent director, and non-co-opted independent directors ($N = 64{,}345$) | | | | | |
| *FOB* | −0.250*** | −0.118*** | −0.156** | −0.162* | −0.088*** |
| | (−4.100) | (−3.198) | (−2.132) | (−1.894) | (−3.193) |
| *CONTROLS* | Yes | Yes | Yes | Yes | Yes |
| *INDUSTRY* | Yes | Yes | Yes | Yes | Yes |
| *YEAR* | Yes | Yes | Yes | Yes | Yes |
| Panel E: Excluding the GFC period 2007–2009 ($N = 64{,}358$) | | | | | |
| *FOB* | −0.182*** | −0.185** | −0.106* | −0.167** | −0.062** |
| | (−2.267) | (−2.201) | (−1.872) | (−2.143) | (−2.109) |
| *CONTROLS* | Yes | Yes | Yes | Yes | Yes |
| *INDUSTRY* | Yes | Yes | Yes | Yes | Yes |
| *YEAR* | Yes | Yes | Yes | Yes | Yes |
| Panel F: Controlling for additional CEO characteristics *CEOT*, *CEOCONF*, and *FCEO* ($N = 66{,}435$) | | | | | |
| *FOB* | −0.101** | −0.093* | −0.165 | −0.182** | −0.134** |
| | (−1.931) | (−1.893) | (−1.072) | (−2.113) | (−2.188) |
| *CONTROLS* | Yes | Yes | Yes | Yes | Yes |
| *INDUSTRY* | Yes | Yes | Yes | Yes | Yes |
| *YEAR* | Yes | Yes | Yes | Yes | Yes |

*Note*: This table presents the results of additional analyses using alternative variables (panel A), excluding dominating industry sectors in the sample (panel B), controlling for additional loan characteristics (panel C), controlling for additional board characteristics (panel D), excluding the GFC period (panel E), and controlling for additional CEO characteristics (panel F). Industry and period effects are included in the regressions. Robust *t*-statistics are presented in parentheses. All the variables are defined in Table 1.

Abbreviations: GFC, global financial crisis; OLS, ordinary least squares.

***Statistically significant at the 1% level.

**Statistically significant at the 5% level.

*Statistically significant at the 10% level.

**TABLE 7** Propensity score matching.

| Panel A Variable | Pre-match | Post-match | |
|---|---|---|---|
| | *W0* | | *PVIOL* |
| *FOB* | - | - | −0.258*** |
| | - | - | (−3.315) |
| *BSIZE* | 0.433*** | −0.102* | −0.015*** |
| | (5.138) | (−1.891) | (−2.634) |
| *BTEN* | −0.001 | 0.005 | −0.006 |
| | (−0.265) | (0.548) | (−0.271) |
| *BIND* | 1.128*** | 0.277 | 0.022 |
| | (4.744) | (1.153) | (1.353) |
| *DUAL* | 0.054 | −0.257 | 0.052** |
| | (1.479) | (−1.672) | (2.160) |
| *ROA* | 1.150*** | 0.337 | −0.494*** |
| | (3.172) | (0.574) | (−3.310) |
| *TANG* | 0.231** | 0.161 | −0.033** |
| | (2.163) | (1.237) | (−2.127) |
| *DTD* | −0.019 | −0.004 | −0.001*** |
| | (−0.243) | (−0.884) | (−3.504) |
| *INCVOL* | 0.098 | 0.005 | 0.006** |
| | (1.373) | (0.835) | (2.104) |
| *CAPEX* | −1.743** | −1.810 | −0.203 |
| | (−2.149) | (−1.461) | (−1.012) |
| *LEV* | −0.955*** | −0.235 | 0.342*** |
| | (−3.722) | (−0.821) | (4.225) |
| *CRATIO* | −0.113*** | −0.017 | −0.006 |
| | (−2.992) | (−0.322) | (−0.630) |
| *INTCOV* | 0.027 | −0.012 | 0.019** |
| | (1.177) | (−0.570) | (2.155) |
| *FSIZE* | 0.481*** | 0.256* | −0.012 |
| | (3.463) | (1.983) | (−0.442) |
| *RATE* | 0.302*** | 0.012 | −0.153*** |
| | (3.435) | (0.180) | (−7.413) |
| *LMAT* | −0.134 | 0.098 | 0.003 |
| | (−0.796) | (0.402) | (0.048) |
| *REV* | 0.242*** | 0.159* | 0.018 |
| | (3.358) | (1.942) | (0.413) |
| *SYND* | −0.170 | −0.385 | 0.122*** |
| | (−1.158) | (−1.492) | (3.503) |
| *SPRATE* | −0.024 | −0.027 | 0.032 |
| | (−0.002) | (−0.341) | (1.438) |
| *CONSTANT* | −8.421*** | −0.063 | 1.433*** |
| | (−5.190) | (−0.055) | (5.561) |
| *INDUSTRY* | Y | Y | Y |
| *PERIOD* | Y | Y | Y |
| *N* | 72,966 | 27,228 | 27,228 |
| Pseudo-$R^2$ | .292 | .019 | .155 |

| Panel B: Difference in firm characteristics | | | | |
|---|---|---|---|---|
| **Variable** | **Treatment** | **Control** | **Difference** | ***t*-stat** |
| *BSIZE* | 9.656 | 10.174 | −0.518 | −0.025 |
| *BTEN* | 8.911 | 9.052 | −0.141 | −0.600 |
| *BIND* | 0.923 | 0.885 | 0.038 | 1.800 |
| *DUAL* | 0.254 | 0.320 | −0.066 | −0.001 |
| *ROA* | 0.009 | 0.009 | 0.000 | 0.560 |
| *TANG* | 0.456 | 0.434 | 0.022 | 1.110 |
| *DTD* | 5.229 | 5.214 | −0.015 | −0.043 |
| *INCVOL* | 0.186 | 0.180 | 0.006 | 0.029 |
| *CAPEX* | 0.030 | 0.031 | −0.001 | −0.900 |
| *LEV* | 0.307 | 0.318 | −0.011 | −0.980 |
| *CRATIO* | 1.831 | 1.830 | 0.001 | 0.910 |
| *INTCOV* | 20.431 | 26.453 | −6.022 | −0.470 |
| *FSIZE* | 3.402 | 3.374 | 0.028 | 1.021 |
| *RATE* | 0.425 | 0.412 | 0.013 | 1.064 |
| *LMAT* | 1.726 | 1.718 | 0.008 | 0.812 |
| *REV* | 0.730 | 0.699 | 0.031 | 0.001 |
| *SYND* | 0.975 | 0.982 | −0.007 | −0.010 |
| *SPRATE* | 0.121 | 0.129 | −0.008 | −0.002 |
| **Panel C: Propensity score estimator** | | | | |
| **Variable** | **Treatment** | **Control** | **Difference** | ***t*-stat** |
| *PVIOL* | 0.243 | 0.313 | −0.070*** | −4.980 |

