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Your gender identity is who you are: Female chief executive officers and corporate debt structure

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Abstract

Using a large sample of S&P 1500 firms during 1993–2021, we empirically examine the implications of CEO gender on corporate debt structure. We find that after controlling for endogeneity, firms managed by female CEOs issue less debt than those managed by male CEOs. Female CEOs being more risk averse than male CEOs is the underlying mechanism which drives the negative relation between female CEOs and firm leverage. Further, we find that the effect of CEO gender is more pronounced when the firm's CEO is younger, the litigation risk is higher, and the market is more competitive. In terms of debt structure, firms managed by female CEOs prefer to maintain positive debt capacity and have longer debt maturities. Finally, we show that CEO gender has a stronger impact on debt structure than CFO gender. Taken together, our evidence suggests that there exist gender differences in terms of corporate debt borrowing decision making.

KEYWORDS

CEO, debt structure, gender, risk aversion

1 | INTRODUCTION

It has been well-known that general economic agents show gender differences in risk preferences, social preferences, and competitive preferences.[1] However, economists and policy makers remain doubtful about whether the observed gender differences still exist among top executives of public firms who are well educated and have excellent work experience. With the increase in the female representation in the chief executive officer (CEO) positions of US public firms over the past 20 years, a growing stream of economics and finance literature has started to examine the role of female executives in firm activities, such as accruals quality (Barua et al., 2010), accounting conservatism (Francis et al., 2015; Ho et al., 2015), corporate risk taking (Faccio et al., 2016), executives' access to information (Inci et al., 2017), bank loans (Luo et al., 2018), and stock price crash risk (Li & Zeng, 2019). In this article, we investigate whether, and through which channel, CEO gender affects corporate debt structure.

Using a sample of 1500 companies from S&P and 28,389 effective firm-year observations from 1993 to 2021, we find strong support for this hypothesis. We control for some firm characteristics, CEO characteristics, corporate governance, and board gender diversity. Ordinary least

squares (OLS) regressions indicate that firms managed by female CEOs have a 2.7% (2.9%) lower book (market) value of leverage than firms managed by male CEOs, which is about 11.2% (14.4%) of an average corporate book (market) leverage value. The empirical relation that exists between CEO gender and corporate debt structure may be spurious due to omitted variables, simultaneity, or measurement errors. Along with OLS regressions, we also adopt four identification methods to mitigate the potential estimation bias due to endogeneity.

First, we apply a propensity score matching (PSM) approach to address possible bias caused by confounding variables that could exist in the treatment effect estimates obtained from a brief comparison of leverage between firms managed by female and male CEOs. Specifically, we estimate the propensity score of each firm hiring a female CEO by running a probit regression using the observable variables which we have controlled for in our OLS regressions. Based on the estimated propensity scores, we then construct a control group of firms with male CEOs using one-to-one nearest-neighbour matching and a calliper of 1%. Firms managed by female CEOs in the treatment group are clearly less leveraged than firms managed by male CEOs in the matched control group, consistent with our OLS regression results.

Our second identification method is Heckman's (1979) two-stage procedure, which considers the endogeneity of the firm–CEO match that results from some choices of female CEOs related to unobserved firm characteristics. The first stage of probit regression models the decision of firms to hire female CEOs. In the second-stage regression, we add the inverse Mills ratio, estimated by the first-stage probit regression, as an independent variable to correct for the potential selection bias. As suggested by Li and Prabhala (2007), an explanatory variable should be present in the first-stage regression equation but not be included in the second-stage regression equation. Such a variable should be related to the choice of female CEOs but not debt structure. In the spirit of Huang and Kisgen (2013), we employ the gender status equality score of the state in which the firm is headquartered to serve as such an identification restriction. The results of Heckman's two-stage procedure confirm that there is a negative relationship between female CEOs and firm leverage.

Our third identification method is a difference-in-differences (DID) investigation design. We examine the influence of transitions from male to female CEOs on leverage changes compared to the influence of transitions from male to male CEOs. Our findings show that leverage ratios of firms are significantly lower over the three-year period after the CEO changed from male to female than they are over the same period after the CEO changed from male to male.

Finally, we adopt a fixed effects model to alleviate the possible endogeneity problems caused by unobserved heterogeneity among firms and time-varying heterogeneity among industries, following the advice of Gormley and Matsa (2014). To be specific, we contain firm fixed effects and industry–year interaction fixed effects in the baseline panel regression. The negative impact of female CEOs on corporate debt levels remains robust in the high-dimensional fixed effects model. Taken together, our four identification methods suggest that female CEOs are negatively associated with firm leverage after addressing the potential endogeneity concern.

We then investigate two plausible channels through which firms with female CEOs borrow less from the external debt market. Previous managerial gender studies show that female CEOs are not only more risk averse than male CEOs, but also less overconfident. To understand which of these two traits is more important in affecting corporate debt structure, we differentiate the effects of these two traits, which helps to enhance our article's contribution to the managerial gender literature. Specifically, we follow Li and Zeng (2019) and separately regress CEO gender on two CEO risk aversion proxies and one CEO overconfidence proxy. The residuals of the two regressions represent the part of the variation in CEO gender which is unrelated to CEO risk aversion and the portion of the CEO gender change which is unrelated to CEO overconfidence. Then we examine whether these two residuals are related to corporate debt structure. Our results show that only the part of CEO gender change which is unrelated to overconfidence is significantly negatively associated with firm leverage, suggesting that the variation of firm leverage is mainly explained by the variation in CEO risk aversion, not the variation in CEO overconfidence. Only the risk aversion mechanism is supported by our empirical evidence.

We then examine the cross-sectional variation in the association between CEO gender and corporate debt structure. First, our cross-sectional analyses show that the CEO's gender affects the corporate debt structure more significantly for firms that are managed by younger CEOs. Since younger CEOs prefer to engage in riskier firm activities (e.g., Li et al., 2017; Serfling, 2014), our empirical results suggest that the risk aversion trait of female CEOs may mitigate young CEOs' risk taking tendency. Second, we observe that the effect of female CEOs on corporate debt structure is more significant among firms with higher ex-ante litigation risk, which is in line with the view that female CEOs are more compliant with financial market regulation and are more sensitive to ex-ante litigation risk (e.g., Francis et al., 2015; Ho et al., 2015). Third, we find that the impact of female CEOs on corporate debt structure is stronger on the firms operating in industries with

higher market competition, suggesting that the risk aversion mechanism is more pronounced when competition in the market increases the likelihood of a female CEO losing her job. The results of these cross-sectional analyses further support the risk aversion channel through which firms with female CEOs issue less debt.

Next we explore whether CEO gender affects the specific firm debt structure decisions. First, we adopt Byoun's (2008) empirical model to estimate a firm's target debt ratio. If a firm's actual debt level is less than the model predicted level, then it is less likely that the firm will fall into financial distress since the firm has more financial slack to borrow externally in the future. Consistent with the risk aversion channel, we find a positive effect of female CEOs on debt capacity. Second, we study whether firms with female CEOs tend to issue long-term debt rather than short-term debt. To the extent that short-term debts have more refinancing risk and are associated with more scrutiny during refinancing negotiations, we expect female CEOs to have a positive effect on debt maturities. The results of our research support this prediction, which is also in line with the risk aversion channel.

In our supplementary tests, we find that first, the relationship between CEO gender and debt levels is not mainly driven by corporate governance. Second, we observe that CEO gender has a more pronounced impact on debt levels than CFO gender. Third, we show that our main result is robust to additional control variables: analyst coverage, institutional ownership, CEO fixed compensation, CEO tenure, firm efficiency, and managerial ability. Finally, we show that our primary results are robust to market turbulence and regulation changes during our sample period.

This study makes contributions to the existing literature in three areas. First, it makes a contribution to the literature on the impact of top executive gender on corporate outcomes, as we provide robust evidence of the association between CEO gender and the debt structure of firms. Second, the finance literature has shown that top executives of public companies exhibit the gender differences found in psychology and sociology, when they make important firm decisions. Previous sociology and cognitive psychology studies suggest that women are more averse to risk (e.g., Brooks et al., 2019; Levin et al., 1988; Sundén & Surette, 1998) and less overconfident (e.g., Barber & Odean, 2001; Feingold, 1994; Niederle & Vesterlund, 2007; Svenson, 1981) than men. However, it is unclear which of these traits is more important in affecting top executives' major firm decisions. By identifying the underlying mechanism by which female CEOs tend to borrow less externally, our article also makes a major contribution to the existing literature. Third, to our knowledge, we are the first study to explore how CEO gender affects a firm's debt capacity and debt maturities. We show that firms with female CEOs have a greater likelihood of maintaining positive capacity for debt and issue long-term debt. Finally, our research is closely similar to Faccio et al. (2016), who study the impact of CEO gender on risk taking in firms by using a sample of European firms in the Amadues Top 250,000 database.[2] We show that the effect of CEO gender on firm's debt levels exists not only in the bank-based financial systems of Europe, but also in the US, where public firms are less constrained by external financing and have a lower female executive representation.

The rest of the article is organized as follows. In Section 2, we present a review of the previous studies relevant to our article and develop our hypotheses. In Section 3, we describe our data sources, definitions of key variable, research design, and summary statistics. Section 4 shows our main empirical tests results. Section 5 conducts some supplementary tests and further discussions on the robustness of our main results. Finally, Section 6 concludes.

2 | RELATED LITERATURE AND HYPOTHESES

In a perfect capital market defined by Modigliani and Miller (1958), the value of a firm is not related to its capital structure. By introducing various frictions into the perfect capital market, subsequent studies show that capital structure may be explained by the trade-off theory (Kraus & Litzenberger, 1973), proxy theory (Jensen, 1986; Jensen & Meckling, 1976), signalling hypothesis (Ross, 1977), the pecking order theory (Myers, 1984), and the market timing theory (Baker & Wurgler, 2002). A recent strand of studies examines whether firm characteristics or managerial traits impact the capital structure decisions of firms, including information asymmetry (Houston & James, 1996), tangible assets (Denis & Mihov, 2003), corporate governance (Bebchuk et al., 2009), firm age (Kieschnick & Moussawi, 2018), and managers' personal preference (Cronqvist et al., 2012; Korkeamäki et al., 2017).

Previous psychology and behavioural economics suggest that women can be more averse to risk and less overconfident compared to men. First, based on the survey responses to hypothetical situations, Barsky et al. (1997) construct a preference parameter relating to risk tolerance and suggest that females have a lower risk tolerance than males. Most recent research based on archival and survey data confirms that females are more averse to risk in terms of financial decision making compared to men, allocation of assets in their retirement savings plans, and personal portfolio management (e.g., Agnew et al., 2003; Brooks et al., 2019; Jianakoplos & Bernasek, 1998). Since a firm's leverage has a positive effect on the likelihood of financial trouble (Kaplan & Zingales, 1997; Whited & Wu, 2006), we hypothesize that female CEOs who are more

risk averse will borrow less externally than male CEOs. Second, Huang and Kisgen (2013) suggest that female executives are less likely to be overconfident when making investment and financing decisions than male executives. Consistent with Huang and Kisgen's (2013) findings, previous studies demonstrate that women are often less overconfident than men in terms of driving test performance, exam answers, investment, and compensation package choices (e.g., Barber & Odean, 2001; Lundeberg et al., 1994; Niederle & Vesterlund, 2007; Svenson, 1981). Since female CEOs with less overconfidence tend to conservatively estimate a project's net present value (NPV), we anticipate that female CEOs may pursue fewer investment activities and in turn borrow less from the external credit market than male CEOs. Linking the emerging evidence on these two gender differences between female CEOs and male CEOs to the potential risk associated with firm leverage, we conjecture that, ceteris paribus, companies managed by female CEOs borrow less externally than firms managed by male CEOs. Therefore, we state our three hypotheses as:

H1. Female CEOs have a negative impact on leverage.

H2. Female CEOs have a negative impact on leverage due to more risk aversion.

H3. Female CEOs have a negative impact on leverage due to less overconfidence.

3 | DATA, VARIABLE DEFINITIONS, AND SAMPLE DESCRIPTION

3.1 | Sample

We include US public firms with executive data in ExecuComp in our sample from 1993 through 2021 inclusive.[3] We require that firms have accounting data in Compustat and stock return data in the Centre for Research in Security Prices (CRSP). We collect the data on corporate debt structure from Standard and Poor's (S&P) Capital IQ database, and the data on managerial entrenchment and board directors from the Institutional Shareholder Services (ISS, formerly RiskMetrics) database. Since the ExecuComp database is available from 1992, we choose 1993 as the first year in our sample (Colla et al., 2013). Following the previous studies on capital structure, we exclude firms in the financial industry (SIC code 6000–6999) because the external financing decisions of financial firms may not transmit the same information as those of non-financial firms. In addition, debt structure is fundamentally different between financial firms and non-financial firms. To address the influence of potential outliers, we winsorize all continuous accounting variables at the 1st and 99th percentiles. Applying the aforementioned data filters, we are left with an effective sample containing 28,389 firm-year observations, allowing us to track CEO gender and corporate debt structure at the same time as controlling for relevant firm and CEO characteristics.

3.2 | Dependent variables: Debt structure

In this article, we focus on the empirical relationship between the gender of CEO and the debt structure of firms. Following the previous capital structure literature, we adopt book leverage (*BLev*) and market leverage (*MLev*) as the proxies for corporate debt structure (e.g., Ortiz-Molina, 2007; Rajan & Zingales, 1995):

$$BLev_{i,t} = \frac{Current\ Debt_{i,t} + Long-term\ Debt_{i,t}}{Total\ Assets_{i,t}}, \quad (1)$$

$$MLev_{i,t} = \frac{\text{CurrentDebt}_{i,t} + \text{Long-term Debt}_{i,t}}{\text{Current Debt}_{i,t} + \text{Long-term Debt}_{i,t} + \text{Market Value of Equity}_{i,t}}. \quad (2)$$

To further examine the different aspects of corporate debt structure, we define the following four proxy variables. *BDebtCap* is an indicator variable that is equal to one if a firm's book value of debt is below its estimated target book value of debt and zero otherwise. *MDebtCap* is an indicator variable that is equal to one if a firm's market value of debt is below its estimated target market value of debt and zero otherwise. The target debt levels are estimated based on the models of Byoun (2008) and Lemmon and Zender (2010). *BDebtCap* and *MDebtCap* indicate whether a firm keeps its financial flexibility for potential future external borrowing. *LDebt* equals the long-term debt of firms divided by total debt. *DLDebt* is an indicator variable that is equal to one if the *LDebt* of a firm is above its three-digit SIC industry mean and zero otherwise. Companies relying heavily on short-term financing are more vulnerable to liquidity shocks than those financing with long-term debt because short-term debt facilities need to be refinanced more frequently. *LDebt* and *DLDebt* represent the debt structure of a firm based on its debt maturities.

