

# Corporate Board Gender Diversity and Financing Decision

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## Abstract

Based on a total of 1,590 listed non-financial firms on the Taiwan Stock Exchange and the Taipei Exchanges covering the period of 2007~2020, this study examines whether a firm's financing decision, namely, capital structure policy is affected by corporate board gender diversity. While existing research has explored the effects of a firm's board diversity on various financial and non-financial consequences, this study argues that board gender diversity contributes to better financial performance and higher social reputation, on the one hand, it allows the firm to borrow more funds or enjoy better loan conditions, and on the other hand, it also leads to a higher level of trust in the firm's ability to repay debts from its funders. All of these factors make the firm more likely to have a higher level of debt utilization. Through correlation analysis and multiple regression estimation, principal outcome shows that firm with greater degree of board gender diversity tends to use more debt financing in the capital structure decision.

**Keywords:** board gender diversity, capital structure

## 1. Introduction

Gender diversity on the board of directors refers to the situation in which there is a balanced or nearly balanced ratio of male and female directors with different backgrounds, experiences, skills, and perspectives, thus achieving the goal of diversity. Such a board can better reflect the diverse challenges and opportunities faced by the firm, and can better represent the shareholders and stakeholders of the firm. Among the various dimensions of board diversity, the gender diversity of board members is often a subject of discussion (Lin & Chang, 2023). The phenomenon of gender issues being increasingly highlighted in the development of various sectors in politics, economy, and society is evident as more and more women assume positions of power and influence. Female directors have played an important role in their own firms, becoming outstanding business leaders and role models. Their success has also encouraged more women to enter the business field and driven progress towards gender equality.

There are several practical advantages to having gender diversity on a board of directors. First, improved firm performance: gender diversity on a board of directors can help to improve a firm's performance. A diverse board can analyze problems from different angles and make better decisions, thus enhancing the firm's overall performance. Second, expanded market opportunities: gender diversity on a board of directors can help to expand a firm's market opportunities. A diverse board can better reflect the needs of consumers and market trends, and thereby develop and promote products and services more effectively. Third, increased innovation: gender diversity on a board of directors can help to increase a firm's innovation. A diverse board can bring more diverse ideas and perspectives, which can aid in innovation and improvement of products and services. Fourth, enhanced firm image: gender diversity on a board of directors can help to enhance a firm's image. A diverse board can better represent the firm's shareholders and stakeholders, thereby enhancing the firm's social reputation and image.

The drawbacks of gender diversity on a board of directors may include, first, overemphasis on gender while neglecting other forms of diversity: while focusing on gender diversity, attention should also be given to other forms of diversity such as race, cultural background, age, etc. Otherwise, there may be inequalities or discrimination in other areas of diversity. Second, unclear criteria for selecting directors: to achieve gender

diversity, gender may be viewed as the primary criterion for selecting directors. This may result in the selection of less qualified individuals lacking experience or professional competence. Third, focus on symbolic diversity rather than substantive diversity: overemphasis on symbolic gender diversity may cause firms to overlook substantive diversity. If board members come from similar backgrounds, education levels, or professions, this may result in a lack of genuine diversity. Fourth, high costs for development and training: to achieve gender diversity, firms may need to invest more time and resources in developing and training female leaders. Therefore, they may face some challenges in terms of costs.

Female directors have the following advantages in academic research on corporate governance (Adams & Ferreira, 2009; García & Herrero, 2018; Beltran, 2019; Flabbi, Macis, Moro, & Schivardi, 2019; Lückers-Rovers, 2013). First, increase board diversity: the addition of female directors can increase board diversity, bringing different perspectives and experiences to better understand the firm's risks and challenges. Second, improve decision-making quality: female directors can bring more innovation and diverse thinking, improving decision-making quality and reducing risk. Third, improve firm performance: research shows a positive correlation between the proportion of female directors in the boardroom and firm performance. The participation of female directors can help improve firm performance. Fourth, increase corporate social responsibility: female directors have a stronger sense of corporate social responsibility, bringing more social values and awareness, and improving the firm's social image and reputation. Fifth, strengthen internal supervision: female directors usually have a stronger awareness and attitude towards anti-corruption and integrity, strengthening the firm's internal oversight mechanism and preventing improper behavior and risk. Overall, the addition of female directors can bring many benefits, improving the quality and efficiency of corporate governance, and achieving better economic and social benefits.

In academic research on corporate governance, some studies have also pointed out the following drawbacks of female directors (Chapple & Humphrey, 2014; Ellwood & Garcia-Lacalle, 2015; Gregory-Smith, Main, & O'Reilly, 2014; Wang, 2020). First, shorter tenure: female directors' tenure on boards is usually shorter, which may be related to balancing their responsibilities in work and family roles. Second, difficulty in expanding networking: female directors may have fewer opportunities in business social settings, which may affect their ability to expand their networking. Third, negative bias in appointment: some appointees may hold biases against female directors and may be inclined to choose male directors, leading to fewer opportunities for female directors. Fourth lack of experience and skills: female directors may have relatively less experience and skills in certain industries and fields, which may affect their contribution to firm decision-making. It should be noted that the above drawbacks are only the results of some studies and do not represent all female directors will have these issues. With the passage of time and social progress, these drawbacks may improve or new challenges may arise.