*Note*: This table presents the results of the propensity score matching test in three panels. Panel A shows the pre- and post-sample results, panel B presents the differences in firm characteristics for the matched sample, and panel C shows the propensity score estimator. Robust *t*-statistics are presented in parentheses. All the variables are defined in Table 1.
***Statistically significant at the 1% level.
**Statistically significant at the 5% level.
*Statistically significant at the 10% level.

results (column 2 in panel A of Table 7) suggest that all the control variables are statistically insignificant. This ensures that firm-level characteristics in both treatment and control groups are identical. In addition, the coefficients in column 2 are generally smaller than those in column 1 in terms of magnitude, indicating a decrease in the degree of freedom in the restricted sample. The pseudo-$R^2$ declines from .292 to .019. This indicates that PSM eliminates all variances in the independent variables except the difference in the presence of female directors. The second test examines the differences in the mean of each observable characteristic between the treatment and control firms in the post-match sample. Panel B of Table 7 shows that, in the post-match sample, none of the differences in the obvious features between the treatment and control groups is statistically significant.[9] Together, our diagnostic tests indicate that PSM eliminates all the observable differences in the control variables except those relating to board gender diversity. We present the results of the PSM estimator in panel C, which are also aligned with our main findings. In the second step, we rerun our baseline model using a matched sample

and report the results in column 3 of panel A in Table 7. The coefficient on *PVIOL* is significantly negative, suggesting that board gender diversity has a strong impact on reducing loan covenant violations.[10]

### 5.2.2 | DID estimate

We use a DID analysis around the appointments of female directors on the board to address potential endogeneity concerns. The DID employs the notion of "parallel trends" using the treatment and control groups to capture the variation in outcomes. Therefore, disparities in variations in the outcome before and after the treatment among the two groups should be attributed to the impact of treatment. We implement the DID estimator using the following model.

$$CV_{i,t} = \alpha + \beta_1 (APP \times POST)_{i,t} + \beta_2 (APP)_{i,t} + \beta_3 (POST)_{i,t} + \beta_4 (\text{controls})_{i,t} + \beta_5 \sum (\text{industry effects})_i + \beta_6 \sum (\text{period effects})_t + \varepsilon_{it} \quad (2)$$

The variable *APP* is a dummy variable equal to 1 (0) if the firm is in the treatment group (control group). *POST* is a dummy variable equal to 1 (0) for the period after (before) the treatment group. The sample for this analysis includes observations 1 year before and after the director's appointment, excluding the appointment year. Similar to Sila et al. (2016) and Atif et al. (2021), we chose our treatment group with female director appointments on the board. We need a firm to appoint a female director to replace a departing male director in the year of the appointment for the treatment group. The departing male director must also be older than 60 to reduce the probability of director turnover being affected by poor performance or strategic shifts.[11] We applied these criteria and found 76 female director appointments for the treatment group.[12] Moreover, for the control group, we have identified 420 instances in which a departing male director, aged above 60, was replaced by a newly appointed male director. Next, we match the treatment and the observations of the control groups using the matching procedure, as in Section 5.2.1, to ensure that variances in firm features do not drive DID. Panel A of Table 8 presents no statistically significant variances in observable characteristics between the matched treatment and control groups.

Panel B reports the results from DID analysis based on the matched sample. We show that our variable of interest (i.e., *APP* × *POST*) has a negative and significant (at the 1% level) impact on loan covenant violations in both OLS and fixed effect estimations (columns 1 and 2, respectively). This suggests fewer loan covenant violations after a female director's appointment than a male director.

We also examine the parallel trend assumptions to ensure that our treatment and control groups were not already different prior to female appointments (Roberts & Whited, 2013). Following the prior literature (e.g., Lim et al., 2020; Roberts & Whited, 2013), we use the falsification test and rerun Equation (2) by considering female appointments that happened 2 years prior to the actual event. The dummy variable *POST2* is equal to 1 (0) for the period after (before) the

**TABLE 8** Difference-in-differences analysis.

| Panel A: Difference in firm characteristics | | | | |
|---|---|---|---|---|
| **Variable** | **Treatment** | **Control** | **Differences** | ***t*-stat** |
| *BSIZE* | 7.012 | 6.987 | 0.025 | 0.023 |
| *BTEN* | 6.345 | 6.256 | 0.089 | 1.123 |
| *BIND* | 0.875 | 0.862 | 0.013 | 1.003 |
| *DUAL* | 0.231 | 0.294 | −0.063 | −0.453 |
| *ROA* | 0.005 | 0.006 | −0.001 | −0.045 |
| *TANG* | 0.345 | 0.344 | 0.001 | 1.053 |
| *DTD* | 4.189 | 4.176 | 0.013 | 0.067 |
| *INCVOL* | 0.167 | 0.159 | 0.008 | 0.043 |
| *CAPEX* | 0.027 | 0.025 | 0.002 | 1.054 |
| *LEV* | 0.258 | 0.245 | 0.013 | 0.457 |
| *CRATIO* | 1.785 | 1.885 | −0.1 | −0.133 |
| *INTCOV* | 14.125 | 13.478 | 0.647 | 1.313 |
| *FSIZE* | 4.785 | 4.352 | 0.433 | 1.031 |
| *RATE* | 0.387 | 0.398 | −0.011 | −0.104 |
| *LMAT* | 1.124 | 1.125 | −0.001 | −1.137 |
| *REV* | 0.501 | 0.498 | 0.003 | 0.452 |
| *SYND* | 0.678 | 0.705 | −0.027 | −0.198 |
| *SPRATE* | 0.098 | 0.085 | 0.013 | 1.341 |
| **Panel B: Difference-in-differences estimator** | | | | |
| | **(1)** | **(2)** | **(3)** | **(4)** |
| **Variable** | ***PVIOL*** | | | |
| *APP* × *POST* | −0.443*** | −0.367*** | - | - |
| | (−3.321) | (−3.154) | - | - |
| *APP* | −1.347** | −1.123** | −0.176** | −0.192* |
| | (−2.189) | (−2.194) | (−2.115) | (−1.976) |
| *POST* | −4.122 | −2.131 | - | - |
| | (−1.467) | (−1.422) | - | - |
| *APP* × *POST2* | - | - | −0.209 | −0.147 |
| | - | - | (−1.221) | (−1.191) |
| *POST2* | - | - | −3.134 | −1.123 |
| | - | - | (−1.401) | (−1.231) |
| *CONTROLS* | Y | Y | Y | Y |
| *INDUSTRY* | Y | N | Y | N |
| *YEAR* | Y | Y | Y | Y |
| *N* | 304 | 304 | 1216 | 1216 |
| Adj. $R^2$ | .186 | .163 | .151 | .164 |

*Note*: This table presents the results of the difference-in-differences analysis in two panels. Panel A shows the differences in firm characteristics, and panel B presents the difference-in-differences estimator for the matched sample. Robust *t*-statistics are presented in parentheses. All the variables are defined in Table 1.