3.3 | Research design

The independent variable we focused in our baseline regression is CEO gender: $Female_{i,t}$. $Female_{i,t}$ is an indicator variable equal to one if firm *i*'s CEO is female in

fiscal year t and zero otherwise. An executive is identified as a firm's CEO if the corresponding ExecuComp's data item "CEOANN" is "CEO" (Jiang et al., 2010). Our baseline regression model is:

$$\begin{aligned}\text{Debt structure}_{i,t} = {} & \beta_0 + \beta_1 \text{Female}_{i,t-1} \\ & + \Gamma' \text{Control variables}_{i,t-1} + \theta_j + \mu_t \\ & + \epsilon_{i,t}, \end{aligned} \tag{3}$$

where i represents the firm index, t represents the year index, and j represents the industry index.

Following the previous studies on the determinants of corporate debt structure (e.g., Boubaker et al., 2018; Dakua, 2019; Denis & Mihov, 2003), we include controls for three sets of variables that may impact the empirical relationship between CEO gender and firms' debt structure. The first set is firm characteristics, including firm size ($Size_{t-1}$), market to book ratio (MTB_{t-1}), firm profitability ($Profitability_{t-1}$), fixed assets ($FAsset_{t-1}$), firm debt rating indicator ($Rating_{t-1}$), and firm age ($FirmAge_{t-1}$). The second set is CEO characteristics, including CEO total compensation ($CEOComp_{t-1}$), CEO pay slice ($CEOPower_{t-1}$), and CEO age ($CEOAge_{t-1}$). The third set is the proxies for corporate governance and board gender diversity, including the managerial entrenchment index ($EIndex_{t-1}$), number of female directors as a percentage of total number of directors ($DirGenRatio_{t-1}$), and the total number of board directors ($Director_{t-1}$). We also include year (μ_t) fixed effects and industry fixed effect based on three-digit SIC (θ_j). Standard errors are clustered at the firm and year levels (Petersen, 2009). The detailed definitions of all variables are presented in Appendix A (Table A1).

Size captures a firm's external borrowing ability and indicates a firm's information asymmetry (Houston & James, 1996). *MTB* indicates the growth opportunities of a firm in the future. The agency theory shows that a firm's future growth opportunities are negatively related to its optimal leverage ratios (Myers, 1977, 1984). *Profitability* represents the paying capacity of a firm to pay debt principal as well as interest payments with its operating cash flows (Kieschnick & Moussawi, 2018). *FAsset* measures a firm's asset tangibility. The prediction of the trade-off theory is that a firm that has more tangible assets has a higher external borrowing ability (Denis & Mihov, 2003; Williamson, 1988). *Rating* denotes if the long-term debt of a firm is rated by credit agencies or not. Cheng and Subramanyam (2008) argue that debt credit ratings mitigate information asymmetry and reduce credit risks. *FirmAge* measures which stage of the life cycle a company is currently in. Kieschnick and Moussawi (2018) show that the age of the firm has a positive effect on the probability that the firm uses debt financing but is negatively associated with how much debt the firm uses. Besides these six firm characteristics, we also control for three CEO attributes that are related to CEO risk taking activities and the potential conflict of interests between managers and shareholders. *CEOComp* is a proxy for a CEO's personal loss in the event of the firm's default. *CEOPower* represents the total compensation of the CEO divided by the sum of the total compensation of all five highest-paid executives. *CEOPower* reflects the extent to which a CEO is able to extract rents from its own company (Bebchuk et al., 2011). *CEOAge* is the age of a CEO in the corresponding firm–year. Serfling (2014) predicts that old CEOs prefer to take less risk than young CEOs, and finds that *CEOAge* is negatively related to debt financing activities. Finally, we control for corporate governance and board gender diversity. *EIndex* is Bebchuk et al.'s (2009) management entrenchment index that consists of six crucial anti-takeover clauses. Kieschnick and Moussawi (2018) find that better corporate governance gives better access to the external financing market. Adams and Ferreira (2009) suggest that a gender-diverse corporate board tends to do a better job in monitoring firm activities. Ahmed and Atif (2021) and Poletti-Hughes and Martinez Garcia (2022) also find that female directors influence a firm's debt financing decision. We control for *DirGenRatio* and *Director* in order to exclude an alternative explanation that the monitoring of a gender-diverse board can have an impact on the empirical relationship between CEO gender and debt structure.

3.4 | Summary statistics

US firms tend to hire more female CEOs over time. Figure 1 shows that less than 0.5% of non-financial S&P 1500 firms were run by female CEOs in fiscal year 1993, while the female CEO ratio increased to 7% in 2021. The dramatic increase in female representation in CEO positions began in the early 2000s. From 2002 to 2021, there has been a sevenfold increase in the female CEO ratio. Over the same period, we also observe a decreasing trend of corporate debt ratios except for the period 2019–2021. Such a noteworthy pattern leads to our research question whether the increase of female representation in corporate leadership roles may help to explain the decrease in corporate external borrowing.

Panel A of Table 1 shows the summary statistics of all variables included in our baseline empirical tests. The means (medians) of *BLev* and *MLev* are 24.2% (20.6%) and 20.2% (14.4%), which are similar to those reported in Ortiz-Molina (2007) and Kieschnick and Moussawi (2018). About 60.0% and 57.7% of the firm–year observations

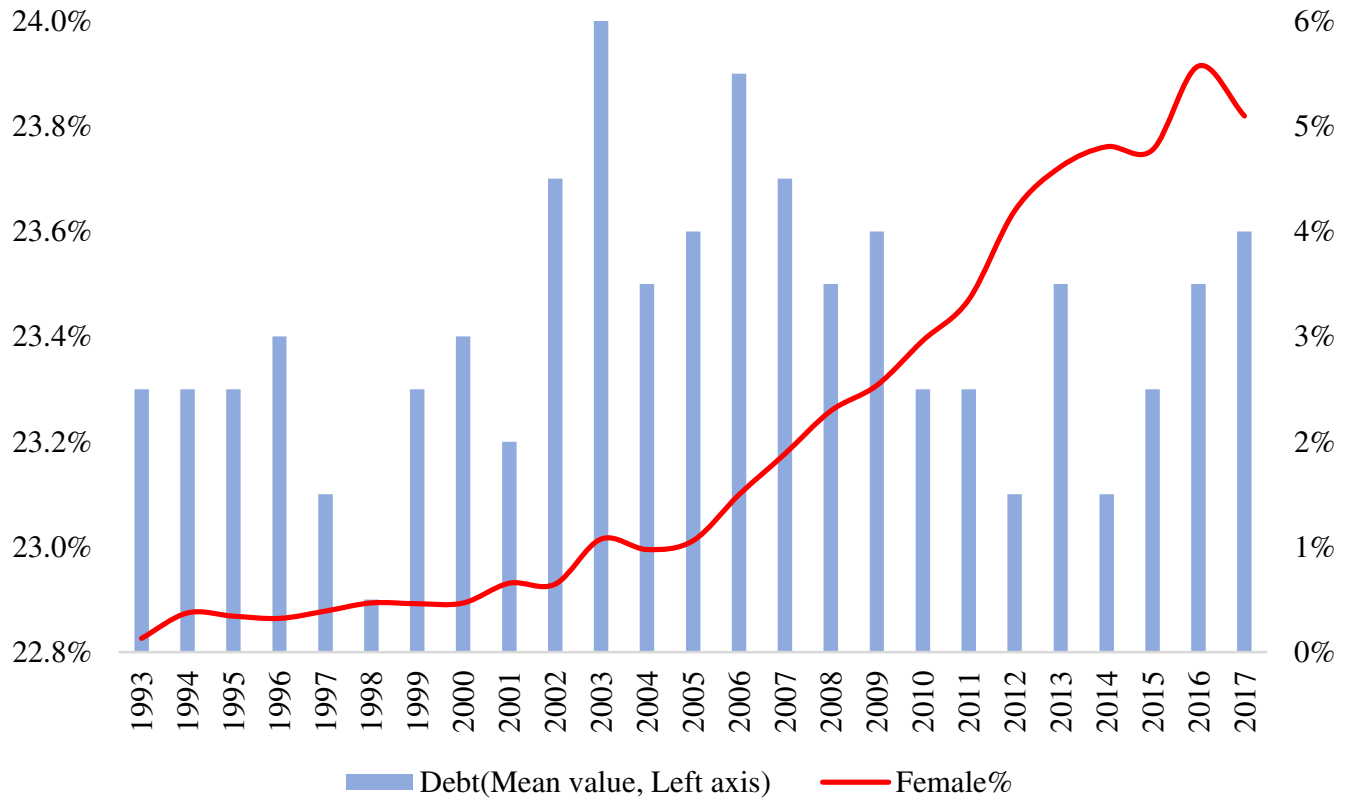

FIGURE 1 Average corporate debt ratios and the percentage of firms with female CEOs. This figure plots the time-series average corporate debt ratios (*BLev*) and the percentage of firms with female CEOs in the sample, which consists of 28,389 non-financial firm–year observations covered by ExecuComp over the period 1993–2021 with non-missing data on CEO gender and corporate debt structure. [Colour figure can be viewed at wileyonlinelibrary.com]

in our sample have positive book value debt capacity and positive market value debt capacity. The distribution of long-term debt ratios is right-skewed, while the distribution of bank debt ratios is left-skewed. The mean and median of *LDebt* are 91.5% and 98.1%. About 71.2% of the firm–year observations in our sample have long-term debt ratios that are above the sample mean. Panel A of Table 1 also indicates that female CEOs represent about 2.5% of the firm–year observations in our sample. The summary statistics of our channel variables and control variables are generally consistent with those provided in the previous corporate finance studies.

Panel B of Table 1 shows the summary statistics of our debt structure variables, partitioned by CEO gender. The last two columns are the t-tests of the differences in the variables' means and the Wilcoxon tests of the differences in medians between firms with female and male CEOs. On average, book leverage and market leverage of firms with female CEOs are less than those of firms with male CEOs, and the differences between two groups of firms are statistically significant at the 10% and 1% levels. Firms managed by female CEOs are more likely to have positive debt capacity than firms managed by male CEOs, in terms of both *BDebtCap* and *MDebtCap*. Regarding debt maturity, firms managed by female CEOs tend to hold more long-term debt than firms managed by male CEOs.

4 | MAIN EMPIRICAL RESULTS

4.1 | Baseline regressions

Table 2 presents the results of our baseline regression Equation (3), investigating the relationship between CEO gender and corporate debt levels. In columns (1) and (3), we only add the year and industry fixed effects, without the inclusion of any control variables. In line with our prediction, the coefficients of $Female_{t-1}$ are negative and statistically significant at the 5% level. On average, firms with female CEOs have a 2.7% lower book value of leverage and a 3.0% lower market value of leverage than firms with male CEOs. Since the firms in our sample have an average of 24.2% book value of leverage and 20.2% market value of leverage, the decrease in leverage associated with female CEOs is also economically significant.

In columns (2) and (4), we add the control variables of firm characteristics, CEO characteristics, corporate

TABLE 1 Summary statistics.

Panel A. Full sample						
Variables	**Observations**	**Mean**	**S.D.**	**P25**	**P50**	**P75**
Dependent variables						
BLev	28,389	0.242	0.211	0.061	0.206	0.372
MLev	28,389	0.202	0.207	0.044	0.144	0.294
BDebtCap	28,047	0.600	0.490	0.000	1.000	1.000
MDebtCap	28,047	0.577	0.494	0.000	1.000	1.000
LDebt	28,389	0.915	0.144	0.916	0.981	0.998
DLDebt	28,389	0.712	0.453	0.000	1.000	1.000
Independent variable of interest						
Female	28,389	0.025	0.156	0.000	0.000	0.000
CFOGender	16,795	0.104	0.306	0.000	0.000	0.000
Channel variables						
Delta	18,590	5.411	1.610	4.447	5.422	6.406
Vega	18,590	3.529	1.978	2.373	3.849	4.985
Option	16,099	0.206	0.404	0.000	0.000	0.000
Forecast	21,212	0.934	0.249	1.000	1.000	1.000
Control variables						
Size	28,389	3.711	1.965	2.612	3.201	3.946
MTB	28,389	1.601	1.322	0.910	1.192	1.841
Profitability	28,389	0.809	1.846	0.012	0.073	0.434
FAsset	28,389	0.429	0.341	0.075	0.370	0.809
Rating	28,389	0.369	0.482	0.000	0.000	1.000
FirmAge	28,389	6.933	13.170	2.485	3.219	3.784
CEOComp	28,389	8.043	1.283	7.305	8.116	8.841
CEOPower	28,389	0.380	0.150	0.289	0.373	0.461
CEOAge	28,389	4.022	0.139	3.951	4.043	4.111
EIndex	28,389	2.953	1.633	2.000	3.000	4.000
DirGenRatio	28,389	0.143	0.102	0.091	0.125	0.200
Director	28,389	2.301	0.252	2.197	2.303	2.485

Panel B. Univariate tests						
	Female CEOs		**Male CEOs**		**Differences**	
	Mean	**Median**	**Mean**	**Median**	***t*-test**	**Wilcoxon test**
BLev	0.228	0.194	0.243	0.207	−0.015*	−0.013*
					(−1.892)	(−1.836)
MLev	0.182	0.134	0.203	0.144	−0.021***	−0.010***
					(−2.713)	(−2.139)
BDebtCap	0.646	1.000	0.606	1.000	0.040*	0.000*
					(1.903)	(1.903)
MDebtCap	0.681	1.000	0.632	1.000	0.049**	0.000**
					(2.276)	(2.276)
LDebt	0.970	0.989	0.955	0.987	0.015***	0.002***
					(4.033)	(3.120)

(Continues)

TABLE 1 (Continued)

Panel B. Univariate tests						
	Female CEOs		Male CEOs		Differences	
	Mean	Median	Mean	Median	*t*-test	Wilcoxon test
DLDebt	0.748	1.000	0.711	1.000	0.037***	0.000***
					(2.131)	(2.132)

Note: Panel A presents the descriptive statistics of all variables in our empirical analyses. Our main sample includes 28,389 firm–year observations covered by ExecuComp over the period 1993–2021 with available data for our empirical analyses. The number of observations, mean, standard deviation, 25th percentile, 50th percentile, and 75th percentile are reported from left to right, in sequence for each variable. The detailed definition of all variables is provided in Appendix A. Panel B presents the univariate comparison of debt structure between firms with female and male CEOs. The mean and median of debt structure proxies are reported. The last two columns present the differences in mean and the differences in median. The detailed definition of all variables is provided in Appendix A. The statistics of *t*-tests on the mean difference and the statistics of Wilcoxon tests on the median difference are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

governance, and board gender diversity. The adjusted R^2 increases from 0.050 in column (1) to 0.097 in column (2) and from 0.031 in column (3) to 0.120 in column (4), suggesting that our control variables help to explain the variations of the leverage ratios in the baseline model. The coefficients of $Female_{t-1}$ are negative and statistically significant at the 5% level in columns (2) and (4). After including these control variables, firms managed by female CEOs have an average book value of leverage that is 2.7% lower and a 2.9% lower market value of leverage than firms managed by male CEOs. These findings support our hypothesis H1 that female CEOs have a negative impact on firm leverage.