Currently, research on board diversity mostly focuses on gender diversity (Eagly, Johannesen-Schmidt, & van Engen, 2003; Adams & Ferreira, 2009; Abbott, Parker, & Presley, 2012; Wang & Chang, 2016) and ethnic diversity (Hillman, Cannella, & Harris, 2002; Bernardi, Bean, & Weippert, 2005; Cook & Glass, 2015), with gender diversity research being the majority. Based on the resource dependence theory, as the board provides a connection to external resources and different backgrounds of board members can obtain various resources, increasing the number of female directors can focus on and promote relationships with stakeholders related to women in the firm (Tsai, Weng, Wang, & Chang, 2020). Hillman, Shropshire, and Cannella (2007) point out that a higher proportion of female members in a firm leads to more diverse advice, consultation, and communication channels, which improves the legitimacy of decision-making. Based on the agency theory, as the separation of ownership and control leads to agency problems, female directors can enhance the quality of deliberation on complex issues, reduce the likelihood of major decision-making errors, and strengthen the independence of the board, lower agency costs, and improve firm performance (Kravitz, 2003). A higher proportion of female directors can provide more effective oversight, require higher audit quality, and reduce agency problems (Gul, Srinidhi, & Ng, 2011; Lai, Srinidhi, Gul, & Tsui, 2017).

According to Tsai, Weng, Wang, and Zhang (2020), Barber and Odean (2001) and Huang and Kisgen (2013), female executives exhibit lower levels of over-confidence compared to male executives. Levi, Li, and Zhang (2014) discovered that firms with a higher proportion of female directors are better at avoiding erroneous merger decisions. Some existing research also suggests that women are relatively better at maintaining good interpersonal relationships and tend to make ethical decisions, while men are more concerned with income and have a higher risk of violating ethical standards (Betz, O'Connell & Shepard, 1989; Nguyen, Basuray, Smith, Kopka, & McCulloh, 2008). Furthermore, women have a higher tendency to avoid risks than men (Byrnes, Miller, & Schafer, 1999; Eckel & Grossman, 2008; Croson & Gneezy, 2009), and exhibit lower levels of risk aversion in financial decision-making (Riley & Chow, 1992; Powell & Ansic, 1997; Sunden & Surette, 1998).

As indicated above, most research on board gender diversity focuses on exploring the financial and non-financial consequences for firms that are influenced by board gender diversity, with relatively little attention paid to the impact on a firm's financing policies (García & Herrero, 2018, 2021). Corporate capital structure policy is an important issue as it involves various aspects such as firm financing, risk management, and financial performance (Modigliani & Miller, 1958; Miller, 1977; Modigliani & Miller, 1963; Myers & Majluf, 1984; Myers, 1984; Jensen, 1986; Pfeffer & Salancik, 1978; Davis, Schoorman, & Donaldson, 1997). Capital structure policy can be defined as the financing methods a firm adopts, its capital costs and repayment plans, and the proportion between shareholders' equity and debt. Corporate capital structure policy is important for several reasons: First, affects the firm's financial risk: the firm's capital structure can affect its financial risk. For example, excessive debt financing may increase the firm's financial risk as it needs to pay high interest and repay principal. On the other hand, more equity financing may reduce the firm's financial risk as it does not need to pay fixed interest and principal. Second, affects shareholders' equity: The firm's capital structure also affects shareholders' equity. For example, if the firm uses more debt financing, repayment of interest and principal may reduce shareholder dividends as the firm needs to pay more debt. On the other hand, if the firm uses more equity financing, shareholders' equity may increase as shareholders hold more shares. Third, affects the firm's capital cost: The firm's capital structure also affects its capital cost. For example, using more debt financing may lower the firm's weighted average cost as debt typically has lower costs. On the other hand, using more equity financing may increase the firm's capital cost as shareholders require higher dividends and capital return.

Gender diversity in the board of directors is highly likely to have an impact on a firm's capital structure policies. When the board of directors is gender-diverse, board members typically have different backgrounds, experiences, and perspectives, which may affect the development and implementation of a firm's capital structure policies. Firstly, increasing the proportion of female members in the boardroom can lower the firm's debt ratio. This is because female board members are more likely to adopt conservative financial strategies, such as using less debt financing. Female board members may be more concerned with the long-term interests of the firm rather than short-term gains, and thus more likely to support reducing the firm's debt burden. Therefore, an increase in gender diversity in the board of directors can lead to a capital structure that is more equity-oriented. Additionally, female board members may be more inclined to use internal financing (such as savings or asset sales) to raise funds. This may be because women are more inclined towards long-term planning and risk management, and believe that internal financing may be more stable and sustainable than external financing.

On the other hand, gender diversity in the board of directors may lead to the firm using more debt financing. That is, the higher the gender diversity, the higher the firm's financial leverage. This relationship may be because gender diversity brings more perspectives and experiences, promotes innovation and exploration, and thereby increases the firm's investment and funding requirements, leading to higher financial leverage. Especially when a firm faces a funding gap, using debt financing may be more attractive than equity financing, as equity financing may dilute shareholder equity. In addition, when the firm's debt financing costs decrease, the firm is more likely to use debt financing. The addition of female directors may improve the firm's governance structure and risk management, thereby increasing the firm's credit rating and reducing its debt financing costs, which may make the firm more inclined to use debt financing. Some studies such as Mittal and Lavina (2018), Kristanti, Kristanti, Rahayu, and Huda (2016) and Darrat, Gray, Park, and Wu (2014) have also indicated that the presence of women reduces the firm's likelihood of bankruptcy.