***Statistically significant at the 1% level.

**Statistically significant at the 5% level.

*Statistically significant at the 10% level.

**TABLE 9** Two-stage least squares.

| Variable | First stage *FOB* 1 | Second stage *PVIOL* 2 |
|---|---|---|
| *FMR* | 0.157** | |
| | (2.188) | |
| *FOB-Fitted* | | −0.197** |
| | | (2.193) |
| *BSIZE* | 1.032* | 0.133 |
| | (1.845) | (1.236) |
| *BTEN* | 0.053 | 1.190 |
| | (1.118) | (0.223) |
| *BIND* | 0.142*** | 1.143* |
| | (3.256) | (1.981) |
| *DUAL* | −0.571 | 0.123* |
| | (−1.533) | (1.949) |
| *ROA* | 0.038** | −1.102* |
| | (2.211) | (−1.897) |
| *TANG* | 0.032* | 0.184 |
| | (1.933) | (0.338) |
| *DTD* | 0.018** | −1.016* |
| | (2.144) | (−1.872) |
| *INCVOL* | −0.128** | 0.209* |
| | (−2.119) | (1.932) |
| *CAPEX* | 0.022 | 0.117 |
| | (1.076) | (1.332) |
| *LEV* | 0.135 | 0.135 |
| | (0.342) | (0.236) |
| *CRATIO* | 1.109* | 1.164* |
| | (1.882) | (1.962) |
| *INTCOV* | 0.031 | −0.371 |
| | (1.615) | (−1.138) |
| *FSIZE* | 1.035 | −1.342** |
| | (0.109) | (−2.174) |
| *RATE* | −0.134** | −1.345** |
| | (2.146) | (−2.212) |
| *LMAT* | 0.042** | 0.236* |
| | (2.118) | (1.889) |
| *REV* | 0.004 | 0.018 |
| | (1.224) | (1.134) |
| *SYND* | 0.063** | 0.137* |
| | (2.123) | (1.896) |
| *SPRATE* | 0.037** | 0.044** |
| | (2.192) | (2.221) |
| *CONSTANT* | 1.163*** | 1.112*** |
| | (3.163) | (2.894) |
| *INDUSTRY* | Y | Y |
| *PERIOD* | Y | Y |
| *N* | 72,966 | 72,966 |
| Model fits | | |
| *F*-statistics | 11.263*** | |
| | [0.000] | |
| Cragg–Donald Wald *F*-statistics | 93.153 | |
| Stock–Yogo weak ID test critical values at 10% IV size | 15.118 | |

*Note*: This table presents the results of the 2SLS regressions. Column 1 shows the first-stage regression where *FOB* is the dependent variable and the model fits for the instrumental variable. Column 2 shows the second-stage regression results where *PVIOL* is the dependent variable. Robust *t*-statistics are presented in parentheses. All the variables are defined in Table 1.
***Statistically significant at the 1% level.
**Statistically significant at the 5% level.
*Statistically significant at the 10% level.

appointment. Columns 3 and 4 (OLS and FE, respectively) in panel B of Table 8 show that the coefficients on *APP* × *POST2* are statistically insignificant, suggesting that the impact on loan covenant violations is unlikely to be driven by a pseudo appointments event.[13]

### 5.2.3 | IV approach

Finally, we address the endogeneity concerns using the IV approach, estimating the regression using 2SLS to remove the exogenous element from board gender diversity. The challenge of employing 2SLS lies in the identification of exogenous IVs that lack a direct relationship with loan covenant violations. We use the female-to-male workforce participation ratio (*FMR*) as an IV following the extant literature (e.g., Atif et al., 2021; Chen et al., 2017). The IV is calculated as the female participation ratio divided by the male participation ratio for the state of the firm's head office.[14] The female (male) participation ratio is calculated as the percentage of the non-institutional population of women (men) in the civilian workforce. The rationale of using the IV is that firms in states with higher female-to-male participation are in a better position to hire female directors, given the bigger pool of aspirants, and should, therefore, have a greater proportion of female directors. Moreover, there is little to no evidence suggesting that female-to-male participation in the state affects a firm's probability of loan covenant violations. Hence, we expect the IV to be positively correlated with *FOB* due to a high likelihood of meeting the exclusion criterion. The IV is (un)likely to correlate with the (dependent variable, i.e., *PVIOL*) probability of having female board directors. Column 1 of Table 9 shows the results of the first-stage regression, where the dependent variable is the board gender diversity (*FOB*). We include the same independent variables as the regression in column 2 of Table 3. In accordance with the criteria necessary for a valid