With respect to our control variables, MTB_{t-1}, $Profitability_{t-1}$, and $FAsset_{t-1}$ are negatively associated with the two leverage ratios. An increase of one standard deviation in MTB_{t-1} causes a 3.0% (-0.023×1.322) decrease in $BLev_t$ and a 5.3% (-0.040×1.322) decrease in $MLev_t$. An increase of one standard deviation in $Profitability_{t-1}$ leads to a 2.0% (-0.011×1.846) decrease in $BLev_t$ and a 1.8% (-0.010×1.846) decrease in $MLev_t$. An increase of one standard deviation in $FAsset_{t-1}$ is related to a 1.6% (-0.047×0.341) decrease in $BLev_t$ and a 1.3% (-0.039×0.341) decrease in $MLev_t$. The economic impact of CEO gender on the two leverage ratios is comparable to these three control variables, indicating that CEO gender is an essential factor related to corporate debt structure. We also find that $Size_{t-1}$ and $CEOComp_{t-1}$ have a positive effect on the leverage ratios of a firm.

4.2 | Endogeneity

Our baseline regression results reported in Section 4.1 indicate a negative association between female CEOs and firm leverage. However the relation between CEO gender and capital structure decisions may be plagued by two potential endogeneity issues. First, a self-selection concern may arise if female CEOs choose to work in firms with a less aggressive capital structure policy. In addition, a reverse causality may also arise if firms with more conservative corporate boards choose a lower capital structure and at the same time choose to hire female CEOs. Second, an unobserved heterogeneity concern may arise if unobservable firm characteristics correlate with both CEO gender and capital structure. In this section, we mitigate the potential endogeneity issues using four identification methods: a PSM approach, Heckman's two-stage procedure, a DID framework, and a high-dimensional fixed effects model.

4.2.1 | Propensity score matching (PSM) approach

To alleviate the potential self-selection bias due to the fact that female CEOs assigned to firms are not randomized, we use a PSM approach. Firms with female CEOs are assigned to a treatment group while firms with male CEOs are assigned to a control group. We calculate the likelihood that a firm hires a female CEO by a probit model, where the dependent variable is $Female_t$ and the independent variables are the same as those 12 control variables included in columns (2) and (4) of Table 2. The results of the probit regression are reported in column (1) of Panel A of Table 3. We find that *MTB*, *FAsset*, *FirmAge*, and *DirGenRatio* have a positive impact on the likelihood of a firm hiring a female CEO, while *Rating*, *CEOAge*, and *Director* are negatively related to the likelihood of a firm hiring a female CEO. The coefficients of covariates reveal that there exists a significant difference in the observed characteristics between firms managed by female CEOs and male CEOs. Based on the propensity

TABLE 2 Female CEOs and corporate debt structure.

	$BLev_t$		$MLev_t$	
	(1)	(2)	(3)	(4)
$Female_{t-1}$	−0.027**	−0.027**	−0.030**	−0.029**
	(−1.997)	(−2.000)	(−2.433)	(−2.575)
$Size_{t-1}$		0.010***		0.006*
		(3.013)		(1.890)
MTB_{t-1}		−0.023***		−0.040***
		(−10.639)		(−24.991)
$Profitability_{t-1}$		−0.011***		−0.010***
		(−5.121)		(−6.271)
$FAsset_{t-1}$		−0.047***		−0.039***
		(−3.752)		(−3.258)
$Rating_{t-1}$		0.006		0.010
		(0.812)		(1.285)
$FirmAge_{t-1}$		0.000		0.000
		(0.799)		(0.912)
$CEOComp_{t-1}$		0.004*		0.002
		(1.764)		(0.709)
$CEOPower_{t-1}$		0.018		0.007
		(1.201)		(0.481)
$CEOAge_{t-1}$		0.010		−0.002
		(0.425)		(−0.099)
$EIndex_{t-1}$		−0.004		−0.003
		(−1.503)		(−1.439)
$DirGenRatio_{t-1}$		0.048		0.061*
		(1.324)		(1.954)
$Director_{t-1}$		−0.007		0.000
		(−0.479)		(0.015)
Intercept	0.248***	0.218**	0.240***	0.288***
	(5.888)	(2.078)	(5.953)	(2.967)
Observations	28,389	28,389	28,389	28,389
Adjusted-R^2	0.050	0.097	0.031	0.120
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes

Note: This table presents the panel regression results of the relation between female CEOs and corporate debt structure. Our sample covers firm–year observations with non-missing values for all variables during 1993–2021. The dependent variables are two proxies of firm leverage: $BLev_t$ and $MLev_t$. The independent variable of interest is $Female_{t-1}$, equal to one if a firm has a female CEO and zero otherwise. The coefficients of the three-digit SIC industry fixed effects and year fixed effects are suppressed for brevity in the respective columns. The detailed definition of all variables is provided in Appendix A. The *t*-values in parentheses are based on double clustered standard errors by firm and year (Petersen, 2009).
*, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

scores estimated by the probit model, we adopt a one-to-one match method. Specifically, we require that each firm in our treatment group to be matched to a firm with the closest propensity score in our control group. We further require that the difference in the propensity scores between a treatment group and a matched control group firm be less than a caliper width of 1%.

TABLE 3 Female CEOs and corporate debt structure: Propensity score matching (PSM).

Panel A. PSM regressions and post-match diagnostic regressions		
	Pre-match	**Post-match**
	***Female*$_t$**	***Female*$_t$**
	(1)	**(2)**
$Size_{t-1}$	−0.010	−0.003
	(−0.716)	(−0.124)
MTB_{t-1}	0.038***	0.002
	(2.77)	(0.09)
$Profitability_{t-1}$	−0.010	−0.026
	(−0.870)	(−1.223)
$FAsset_{t-1}$	0.249***	0.025
	(4.04)	(0.20)
$Rating_{t-1}$	−0.097**	−0.077
	(−2.473)	(−0.873)
$FirmAge_{t-1}$	0.006***	−0.001
	(3.14)	(−0.228)
$CEOComp_{t-1}$	0.025	0.009
	(1.50)	(0.28)
$CEOPower_{t-1}$	0.176	−0.255
	(1.44)	(−0.973)
$CEOAge_{t-1}$	−0.934***	0.322
	(−8.723)	(1.15)
$EIndex_{t-1}$	0.022*	0.015
	(1.70)	(0.58)
$DirGenRatio_{t-1}$	4.725***	0.151
	(28.87)	(0.48)
$Director_{t-1}$	−0.228***	0.240
	(−3.872)	(1.459)
Intercept	0.893**	−1.836
	(2.13)	(−1.597)
Observations	28,389	1288
Pseudo R^2	0.176	0.004

Panel B. Differences in firm and CEO characteristics								
	Pre-match				**Post-match**			
	Female	**Male**			**Female**	**Male**		
	(*N* = 706)	**(*N* = 27,683)**	**Difference**	**T-statistics**	**(*N* = 644)**	**(*N* = 644)**	**Difference**	**T-statistics**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Size	4.663	3.686	0.977***	13.084	4.582	4.528	0.054	0.357
MTB	1.581	1.601	−0.020	−0.392	1.624	1.651	−0.027	−0.324
Profitability	0.794	0.809	−0.015	−0.203	0.856	0.947	−0.091	−0.825
FAsset	0.459	0.428	0.031**	2.374	0.455	0.454	0.001	0.053
Rating	0.343	0.370	−0.027	−1.454	0.346	0.354	−0.008	−0.291

TABLE 3 (Continued)

Panel B. Differences in firm and CEO characteristics

	Pre-match				Post-match			
	Female ($N = 706$)	Male ($N = 27{,}683$)	Difference	T-statistics	Female ($N = 644$)	Male ($N = 644$)	Difference	T-statistics
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FirmAge	14.415	6.742	7.673***	15.351	14.062	13.783	0.279	0.240
CEOComp	8.373	8.035	0.338***	6.940	8.350	8.319	0.031	0.398
CEOPower	0.398	0.379	0.019***	3.260	0.399	0.404	−0.005	−0.636
CEOAge	4.004	4.022	−0.018***	−3.353	3.999	3.990	0.009	1.196
EIndex	3.332	2.943	0.389***	6.256	3.296	3.210	0.086	1.064
DirGenRatio	0.281	0.140	0.141***	37.302	0.265	0.260	0.005	0.703
Director	2.293	2.301	−0.008	−0.919	2.297	2.280	0.017	1.024

Panel C. PSM estimator

	Female ($N = 644$)	Male ($N = 644$)	Difference	T-statistics
	(1)	(2)	(3)	(4)
BLev	0.223	0.265	−0.042***	−3.196
MLev	0.178	0.217	−0.039***	−3.402

Note: Panel A reports the coefficient estimates from the probit model estimating the propensity scores. Our sample covers firm-year observations with non-missing values for all variables during 1993–2021. The dependent variable is $Female_{t-1}$ that is equal to one if a firm is managed by a female CEO and zero otherwise. The independent variables are the firm and CEO characteristics, the same as those reported in Table 2. We use a nearest-neighbour one-to-one match method with a calliper width of 1%. Column (1) reports the results of the pre-match propensity score regression. Column (2) reports the results of the post-match diagnostic regression. The detailed definition of all variables is provided in Appendix A. The *z*-values reported in parentheses are based on double clustered standard errors by firm and year (Petersen, 2009).

*, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Panel B compares the firm and CEO characteristics between firms managed by female CEOs and propensity score matched firms managed by male CEOs. In columns (1)–(2) and (5)–(6), we report the mean of firm and CEO characteristics between the treatment (female) and control (male) group. In columns (3) and (7), we report the differences between the treatment and control group. In columns (4) and (8), we report the statistics of t-tests on the mean difference between the two groups. The detailed definition of all variables is provided in Appendix A. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Panel C reports female CEOs' average treatment effects on corporate debt structure measured by *BLev* and *MLev*. In columns (1)–(2), we report the mean of *BLev* and *MLev* in the treatment (female) and control (male) group. In column (3), we report the differences between the two groups. In column (4), we report the statistics of t-tests on the mean difference between the two groups. The detailed definition of all variables is provided in Appendix A. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Next, we conduct two efficiency tests to verify that firms in the treatment and control group are comparable in terms of observed characteristics. We first re-estimate the probit model for the post-match sample. The regression results are tabulated in column (2) of Panel A of Table 3. All the estimated coefficients are statistically insignificant, suggesting that the observable characteristics of firms in the treatment and control group are indistinguishable. The absolute values of the estimated coefficients in column (2) are much smaller than those in column (1), indicating that the results in column (2) are not just due to the drop in the number of firm–year observations from the pre-match to the post-match sample. The pseudo R^2 drops from 0.176 in the pre-match sample to 0.004 in the post-match sample, which further ensures that our PSM method removes all observable differences between firms in the treatment and control group, except CEO gender. We next employ mean-difference tests to compare the observable characteristics between firms in the treatment and control group. Panel B of Table 3 shows that all the differences in the observable characteristics between the treatment group and the control group are statistically insignificant at the 10% level. Taken together, our efficiency tests show that any corporate debt structure difference between treatment and control group firms is likely driven by CEO gender, instead of the observable firm and CEO characteristics that were included in our baseline regression.

Finally, we compare book leverage and market leverage between the treatment and control group. Panel C of Table 3 presents the average treatment effects estimated by PSM. We find that the differences in book leverage

and market leverage between the treatment group and the control group are negative and statistically significant at the 1% level, which is in agreement with our baseline regression findings reported in Section 4.1.

4.2.2 | Heckman's two-stage estimation procedure

While our PSM helps to address selection bias due to observable variables, female CEOs may choose to work for firms with certain unobserved characteristics that correlate with corporate debt structure. To mitigate this endogeneity concern, we use Heckman's (1979) two-stage estimation procedure to control for any potential self-selection biases and reveal the pure impact of CEO gender on debt structure. In the first-stage regression, we estimate an empirical model to examine the choices of firms with female and male CEOs. In the second-stage regression, we address the potential selection bias in our baseline regression model. According to Li and Prabhala (2007), a variable that affects the selection of female CEOs but not the debt structure decisions should be included in the first-stage regression, but the variable should not be included as an independent variable in the second-stage regression. Sugarman and Straus (1988) assign each of the 50 US states a gender status equality score ranging from 19.2 (Mississippi) to 59.9 (Oregon). If a state has a higher gender equality score, its job market is more friendly to women. If a firm's headquarters is located in a state with a higher gender equality score, then it is more likely for the firm to choose a female CEO. However, it is doubtful that the state-level gender equality score would affect a firm's external borrowing decision other than through its direct effect on CEO gender. Similar to Huang and Kisgen (2013), we employ states' gender status equality scores (*Gender_Equality*) based on firm headquarters' location as the variable in the first-stage regression suggested by Li and Prabhala (2007).

We tabulate the regression results for Heckman's (1979) two-stage selection procedure in Table 4. Column (1) shows that in the selection step, the coefficient of $Gender\_Equality_{t-1}$ is positive and statistically significant. The first-stage regression result suggests that *Gender_Equality* is associated with the likelihood of a firm hiring a female CEO. Then we estimate *Inverse Mills Ratio* using the first-stage regression. In the outcome step, we add *Inverse Mills Ratio* as a control variable to adjust for any selection bias. Columns (2) and (3) show that after controlling for the potential endogeneity in the second-stage regression, the estimated coefficients of $Female_{t-1}$ are negative and statistically significant.

4.2.3 | Difference-in-differences framework

Our next method of identification is a DID method comparing firm leverage around a window of male-to-female CEO transitions with a control sample of male-to-male CEO turnovers. The DID estimator is a panel data (repeated cross-section) estimator, which mitigates the concern on the omitted variable bias and helps to strengthen the relation between the gender of CEO and debt structure of firm, utilizing an exogenous shock on CEO gender. Any differences in the changes in capital structure before and after the CEO turnovers between the male-to-female and male-to-male CEO transitions are likely due to the impact of the change in CEO gender, instead of the difference between the two transition groups before the CEO turnovers.

We construct a matching sample of firms that have undergone CEO transitions from male to female and from male to male, following with Huang and Kisgen (2013).[4] The year of a CEO turnover is the first year when a new CEO is appointed. The sample for the DID analysis includes firm–year observations for the 3 years before and 3 years after a new CEO is hired. We drop the transition year in the DID sample. For a transition to enter our DID sample, a new CEO must remain in the CEO position for more than three consecutive years. We further require companies in our DID sample to have obtainable financial data in Compustat for more than 2 years prior to a CEO's turnover. The application of the above sample selection criteria leads to a DID sample of 2834 male-to-male transitions and 88 male-to-female transitions. Our DID regression model is illustrated in the following equation:

$$\text{Debt structure}_{i,t} = \beta_0 + \beta_1 FeTran_i \times TranPost_{i,t} + \beta_2 FeTran_i + \beta_3 TranPost_{i,t} + \gamma' \text{Control variables}_{i,t} + \theta_j + \mu_t + \epsilon_{i,t}, \quad (4)$$

where $FeTran_i$ is an indicator variable equal to one if firms experience the transition from male to female and zero if firms experience the transition from male to male; $TranPost_{i,t}$ is an indicator variable that is equal to one if firm-year t is after the CEO appointment year and zero otherwise; *Control variables* are variables reported in our regression model for the baseline; and θ_j and μ_t are industry fixed effects and year fixed effects.