In order to investigate whether gender diversity on boards of directors affects the capital structure of publicly traded firms in Taiwan's financial market, this study employs data from 1,590 listed and OTC firms in Taiwan from 2007 to 2020. We examine whether an increase in the degree of gender diversity on boards of directors will increase or decrease a firm's use of debt financing. This study highlights the potential influence of board gender diversity on corporate financing decisions in the literature development of board gender diversity. The influence of board members has been mentioned in the Upper Echelons Theory (Hambrick & Mason, 1984), which affects corporate decisions. However, the discussion on how board members' gender affects corporate financing decisions is relatively less explored within the framework of upper echelons theory. This study aims to contribute to filling this research gap. The variables used to measure the degree of gender diversity on boards of directors include whether the firm has female directors, the number of female directors, the percentage of female directors on the board, whether the chairperson and vice chairperson are female, and whether the firm has independent female directors. The capital structure is measured by debt ratio and leverage ratio. The results of correlation analysis and regression estimation indicate that an increase in the degree of gender diversity on boards of directors leads to an increase in a firm's debt ratio and a significant increase in its leverage ratio. Moreover, the firms with higher levels of gender diversity are also among the group of firms with high debt and leverage ratios

in the entire sample.

This study provides an overview of the female's influence on financial decisions by analyzing the impact of their presence on the corporate board on the level of debt use, and thus fills the gap in the research on firm's capital structure may affected by board gender diversity. The next section is literature review and hypothesis development. Section 3 introduces variables, econometric model, samples and data sources. Section 4 presents empirical result and discussion, and the last section is the conclusion.

## **2. Literature Review and Hypothesis Development**

### *2.1 The Development and Regulation of Board Gender Diversity*

Board gender diversity has become an increasingly important issue in corporate governance, as many countries have recognized the importance of promoting gender equality and diversity in the workplace. In Europe, several countries have implemented mandatory quotas for women on boards of listed firms. Norway was the first country to introduce a quota in 2003, requiring that at least 40% of board seats be held by women. Other countries including France, Germany, Italy, Spain, and Belgium have since followed suit. The UK has adopted a voluntary approach, with the government setting a target of 33% female representation on boards of FTSE 350 firms by 2020.

In the United States, there is no mandatory quota for board gender diversity, but many firms have implemented voluntary initiatives to increase female representation on their boards. For example, the 30% Club is a global campaign that aims to achieve 30% female representation on boards of listed firms by 2020. California has also passed a law requiring that publicly traded firms based in the state have at least one woman on their board of directors by the end of 2019, and depending on the size of the board, additional women by the end of 2021. In Asia, the development and regulation of board gender diversity varies across countries. Japan has traditionally had low levels of female representation on boards, but has recently introduced a voluntary code for listed firms to promote gender diversity. Singapore and Malaysia have also introduced voluntary initiatives to increase female representation on boards, while India has implemented mandatory quotas for female directors on boards of certain firms.

In Taiwan, the issue of board gender diversity has gained increasing attention in recent years. While there are no mandatory quotas for female representation on boards of listed firms, the Taiwan Stock Exchange (TWSE) has implemented a voluntary corporate governance code that encourages firms to increase gender diversity on their boards. The TWSE Corporate Governance Code was first introduced in 2015, and was revised in 2018 to strengthen the requirements for board gender diversity. The code recommends that listed firms should have at least one female director on their board, and that the proportion of female directors should be increased gradually to reach a target of at least one-third of the board. In addition to the TWSE Corporate Governance Code, the Taiwan Ministry of Economic Affairs (MOEA) has also introduced initiatives to promote gender diversity on boards of listed firms. In 2016, the MOEA launched a program to encourage listed firms to increase female representation on their boards, and provides training and resources to support this effort. Despite these initiatives, progress in increasing board gender diversity in Taiwan has been slow. According to a report by the Taiwan Corporate Governance Association, as of 2020, the proportion of female directors on the boards of listed firms in Taiwan was only 9.9%, far below the target of one-third set by the TWSE. In response to this, the TWSE and the MOEA have indicated that they will continue to promote gender diversity on boards of listed firms through various measures, including strengthening the requirements for board gender diversity in the TWSE Corporate Governance Code, providing incentives and rewards for firms with diverse boards, and increasing public awareness of the importance of gender diversity in corporate governance.

In China, the issue of board gender diversity has also gained increasing attention in recent years. However, there are currently no mandatory quotas for female representation on boards of listed firms in China. In 2011, the China Securities Regulatory Commission (CSRC) issued a guideline for the governance of listed firms, which encourages firms to promote gender diversity on their boards. The guideline recommends that listed firms should have at least one female director on their board, and that the proportion of female directors should be increased gradually. In 2018, the CSRC revised the guideline to further promote gender diversity on boards of listed firms. The revised guideline encourages listed firms to establish a mechanism to promote gender diversity on their boards, and to disclose information related to the gender diversity of their board members. In addition to the CSRC guideline, various organizations in China have also launched initiatives to promote gender diversity on boards of listed firms. For example, the China Women's Development Foundation, in collaboration with the CSRC and other organizations, launched a program in 2017 to promote the appointment of women to boards of listed firms. Despite these initiatives, progress in increasing board gender diversity in China has been slow.

According to a report by the 30% Club China, as of 2021, the proportion of female directors on the boards of listed firms in China was only 14.9%, far below the target of one-third set by the CSRC. In response to this, the CSRC and other organizations in China have indicated that they will continue to promote gender diversity on boards of listed firms through various measures, including increasing public awareness of the importance of gender diversity in corporate governance, providing incentives and rewards for firms with diverse boards, and strengthening regulations related to board gender diversity.