**TABLE 10** Female directors and loan covenant violations: channel analysis.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| **Variable** | | | ***PVIOL*** | | | |
| *FOB × STRICT* | −0.218*** | −0.198** | - | - | - | - |
| | (−3.136) | (−2.112) | - | - | - | - |
| *STRICT* | 0.123** | 0.120** | - | - | - | - |
| | (2.198) | (2.112) | - | - | - | - |
| *FOB × TOBINSQ* | - | - | −0.329** | −0.281** | - | - |
| | - | - | (−2.015) | (−2.019) | - | - |
| *TOBINSQ* | - | - | −0.063** | −0.040** | - | - |
| | - | - | (−2.144) | (−2.140) | - | - |
| *FOB × GOV* | - | - | - | - | −0.227*** | −0.210*** |
| | - | - | - | - | (−3.345) | (−3.389) |
| *GOV* | - | - | - | - | −0.123*** | −0.113*** |
| | - | - | - | - | (−3.123) | (−3.138) |
| *FOB* | −0.188** | −0.198*** | −0.143** | −0.231** | −0.261** | −0.211** |
| | (−2.158) | (−2.450) | (−2.112) | (−2.131) | (−2.173) | (−2.201) |
| *BSIZE* | −0.027** | −0.016* | −0.018** | −0.011** | −0.013*** | −0.012** |
| | (−2.180) | (−1.980) | (−2.145) | (−2.137) | (−2.632) | (−2.123) |
| *BTEN* | −0.055 | −0.023 | −0.006 | −0.023 | −0.012 | −0.012 |
| | (−1.138) | (−1.174) | (−1.330) | (−1.229) | (−1.111) | (−1.111) |
| *BIND* | −0.022* | −0.027 | −0.001 | −0.007 | −0.211* | −0.187** |
| | (−1.963) | (−1.365) | (−1.401) | (−1.337) | (−1.997) | (−2.193) |
| *DUAL* | 0.063** | 0.055 | 0.089** | 0.033* | 0.023 | 0.011 |
| | (2.192) | (1.145) | (2.197) | (1.199) | (0.534) | (0.134) |
| *ROA* | 0.152** | 0.130** | 0.290** | 0.123** | 0.128*** | 0.112*** |
| | (2.124) | (2.163) | (2.123) | (2.119) | (3.161) | (3.115) |
| *TANG* | −0.023* | −0.028* | −0.021 | −0.022 | 0.013 | 0.015 |
| | (−1.982) | (−1.987) | (−1.154) | (−1.101) | (0.094) | (0.051) |
| *DTD* | −0.020** | −0.022** | −0.034** | −0.009*** | −0.014*** | −0.012*** |
| | (−2.100) | (−2.121) | (−2.130) | (−2.747) | (−2.746) | (−3.127) |
| *INCVOL* | 0.126** | 0.176** | 0.138** | 0.156** | 0.140** | 0.152** |
| | (2.198) | (2.198) | (2.109) | (2.115) | (2.221) | (2.196) |
| *CAPEX* | 0.013 | 0.014 | 0.019 | 0.028 | 0.027 | 0.013 |
| | (0.118) | (0.114) | (0.119) | (0.118) | (1.124) | (1.131) |
| *LEV* | 0.320*** | 0.123** | 0.113** | 0.220* | 0.110** | 0.221* |
| | (3.132) | (2.176) | (2.118) | (1.889) | (2.108) | (1.879) |
| *CRATIO* | −0.020*** | −0.025*** | −0.032*** | −0.038** | −0.016* | −0.014* |
| | (−3.138) | (−3.133) | (−3.120) | (−2.198) | (−1.899) | (−1.899) |
| *INTCOV* | −0.012 | −0.012 | −0.011 | −0.011 | 0.009 | 0.007 |
| | (−0.437) | (−1.136) | (−0.186) | (−1.188) | (1.050) | (0.011) |
| *FSIZE* | −0.033*** | −0.022*** | 0.077** | 0.056** | −0.031 | −0.020 |
| | (−2.856) | (−2.882) | (2.173) | (2.176) | (−1.088) | (−1.023) |
| *RATE* | −0.111*** | −0.134*** | −0.111** | −0.125** | −0.121*** | −0.131** |
| | (−3.133) | (−3.123) | (−2.190) | (−2.177) | (−4.624) | (−2.174) |
| *LMAT* | −0.111** | −0.103** | 0.052** | 0.050** | −0.126** | −0.124** |
| | (−2.116) | (−2.129) | (2.129) | (2.123) | (−2.224) | (−2.124) |
| *REV* | −0.019 | −0.001 | 0.014 | 0.021 | 1.021 | 1.017 |
| | (−1.044) | (−0.038) | (1.033) | (1.123) | (1.343) | (1.331) |

**TABLE 10** (Continued)

| Variable | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | *PVIOL* | | | | | |
| *SYND* | 0.010* | 0.022** | 0.061** | 0.063** | 0.072 | 0.113 |
| | (1.889) | (2.119) | (2.120) | (2.116) | (1.017) | (1.023) |
| *SPRATE* | 0.044** | 0.019** | 0.012** | 0.026** | −0.013 | −0.017 |
| | (2.217) | (2.135) | (2.176) | (2.155) | (−0.319) | (−0.319) |
| *CONSTANT* | 1.420*** | 1.390*** | 1.515** | 1.129** | 1.432*** | 1.121*** |
| | (3.112) | (3.128) | (2.162) | (1.162) | (2.723) | (3.122) |
| *INDUSTRY* | Y | N | Y | N | Y | N |
| *PERIOD* | Y | Y | Y | Y | Y | Y |
| *N* | 64,755 | 64,755 | 72,966 | 72,966 | 55,890 | 17,076 |
| Adj. $R^2$ | .172 | .155 | .151 | .156 | .123 | .112 |

*Note*: This table presents the regression results of channel analysis. Columns 1 and 2 use the interaction of *FOB* and *STRICT*, columns 3 and 4 present results using the interaction of *FOB* and *TOBINSQ*, and columns 5 and 6 present results using the interaction between *FOB* and *GOV*. Robust *t*-statistics are presented in parentheses. All the variables are defined in Table 1.

***Statistically significant at the 1% level.

**Statistically significant at the 5% level.

*Statistically significant at the 10% level.

instrument, *FOB* has a positive and significant (at the 5% level) relationship with the IV in column 1, indicating that our IV is valid. Moreover, both the *F*-statistic and the *p*-value of the Cragg–Donald *F* weak-instrument test reject the null hypothesis of the weak instrument (Cragg & Donald, 1993; Stock & Yogo, 2005).

Column 2 of Table 9 reports the results for the second-stage regression, which uses the predicted board gender diversity from the first-stage regression (*FOB-Fitted*) to estimate loan covenant violations. The results are similar to our main regression analysis, suggesting a negative relationship between board gender diversity and the probability of loan covenant violations. Overall, based on identification strategies, we conclude that our main results are robust to potential endogeneity concerns.

## 5.3 | Channel analysis: how board gender diversity influences covenant violations

Board gender diversity may influence loan covenant violations in at least three direct and indirect channels. First, studies find that gender diversity in a bank's board influences lending strategies and the cost of loans, as women tend to be better at bargaining financial dealings (Kray et al., 2001; Mazei et al., 2015) than their male counterparts. Consequently, firms with gender-diverse boards can negotiate better borrowing terms (Karavitis et al., 2021), including less stringent loan covenants. Accordingly, gender-diverse firms may encounter less strict covenants, which lowers a firm's risk of violating those covenants. Hence, we test whether loan covenant strictness matters in the relationship between board gender diversity and loan covenant violations. Following prior studies (Gao et al., 2020; Murfin, 2012), we measure covenant strictness using all of the contract terms of loans and borrower fundamentals at the time of origination and then expand them to the life of the loan. We interact *FOB* with covenant strictness (*STRICT*) and expect that we should find a significantly negative coefficient if female directors exert influence on loan covenant violations through covenant strictness. The findings in Table 10 (columns 1 and 2) suggest that the relationship between board gender diversity and loan covenant violations is channeled through covenant strictness, consistent with our expectations.