Our DID model specification has three major advantages. First, a new CEO must keep her position for more than 3 years so that there is enough time for her to adjust corporate debt structure. Second, our sample contains a number of firm–year observations before and after the appointment of new CEOs, which provides us with a balanced DID sample and removes any potential noise in

TABLE 4 Female CEOs and corporate debt structure: Heckman's two-stage procedure.

	Selection	Outcome	
	$Female_{t-1}$	$BLev_t$	$MLev_t$
	(1)	(2)	(3)
$Female_{t-1}$		−0.024***	−0.026***
		(−3.014)	(−3.776)
$Gender\_Equality_{t-1}$	0.006**		
	(2.138)		
$Size_{t-1}$	0.019	0.011***	0.006***
	(1.241)	(5.800)	(3.517)
MTB_{t-1}	0.046***	−0.017***	−0.034***
	(3.946)	(−9.123)	(−22.420)
$Profitability_{t-1}$	−0.014*	−0.011***	−0.010***
	(−1.688)	(−10.238)	(−11.390)
$FAsset_{t-1}$	0.062	−0.037***	−0.030***
	(1.033)	(−5.977)	(−4.892)
$Rating_{t-1}$	0.018	0.010**	0.012***
	(0.327)	(2.434)	(2.894)
$FirmAge_{t-1}$	0.011***	0.001***	0.001***
	(4.352)	(2.683)	(3.018)
$CEOComp_{t-1}$	0.008	0.005***	0.001
	(0.342)	(3.810)	(0.824)
$CEOPower_{t-1}$	0.372	0.062***	0.036**
	(1.369)	(3.702)	(2.374)
$CEOAge_{t-1}$	−1.800***	−0.233***	−0.202***
	(−13.050)	(−4.155)	(−4.016)
$EIndex_{t-1}$	−0.067***	−0.016***	−0.013***
	(−4.422)	(−7.104)	(−6.193)
$DirGenRatio_{t-1}$	5.368***	0.774***	0.648***
	(26.052)	(4.808)	(4.598)
$Director_{t-1}$	−0.271***	−0.077***	−0.063***
	(−3.570)	(−6.953)	(−6.216)
Inverse Mills Ratio		0.160***	0.128***
		(4.798)	(4.350)
Intercept	4.313***	0.589***	0.620***
	(8.028)	(6.422)	(7.340)
Observations	17,047	17,047	17,047
Pseudo/Adjusted-R^2	0.311	0.121	0.138
Industry fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes

Note: This table presents Heckman's (1979) two-stage procedure results of the empirical relation between female CEOs and corporate debt structure. Our sample covers firm–year observations with non-missing values for all variables during 1993–2021. Column (1) reports the results of the first-stage selection equation estimated by a probit regression, in which the dependent variable is $Female_{t-1}$. In the first-stage regression, $Gender\_Equality_{t-1}$ is included as an explanatory variable, which is the state-level gender equality index based on the location of a firm's headquarters (Huang & Kisgen, 2013; Sugarman & Straus, 1988). Columns (2) and (3) report the results of the second-stage regressions, where the dependent variables are $BLev_t$ and $Mlev_t$. We estimate *Inverse Mills Ratio* using the first-stage regression and include it in the second-stage equation to adjust for any potential selection bias. The coefficients of the three-digit SIC industry fixed effects and year fixed effects are suppressed for brevity in the respective columns. The detailed definition of all variables is provided in Appendix A. The *z*-values and t-values reported in parentheses are based on double clustered standard errors by firm and year (Petersen, 2009). *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

the transition years. Third, our DID model reduces the impact of unobservable firm characteristics that are time-invariant, by comparing the transitions from male to female and from male to male. It is very unlikely that the decrease in the two leverage ratios during the CEO transition periods can be alternatively explained by unobservable omitted variables, since such latent variables must have coincidentally changed over the CEO turnover window and have no relation to the transition itself.

The DID regression results are summarized in Table 5. We find that the estimated coefficients of $FeTran_i \times TranPost_{i,t}$ are negative and statistically significant at the 10% level. This suggests that firms hold lower book leverage and market leverage after female CEO appointments than after male CEO appointments. Our baseline regression findings in Section 4.1 remain robust in the DID framework.

4.2.4 | High-dimensional fixed effects model

We have controlled for the industry and year fixed effects in our baseline regressions. Lemmon et al. (2008) argue that the variations in leverage ratios are mainly motivated by an unobserved time-invariant effect that produces a stable capital structure. The correlation between CEO gender and corporate debt levels may be influenced by time-invariant and unobservable firm characteristics that are not controlled in our baseline regressions. Our PSM identification method only matches firms by observed firm characteristics and may not mitigate the estimation bias due to latent variables. Gormley and Matsa (2014) argue that a high-dimensional fixed effects

TABLE 5 Female CEOs and corporate debt structure: Difference-in-differences (DID).

	$BLev_{t+1}$	$MLev_{t+1}$
	(1)	(2)
$FeTran \times TranPost_t$	−0.026*	−0.027*
	(−1.794)	(−1.706)
$FeTran$	0.007	−0.028***
	(0.798)	(−4.231)
$TranPost_t$	−0.007*	−0.002
	(−1.864)	(−0.519)
$Size_t$	0.003	0.002
	(1.344)	(1.039)
MTB_t	−0.008	−0.017*
	(−0.795)	(−1.759)
$Profitability_t$	−0.035	−0.086***
	(−0.864)	(−3.217)
$FAsset_t$	0.002	−0.010
	(0.320)	(−1.012)
$Rating_t$	−0.014**	−0.019***
	(−2.785)	(−3.812)
$FirmAge_t$	0.001***	0.001***
	(5.423)	(4.710)
$CEOComp_t$	−0.003	−0.003
	(−1.587)	(−1.490)
$CEOPower_t$	0.026	0.035*
	(1.362)	(1.922)
$CEOAge_t$	−0.052**	−0.050***
	(−2.206)	(−2.701)
$EIndex_t$	−0.003	−0.007***
	(−1.586)	(−3.723)
$DirGenRatio_t$	0.102***	0.149***
	(4.043)	(6.165)
$Director_t$	−0.030***	−0.034***
	(−2.851)	(−3.262)
Intercept	0.491***	0.507***
	(5.104)	(6.098)
Observations	10,055	10,055
Adjusted-R^2	0.007	0.014
Industry fixed effects	Yes	Yes
Year fixed effects	Yes	Yes

Note: This table presents the DID regression results for the empirical relation between female CEOs and corporate debt structure. Our sample includes firm–year observations 3 years before and 3 years after a CEO turnover, excluding the year of the transition. The CEO turnover is either male-to-male or male-to-female. The sample period is 1993–2021. We require that firms have more than 2 years of non-missing data before a CEO turnover. The dependent variables are $BLev_{t+1}$ and $MLev_{t+1}$. *FeTran* is an indicator variable equal to one if a CEO transition is male-to-female and zero if a CEO transition is male-to-male. $TranPost_t$ is an indicator variable equal to one if a firm–year is after a CEO transition and zero otherwise. The coefficients of the three-digit SIC industry fixed effects and year fixed effects are suppressed for brevity in the respective columns. The detailed definition of all variables is provided in Appendix A. The *t*-values reported in parentheses are based on double clustered standard errors by firm and year (Petersen, 2009). *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

model can help alleviate the endogeneity due to unobserved heterogeneity. We take their suggestions and control for unobserved heterogeneity among different firms and time-varying heterogeneity among different industries. Specifically, we include the firm fixed effects and year fixed effects in our baseline regressions and tabulate the results in columns (1) and (3) of Table 6. We also control for the firm fixed effects and interacted industry–year fixed effects and summarize the results in columns (2) and (4) of Table 6. The coefficients of $Female_{t-1}$ are negative and statistically significant at the 1% level in the high-dimensional fixed effects model. We find no evidence of an effect of the above potential factors on our primary result.

4.2.5 | Summary of identification results

We summarize the estimated coefficients of $Female_{t-1}$ in our identification tests and report them in Appendix B. We find that the coefficients are negative and statistically significant in all eight columns. By comparison, the estimated coefficients on $Female_{t-1}$ in columns (5)–(8) (Heckman two-stage and High-dimensional fixed effects) are similar to those of the baseline regression, while the coefficients in column (3) and (4) (PSM) are larger than those of the baseline regression. However, in our PSM estimation sample, we throw out unmatched observations in the control and treatment samples. The sample size of the regression based on the PSM sample is greatly reduced. Therefore, the magnitude and statistical significance of the regression coefficients of OSL and PSM cannot be directly compared.

4.3 | Channels

Previous behavioural studies show that females can be more averse to risk and less overconfident than males. Either risk aversion or a lack of confidence may result in

TABLE 6 Female CEOs and corporate debt structure: High-dimensional fixed effects.

	$BLev_t$		$MLev_t$	
	(1)	(2)	(3)	(4)
$Female_{t-1}$	−0.021***	−0.025***	−0.022***	−0.027***
	(−2.868)	(−3.216)	(−3.411)	(−3.856)
$Size_{t-1}$	0.009***	0.009***	0.006***	0.006***
	(6.525)	(5.871)	(4.482)	(4.147)
MTB_{t-1}	−0.023***	−0.023***	−0.039***	−0.037***
	(−23.400)	(−21.939)	(−52.114)	(−46.972)
$Profitability_{t-1}$	−0.011***	−0.011***	−0.009***	−0.009***
	(−13.886)	(−13.542)	(−14.477)	(−13.653)
$FAsset_{t-1}$	−0.038***	−0.052***	−0.034***	−0.047***
	(−8.171)	(−10.686)	(−7.445)	(−9.758)
$Rating_{t-1}$	0.005	0.007**	0.007**	0.009***
	(1.548)	(2.209)	(2.178)	(2.662)
$FirmAge_{t-1}$	0.000	0.000	0.000	0.000
	(1.016)	(0.869)	(1.254)	(0.975)
$CEOComp_{t-1}$	0.002**	0.001	0.000	−0.001
	(2.334)	(0.564)	(0.072)	(−0.894)
$CEOPower_{t-1}$	0.016*	0.010	0.009	0.001
	(1.848)	(1.119)	(1.084)	(0.099)
$CEOAge_{t-1}$	0.010	0.011	−0.001	−0.002
	(1.054)	(1.159)	(−0.096)	(−0.174)
$EIndex_{t-1}$	−0.005***	−0.006***	−0.004***	−0.004***
	(−5.512)	(−6.158)	(−4.243)	(−4.415)
$DirGenRatio_{t-1}$	0.031**	0.047***	0.038***	0.049***
	(2.225)	(3.196)	(2.769)	(3.362)
$Director_{t-1}$	−0.009	−0.016***	−0.001	−0.008
	(−1.522)	(−2.712)	(−0.111)	(−1.385)
Intercept	0.214***	0.191***	0.283***	0.245***
	(4.746)	(3.788)	(6.155)	(5.150)
Observations	28,389	26,973	28,389	26,973
Adjusted-R^2	0.152	0.212	0.169	0.223
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	No	Yes	No
Industry × Year fixed effects	No	Yes	No	Yes

Note: This table presents the high-dimensional fixed effects regression results. Our sample covers firm–year observations with non-missing values for all variables during 1993–2021. The dependent variables are two measures of firm leverage: $BLev_t$ and $MLev_t$. The independent variable of interest is $Female_{t-1}$ that is equal to one if a firm has a female CEO and zero otherwise. In columns (1) and (3), we control for the firm fixed effects and year fixed effects. In columns (2) and (4), we control for the firm fixed effects and interacted industry-year fixed effects. The coefficients of the fixed effects are suppressed for brevity in the respective columns. The detailed definition of all variables is provided in Appendix A. The *t*-values reported in parentheses are based on double clustered standard errors by firm and year (Petersen, 2009). *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

firms managed by female CEOs borrowing less externally than firms managed by male CEOs. Thus, we test the effect of the underlying channel through which CEO gender may influence corporate debt structure decisions. Few previous managerial gender studies directly compare the roles of these two traits in influencing corporate

outcomes. Differentiating the impact of these two channels helps to improve the contribution of this article to the existing literature on the role of female managers in corporate finance. Evidence on these two channels may also help us to mitigate the potential confounding effect of unobservable firm characteristics.

We adopt the measures of risk preference and overconfidence tendency related to CEO compensation incentives. First, we follow a large strand of managerial compensation studies (e.g., Coles et al., 2006; Core & Guay, 2002) and use *Delta* and *Vega* of a CEO's option portfolio to measure CEO risk aversion. *Delta* measures the sensitivity of CEO wealth to stock price, while *Vega* measures the sensitivity of CEO wealth to stock return volatilities. Second, we use CEO stock options (*Option*) and management earnings forecast (*Forecast*) as proxies for CEO overconfidence (Hirshleifer et al., 2012; Hribar & Yang, 2016; Libby & Rennekamp, 2012; Malmendier & Tate, 2005).

To investigate whether CEO risk aversion or overconfidence may explain the empirical relation between CEO gender and corporate debt structure, we include the above variables and their interaction terms with $Female_{i,t-1}$ in our baseline Equation (3). The specific equation is as follows:

$$\begin{aligned}\text{Debt structure}_{i,t} = {} & \beta_0 + \beta_1 \text{Female}_{i,t-1} + \beta_2 \text{Proxy}_{i,t-1} + \beta_3 \text{Female}_{i,t-1} \\ & \times Proxy_{i,t-1} + \gamma' \text{Control variables}_{i,t-1} + \theta_j + \mu_t + \epsilon_{i,t},\end{aligned} \tag{5}$$

where $Debtstructure_{i,t}$ includes book leverage and market leverage. $Proxy_{i,t-1}$ stands for $Delta_{i,t-1}$, $Vega_{i,t-1}$, $Option_{i,t-1}$, and $Forecast_{i,t-1}$, respectively. Specifically, $Delta_{i,t-1}$ is the pay-performance sensitivity of firm i's CEO, defined as the increase in the option portfolio value of CEO for a 1% increase in firm i's stock price (Core & Guay, 2002); $Vega_{i,t-1}$ is the risk taking incentive of firm i's CEO, defined as the increase in the CEO's option portfolio value for a 1% increase in firm i's stock return volatility (Core & Guay, 2002); and $Option_{i,t-1}$ indicates whether firm i's CEO is overconfident or not, which is equal to one if the CEO has ever held her option at least 67% in-the-money until the option's expiration year over our sample period and zero otherwise (Hirshleifer et al., 2012; Malmendier & Tate, 2005). $Forecast_{i,t-1}$ is an indicator variable equal to one if a firm issues a management earnings forecast and zero otherwise (Hribar & Yang, 2016; Libby & Rennekamp, 2012).