In Japan, there is no mandatory quota for female representation on boards of listed firms, but the issue of board gender diversity has gained increasing attention in recent years. In 2014, the Japanese government launched the “Womenomics” initiative, which aims to promote the active participation of women in society and increase the number of women in leadership positions, including on corporate boards. In 2015, the Japanese government issued a “comply or explain” code for corporate governance, which encourages listed firms to promote gender diversity on their boards. The code recommends that listed firms should have at least one female director on their board, and that the proportion of female directors should be increased gradually. In 2020, the Japanese government revised the code to further promote gender diversity on boards of listed firms. The revised code recommends that listed firms should aim for a minimum of two female directors on their board, and that they should disclose their policies and progress towards achieving gender diversity. In addition to the government’s initiatives, various organizations in Japan have also launched initiatives to promote gender diversity on boards of listed firms. For example, the 30% Club Japan, a business-led initiative, aims to achieve 30% female representation on boards of listed firms by 2020. As of 2021, the proportion of female directors on the boards of listed firms in Japan was 17.6%, according to a report by the Ministry of Economy, Trade and Industry. While this represents an increase from previous years, progress in increasing board gender diversity in Japan has been slow. In response to this, the Japanese government and other organizations in Japan have indicated that they will continue to promote gender diversity on boards of listed firms through various measures, including providing incentives and rewards for firms with diverse boards, and strengthening regulations related to board gender diversity.

## 2.2 Board Gender Diversity and Capital Structure

There are some arguments suggesting that having female directors on a firm’s board has effects on financial decisions through behavioral differences between men and women in terms of risk aversion, overconfidence, and mutual trust (Huang & Kisgen, 2013; Hernández-Nicolás, Martín-Ugedo, & Míguez-Vera, 2015; Pandey et al., 2019). Firstly, research has shown that female directors are more likely to be risk-averse than their male counterparts, and may therefore be more likely to prefer conservative financing strategies, such as lower levels of debt (Barua, Davidson, Rama, & Thiruvadi, 2010; Jianakops & Bernasek, 1998; Dwyer, Gilkeson, & List, 2002; Watson & McNaughton, 2007; Harris, 2014). This may result in a lower debt-to-equity ratio for firms with female directors on their board. Female directors tend to be more risk-averse than their male counterparts and may prefer more conservative financing strategies. As a result, firms with more female directors may be less likely to use debt financing and may have lower levels of debt on their balance sheets. Firms with more female directors on their boards had lower leverage ratios, indicating that they used less debt financing than firms with fewer female directors. This may be due to the fact that female directors may be more likely to prioritize financial stability and avoid excessive risk-taking.

Compared to men, Dwyer et al. (2002) found that women are less likely to make investment decisions for the largest and most risky mutual funds. Similarly, Barua, Davidson, Rama, and Thiruvadi (2010) found that women in senior management make relatively more cautious and conservative decisions than men due to the potential negative consequences. Women tend to be more thorough and detailed in their work than men, a phenomenon known as the selectivity hypothesis (Meyers-Levy, 1989; Meyers-Levy & Maheswaran, 1991; Chung & Monroe, 1998; O’Donnell & Johnson, 2001). The selectivity hypothesis suggests that men and women have different levels of detail and information in their cognitive processes, and that women tend to stick to their judgments and use more comprehensive and detailed information. Moreover, compared to men, women generally have a greater aversion to risk and are more conservative (Jianakops & Bernasek, 1998; Dwyer et al., 2002; Watson & McNaughton, 2007). Harris (2014) also noted that the risk-averse nature of female directors will affect decisions on relevant financing policies, thus reducing the debt-to-equity ratio. As a result, it is more difficult to make riskier investment decisions and engage in debt activities, thus, the checking hypothesis is:

*Hypothesis 1-A: The degree of board gender diversity and the use of debt is negatively correlated. Greater degree of board gender diversity is associated with lower level of debt use.*

On the contrary, female directors may also have a positive impact on a firm’s ability to obtain debt financing.

Firms with more diverse boards, including a higher proportion of women, are more likely to be able to raise capital through debt issuances. Mittal and Lavina (2018), Kristanti et al. (2016) and Darrat, Gray, Park, and Wu (2014) showed that the presence of women reduces the likelihood of bankruptcy. Diverse boards are viewed as more competent and trustworthy by external stakeholders, which can increase their confidence in the firm's ability to repay debt. Firms with more diverse boards may have a better reputation with investors, lenders, and other stakeholders, which may make it easier for them to access debt financing. Firms with diverse boards are more likely to be viewed as trustworthy and competent, which can increase their credibility with lenders and lead to more favorable lending terms. Firms with more gender-diverse boards may have a broader range of perspectives and experiences, which could lead to more effective decision-making around debt financing. This could include a better understanding of the risks and benefits associated with different types of debt, as well as a more nuanced understanding of the firm's financial position and cash flow needs.