Second, extant literature suggests that women on board help improve a firm's financial performance (Post & Byron, 2015; Simionescu et al., 2021). As per the upper-echelon theory (Hambrick, 2007), directors' information-seeking and evaluation processes are contingent on their experience, knowledge, and values. For gender-diverse boards, these differential perspectives provide critical and potentially performance-enhancing information in the environment (C. A. Peterson & Philpot, 2007). Given their diverse skills, knowledge, and risk assessment perspective, female directors contribute to diversifying the perspectives available to a board, which may help improve a firm's ability to generate profit from its assets and investments (Miller & del Carmen Triana, 2009). Firms with sound financial positions would experience fewer covenant violations, as there is evidence that financially distressed firms are more likely to experience covenant violations (Acharya et al., 2014; Chodorow-Reich & Falato, 2022). We test this assertion using Tobin's *Q* as a measure of financial performance to examine whether the relationship between board gender diversity and loan covenant violations is driven through financial performance. We interact *TOBINSQ* and *FOB* and re-estimate Equation (1). We should observe a negative coefficient on the

**TABLE 11** Female directors' experience, financial distress, and loan covenant violations.

| | | | | | HighDistress | | LowDistress | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Variable | *PVIOL* | | | | | | | |
| *FOB × DTIME* | −0.110** | −0.123** | - | - | - | - | - | - |
| | (−2.220) | (−2.129) | - | - | - | - | - | - |
| *DTIME* | 0.059 | 0.050 | - | - | - | - | - | - |
| | (−1.123) | (−1.021) | - | - | - | - | - | - |
| *FOB × DTINCO* | - | - | −0.110** | −0.098** | - | - | - | - |
| | - | - | (−2.001) | (−2.011) | - | - | - | - |
| *DTINCO* | - | - | 0.063 | 0.047 | - | - | - | - |
| | - | - | (0.046) | (0.040) | - | - | - | - |
| *FOB* | −0.237** | −0.221** | −0.181** | −0.101** | −0.263*** | −0.201*** | −0.087* | −0.021* |
| | (−2.198) | (−2.160) | (−2.125) | (−2.112) | (−2.473) | (−2.401) | (−1.923) | (−1.910) |
| *BSIZE* | −0.011*** | −0.010** | −0.009** | −0.004** | −0.016*** | −0.011** | 0.004 | −0.001 |
| | (−2.980) | (−2.180) | (−2.135) | (−2.133) | (−2.622) | (−2.122) | (0.544) | (−1.133) |
| *BTEN* | −0.011* | −0.013* | −0.002 | −0.013 | −0.002 | −0.003 | −0.005*** | −0.009 |
| | (−1.938) | (−1.978) | (−1.410) | (−1.419) | (−1.124) | (−1.120) | (−4.158) | (−1.119) |
| *BIND* | −0.025 | −0.021 | −0.023 | −0.020 | −0.018 | −0.010 | 0.006 | −0.015 |
| | (−1.603) | (−1.333) | (−1.401) | (−1.417) | (−0.497) | (−0.293) | (0.223) | (−1.356) |
| *DUAL* | 0.032* | 0.030 | 0.021* | 0.032 | 0.025 | 0.019 | 0.036* | 0.033 |
| | (1.892) | (1.122) | (1.897) | (1.197) | (0.934) | (0.834) | (1.843) | (1.193) |
| *ROA* | −0.152*** | −0.138** | −0.231*** | −0.122** | −0.478*** | −0.213*** | −0.479*** | −0.111** |
| | (−3.194) | (−2.167) | (−3.123) | (−2.112) | (−4.161) | (−3.133) | (−3.780) | (−2.122) |
| *TANG* | −0.024* | −0.021* | −0.022 | −0.019 | 0.002 | 0.014 | −0.045* | −0.002 |
| | (−1.782) | (−1.982) | (−1.158) | (−1.127) | (0.092) | (0.052) | (−1.934) | (−1.136) |
| *DTD* | −0.028** | −0.027** | −0.011** | −0.009** | −0.001*** | −0.003*** | −0.001*** | −0.013** |
| | (−2.130) | (−2.121) | (−2.145) | (−2.127) | (−3.126) | (−3.121) | (−3.771) | (−2.155) |
| *INCVOL* | 0.120** | 0.191** | 0.153** | 0.152** | 0.152** | 0.151** | 0.213** | 0.151** |
| | (2.190) | (2.191) | (2.100) | (2.101) | (2.201) | (2.191) | (2.198) | (2.123) |
| *CAPEX* | 0.014 | 0.011 | 0.012 | 0.009 | 0.023 | 0.016 | −0.183 | 0.083 |
| | (0.112) | (0.110) | (0.114) | (0.112) | (0.124) | (0.121) | (−0.897) | (0.111) |
| *LEV* | 0.323*** | 0.322** | 0.323*** | 0.221** | - | - | - | - |
| | (3.172) | (2.101) | (3.118) | (2.118) | - | - | - | - |
| *CRATIO* | −0.023*** | −0.021*** | −0.021*** | −0.018** | −0.020* | −0.012* | −0.023*** | −0.035** |
| | (−3.159) | (−3.133) | (−4.150) | (−2.132) | (−1.873) | (−1.898) | (−3.564) | (−2.130) |
| *INTCOV* | −0.002 | −0.013 | −0.016 | −0.019 | 0.000 | 0.002 | −0.001 | −0.012 |
| | (−0.837) | (−1.137) | (−0.188) | (−1.178) | (0.056) | (0.013) | (−0.642) | (−1.190) |
| *FSIZE* | −0.041*** | −0.031*** | −0.033*** | −0.030** | 0.033 | 0.022 | −0.105*** | −0.201** |
| | (−2.830) | (−2.822) | (−2.670) | (−2.170) | (1.088) | (1.023) | (−4.462) | (−2.138) |
| *RATE* | −0.113*** | −0.132*** | −0.125*** | −0.120** | −0.128*** | −0.121** | −0.076*** | −0.124** |
| | (−3.139) | (−3.129) | (−3.190) | (−2.190) | (−5.624) | (−2.164) | (−2.836) | (−2.111) |
| *LMAT* | −0.072** | −0.052** | −0.051*** | −0.050*** | −0.126** | −0.124** | −0.081* | −0.055*** |
| | (−2.156) | (−2.123) | (−2.529) | (−2.523) | (−2.224) | (−2.124) | (−1.800) | (−2.122) |
| *REV* | −0.002 | −0.004 | 0.013 | 0.014 | 0.023 | 0.017 | −0.029 | 0.013 |
| | (−0.042) | (−0.039) | (1.042) | (1.043) | (1.340) | (1.321) | (−1.520) | (1.044) |
| *SYND* | 0.071*** | 0.057** | 0.072** | 0.073** | 0.076 | 0.110 | 0.061* | 0.076** |
| | (2.819) | (2.119) | (2.110) | (2.111) | (1.015) | (1.020) | (1.711) | (2.113) |