The results of our channel tests are represented in Table 7. In columns (1) to (4) of Table 7, the coefficients on $Female_{t-1} \times Delta_{t-1}$ and $Female_{t-1} \times Vega_{t-1}$ are negative and statistically significant, while the coefficients on $Female_{t-1}$ are statistically insignificant. These results indicate that the CEO risk aversion is the channel through which CEO gender affects corporate debt structure. In columns (5) and (8) of Table 7, the coefficients on $Female_{t-1}$ are still negative and statistically significant while the coefficients on $Female_{t-1} \times Option_{t-1}$ and $Female_{t-1} \times Forecast_{t-1}$ are statistically insignificant. These results suggest that the effect of CEO gender on corporate debt structure cannot be explained by CEO overconfidence. These results suggest that the empirical association between CEO gender and the two leverage ratios is mainly explained by CEO risk aversion, not CEO overconfidence. Although both the risk aversion and overconfidence channels are potential explanations for why female and male CEOs make different debt structure decisions, the empirical results in this section only support our hypothesis H2, the risk aversion channel.

5 | SUPPLEMENTARY TESTS AND FURTHER DISCUSSIONS

5.1 | Cross-sectional analyses

To test whether the influence of CEO gender on corporate debt structure shows any cross-sectional variations with respect to CEO and firm characteristics, we employ three cross-sectional analyses in this section. Specifically, we add CEO age, industry litigation risk, and industry competition and their interaction terms with $Female_{t-1}$ in Equation (3) to examine the effect of CEO and firm characteristics on our baseline results.

5.1.1 | CEO age

The personal wealth of CEOs is usually tied to firm performance through their incentive compensation packages. However, a CEO's pay-performance sensitivity is related to her age. If younger CEOs have a permanent increase in their compensation, then they can enjoy such a pay jump for a longer period than older CEOs (Andreou et al., 2017). Accordingly, younger CEOs are incentivized to take higher risks in order to signal their ability in the labor market. Consistent with the view that younger CEOs prefer to take higher risk, Serfling (2014) documents that older CEOs make less R&D investment, engage in more diversifying acquisitions, choose more diversified firm operations, and maintain lower operating leverage. In addition, older CEOs have a shorter career horizon, so they tend to have less career concerns and are more likely to enjoy a "quiet life". Consistent with the career concerns' view, Li et al. (2017) find that younger CEOs tend to engage in new lines of business,

TABLE 7 Channels: Risk aversion or overconfidence.

	$BLev_t$	$MLev_t$	$BLev_t$	$MLev_t$	$BLev_t$	$MLev_t$	$BLev_t$	$MLev_t$
	Proxzy = Dela		***Proxzy = Vega***		***Proxzy = Option***		***Proxzy = Forecast***	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
$Female_{t-1}$	0.066	0.027	0.009	−0.003	−0.046**	−0.051***	−0.032**	−0.054***
	(1.152)	(0.801)	(0.341)	(−0.168)	(−2.460)	(−2.663)	(−2.515)	(−4.290)
$Proxzy_{t-1}$	0.007***	0.006***	−0.001	−0.001	0.001	0.004	0.000	−0.018***
	(2.596)	(5.264)	(−0.605)	(−0.752)	(0.141)	(0.594)	(0.016)	(−6.459)
$Female_{t-1} \times Proxzy_{t-1}$	−0.020*	−0.012*	−0.014**	−0.010*	−0.024	0.008	0.014	0.028
	(−1.825)	(−1.822)	(−2.218)	(−1.915)	(−0.605)	(0.190)	(0.759)	(1.527)
$Size_{t-1}$	0.006	0.005**	0.007	0.006	0.005	0.000	0.007***	0.006***
	(1.284)	(2.563)	(1.368)	(1.187)	(1.354)	(0.067)	(3.840)	(3.031)
MTB_{t-1}	−0.022***	−0.038***	−0.022***	−0.038***	−0.023***	−0.041***	−0.022***	−0.041***
	(−9.505)	(−35.366)	(−9.583)	(−21.404)	(−11.687)	(−20.157)	(−20.899)	(−39.277)
$Profitability_{t-1}$	−0.013***	−0.011***	−0.012***	−0.010***	−0.012***	−0.012***	−0.011***	−0.010***
	(−6.843)	(−13.210)	(−6.306)	(−6.731)	(−8.052)	(−7.792)	(−14.190)	(−13.127)
$Fasset_{t-1}$	−0.029**	−0.036***	−0.028*	−0.035**	−0.068***	−0.057***	−0.043***	−0.048***
	(−1.996)	(−6.659)	(−1.893)	(−2.433)	(−7.065)	(−5.796)	(−8.515)	(−9.639)
$Rating_{t-1}$	0.001	−0.003	0.002	−0.002	−0.013*	−0.007	0.004	0.004
	(0.092)	(−0.642)	(0.206)	(−0.147)	(−1.753)	(−0.932)	(0.962)	(1.016)
$FirmAge_{t-1}$	0.006	0.009***	0.005	0.009	0.021***	0.018***	0.002	0.005**
	(0.882)	(3.808)	(0.809)	(1.438)	(4.146)	(3.512)	(1.009)	(2.297)
$CEOComp_{t-1}$	0.002	0.001	0.006*	0.005	0.006*	0.003	0.006***	0.005***
	(0.493)	(0.360)	(1.835)	(1.418)	(1.902)	(0.984)	(4.573)	(3.782)
$CEOPower_{t-1}$	0.008	0.006	0.008	0.006	0.031*	0.003	0.013	0.004
	(0.508)	(0.562)	(0.492)	(0.415)	(1.692)	(0.141)	(1.320)	(0.386)
$CEOAge_{t-1}$	−0.007	−0.010	0.002	−0.003	0.003	−0.008	0.012	−0.021*
	(−0.254)	(−0.808)	(0.075)	(−0.140)	(0.166)	(−0.360)	(1.084)	(−1.952)
$Eindex_{t-1}$	−0.007***	−0.006***	−0.008***	−0.006***	−0.001	−0.004*	−0.005***	−0.004***
	(−2.973)	(−5.620)	(−3.090)	(−2.773)	(−0.424)	(−1.683)	(−4.604)	(−3.953)
$DirGenRatio_{t-1}$	0.031	0.051***	0.029	0.049	0.076**	0.106***	0.055***	0.082***
	(0.797)	(2.930)	(0.743)	(1.341)	(2.422)	(3.298)	(3.429)	(5.220)
$Director_{t-1}$	−0.008	−0.001	−0.007	0.000	0.004	0.004	0.001	0.005
	(−0.462)	(−0.103)	(−0.189)	(0.208)	(0.244)	(0.282)	(0.206)	(0.793)
Intercept	0.224*	0.237***	1.561	1.835*	0.215	0.441***	0.283***	0.330***
	(1.838)	(4.086)	(1.607)	(1.870)	(1.466)	(2.954)	(5.462)	(6.556)
Observations	18,590	18,590	18,590	18,590	16,099	16,099	21,212	21,212
Adjusted-R^2	0.145	0.188	0.144	0.187	0.121	0.161	0.071	0.126
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table presents the regression results of firm leverage on the variations of CEO gender which can be explained by CEO risk aversion or overconfidence. Our sample covers firm-year observations with non-missing values for all variables during 1993–2021. The dependent variables are two measures of debt level: $BLev_t$ and $MLev_t$. The independent variables of interest are $Female_{t-1} \times Proxy_{t-1}$. The coefficients of the three-digit SIC industry fixed effects and year fixed effects are suppressed for brevity in the respective columns. The detailed definition of all variables is provided in Appendix A. The *t*-values reported in parentheses are based on double clustered standard errors by firm and year (Petersen, 2009). *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

undertake bolder expansions and divestments, and increase firm size through inorganic investment plans such as mergers and acquisitions (M&As). Since female CEOs tend to be more risk averse than male CEOs, the risk aversion mechanism may mitigate the risk taking tendency of young CEOs. Therefore, we posit that the association between CEO gender and firms' debt structure is more strongly correlated for firms with younger CEOs.

The average age of CEOs in our main sample is 55, similar to Antia et al. (2010) and Andreou et al. (2017). We construct a variable *Young*, that equals one if a CEO's age is below 55 and zero otherwise, to measure whether the CEO is young. Columns (1) and (2) of Table 8 report the influence of CEO age on the correlation between CEO gender and the debt structure. The estimated coefficients on $Female_{t-1} \times Young_{t-1}$ and $Female_{t-1}$ are negative and statistically significant, which confirms our prediction that the career concerns related to CEO age magnifies the difference in the risk taking tendency between female and male CEOs.

5.1.2 | Litigation risk

Next, we focus on the impact of corporate litigation risk on the empirical relationship between CEO gender and firm capital structure. Assuming that CEOs maximize their expected utility, they will weigh the expected pecuniary gain of risk taking against the expected costs of risk taking. Previous studies suggest that women do better than men in complying with tax rules, business ethics, financial reporting guidelines, financial market regulations, and professional financial advice than men (e.g., Baldry, 1987; Barnett et al., 1994; Bernardi & Arnold, 1997; Brooks et al., 2019; Fallan, 1999; Ittonen et al., 2013). As female CEOs are more sensitive to litigation risk comparing to their male peers, we conjecture that high ex ante litigation risk will exacerbate the impact of CEO gender on corporate debt structure.

Following Venkataraman et al. (2008) and Goh and Li (2011), we adopt the following primary SIC codes to identify industries with high litigation risk: 2833–2836 (Biotechnology), 3570–3577 (Computer Equipment), 3600–3674 (Electronics), 5200–5961 (Retailing), and 7370–7374 (Computer Services). *Hrisk* is equal to one if the firm is in one of the industries mentioned above and zero otherwise. Columns (3) and (4) of Table 8 report the influence of litigation risk on the relation between CEO gender and corporate leverage. The coefficients on $Female_{t-1}$ are all negative and statistically significant at the 1% level, and the coefficients on interaction term $Female_{t-1} \times Hrisk_{t-1}$ are also negative and statistically significant. These findings confirm that the potential future litigation risk magnifies the role of the risk aversion channel, leading to firms with female CEOs issuing less debt.

5.1.3 | Product market competition

Third, we examine if the relation between CEO gender and firm capital structure varies across firms in competitive and non-competitive industries. Froot et al. (1993) find that firms facing higher market competition have a larger default probability. Bushman et al. (2010) also show that the probability of CEO turnovers has a positive effect on market competition. Therefore, CEOs of firms in highly competitive industries are unlikely to enjoy a "quiet life" and a stable career (Akdoğu & MacKay, 2012). Given that market competition may increase the tendency of CEOs to engage in risk taking activities, we expect that CEO gender will have a larger impact on corporate debt structure for companies in highly competitive industries.

For firms with the same first three-digit SIC codes (Boubaker et al., 2018), we use the Herfindahl Index (HHI) based on total assets to proxy for product market competition. We construct *Hcompetition* to measure the product market competition according to the annual median of the HHI. Industries with a larger HHI have a lower level of market competition. *Hcompetition* is equal to one for firms in the industry with high competition and zero otherwise. Columns (5) and (6) of Table 8 report that the estimated coefficients on $Female_{t-1}$ and $Female_{t-1} \times Hcompetition_{t-1}$ are all negative and statistically significant. This finding suggests that market competition enhances the variation in risk aversion preference between female and male CEOs, resulting in a more pronounced association between CEO gender and firm debt structure for firms in highly competitive industries.

5.2 | CEO gender and specific debt structure

So far, we have demonstrated that because women have greater risk aversion compared to men, firms with female CEOs have lower leverage ratios than firms with male CEOs. In this section, we further demonstrate that CEO gender is associated with not only the general capital structure but also specific debt structure decisions, such as debt capacity and debt maturities.

TABLE 8 Cross-sectional analyses.

	$BLev_t$	$MLev_t$	$BLev_t$	$MLev_t$	$BLev_t$	$MLev_t$
	Proxzy* = *Young		***Proxzy* = *Hrisk***		***Proxzy* = *Hcompetition***	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
$Female_{t-1}$	−0.025**	−0.025*	−0.028***	−0.030***	−0.017*	−0.014*
	(−2.645)	(−1.779)	(−4.733)	(−4.507)	(−1.710)	(−1.738)
$Proxzy_{-1}$	−0.003	−0.005	0.006*	0.010***	0.002	0.002
	(−0.802)	(−1.198)	(2.044)	(3.839)	(0.958)	(0.741)
$Female_{t-1} \times Proxzy_{t-1}$	−0.026**	−0.032*	−0.034*	−0.030*	−0.019*	−0.029***
	(−2.102)	(−1.750)	(−1.887)	(−1.727)	(−1.871)	(−2.900)
$Size_{t-1}$	0.007***	0.005***	0.009***	0.007***	0.007	0.006***
	(3.832)	(2.812)	(4.935)	(3.816)	(1.249)	(2.874)
MTB_{t-1}	−0.022***	−0.041***	−0.023***	−0.042***	−0.023***	−0.040***
	(−21.045)	(−40.160)	(−28.893)	(−48.782)	(−24.916)	(−31.274)
$Profitability_{t-1}$	−0.011***	−0.010***	−0.011***	−0.010***	−0.011***	−0.010***
	(−20.595)	(−12.972)	(−22.185)	(−17.043)	(−20.506)	(−13.266)
$FAsset_{t-1}$	−0.044***	−0.045***	−0.036***	−0.040***	−0.031***	−0.039***
	(−17.043)	(−9.423)	(−14.980)	(−12.329)	(−7.128)	(−8.026)
$Rating_{t-1}$	0.005*	0.003	0.005**	0.003	0.012***	0.010***
	(1.869)	(0.921)	(2.440)	(1.261)	(5.481)	(4.060)
$FirmAge_{t-1}$	0.003*	0.006***	0.008***	0.009***	0.000	−0.000*
	(1.921)	(2.842)	(6.256)	(8.884)	(0.797)	(−1.724)
$CEOComp_{t-1}$	0.006***	0.005***	0.004**	0.003***	0.003**	0.002
	(4.376)	(3.720)	(2.760)	(2.822)	(2.178)	(0.968)
$CEOPower_{t-1}$	0.011	0.001	0.014	0.006	0.021**	0.007
	(0.947)	(0.131)	(1.420)	(0.794)	(2.327)	(0.952)
$CEOAge_{t-1}$	−0.020	−0.037**	0.000	−0.005	0.006	−0.002
	(−1.209)	(−2.219)	(0.007)	(−0.622)	(0.721)	(−0.226)
$EIndex_{t-1}$	−0.004***	−0.004***	−0.003***	−0.003***	−0.002***	−0.003***
	(−6.050)	(−3.889)	(−7.176)	(−6.474)	(−3.321)	(−7.059)
$DirGenRatio_{t-1}$	0.058***	0.088***	0.042***	0.059***	0.017	0.062***
	(6.550)	(5.756)	(5.193)	(6.530)	(1.278)	(5.819)
$Director_{t-1}$	−0.004	0.002	−0.015***	−0.007	−0.005	0.000
	(−0.775)	(0.302)	(−3.038)	(−1.547)	(−0.887)	(0.046)
Intercept	0.324***	0.397***	−0.828***	−0.279	−0.586	0.288***
	(4.330)	(5.497)	(−3.134)	(−1.107)	(−1.575)	(8.501)
Observations	28,389	28,389	28,389	28,389	28,389	28,389
Adjusted-R^2	0.069	0.124	0.052	0.108	0.055	0.120
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table presents the cross-sectional analyses of the effect of CEO age, litigation risk, and market competition on the relation between CEO gender and corporate debt structure. Our sample covers firm–year observations with non-missing values for all variables during 1993–2021. The dependent variables are two leverage ratios: $BLev_t$ and $MLev_t$. The independent variables of interest are $Female_{t-1} \times Proxy_{t-1}$. In columns (1) and (2), variable *Young* equals one if a CEO's age is below median and zero otherwise. In columns (3) and (4), *Hrisk* is equal to one if a firm is in one of the industries with high litigation risk and zero otherwise. In columns (5) and (6), *Hcompetition* is equal to one if a firm is in the industries with an below-median Herfindahl Index based on total assets and zero otherwise. *Hcompetition* measures the product market competition. The control variables are the same as those in Equation (3). The coefficients of the control variables, three-digit SIC industry fixed effects, and year fixed effects are suppressed for brevity in the respective columns. The detailed definition of all variables is provided in Appendix A. The *t*-values reported in parentheses are based on double clustered standard errors by firm and year (Petersen, 2009). *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