Additionally, firms with more gender-diverse boards may be better positioned to attract and retain top talent, which could lead to better financial performance and a greater ability to service debt. Above-mentioned studies have shown that firms with more diverse boards tend to have better governance and performance, which could make them more attractive to lenders. Another possible explanation is that firms with more gender-diverse boards may be more committed to socially responsible and sustainable business practices, which could include a greater focus on responsible borrowing and debt management. This could lead to a greater willingness to use debt financing to support socially responsible initiatives, such as investing in renewable energy or reducing greenhouse gas emissions. In contrast to *Hypothesis 1-A*, this study proposes an alternative hypothesis:

*Hypothesis 1-B: The degree of board gender diversity and the use of debt is positively correlated. Greater degree of board gender diversity is associated with higher level of debt use.*

### 3. Variable, Econometric Model and Data

#### 3.1 Variable

##### 3.1.1 Explained Variable-Capital Structure

This study refers to the previous literature (Fama & French, 2002) and adopts four variables of capital structure. First, the debt ratio (*debt*), defined as the total liabilities divided by the total net worth. Second, whether the debt ratio is higher than the average of the current year (*debt<sub>tab</sub>*), and when the debt ratio is higher than the average of all firms in the current year, *debt<sub>tab</sub>* is 1, and 0 otherwise. Third, leverage ratio (*lev*), defined as the total liabilities divided by the total net worth. Fourth, whether the leverage ratio is higher than the average of the current year (*lev<sub>ab</sub>*), and when the leverage ratio is higher than the average of all firms in the current year, *lev<sub>ab</sub>* is 1, and 0 otherwise. The larger the value of these four variables, the more inclined the firm's capital structure is to use debt financing, and vice versa.

##### 3.1.2 Main Explanatory Variable-Board Gender Diversity

This study aims to explore the relationship between board gender diversity and capital structure. The main explanatory variable is board gender diversity, which is measured by six variables: (1) a dummy variable indicating whether the firm has female directors (*fdd*), with a value of 1 if the firm has at least one female director and 0 if it has none. (2) the number of female directors (*fdn*). (3) female directors ratio (*fdr*), defined as the proportion of female directors to the total number of board members. (4) a dummy variable indicating whether the board chair is female (*fbcd*), with a value of 1 if the board chair is female and 0 if not. (5) a dummy variable indicating whether the vice-chair is female (*fvbcd*), with a value of 1 if the vice-chair is female and 0 if not, and (6) a dummy variable indicating whether the firm has female independent directors (*fid*), with a value of 1 if the firm has at least one female independent director and 0 if it has none.

##### 3.1.3 Main Explanatory Variable-Board Gender Diversity

In addition to board gender diversity, this study incorporates other determinants of capital structure into regression equation by referring to existing studies such as Kumar and Bodla (2014), Hall, Hutchinson, and Michaelas (2000), Baskin (1989), Frank and Goyal (2009), DeAngelo and Masulis (1980), Flannery and Rangan (2006), Crutchley, Jensen, Jahera, and Raymond (1999), Panno (2003) and Lee and Yeh (2004). Capital structure determinants including firm's size (natural logarithm of total assets: *asset*), market to book value (market value of common equity to book value of common equity: *mtb*), tangible assets ratio (tangible assets to total assets: *tang*), depreciation expense ratio (depreciation to total assets: *dep*), R&D expense ratio (R&D expense to net sales: *rd*), institutional investors' shareholdings (the number of shares hold by institutional investors divided by the number of shares outstanding: *insthold*), directors shareholding (the number of shares hold by directors divided by the number of shares outstanding: *dirhold*) and the shareholding pledge ratio of directors (the ratio of

all shares pledged for loan by all directors to shares hold by all directors: *pledge*). Finally, considering the differences of capital structure in different industries and different years, the 30 industry dummy variables (INDUSTRY) and 13 year dummy variables (YEAR) are included in the regression estimation. The abbreviations and brief definitions of the above variables are reported in Table 1.

Table 1. Abbreviations and definitions of variable

Variable	Abbreviation	Definition
<b>Explained variable-capital structure</b>		
Debt ratio	<i>debt</i>	Total liabilities/total assets
Debt ratio greater than mean	<i>debtat</i>	If the debt ratio is larger than the mean of all firms in specific year, it is equal to 1, and 0 otherwise.
Leverage ratio	<i>lev</i>	Total liabilities/total equity
Leverage ratio greater than mean	<i>levab</i>	If the leverage ratio is larger than the mean of all firms in specific year, it is equal to 1, and 0 otherwise.
<b>Main explanatory variable – corporate board diversity</b>		
Female director dummy	<i>fdd</i>	A dummy variable indicating whether the firm has female directors, with a value of 1 if the firm has at least one female director and 0 if it has none
The number of female director	<i>fdn</i>	The number of female directors
Female director ratio	<i>fdr</i>	The proportion of female directors to the total number of board members
Female board chair dummy	<i>fbcd</i>	A dummy variable indicating whether the board chair is female, with a value of 1 if the board chair is female and 0 if not
Female board vice-chair dummy	<i>fbvcd</i>	A dummy variable indicating whether the board vice-chair is female, with a value of 1 if the board vice-chair is female and 0 if not
Female independent director dummy	<i>fidd</i>	A dummy variable indicating whether the firm has female independent directors, with a value of 1 if the firm has at least one female independent director and 0 if it has none
<b>Control variable</b>		
Scale	<i>asset</i>	The total amount of assets takes the natural logarithm
Market-to-book ratio	<i>mtb</i>	(Share value per share of common stock/carrying amount per share)
Fixed assets to total assets	<i>tang</i>	(Non-current assets/total assets) *100%
Depreciation to total assets	<i>dep</i>	(Depreciation/Total Assets) *100%
R&D expense to net sales	<i>rd</i>	(R&D Expenses/Net Revenue) *100%
Institutional investor shareholding	<i>insthold</i>	(Number of shares held by institutional investor /Number of shares outstanding)* 100%
Directors' shareholding	<i>dirhold</i>	(Number of directors' shares held / Number of outstanding shares) * 100%
Directors' shareholding pledge ratio	<i>pledge</i>	(Number of shares pledged by directors/Number of shares held by directors)*100%
Industry dummies	INDUSTRY	Industry dummies vector, including 30 industry dummies (sample belongs to 31 industries)
Year dummies	YEAR	Year dummies vector, including 13 industry dummies (sample is ranged from 14 years)

Note. This table reports the abbreviations and brief definitions of variable. The definition of variables refers to the Taiwan Economic Journal (TEJ).