**TABLE 11** (Continued)

| | | | | | HighDistress | | LowDistress | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Variable | *PVIOL* | | | | | | | |
| *SPRATE* | 0.021** | 0.013** | 0.022** | 0.021** | −0.005 | −0.014 | 0.044** | 0.024** |
| | (2.215) | (2.105) | (2.172) | (2.152) | (−0.318) | (−0.318) | (2.412) | (2.202) |
| *CONSTANT* | 1.417*** | 1.314*** | 1.508*** | 1.518*** | 1.425*** | 1.422*** | 1.287*** | 1.510*** |
| | (3.134) | (3.122) | (3.162) | (3.262) | (7.213) | (4.122) | (4.312) | (3.164) |
| *INDUSTRY* | Y | N | Y | N | Y | N | Y | N |
| *PERIOD* | Y | Y | Y | Y | Y | Y | Y | Y |
| *N* | 72,966 | 72,966 | 72,966 | 72,966 | 13,682 | 13,682 | 17,474 | 72,966 |
| Adj. $R^2$ | .161 | .164 | .152 | .155 | .127 | .128 | .156 | .150 |

*Note*: This table presents regression results for the relationship between female directors' experience and the probability of loan covenant violations, as well as financial distress. The regression results in columns 5–8 do not include *LEV* to avoid a collinearity problem. Robust *t*-statistics are presented in parentheses. All the variables are defined in Table 1.

***Statiscally significant at the 1% level.

**Statistically significant at the 5% level.

*Statistically significant at the 10% level.

interaction term if a firm's financial performance matters in this relationship. The results in Table 10 (columns 3 and 4) show that the relationship is driven by financial performance, suggesting that firms with better financial performance are less likely to violate loan covenants, which, in turn, suggests that financial constraints drive loan covenant violations.

The third and final channel through which female directors could influence covenant violations is a better and more effective monitoring role that results in enhanced corporate governance. Gender-diverse boards allocate more effort to monitoring, as male directors engage in their duties more diligently, which is likely to amplify the comprehensiveness of discussions about loans and financing options through stronger board monitoring (Adams & Ferreira, 2009). Extant studies by Goh et al. (2016) and Elbadry et al. (2015) report that firms with better corporate governance suffer less from information asymmetry, as management is more aware of potential problems in their operational areas. Better corporate governance helps keep the management pro-activeness in financial and operational control, which, in turn, helps avoid violating loan covenants. Hence, we conjecture that corporate governance influences the relationship between board gender diversity and loan covenant violations. We test this assertion through the strength of the firm's corporate governance mechanism. We use the corporate governance score from ASSET4 and create a dummy variable (firms with more than a sample median score [high governance] equal to 1 and 0 otherwise [low governance]). We then interact *FOB* and *GOV* and should expect a negative coefficient if corporate governance influences the relationship. Our results in columns 5 and 6 indicate that the relationship is pronounced in highly governed firms, suggesting that a firm's corporate governance does influence the relationship between board gender diversity and loan covenant violations.

## 5.4 | Additional analysis

In this section, we examine whether the relationship between board gender diversity and loan covenant violations is driven by traditionally female-dominated industries, as one may argue that the impact is driven by such dominance. We classify industry sectors based on prior research (e.g., Atif et al., 2021) and on the Institute for Women's Policy Research, which asserts that the *Manufacturing*, *Communication*, *Utilities*, *Mining*, and *Construction* industry sectors are all male dominated. Table A3 presents the results of the coefficient of interest (i.e., the coefficient on *FOB*) for each OLS regression for all the industry sectors, including the control variables as specified in Model 1. There are differences across industry sectors, but the relationship is pronounced in female-dominated industries. The plausible explanation for this result is monitoring intensity by female directors in such industry sectors compared with gender-diverse industries.

One could argue further that a director's experience influences their monitoring ability as more knowledge is gained of firms and the industry environment over time (see Knight et al., 1999). To address this concern, we use two variables. First, we create a dummy variable (*DTIME*) equal to 1 (0) for a director's experience in the role above (below) the average. Second, we create a dummy variable (*DTINCO*) equal to 1 (0) for the director's experience in the firm above (below) the average. We then interact both variables with our main variable of interest (*FOB*). The results in Table 11 (columns 1–4) present that experienced female directors have a pronounced effect on loan covenant violations.

Finally, we test whether the relationship in firms experiencing financial distress is pronounced compared with their peers. Following Opler and Titman (1994), we use financial leverage to measure financial distress, given a higher level of fixed commitments accompanied by a higher potential for financial distress. We assign firms into top

and bottom terciles based on leverage. Our results in columns 5–8 of Table 11 show that firms in financial distress experience a pronounced effect of board gender diversity on loan covenant violations.

## 6 | CONCLUSION

Loan covenant violations over the course of a loan indicate a technical default for firms allowing temporary control rights to lenders. These violations turn into high costs to shareholders. Extant literature suggests that board characteristics affect loan pricing and non-pricing provisions, including covenants (Lin et al., 2016). However, the relationship between female directorship and loan covenant violations is little known in the literature. Our study bridges this vital research gap by empirically examining the relationship.

To test the propositions empirically, we employ 72,966 firm-quarter observations for US firms between 1999 and 2019. We summarize our major findings as follows. First, we provide strong evidence that firms with higher female representation on their boards have a lower tendency to violate loan covenants. Second, the negative relationship between board gender diversity and loan covenant violations is stronger when firms have more female directors, which supports the critical mass theory. Third, our analysis further reveals that female independent directors reduce loan covenant violations more significantly than female executive directors do, indicating that the monitoring effect dominates the executive effect. Our channel analyses indicate that the relationship is channeled by loan covenant strictness, the financial performance of firms, and better corporate governance. In an additional analysis, we show that the relationship is pronounced in female-dominated industries and in financially distressed firms. Our results also suggest that experienced female directors have a stronger negative influence on covenant violations than their non-experienced peers. The empirical results are consistent with a series of robustness checks, including subsample analyses, alternative variables, and industry controls and adjustments. Our findings are also robust to possible endogeneity concerns, as indicated by PSM, DID, and IV techniques.