5.2.1 | Debt capacity

Denis and Sibilkov (2009), Harford et al. (2009), and Faulkender et al. (2012) show that actual firm leverage usually fluctuates around the predicted target level, and the difference between the real leverage ratio and target leverage ratio affects firm future financing capability. Firms with leverage above target have a tendency to increase the rate of leverage adjustment towards target leverage ratio, while firms with leverage below target tend to decrease the rate of leverage adjustment towards the target leverage ratio (Lemmon & Zender, 2010). Since firms with above-target leverage have more financial flexibility to borrow in the external credit markets than firms with below-target leverage, female CEOs are more likely to keep their firms' actual leverage below the target level according to the risk aversion channel.

To estimate a firm's target leverage, we adopt Byoun's (2008) empirical model:

$$\text{Debt structure}_{i,t} = \beta_0 + \gamma' \Theta_{i,t-1} + \theta_j + \mu_t + \epsilon_{i,t}, \quad (6)$$

where Debt structure is either book leverage or market leverage, Θ is a variable vector related to the capital structure of the firm, θ_j is the industry fixed effects based on three-digit SIC, and μ_t is the year fixed effects. Following Flannery and Rangan (2006) and Byoun (2008), Θ includes the following firm and industry characteristics: *Size* defined as the natural logarithm of total assets, *Profit* defined as the ratio of earnings before interest, taxes, depreciation, and amortization to total assets, *Fixed assets* defined as fixed assets divided by total assets, *Median debt ratio* defined as the industry median debt ratio, *Tax* defined as the ratio of income tax to total sales, *Div* defined as the ratio of common stock dividends to total assets, *Depreciation* defined as the ratio of depreciation and amortization to total assets, *R&D* defined as the ratio of R&D expenditure to total assets, *R&D indicator* defined as a dummy variable equal to one if *R&D* is positive and zero otherwise, and *AZ* defined as the modified Altman's Z-score (MacKie-Mason, 1990).

The residual estimated from regression Equation (6) represents the variance between the actual leverage and the model predicted target leverage. We define *BDebtCap* (*MDebtCap*) as an indicator variable, equal to one if book leverage (market leverage) is less than predicted book leverage (market leverage) and zero otherwise. Then we substitute the dependent variable in our baseline regression Equation (3) by one of these two debt capacity indicator variables. Columns (1)–(2) of Table 9 present the marginal effect of $Female_{t-1}$ on the debt capacity indicator variables estimated by probit regressions. The coefficients of $Female_{t-1}$ are positive and statistically significant. Firms managed by female CEOs have a 8.4% (12.1%) higher probability of keeping actual book (market) leverage to be less than the predicted book (market) leverage. Given that the mean values of *BDebtCap* and *MDebtCap* are 60.0% and 57.7%, the impact of CEO gender on debt capacity is economically important. The positive relation between female CEOs and debt capacity confirms that the risk aversion channel plays an essential role in explaining the gender difference in corporate debt structure. Our result is also in agreement with the study of Byoun (2008) and Lemmon and Zender (2010), that companies with a conservative corporate policy tend to have positive debt capacity, in order to keep external borrowing acceptable in the future.

5.2.2 | Debt maturities

When refinancing existing debts with new borrowing proceeds, firms usually bear the risk that the changes in market conditions or capital market imperfections may induce more external borrowing costs (Froot et al., 1993). An important aspect of corporate debt structure is debt maturity, because shortening debt maturity increases the potential costs stemming from refinancing risk (Harford et al., 2014). On the one hand, the firms with more short-term debts must engage in frequent renegotiations with their lenders, which exposes the firms to more refinancing risk (Diamond & Verrecchia, 1991). Rajan and Winton (1995) also reveal that CEOs are subject to scrutiny from firm lenders when their firms frequently borrow from the external credit market. On the other hand, long-term debt provides firms with a relatively less frequent refinancing environment, which results in less refinancing risk (Huang & Kisgen, 2013; Johnson, 2003). Thus, CEOs with a higher degree of risk aversion prefer to borrow more long-term debt rather than short-term debt (Dang & Phan, 2016). We expect that firms that are managed by female CEOs will have longer debt maturities than firms that are managed by male CEOs.

To study the effect of CEO gender on debt maturity, we substitute the dependent variable in our baseline regression Equation (3) by one of the following two debt maturity proxy variables: $LDebt_t$ and $DLDebt_t$. *LDebt* is the ratio of long-term debt to total debt, and *DLDebt* is an indicator variable that is equal to one if *LDebt* is higher than its industry median and zero otherwise. Columns (3)–(4) of Table 9 show that the estimated coefficients of $Female_{t-1}$ are positive and statistically significant. Column (3) suggests that, on average, firms with female CEOs have long-term debt to total debt ratios that are 0.9% higher than firms with male CEOs. Column

TABLE 9 The impact of CEO gender on debt capacity and maturity.

	$BDebtCap_t$	$MDebtCap_t$	$LDebt_t$	$DLDebt_t$
	(1)	(2)	(3)	(4)
$Female_{t-1}$	0.084**	0.121**	0.009*	0.111**
	(2.003)	(2.227)	(1.801)	(2.147)
Observations	28,047	28,047	28,389	28,389
Pseudo/Adjusted-R^2	0.019	0.091	0.492	0.0001
Control variables	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes

Note: This table presents the regression results of the relation between female CEOs and firm specific debt structure. Our sample covers firm–year observations with non-missing values for all variables during 1993–2021. In columns (1)–(2), the dependent variables are debt capacity: $BDebtCap_t$ and $MDebtCap_t$. In columns (3)–(4), the dependent variables are debt maturities: $LDebt_t$ and $DLDebt_t$. The independent variable of interest is $Female_{t-1}$. We report the probit regression results (marginal effect reported) in columns (1), (2), and (4) and the OLS regression results in column (3). The control variables are the same as those in Equation (3). The coefficients of the control variables, three-digit SIC industry fixed effects, and year fixed effects are suppressed for brevity in the respective columns. The detailed definition of all variables is provided in Appendix A. The *z*-values and t-values reported in parentheses are based on double clustered standard errors by firm and year (Petersen, 2009). *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

(4) indicates that firms with female CEOs have a 11.1% higher probability of keeping an above-industry-median long-term debt ratio. Our empirical results support the notion that female CEOs prefer to borrow long-term debt and reduce debt refinancing risk, consistent with a risk-averse channel.

5.3 | CEO gender and corporate governance

Previous studies on agency theory suggest that managers tend to take more risk when firms lack effective governance monitoring mechanisms. If firms that have good corporate governance tend to hire female CEOs, then corporate debt levels may be affected by corporate governance, instead of CEO gender. Besides, we do not know whether CEO gender matters if there is an optimal capital structure that the board of directors would like to achieve. To investigate the potential confounding bias due to corporate governance, we add the interaction terms between CEO gender and corporate governance to our baseline regressions: $Female_{t-1} \times Eindex_{t-1}$. Table 10 shows that after directly controlling for corporate governance, the coefficients of $Female_{t-1}$ remain negative and statistically significant. The coefficients of the interaction term, $Female_{t-1} \times Eindex_{t-1}$, are statistically insignificant, suggesting that the impact of CEO gender on debt levels is not primarily driven by corporate governance.

5.4 | CEO gender versus CFO gender

Previous studies suggest that CEOs and CFOs may play different roles in corporate activities. Usually, CEOs are responsible for major firm decisions, manage the whole firm's operations, allocate a firm's internal resources, and report firm operations to corporate board; while CFOs usually manage firms' financial activities. Top executives may play an equally or even more important role in firm decision making and outcomes. Jiang et al. (2010) show that CFO equity incentives have a larger effect on accrual management and earnings surprise than CEO equity incentives. Li and Zeng (2019) document a negative relation between female CFOs and stock price crash risk, while the influence of female CEOs on crash risk is not statistically significant. In this section, we further investigate the role of CEOs and CFOs in making capital structure decisions.

Columns (1) and (4) of Table 11 show that female CFOs are also related to less corporate debt levels.[5] Firms managed by female CFOs have an average 1.5% lower book value of leverage and a 0.7% lower market value of leverage than firms managed by male CFOs. However, the impact of female CFOs on firm leverage is less economically significant than the impact of CEOs, as documented in Section 4.1. In columns (2) and (5), we add CEO gender and CFO gender in our baseline regressions. The results show that the coefficients of both CEO and CFO gender are negative and statistically significant. In columns (3) and (6), by including the interaction term

TABLE 10 CEO gender and corporate governance.

	$BLev_t$		$MLev_t$	
	(1)	(2)	(3)	(4)
$Female_{t-1}$	−0.038**	−0.040**	−0.046***	−0.045***
	(−2.328)	(−2.471)	(−3.103)	(−3.179)
$Eindex_{t-1}$	−0.003***	−0.004***	−0.002***	−0.003***
	(−3.205)	(−4.282)	(−2.689)	(−3.824)
$Female_{t-1} \times Eindex_{t-1}$	0.003	0.004	0.004	0.005
	(0.682)	(0.906)	(1.098)	(1.246)
Intercept	0.251***	0.219***	0.243***	0.289***
	(14.030)	(5.098)	(11.883)	(6.733)
Observations	28,389	28,389	28,389	28,389
Adjusted-R^2	0.051	0.097	0.031	0.120
Control variables	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes

Note: This table presents the regression results of the impact of corporate governance on the relation between corporate debt structure and CEO gender. Our sample covers firm–year observations with non-missing values for all variables during 1993–2021. The dependent variables are two measures of debt level: $BLev_t$ and $MLev_t$. The independent variables of interest are $Female_{t-1}$, $Eindex_{t-1}$, and $Female_{t-1} \times Eindex_{t-1}$. The control variables are the same as those in Equation (3). The coefficients of the control variables, three-digit SIC industry fixed effects, and year fixed effects are suppressed for brevity in the respective columns. The detailed definition of all variables is provided in Appendix A. The *t*-values reported in parentheses are based on double clustered standard errors by firm and year (Petersen, 2009). *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

TABLE 11 CEO gender versus CFO gender.

	$BLev_t$			$MLev_t$		
	(1)	(2)	(3)	(4)	(5)	(6)
$CFOGender_{t-1}$	−0.015***	−0.015***	−0.013**	−0.007*	−0.019***	−0.020**
	(−2.639)	(−2.578)	(−2.258)	(−1.735)	(−3.097)	(−2.701)
$Female_{t-1}$		−0.018**	−0.015*		−0.008*	−0.014**
		(−2.494)	(−1.910)		(−1.995)	(−2.255)
$CFOGender_{t-1} \times Female_{t-1}$			−0.021			−0.018
			(−1.026)			(−0.817)
Intercept	−0.023	−0.016	−0.015	0.169**	0.148***	−0.027
	(−0.417)	(−0.298)	(−0.282)	(2.375)	(3.041)	(−0.544)
Observations	16,795	16,795	16,795	16,795	16,795	16,795
Adjusted-R^2	0.227	0.227	0.227	0.256	0.323	0.257
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table presents the regression results of the relation between corporate debt structure and the gender of CEO and CFO. Our sample covers firm–year observations with non-missing values for all variables during 1993–2021. The dependent variables are two measures of firm leverage: $BLev_t$ and $MLev_t$. The independent variables of interest are $CFOGender_{t-1}$, $Female_{t-1}$, and $CFOGender_{t-1} \times Female_{t-1}$. $CFOGender_{t-1}$ is equal to one if a firm has a female CFO and zero otherwise. $Female_{t-1}$ is equal to one if a firm is managed by a female CFO and zero otherwise. The control variables are the same as those in Equation (3). The coefficients of the control variables, three-digit SIC industry fixed effects, and year fixed effects are suppressed for brevity in the respective columns. The detailed definition of all variables is provided in Appendix A. The *t*-values reported in parentheses are based on double clustered standard errors by firm and year (Petersen, 2009). *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

between CEO gender and CFO gender in the regression, we find that the coefficients of the interaction term are statistically insignificant. Our results indicate that although both female CEOs and CFOs tend to take less leverage, female CEOs are critical for the company to make capital structure decisions. If a firm already employs a female CEO, hiring a female CFO does not significantly reduce the firm's debt level.

5.5 | Additional controls

In this section, we investigate whether our main finding remains robust after controlling for a list of factors that are shown to be related to firm financing decisions in previous studies. Chang et al. (2006) show that analyst coverage affects the pattern of security issuance decisions. Chaganti and Damanpour (1991) find that institutional ownership has a significant impact on the capital structure of firms. Coles et al. (2006) show empirical evidence that the structure of managerial compensation can have effect on a firm's debt policy. Berger et al. (1997) suggest that entrenched CEOs are more likely to avoid debt financing. Furthermore, female and male CEOs may differ in their managerial ability. We augment our baseline regressions with the following control variables: financial analyst coverage (*Analyst*), institutional ownership (*Ownership*), CEO fixed compensation (*CEOFixed*), CEO tenure (*CEOTenure*), firm efficiency (*Efficiency*), and managerial ability (*Mascore*). Table 12 shows that the coefficients of $Female_{t-1}$ remain negative and statistically significant after controlling for these factors.