### 3.2 Econometric Model

This study employs multiple regression estimation to examine the effects of board gender diversity on capital structure. The regression equation is:

$$\begin{aligned}
 \text{CAPITAL}_{i,t} = & \beta_0 + \beta_1 \cdot \text{DIVERSITY}_{i,t} \\
 & + \beta_2 \cdot \text{asset}_{i,t} + \beta_3 \cdot \text{mtb}_{i,t} + \beta_4 \cdot \text{tang}_{i,t} + \beta_5 \cdot \text{dep}_{i,t} + \beta_6 \cdot \text{rd}_{i,t} \\
 & + \beta_7 \cdot \text{dirhold}_{i,t} + \beta_8 \cdot \text{insthold}_{i,t} + \beta_9 \cdot \text{pledge}_{i,t} + \varepsilon_{i,t}
 \end{aligned} \quad (1)$$

where subscript *i* and *t* represent firm *i* in year *t*, respectively. **CAPITAL** is a vector of capital structure variable, including debt ratio (*debt*), whether the debt ratio is greater than mean (*debtat*), leverage ratio (*lev*) and whether the leverage ratio is greater than mean (*levab*). **DIVERSITY** is a vector of board gender diversity variable, including female director dummy (*fdd*), the number of female director (*fdn*), female director ratio (*fdr*), female board chair dummy (*fbcd*), female board vice-chair dummy (*fbvcd*) and female independent director dummy (*fidd*). The control variables in the regression equation include firm size (*asset*), the ratio of market to book value (*mtb*), the ratio of tangible assets to total assets (*tang*), the ratio of depreciation to total assets (*dep*), the ratio of R&D expense to net sales (*rd*), institutional investors' shareholding (*insthold*), directors' shareholding (*dirhold*) and directors' shareholdings pledge ratio (*pledge*), 30 industry dummies and 13 year dummies. The regression equation is pooled-OLS estimated.

### 3.3 Sample Selection and Data Source

This study employs non-financial industry listed firms on the Taiwan Stock Exchange (TWSE) and the Taipei Exchange (TPEX) (excluding the firms of banking, insurance, billing, securities and financial holdings companies) as the research samples, with a total of 1,590 firms. The data is yearly ranged from 2007 to 2020. The data of board member's gender, the data of firm's financial characteristics and governance variables are collected from the Taiwan Economic Journal (TEJ) database. The data of quantitative variables used for subsequent analysis is 5% winsorized.

## 4. Empirical Results

### 4.1 Descriptive Statistics and Correlation Analysis

Table 2 reports descriptive statistics of full samples (panel A), samples of firms with female director ( $fdd=1$ ) (panel B) and samples of firms without female director ( $fdd=0$ ) (panel C). The difference in mean of each variable is reported in rightmost column of table 2. Observing the mean differences of four capital structure variables between two sub-samples, it can be found that they are all positive, and most of them reaches 1% statistical significance level, indicating that the sample of firms with female director, on average, have significantly higher debt ratios, leverage ratio, and greater probability that the debt and leverage ratio are higher than the averages, which shows that firms with greater degree of board gender diversity tend to raise funds by issuing debt securities, which is in line with the hypothesis of this study.

Firms with gender-diverse boards of directors tend to have better corporate governance, financial performance, and social reputation. As a result, they are able to obtain better lending conditions and become firms that can afford higher debt ratios. On the other hand, due to the better conditions of these firms, fund providers are more willing to lend money to firms with a higher degree of gender diversity on their boards of directors, leading to higher debt ratios for these firms.

The lower triangular elements of Table 3 present the Pearson correlation coefficient among variables. By observing the correlation coefficients in the intersection of the 5th~10th row and the 1st~4th columns, it is found that the correlation coefficients of first to third board gender diversity variables and four capital structure variables are all positive and reach at least 5% significance levels, indicating that firm with female director, more female director and greater female director ratio tends to have larger debt ratio, leverage ratio, greater probability that the debt and leverage ratio is higher than average. However, this study found that both the dummy variable indicating whether the chairman of the board is a woman and the capital structure variable were negative, and two of the four coefficients were statistically significant. This suggests that firms with female chairpersons actually have lower debt ratios, which contradicts the hypothesis proposed in this study. The explanation provided in this study is that when the chairman of the board is a woman, she has a more decisive influence on corporate governance, survival, and development. Her decision-making process and risk management will be more focused on the long-term sustainability of the firm. Therefore, the importance of risk management may outweigh the benefits of using debt, which could lead to a lower debt ratio and leverage ratio for the firm.

This study also found that the correlation between the dummy variable indicating whether the firm has female independent directors and the capital structure variable was not significant, indicating that whether the independent directors are women does not affect the firm's capital structure policy. The primary responsibility of independent directors is to supervise objectively and provide professional advice, and they have limited influence on the firm's capital structure policy.

The upper triangular elements of Table 3 present the Spearman rank correlation coefficient among variables, and the result is similar. Most correlation coefficient show that firms with female board members, having more female director, having higher female director ratio tend to have higher debt ratios and leverage ratios. At the same time, the firm's debt ratio and leverage ratio are also higher than the overall sample average. This evidence supports the hypothesis of this study that firms with higher levels of gender diversity on their boards have better corporate governance, higher social reputation, better performance, better business conditions and prospects, and better repayment capacity, allowing them to take on higher levels of debt. Similarly, fund providers are willing to lend money to firms with higher levels of gender diversity on their boards, higher social reputation, and better repayment capacity, resulting in higher debt and leverage ratios.