The policy implications of this paper manifest in two main aspects. First, the findings of our study will reinforce US policymakers to introduce and implement gender-related reforms for listed companies. Second, managers should consider adding female directors to their boards. Moreover, they may consider appointing independent directors to properly safeguard their relationship with creditors. Future research may want to investigate the effect of female directors' characteristics (e.g., qualification and busyness) on various types of loan facilities and covenants across different markets with distinct institutional settings.

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### CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interest.

### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from BoardEx and Thomson Reuters' DealScan. Restrictions apply to the availability of these data, which were used under license for this study. Data are available from the author(s) with the permission of BoardEx and Thomson Reuters' DealScan.

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### NOTES

[1] We start our sample from 1999, as this is the first year for BoardEx data availability.

[2] Following prior literature (e.g., Chava & Roberts, 2008), we use firm-quarter observations, as borrowers are required to file compliance reports to creditors on a quarterly basis.

[3] The probability of loan covenant violations can be obtained from Peter Demerjian's website at https://peterdemerjian.weebly.com/managerialability.html.

[4] DTD is defined as the annual average of the distance to default for gauging how far a limited-liability firm is away from default. We use the Credit Research Initiative (CRI) for the distance-to-default measure, which is managed by the Risk Management Institute (RMI) of the National University of Singapore (NUS).

[5] The operating income variability (*INCVOL*) in year $t-1$ is defined as the coefficient of variation of operating income over a 3-year period. Data sourced from Osiris by Bureau van Dijk.

[6] Our results (untabulated) show that the relationship between females on the board and covenant violations is concave, which indicates an inverse, U-shaped relationship with a 0.778 maximum stationary point.

[7] PSM does not rely on exogenous variation for identification.

[8] For robustness, we allow firm-year observations with female directors to be matched with multiple firm-year observations without female directors and change the permissible difference in propensity scores (i.e., the caliper 0.5%). Our untabulated results remain consistent.

[9] The mean difference between the treatment group and the control group is based on the average treatment effect on the treated group (ATT).

[10] We also form treatment (3 years after) and control groups (3 years before) based on gender diversity recommendations by the National Association of Corporate Directors (NACD) Blue Ribbon Commission 2012 from the United States. Our results remain consistent with the main findings.

[11] Our untabulated results continue to hold if we require the departing directors to be aged 65 or older.

[12] We also consider replacing a director's experience, as this may lead to variations in the level of directors' confidence. We require a firm to appoint a female director (with experience higher than the sample median) replacing a departing male director to be part of the treatment group. We are able to identify 32 appointments. We also identify 158 observations of newly appointed male directors (replacing male directors) with experience above the sample median as the control group. Based on the alternative sample specification, our untabulated results remain consistent.

[13] We are grateful to the anonymous referee for this suggestion.

[14] The data for female-to-male participation are sourced from the US Census Bureau website.

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## APPENDIX A

**TABLE A1** Industry distribution.

| Industry sector | *N* | *PVIOL* | *PCVIOL* | *PPVIOL* | *FOB* |
|---|---|---|---|---|---|
| Energy | 7425 | 0.387 | 0.162 | 0.273 | 0.065 |
| Materials | 6431 | 0.205 | 0.044 | 0.177 | 0.127 |
| Industrial | 16,431 | 0.273 | 0.046 | 0.248 | 0.113 |
| Consumer discretionary | 13,465 | 0.383 | 0.044 | 0.364 | 0.143 |
| Consumer staples | 4175 | 0.286 | 0.038 | 0.267 | 0.166 |
| Health care | 7768 | 0.232 | 0.036 | 0.208 | 0.139 |
| Information technology | 8088 | 0.317 | 0.060 | 0.286 | 0.103 |
| Communication | 3978 | 0.430 | 0.046 | 0.392 | 0.219 |
| Utilities | 4295 | 0.253 | 0.053 | 0.214 | 0.266 |
| Real estate | 910 | 0.477 | 0.036 | 0.456 | 0.155 |

**TABLE A2** Correlation matrix.

| # | Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | *PVIOL* | 1.000 | | | | | | | | | | | | | |
| 2 | *PCVIOL* | .387 | 1.000 | | | | | | | | | | | | |
| 3 | *PPVIOL* | .932 | .093 | 1.000 | | | | | | | | | | | |
| 4 | *FOB* | −.174 | −.120 | −.153 | 1.000 | | | | | | | | | | |
| 5 | *NFOB* | −.221 | −.123 | −.181 | .732 | 1.000 | | | | | | | | | |
| 6 | *W1* | .002 | −.021 | .014 | −.160 | −.126 | 1.000 | | | | | | | | |
| 7 | *W2* | −.125 | −.057 | −.116 | .251 | .351 | −.176 | 1.000 | | | | | | | |
| 8 | *W3* | −.128 | −.063 | −.112 | .158 | .734 | −.244 | −.202 | 1.000 | | | | | | |
| 9 | *FOBIND* | −.184 | −.120 | −.151 | 1.020 | .932 | −.061 | .351 | .657 | 1.000 | | | | | |
| 10 | *FOBEXE* | −.050 | .380 | .318 | .022 | .005 | .040 | .075 | .026 | .023 | 1.000 | | | | |
| 11 | *BSIZE* | −.189 | −.074 | −.182 | .236 | .482 | −.011 | .253 | .293 | .240 | .033 | 1.000 | | | |
| 12 | *BTEN* | −.003 | .051 | −.020 | −.041 | −.094 | .033 | −.064 | −.064 | −.080 | .174 | −.072 | 1.000 | | |
| 13 | *BIND* | −.077 | −.050 | −.061 | .470 | .335 | −.091 | .075 | .261 | .451 | .045 | −.013 | −.093 | 1.000 | |
| 14 | *DUAL* | .021 | .033 | .019 | −.031 | −.008 | .018 | −.018 | −.005 | −.022 | .111 | .044 | .275 | −.082 | 1.000 |
| 15 | *ROA* | −.110 | −.064 | −.090 | .044 | .062 | .002 | .038 | .033 | .057 | .037 | .046 | .028 | .008 | .014 |
| 16 | *TANG* | .004 | .136 | −.046 | −.021 | .005 | −.004 | −.005 | .008 | −.005 | −.012 | .025 | −.004 | .022 | −.036 |
| 17 | *DTD* | −.010 | −.010 | −.011 | −.014 | .012 | −.027 | .003 | .007 | .002 | .022 | −.002 | .002 | .007 | .016 |
| 18 | *INCVOL* | .041 | .034 | .140 | .180 | .013 | .033 | .067 | .033 | .034 | .033 | .008 | −.026 | −.072 | .017 |
| 19 | *CAPEX* | .044 | .181 | −.025 | −.081 | −.096 | −.023 | −.050 | −.056 | −.092 | .014 | −.067 | .012 | −.036 | .009 |
| 20 | *LEV* | .155 | .019 | .127 | .035 | .027 | −.028 | −.009 | .032 | .024 | −.241 | .006 | −.048 | .022 | −.006 |
| 21 | *CRATIO* | −.054 | −.039 | −.038 | −.124 | −.145 | .001 | −.058 | −.108 | −.113 | .029 | −.154 | .072 | −.053 | −.034 |
| 22 | *INTCOV* | −.013 | .011 | −.022 | −.016 | −.003 | .005 | −.001 | −.002 | −.008 | .033 | −.012 | .016 | −.011 | .012 |
| 23 | *FSIZE* | −.251 | −.110 | −.231 | .345 | .445 | −.013 | .223 | .295 | .354 | −.064 | .533 | −.111 | .182 | .046 |
| 24 | *RATE* | −.049 | −.128 | −.214 | .320 | .381 | .002 | .198 | .243 | .322 | .241 | .423 | −.096 | .153 | .023 |
| 25 | *LMAT* | −.042 | −.094 | −.012 | .042 | .033 | .018 | .014 | .014 | .044 | .023 | −.017 | .013 | .026 | −.005 |
| 26 | *REV* | −.077 | .011 | −.062 | .077 | .091 | −.005 | .058 | .046 | .077 | .013 | .071 | .017 | .023 | −.008 |
| 27 | *SYND* | −.023 | −.084 | −.019 | .063 | .070 | .018 | .045 | .032 | .064 | .036 | .082 | −.043 | .035 | .004 |
| 28 | *SPRATE* | .026 | .022 | .028 | −.015 | −.002 | .017 | .005 | −.013 | −.017 | .212 | .065 | −.036 | −.006 | .028 |