5.6 | Sub-sample periods

Previous studies suggest that economic conditions and market regulations influence firms' capital structure (e.g., Baum et al., 2010; Wang et al., 2019). Our sample spans a long period between 1993 and 2021, during which the financial market has experienced the burst of the dot-com bubble (2000–2002), the financial crisis (2007–2008), and the Covid19 pandemic (2020–2021). Also, there are some important financial market regulations implemented during our sample period. To improve the accuracy of corporate disclosures and to protect shareholders from accounting frauds, the US Congress passed the Sarbanes–Oxley Act (SOX) in 2002. In 2006, the Financial Accounting Standards Board (FASB) introduced FAS 123R, after which companies were required to deduct an amount for equity-based compensation on an annual basis, leading to a substantial decline in the use of options for CEO compensation.

In this section, we restrict our sample to different sub-sample periods and check the robustness of our main result. In columns (1)–(4) of Table 13, we divide our sample into the non-crisis and crisis (2000–2002, 2007–2008, and 2020–2021) period. In columns (5)–(8), we divide our sample into the pre-SOX (1993–2002) and post-SOX period. In columns (9)–(12), we divide our sample into the pre-FAS 123R (1993–2006) and post-FAS 123R period. Table 13 reports that the coefficients of $Female_{t-1}$ are

TABLE 12 Additional control variables.

	$BLev_t$	$MLev_t$
	(1)	(2)
$Female_{t-1}$	−0.028***	−0.029***
	(−3.134)	(−3.328)
$Analyst_{t-1}$	0.001***	0.000
	(4.082)	(1.644)
$Ownership_{t-1}$	−0.024***	−0.017***
	(−4.173)	(−3.043)
$CEOFixed_{t-1}$	0.005	−0.001
	(0.754)	(−0.161)
$CEOTenure_{t-1}$	0.000	0.000
	(0.752)	(0.714)
$Efficiency_{t-1}$	−0.008	−0.015*
	(−0.960)	(−1.768)
$Mascore_{t-1}$	0.021	0.013
	(1.630)	(1.033)
Intercept	0.250***	0.321***
	(5.233)	(6.889)
Observations	24,117	24,117
Adjusted-R^2	0.163	0.176
Control variables	Yes	Yes
Industry fixed effects	Yes	Yes
Year fixed effects	Yes	Yes

Note: This table presents the regression results of the relation between female CEOs and corporate debt structure, controlling for additional variables. Our sample covers firm–year observations with non-missing values for all variables during 1993–2021. The dependent variables are two measures of firm leverage: $BLev_t$ and $MLev_t$. The independent variable of interest is $Female_{t-1}$, equal to one if a firm has a female CEO and zero otherwise. In addition to the control variables in Equation (3), we control for financial analyst coverage (*Analyst*), institutional ownership (*Ownership*), CEO fixed compensation (*CEOFixed*), CEO tenure (*CEOTenure*), firm efficiency (*Efficiency*), and managerial ability (*Mascore*). The other control variables are the same as those in Equation (3). The coefficients of the other control variables, three-digit SIC industry fixed effects, and year fixed effects are suppressed for brevity in the respective columns. The detailed definition of all variables is provided in Appendix A. The *t*-values reported in parentheses are based on double clustered standard errors by firm and year (Petersen, 2009). *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

TABLE 13 Sub-sample time periods.

	Non-crisis period		Crisis period		Pre-SOX		Post-SOX		Pre-FAS 123R		Post-FAS 123R	
	$BLev_t$	$MLev_t$	$BLev_t$	$MLev_t$	$BLev_t$	$MLev_t$	$BLev_t$	$MLev_t$	$BLev_t$	$MLev_t$	$BLev_t$	$MLev_t$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$Female_{t-1}$	−0.022**	−0.020***	−0.035**	−0.043***	−0.041*	−0.037*	−0.018**	−0.019***	−0.061**	−0.054**	−0.018**	−0.021***
	(−2.545)	(−2.676)	(−2.096)	(−2.605)	(−1.668)	(−1.841)	(−2.256)	(−2.702)	(−2.053)	(−2.006)	(−2.155)	(−2.781)
Intercept	0.162***	0.239***	0.363***	0.349***	0.295***	0.242***	0.209***	0.314***	0.242**	0.494***	0.213***	0.334***
	(3.067)	(4.451)	(4.967)	(4.904)	(4.418)	(3.523)	(3.500)	(5.121)	(1.994)	(5.045)	(3.138)	(4.994)
Observations	21,566	21,566	6823	6823	8965	8965	19,424	19,424	11,230	11,230	17,159	17,159
Adjusted-R^2	0.163	0.174	0.016	0.021	0.073	0.200	0.177	0.179	0.072	0.189	0.130	0.126
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: This table presents the regression results of the relation between female CEOs and corporate debt structure over different sub-sample time periods. Our sample covers firm–year observations with non-missing values for all variables during 1993–2021. The dependent variables are two measures of firm leverage: $BLev_t$ and $MLev_t$. The independent variable of interest is $Female_{t-1}$, equal to one if a firm has a female CEO and zero otherwise. In columns (1)–(4), we divide our sample into the crisis (2000–2002, 2007–2008, and 2020–2021) and non-crisis period. In columns (5)–(8), we divide our sample into the pre-SOX (1993–2002) and post-SOX period. In columns (9)–(13), we divide our sample into the pre-FAS 123R (1993–2006) and post-FAS 123R period. The control variables are the same as those in Equation (3). The coefficients of the control variables, three-digit SIC industry fixed effects, and year fixed effects are suppressed for brevity in the respective columns. The detailed definition of all variables is provided in Appendix A. The *t*-values reported in parentheses are based on double clustered standard errors by firm and year (Petersen, 2009). *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

negative and statistically significant in all the sub-sample periods. Our findings suggest that the relationship between CEO gender and corporate debt levels is robust to the financial market turbulence and financial market regulation changes during our sample period.

6 | CONCLUSIONS

In this article, we examine the effect of CEO gender on corporate financial decision making in the context of debt structure. We find that firms with female CEOs tend to issue less debt than those with male CEOs. We employ four identification methods to alleviate the potential endogeneity problem: a PSM approach, Heckman's two-stage procedure, a DID framework, and a high-dimensional fixed effects model. Our main result remains robust to these four methods. The negative association between female CEOs and leverage is primarily caused by the fact of female CEOs being more risk averse compared to male CEOs, instead of female CEOs being less overconfident than male CEOs. We further show that the effect of CEO gender on the firm's debt structure is more pronounced or only exists, when the firm's CEO is younger, the litigation risk is higher, and the market is more competitive, which supports the risk aversion channel through which CEO gender affects corporate external borrowing. Consistent with the risk aversion mechanism, our empirical results also suggest that female CEOs prefer to maintain positive debt capacity, which offers financial slack in the future, and female CEOs tend to borrow more long-term debt, which reduces the risk of refinancing. In our supplementary tests, we find that our main results are robust to sub-sample periods and additional control variables. The relation between CEO gender and corporate debt levels may not be fully explained by corporate governance. Although both female CEOs and CFOs reduce the debt levels of firms, our results indicate that CEO gender has a stronger economic effect on firm leverage than CFO gender.

Overall, our study makes a contribution to the literature through providing evidence on the economic effects of female CEOs on firm activities. Our findings also offer new insights on the implications of CEOs' risk preference for capital structure. Due to the data availability issue, we do not observe the detailed terms of firm financing deals. Future studies could investigate how executive gender affects financing deal negotiation and the terms of financing deals, such as bank borrowing and equity issuance.

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DATA AVAILABILITY STATEMENT

Data available on request from the authors.

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ENDNOTES

[1] See Croson and Gneezy (2009) for a review.

[2] The Amadues Top 250,000 database covers both public and private firms.

[3] Compustat ExecuComp covers the S&P 1500 firms and those that were once included in the S&P 1500 index.

[4] Similar to Huang and Kisgen (2013), we cannot compare female-to-female to female-to-male transitions because the number of such transitions is too small.

[5] Our period of study on CFO gender is 2006–2017, because the data item "CFOANN" is only available from 2006.

REFERENCES

Adams, R. B., & Ferreira, D. (2009). Women in the boardroom and their impact on governance and performance. *Journal of Financial Economics*, *94*, 291–309.

Agnew, J., Balduzzi, P., & Sundén, A. E. (2003). Portfolio choice and trading in a large 401 (k) plan. *American Economic Review*, *93*, 193–215.

Ahmed, A., & Atif, M. (2021). Board gender composition and debt financing. *International Journal of Finance and Economics*, *26*, 3075–3092.

Akdoğu, E., & MacKay, P. (2012). Product markets and corporate investment: Theory and evidence. *Journal of Banking and Finance*, *36*, 439–453.

Andreou, P. C., Louca, C., & Petrou, A. P. (2017). CEO age and stock price crash risk. *Review of Finance*, *21*, 1287–1325.

Antia, M., Pantzalis, C., & Park, J. C. (2010). CEO decision horizon and firm performance: An empirical investigation. *Journal of Corporate Finance*, *16*, 288–301.

Baker, M., & Wurgler, J. (2002). Market timing and capital structure. *Journal of Finance*, *57*, 1–32.

Baldry, J. C. (1987). Income tax evasion and the tax schedule: Some experimental results. *Public Finance*, *42*, 357–383.

Barber, B. M., & Odean, T. (2001). Boys will be boys: Gender, overconfidence, and common stock investment. *Quarterly Journal of Economics*, *116*, 261–292.

Barnett, T., Brown, G., & Bass, K. (1994). The ethical judgments of college students regarding business issues. *Journal of Education for Business*, *69*, 333–338.

Barsky, R. B., Juster, F. T., Kimball, M. S., & Shapiro, M. D. (1997). Preference parameters and behavioral heterogeneity: An experimental approach in the health and retirement study. *Quarterly Journal of Economics*, *112*, 537–579.

Barua, A., Davidson, L. F., Rama, D. V., & Thiruvadi, S. (2010). CFO gender and accruals quality. *Accounting Horizons*, *24*, 25–39.

Baum, C. F., Chakraborty, A., & Liu, B. (2010). The impact of macroeconomic uncertainty on firms' changes in financial leverage. *International Journal of Finance and Economics*, *15*, 22–30.

Bebchuk, L. A., Cohen, A., & Ferrell, A. (2009). What matters in corporate governance? *Review of Financial Studies*, *22*, 783–827.

Bebchuk, L. A., Cremers, K. M., & Peyer, U. C. (2011). The CEO pay slice. *Journal of Financial Economics*, *102*, 199–221.

Berger, P. G., Ofek, E., & Yermack, D. L. (1997). Managerial entrenchment and capital structure decisions. *Journal of Finance*, *52*, 1411–1438.

Bernardi, R. A., & Arnold, D. F. (1997). An examination of moral development within public accounting by gender, staff level, and firm. *Contemporary Accounting Research*, *14*, 653–668.

Boubaker, S., Saffar, W., & Sassi, S. (2018). Product market competition and debt choice. *Journal of Corporate Finance*, *49*, 204–224.

Brooks, C., Sangiorgi, I., Hillenbrand, C., & Money, K. (2019). Experience wears the trousers: Exploring gender and attitude to financial risk. *Journal of Economic Behavior & Organization*, *163*, 483–515.

Bushman, R., Dai, Z., & Wang, X. (2010). Risk and CEO turnover. *Journal of Financial Economics*, *96*, 381–398.

Byoun, S. (2008). How and when do firms adjust their capital structures toward targets? *Journal of Finance*, *63*, 3069–3096.

Chaganti, R., & Damanpour, F. (1991). Institutional ownership, capital structure, and firm performance. *Strategic Management Journal*, *12*, 479–491.

Chang, X., Dasgupta, S., & Hilary, G. (2006). Analyst coverage and financing decisions. *Journal of Finance*, *61*, 3009–3048.

Cheng, M., & Subramanyam, K. (2008). Analyst following and credit ratings. *Contemporary Accounting Research*, *25*, 1007–1044.

Coles, J. L., Daniel, N. D., & Naveen, L. (2006). Managerial incentives and risk-taking. *Journal of Financial Economics*, *79*, 431–468.

Colla, P., Ippolito, F., & Li, K. (2013). Debt specialization. *Journal of Finance*, *68*, 2117–2141.

Core, J., & Guay, W. (2002). Estimating the value of employee stock option portfolios and their sensitivities to price and volatility. *Journal of Accounting Research*, *40*, 613–630.

Cronqvist, H., Makhija, A. K., & Yonker, S. E. (2012). Behavioral consistency in corporate finance: CEO personal and corporate leverage. *Journal of Financial Economics*, *103*, 20–40.

Croson, R., & Gneezy, U. (2009). Gender differences in preferences. *Journal of Economic Literature*, *47*, 448–474.

Dakua, S. (2019). Effect of determinants on financial leverage in Indian steel industry: A study on capital structure. *International Journal of Finance and Economics*, *24*, 427–436.

Dang, V. A., & Phan, H. V. (2016). CEO inside debt and corporate debt maturity structure. *Journal of Banking and Finance*, *70*, 38–54.

Demerjian, P., Lev, B., & McVay, S. (2012). Quantifying managerial ability: A new measure and validity tests. *Management Science*, *58*, 1229–1248.

Denis, D. J., & Mihov, V. T. (2003). The choice among bank debt, non-bank private debt, and public debt: Evidence from new corporate borrowings. *Journal of Financial Economics*, *70*, 3–28.

Denis, D. J., & Sibilkov, V. (2009). Financial constraints, investment, and the value of cash holdings. *Review of Financial Studies*, *23*, 247–269.

Diamond, D. W., & Verrecchia, R. E. (1991). Disclosure, liquidity, and the cost of capital. *Journal of Finance*, *46*, 1325–1359.

Faccio, M., Marchica, M.-T., & Mura, R. (2016). CEO gender, corporate risk-taking, and the efficiency of capital allocation. *Journal of Corporate Finance*, *39*, 193–209.

Fallan, L. (1999). Gender, exposure to tax knowledge, and attitudes towards taxation: An experimental approach. *Journal of Business Ethics*, *18*, 173–184.

Faulkender, M., Flannery, M. J., Hankins, K. W., & Smith, J. M. (2012). Cash flows and leverage adjustments. *Journal of Financial Economics*, *103*, 632–646.

Feingold, A. (1994). Gender differences in personality: A meta-analysis. *Psychological Bulletin*, *116*, 429–456.

Flannery, M. J., & Rangan, K. P. (2006). Partial adjustment toward target capital structures. *Journal of Financial Economics*, *79*, 469–506.

Francis, B., Hasan, I., Park, J. C., & Wu, Q. (2015). Gender differences in financial reporting decision making: Evidence from accounting conservatism. *Contemporary Accounting Research*, *32*, 1285–1318.