However, when the chairman of the firm is a woman, there is a relatively lower tendency for the firm to have higher debt and leverage ratios. As in the previous case, this study explains that the chairman's position has a greater responsibility for the firm's long-term sustainable management and stability. If the chairman is a woman, her emphasis on risk management (including financial risk caused by debt) will be higher than that of ordinary



directors, and therefore having a female chairman may actually limit the firm's tendency to use debt. Finally, the factor of whether the independent director of the firm is a woman does not significantly affect the firm's debt use. The main reason is that the focus of independent directors' responsibilities is on professional supervision and consultation, and there is relatively less need for them to intervene in the firm's debt and financial decision-making, so the influence of women in the position of independent director on the firm's capital structure policy is relatively non-existent.

Table 2. Descriptive statistics

Variable	Panel A. Full samples					Panel B. Samples of firms with female director ( <i>fdd</i> =1)					Panel C. Samples of firms without female director ( <i>fdd</i> =0)					Difference in mean
	Num. of obs.	Mean	Std. Dev.	Min	Max	Num. of obs.	Mean	Std. Dev.	Min	Max	Num. of obs.	Mean	Std. Dev.	Min	Max	
<i>debt</i>	20,723	35.839	17.047	1.7900	87.630	10,478	35.898	16.977	1.7900	87.020	9,060	35.228	16.726	1.7900	87.630	0.6699***
<i>debt<sub>tab</sub></i>	20,723	0.4760	0.4994	0.0000	1.0000	10,478	0.4809	0.4997	0.0000	1.0000	9,060	0.4598	0.4984	0.0000	1.0000	0.0211***
<i>lev</i>	20,723	71.565	66.084	1.8200	670.66	10,478	71.272	64.148	1.8200	670.66	9,057	69.173	64.183	1.8200	639.35	2.0991**
<i>lev<sub>ab</sub></i>	20,723	0.3568	0.4791	0.0000	1.0000	10,478	0.3625	0.4807	0.0000	1.0000	9,057	0.3366	0.4726	0.0000	1.0000	0.0258***
<i>fdd</i>	19,901	0.5364	0.4987	0.0000	1.0000	10,675	1.0000	0.0000	1.0000	1.0000	9,226	0.0000	0.0000	0.0000	0.0000	1.0000
<i>f<sub>dn</sub></i>	19,901	0.7911	0.9217	0.0000	6.0000	10,675	1.4748	0.7584	1.0000	6.0000	9,226	0.0000	0.0000	0.0000	0.0000	1.4748***
<i>f<sub>dr</sub></i>	19,901	11.062	12.910	0.0000	75.000	10,675	20.623	10.655	5.0000	75.000	9,226	0.0000	0.0000	0.0000	0.0000	20.623***
<i>fbcd</i>	19,901	0.0535	0.2251	0.0000	1.0000	10,675	0.0998	0.2997	0.0000	1.0000	9,226	0.0000	0.0000	0.0000	0.0000	0.0998***
<i>fvbcd</i>	19,901	0.0174	0.1307	0.0000	1.0000	10,675	0.0324	0.1771	0.0000	1.0000	9,226	0.0000	0.0000	0.0000	0.0000	0.0324***
<i>fidd</i>	19,901	0.1601	0.3667	0.0000	1.0000	10,675	0.2985	0.4576	0.0000	1.0000	9,226	0.0000	0.0000	0.0000	0.0000	0.2985***
<i>asset</i>	21,155	15.007	1.4492	4.6052	21.924	10,674	15.145	1.4036	9.7566	21.924	9,226	15.058	1.3875	9.7957	21.908	0.0874***
<i>mtb</i>	19,727	1.8970	2.9026	0.0800	192.99	10,544	1.9333	2.5149	0.0800	125.78	9,094	1.8475	3.2974	0.0900	192.99	0.0858**
<i>tang</i>	21,154	52.426	23.387	0.0000	100.00	10,674	53.722	23.448	0.1251	100.00	9,226	52.743	22.683	0.1203	100.00	0.9784***
<i>dep</i>	20,977	2.0025	2.5891	0.0000	61.812	10,666	1.9319	2.3543	0.0000	33.250	9,218	2.0161	2.7107	0.0000	54.092	-0.0842**
<i>rd</i>	20,129	71.925	2665.0	0.0000	233489.1	10,237	70.366	2071.4	0.0000	146927.3	8,921	63.776	2983.0	0.0000	233489.1	6.5902
<i>insthold</i>	19,990	39.006	22.806	0.0000	100.00	10,661	39.985	22.893	0.0000	100.00	9,220	37.829	22.629	0.0000	100.00	2.1563***
<i>dirhold</i>	20,011	21.825	14.894	0.0000	99.710	10,675	22.332	14.985	0.0400	99.710	9,225	21.121	14.638	0.0000	99.710	1.2111***
<i>pledge</i>	20,011	7.4121	16.373	0.0000	100.00	10,675	7.3713	16.571	0.0000	100.00	9,225	7.5072	16.163	0.0000	100.00	-0.1359

Note. this table reports the basic statistics of variables, including the number of observations, mean, standard deviation, minimum and maximum of full samples (Panel A), samples of firms with female director, *fdd*=1, Panel B) and samples of firms without female director *fdd*=0, Panel C). The rightmost column reports the differences (and *t*-statistics) in means of each variable. The data period is from 2007 to 2020. \*, \*\* and \*\*\* show that the differences in means reach 10%, 5% and 1% significant levels respectively.