*Note*: This table presents the correlation coefficients based on the whole sample. All variables are defined in Table 1.

**TABLE A2** (Continued)

| # | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | |
| 15 | 1.000 | | | | | | | | | | | | | |
| 16 | −.061 | 1.000 | | | | | | | | | | | | |
| 17 | .012 | −.003 | 1.000 | | | | | | | | | | | |
| 18 | .018 | .026 | −.002 | 1.000 | | | | | | | | | | |
| 19 | −.022 | .431 | −.024 | .031 | 1.000 | | | | | | | | | |
| 20 | −.096 | .154 | −.002 | .122 | .033 | 1.000 | | | | | | | | |
| 21 | .034 | −.170 | .001 | −.104 | −.136 | −.240 | 1.000 | | | | | | | |
| 22 | .091 | −.013 | .009 | .018 | .012 | −.054 | .041 | 1.000 | | | | | | |
| 23 | .073 | .065 | .002 | −.124 | −.025 | .110 | −.240 | −.015 | 1.000 | | | | | |
| 24 | .061 | .081 | .008 | .114 | .012 | .133 | −.203 | −.017 | .342 | 1.000 | | | | |
| 25 | .018 | .005 | −.002 | .003 | −.009 | .118 | .031 | −.009 | .042 | .095 | 1.000 | | | |
| 26 | .033 | .050 | .005 | .045 | .066 | −.165 | .019 | .011 | .075 | .193 | −.033 | 1.000 | | |
| 27 | .005 | .003 | −.007 | −.014 | −.004 | .072 | −.033 | .009 | .171 | .271 | −.029 | .114 | 1.000 | |
| 28 | −.041 | .021 | −.008 | .012 | .002 | .124 | −.046 | −.014 | .130 | .100 | −.021 | −.033 | .040 | 1.000 |

*Note*: This table presents the correlation coefficients based on the whole sample. All variables are defined in Table 1.

**TABLE A3** Industry subsample analysis.

| Industry | OLS *PVIOL* |
|---|---|
| Energy | −0.173*** |
| | (−3.198) |
| Materials | −0.112 |
| | (−1.142) |
| Industrial | −0.079* |
| | (−1.963) |
| Consumer discretionary | −0.123*** |
| | (−3.113) |
| Consumer staples | −0.145** |
| | (−2.154) |
| Health care | −0.155*** |
| | (−3.235) |
| Information technology | −0.124*** |
| | (−3.034) |
| Communication | 0.122* |
| | (1.831) |
| Utilities | 0.141 |
| | (1.142) |
| Real estate | −0.114*** |
| | (−2.782) |
| *CONTROLS* | Y |
| *PERIOD* | Y |

*Note*: This table reports the coefficient for the relationship between board gender diversity and loan covenant violations. The regression is run separately for each Global Industry Classification Standard (two-digit) industry sector. Robust *t*-statistics are presented in parentheses. All the variables are defined in Table 1.

***Statistically significant at the 1% level.

**Statistically significant at the 5% level.

*Statistically significant at the 10% level.

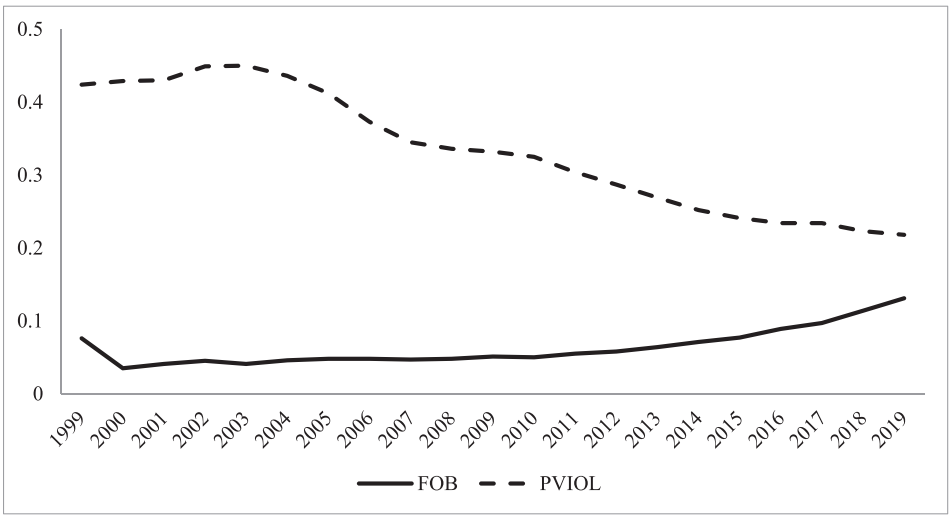


**FIGURE A1** Average percentage of female directors on the board by year and loan covenant violations. The *Y*-axis shows the percentage, and the *X*-axis represents the years. The figure shows the average percentage of female directors (bold line) and loan covenant violations (dashed line) from 1999 to 2019.