Froot, K. A., Scharfstein, D. S., & Stein, J. C. (1993). Risk management: Coordinating corporate investment and financing policies. *Journal of Finance*, *48*, 1629–1658.

Goh, B. W., & Li, D. (2011). Internal controls and conditional conservatism. *Accounting Review*, *86*, 975–1005.

Gormley, T. A., & Matsa, D. A. (2014). Common errors: How to (and not to) control for unobserved heterogeneity. *Review of Financial Studies*, *27*, 617–661.

Harford, J., Klasa, S., & Maxwell, W. F. (2014). Refinancing risk and cash holdings. *Journal of Finance*, *69*, 975–1012.

Harford, J., Klasa, S., & Walcott, N. (2009). Do firms have leverage targets? Evidence from acquisitions. *Journal of Financial Economics*, *93*, 1–14.

Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica*, *47*, 153–161.

Hirshleifer, D., Low, A., & Teoh, S. H. (2012). Are overconfident CEOs better innovators? *Journal of Finance*, *67*, 1457–1498.

Ho, S. S., Li, A. Y., Tam, K., & Zhang, F. (2015). CEO gender, ethical leadership, and accounting conservatism. *Journal of Business Ethics*, *127*, 351–370.

Houston, J., & James, C. (1996). Bank information monopolies and the mix of private and public debt claims. *Journal of Finance*, *51*, 1863–1889.

Hribar, P., & Yang, H. (2016). CEO overconfidence and management forecasting. *Contemporary Accounting Research*, *33*, 204–227.

Huang, J., & Kisgen, D. J. (2013). Gender and corporate finance: Are male executives overconfident relative to female executives? *Journal of Financial Economics*, *108*, 822–839.

Huang, R., Tan, K. J. K., & Faff, R. W. (2016). CEO overconfidence and corporate debt maturity. *Journal of Corporate Finance*, *36*, 93–110.

Inci, A. C., Narayanan, M., & Seyhun, H. N. (2017). Gender differences in executives' access to information. *Journal of Financial and Quantitative Analysis*, *52*, 991–1016.

Ittonen, K., Vähämaa, E., & Vähämaa, S. (2013). Female auditors and accruals quality. *Accounting Horizons*, *27*, 205–228.

Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *American Economic Review*, *76*, 323–329.

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, *3*, 305–360.

Jianakoplos, N. A., & Bernasek, A. (1998). Are women more risk averse? *Economic Inquiry*, *36*, 620–630.

Jiang, J. X., Petroni, K. R., & Wang, I. Y. (2010). CFOs and CEOs: Who have the most influence on earnings management? *Journal of Financial Economics*, *96*, 513–526.

Johnson, S. A. (2003). Debt maturity and the effects of growth opportunities and liquidity risk on leverage. *Review of Financial Studies*, *16*, 209–236.

Kaplan, S. N., & Zingales, L. (1997). Do investment–cash flow sensitivities provide useful measures of financing constraints? *Quarterly Journal of Economics*, *112*, 169–215.

Kieschnick, R., & Moussawi, R. (2018). Firm age, corporate governance, and capital structure choices. *Journal of Corporate Finance*, *48*, 597–614.

Korkeamäki, T., Liljeblom, E., & Pasternack, D. (2017). CEO power and matching leverage preferences. *Journal of Corporate Finance*, *45*, 19–30.

Kraus, A., & Litzenberger, R. H. (1973). A state-preference model of optimal financial leverage. *Journal of Finance*, *28*, 911–922.

Lemmon, M. L., Roberts, M. R., & Zender, J. F. (2008). Back to the beginning: Persistence and the cross-section of corporate capital structure. *Journal of Finance*, *63*, 1575–1608.

Lemmon, M. L., & Zender, J. F. (2010). Debt capacity and tests of capital structure theories. *Journal of Financial and Quantitative Analysis*, *45*, 1161–1187.

Levin, I. P., Snyder, M. A., & Chapman, D. P. (1988). The interaction of experiential and situational factors and gender in a simulated risky decision-making task. *Journal of Psychology*, *122*, 173–181.

Li, K., & Prabhala, N. R. (2007). Self-selection models in corporate finance. In *Handbook of empirical corporate finance* (pp. 37–86). Elsevier.

Li, X., Low, A., & Makhija, A. K. (2017). Career concerns and the busy life of the young CEO. *Journal of Corporate Finance*, *47*, 88–109.

Li, Y., & Zeng, Y. (2019). The impact of top executive gender on asset prices: Evidence from stock price crash risk. *Journal of Corporate Finance*, *58*, 528–550.

Libby, R., & Rennekamp, K. (2012). Self-serving attribution bias, overconfidence, and the issuance of management forecasts. *Journal of Accounting Research*, *50*, 197–231.

Lin, C., Schmid, T., & Xuan, Y. (2018). Employee representation and financial leverage. *Journal of Financial Economics*, *127*, 303–324.

Lundeberg, M. A., Fox, P. W., & Punćcohaŕ, J. (1994). Highly confident but wrong: Gender differences and similarities in confidence judgments. *Journal of Educational Psychology*, *86*, 114–121.

Luo, J.-h., Huang, Z., Li, X., & Lin, X. (2018). Are women CEOs valuable in terms of bank loan costs? Evidence from China. *Journal of Business Ethics*, *153*, 337–355.

MacKie-Mason, J. K. (1990). Do taxes affect corporate financing decisions? *Journal of Finance*, *45*, 1471–1493.

Malmendier, U., & Tate, G. (2005). CEO overconfidence and corporate investment. *Journal of Finance*, *60*, 2661–2700.

Modigliani, F., & Miller, M. H. (1958). The cost of capital, corporation finance and the theory of investment. *American Economic Review*, *48*, 261–297.

Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics*, *5*, 147–175.

Myers, S. C. (1984). The capital structure puzzle. *Journal of Finance*, *39*, 574–592.

Niederle, M., & Vesterlund, L. (2007). Do women shy away from competition? Do men compete too much? *Quarterly Journal of Economics*, *122*, 1067–1101.

Ortiz-Molina, H. (2007). Executive compensation and capital structure: The effects of convertible debt and straight debt on CEO pay. *Journal of Accounting and Economics*, *43*, 69–93.

Petersen, M. A. (2009). Estimating standard errors in finance panel data sets: Comparing approaches. *Review of Financial Studies*, *22*, 435–480.

Poletti-Hughes, J., & Martinez Garcia, B. (2022). Leverage in family firms: The moderating role of female directors and board quality. *International Journal of Finance and Economics*, *27*, 207–223.

Rajan, R., & Winton, A. (1995). Covenants and collateral as incentives to monitor. *Journal of Finance*, *50*, 1113–1146.

Rajan, R. G., & Zingales, L. (1995). What do we know about capital structure? Some evidence from international data. *Journal of Finance*, *50*, 1421–1460.

Ross, S. A. (1977). The determination of financial structure: The incentive-signaling approach. *The Bell Journal of Economics*, *8*, 23–40.

Serfling, M. A. (2014). CEO age and the riskiness of corporate policies. *Journal of Corporate Finance*, *25*, 251–273.

Sugarman, D. B., & Straus, M. A. (1988). Indicators of gender equality for American states and regions. *Social Indicators Research*, *20*, 229–270.

Sundén, A. E., & Surette, B. J. (1998). Gender differences in the allocation of assets in retirement savings plans. *American Economic Review*, *88*, 207–211.

Svenson, O. (1981). Are we all less risky and more skillful than our fellow drivers? *Acta Psychologica*, *47*, 143–148.

Venkataraman, R., Weber, J. P., & Willenborg, M. (2008). Litigation risk, audit quality, and audit fees: Evidence from initial public offerings. *Accounting Review*, *83*, 1315–1345.

Wang, X., Manry, D., & Rosa, G. (2019). Ownership structure, economic fluctuation, and capital structure: Evidence from China. *International Journal of Finance and Economics*, *24*, 841–854.

Whited, T. M., & Wu, G. (2006). Financial constraints risk. *Review of Financial Studies*, *19*, 531–559.

Williamson, O. E. (1988). Corporate finance and corporate governance. *Journal of Finance*, *43*, 567–591.

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APPENDIX A

TABLE A1 Variable definitions.

Variables	Definition	Source
Dependent variables		
BLev	Book leverage, the sum of current liabilities (*item 34*) and long-term debt (*item 9*) normalized by the book value of assets (*item 6*) (Cronqvist et al., 2012; Lin et al., 2018).	Compustat
MLev	Market leverage, the sum of current liabilities (*item 34*) and long-term debt (*item 9*) normalized by the market value of assets. The market value of assets is the book value of assets (*item 6*) minus the book value of equity (*item 60*) plus the market value of equity (*item 25* × *item 24*) (Berger et al., 1997).	Compustat
BDebtCap	The book value of debt capacity, an indicator variable equal to one if the book value of debt capacity is positive and zero otherwise (Byoun, 2008; Lemmon & Zender, 2010).	Compustat
MDebtCap	The market value of debt capacity, an indicator variable equal to one if the market value of debt capacity is positive and zero otherwise (Byoun, 2008; Lemmon & Zender, 2010).	Compustat
LDebt	Long-term debt, long-term debt (*item 9*) minus debt maturing in 1 year (*item 44*) normalized by the book value of total debt (*item 34*+ *item 9*) (Huang et al., 2016).	Compustat
DLDebt	Above the mean of long-term debt, an indicator variable equal to one if a firm's *LDebt* is above the industry mean based on three-digit SIC codes and zero otherwise.	Compustat
Independent variable of interest		
Female	Female CEOs, an indicator variable equal to one if a firm has a female CEO and zero otherwise.	ExecuComp
CFOGender	Female CFOs, an indicator variable equal to one if a firm has a female CFO and zero otherwise.	ExecuComp
Channel variables		
Delta	The value increase in a CEO's option portfolio for a 1% increase in the underlying stock price (Core & Guay, 2002).	ExecuComp
Vega	The value increase in a CEO's option portfolio for a 1% increase in the underlying stock return volatility (Core & Guay, 2002).	ExecuComp
Option	An indicator variable equal to one if a firm's CEO is classified as an overconfident CEO and zero otherwise. A CEO is classified as an overconfident CEO if she, at least once during our sample period, holds an option at least 67% in-the-money until the option's expiration year (Hirshleifer et al., 2012; Malmendier & Tate, 2005).	ExecuComp
Forecast	An indicator variable equal to one if a firm issues a management earnings forecast and zero otherwise (Hribar & Yang, 2016; Libby & Rennekamp, 2012).	I/B/E/S
Control variables		
Size	Firm size, the natural logarithm of the book value of assets (*item 6*).	Compustat
MTB	Market to book ratio, the ratio of the market value of assets (*item 6–item 60* + *item 25* × *item 24*) to the book value of assets (*item 6*).	Compustat
Profitability	Firm profitability, the ratio of income before extraordinary items (*item 18*) to the book value of assets (*item 6*).	Compustat
FAsset	Fixed assets, the ratio of property, plant and equipment (*item 8*) to the book value of assets (*item 6*).	Compustat
Rating	Debt rating, an indicator variable equal to one if a firm has a long-term debt rating from Standard & Poor's and zero otherwise (Huang et al., 2016).	Capital IQ
FirmAge	Firm age, the natural logarithm of one plus the number of years since a firm's stock is covered in CRSP.	CRSP
CEOComp	CEO total compensation, the natural logarithm of a CEO's total compensation (salary + bonuses + options + restricted stocks + other compensation).	ExecuComp
CEOPower	CEO pay slice, the ratio of a CEO's total compensation to the sum of top five executives' total compensation.	ExecuComp
CEOAge	CEO age, the natural logarithm of one plus a CEO's age.	ExecuComp
EIndex	CEO entrenchment index, an entrenchment index composed of the six most important provisions in the *G-index* (Bebchuk et al., 2009).	ISS

TABLE A1 (Continued)

Variables	Definition	Source
DirGenRatio	Female director ratio, the ratio of the number of female directors to the total number of directors.	ISS
Director	Director number, the natural logarithm of one plus the number of a firm's board of directors.	ISS
Analyst	Financial analysts coverage, the maximum number of financial analysts making annual earnings forecasts in any month over a 12-month period (Chang et al., 2006).	I/B/E/S
Ownership	Institutional ownership, the shares held by institutional investors normalized by total shares outstanding.	13F
CEOFixed	CEO fixed compensation, the amount of fixed compensation (salary + bonus) normalized by total annual compensation (Berger et al., 1997).	ExecuComp
CEOTenure	CEO tenure, the number of years a CEO has held the CEO position (Berger et al., 1997).	ExecuComp
Efficiency	Firm efficiency score, computed by data envelopment analysis which includes an output (total sales) and a vector of inputs including firm characteristics (Demerjian et al., 2012).	PD
Mascore	Managerial ability score, computed by the residual from a regression between firm efficiency and firm characteristics (Demerjian et al., 2012).	PD

Note: This table presents variable definitions and data sources. CRSP is the Centre for Research in Security Prices, ExecuComp is Standard and Poor's Executive Compensation database, ISS is the Institutional Shareholder Services, I/B/E/S is the Institutional Brokers' Estimate System, 13F is the Thomson Reuters 13F Database, and PD is Peter Demerjian's website.

APPENDIX B: Summary of identification test results.

	OLS		PSM		Heckman two-stage		High-dimensional	
	$BLev_t$	$MLev_t$	$BLev_t$	$MLev_t$	$BLev_t$	$MLev_t$	$BLev_t$	$MLev_t$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$Female_{t-1}$	−0.027**	−0.029**	−0.052***	−0.049***	−0.024***	−0.026***	−0.022***	−0.027***
	(−2.000)	(−2.575)	(−2.728)	(−3.004)	(−3.014)	(−3.776)	(−3.411)	(−3.856)
Intercept	0.218**	0.288***	0.245	0.320	0.589***	0.620***	0.283***	0.245***
	(2.078)	(2.967)	(0.621)	(0.941)	(6.422)	(7.340)	(6.155)	(5.150)
Observations	28,389	28,389	1288	1288	17,047	17,047	28,389	26,973
Adjusted-R^2	0.097	0.12	0.225	0.245	0.121	0.138	0.169	0.223
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Firm fixed effects	No	No	No	No	No	No	Yes	Yes
Industry×Year fixed effects	No	No	No	No	No	No	Yes	Yes

Note: This table presents the regression results of the baseline estimates using four estimation methods. Columns (1) and (2) report the results of OLS regression results, columns (3) and (4) report the results of PSM regression results, columns (5) and (6) report the Heckman's (1979) two-stage procedure results, and columns (7) and (8) report the high-dimensional fixed effects regression results. Our sample covers firm-year observations with non-missing values for all variables during 1993–2021. The dependent variables are two proxies of firm leverage: $BLev_t$ and $MLev_t$. The detailed definition of all variables is provided in Appendix A. The *t*-values reported in parentheses are based on double clustered standard errors by firm and year (Petersen, 2009). *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.