Table 3. Correlation coefficients matrix

variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
(1) <i>debt</i>	1.0000	0.8629*	1.0000*	0.8211*	0.0210*	0.0229*	0.0258*	-0.0226*	0.0132*	0.0066	0.2246*	-0.0205*	-0.0692*	-0.0087	-0.2403*	0.0392*	-0.0257*	0.0980*
(2) <i>debt<sub>tab</sub></i>	0.8198*	1.0000	0.8629*	0.7758*	0.0194*	0.0198*	0.0255*	-0.0152*	0.0187*	0.0013	0.1869*	-0.0310*	-0.0592*	-0.0060	-0.1949*	0.0212*	-0.0224*	0.0884*
(3) <i>lev</i>	0.8959*	0.6504*	1.0000	0.8211*	0.0210*	0.0229*	0.0258*	-0.0226*	0.0132*	0.0066	0.2246*	-0.0206*	-0.0692*	-0.0087	-0.2403*	0.0392*	-0.0257*	0.0980*
(4) <i>lev<sub>ab</sub></i>	0.8123*	0.7814*	0.7088*	1.0000	0.0268*	0.0270*	0.0341*	-0.0094	0.0076	-0.0009	0.1689*	-0.0095	-0.0977*	-0.0116	-0.1987*	0.0326*	-0.0076	0.0741*
(5) <i>fdd</i>	0.0198*	0.0211*	0.0163*	0.0270*	1.0000	0.9349*	0.9130*	0.2216*	0.1211*	0.4116*	0.0260*	0.0449*	0.0212*	-0.0032	-0.0543*	0.0467*	0.0425*	-0.0149*
(6) <i>f<sub>dn</sub></i>	0.0207*	0.0173*	0.0189*	0.0225*	0.7980*	1.0000	0.9671*	0.2624*	0.1281*	0.4841*	0.0312*	0.0514*	0.0302*	-0.0004	-0.0631*	0.0552*	0.0471*	-0.0171*
(7) <i>f<sub>dr</sub></i>	0.0286*	0.0285*	0.0273*	0.0367*	0.7966*	0.9359*	1.0000	0.2640*	0.1295*	0.4729*	-0.0301*	0.0388*	-0.0023	-0.0225*	-0.0527*	0.0132*	0.0355*	-0.0408*
(8) <i>fbcd</i>	-0.0193*	-0.0103	-0.0137*	0.0050	0.2211*	0.2756*	0.2847*	1.0000	-0.0159*	0.0656*	-0.0041	0.0046	0.0337*	-0.0133*	-0.0193*	0.0199*	0.0064	-0.0110
(9) <i>fvbcd</i>	0.0117	0.0242*	0.0011	0.0089	0.1237*	0.1244*	0.1257*	-0.0163*	1.0000	0.0020	0.0262*	0.0114	0.0282*	0.0080	-0.0160*	0.0093	-0.0154*	0.0125*
(10) <i>fidd</i>	0.0030	0.0012	-0.0018	-0.0015	0.4059*	0.5029*	0.4860*	0.0594*	0.0090	1.0000	-0.0203*	0.1091*	-0.0263*	0.0192*	0.0478*	0.0652*	0.0378*	-0.0549*
(11) <i>asset</i>	0.1773*	0.1457*	0.1319*	0.1295*	0.0312*	0.0486*	-0.0373*	-0.0044	0.0167*	-0.0166*	1.0000	-0.1129*	0.2651*	-0.0728*	-0.2024*	0.3644*	-0.2195*	0.2435*
(12) <i>mtb</i>	-0.0093	-0.0250*	0.0275*	-0.0060	0.0147*	0.0178*	0.0122*	0.0136*	0.0066	0.0507*	-0.1198*	1.0000	-0.1803*	0.0730*	0.1831*	0.1960*	0.1017*	-0.0631*
(13) <i>tang</i>	-0.1004*	-0.0712*	0.1244*	-0.1092*	0.0211*	0.0487*	0.0028	0.0335*	0.0421*	-0.0299*	0.2957*	-0.1007*	1.0000	0.1604*	-0.0938*	0.0841*	-0.0709*	0.1845*
(14) <i>dep</i>	0.0540*	0.0417*	0.0562*	0.0444*	-0.0166*	-0.0151*	-0.0312*	-0.0075	-0.0127*	0.0108	0.0096	0.0692*	0.1490*	1.0000	0.1779*	0.0308*	0.0813*	0.0236*
(15) <i>rd</i>	-0.0378*	-0.0193*	0.0215*	-0.0168*	0.0013	0.0032	0.0034	-0.0018	-0.0033	0.0192*	-0.0117*	0.0485*	-0.0308*	-0.0081	1.0000	-0.1425*	-0.0671*	-0.0767*
(16) <i>insthold</i>	0.0433*	0.0207*	0.0589*	0.0331*	0.0472*	0.0613*	0.0077	0.0168*	0.0014	0.0519*	0.3901*	0.0970*	0.0731*	0.1020*	0.0155*	1.0000	0.3100*	0.0163*
(17) <i>dirhold</i>	-0.0016	-0.0090	0.0294*	0.0064	0.0407*	0.0401*	0.0192*	0.0114	-0.0186*	0.0354*	-0.1384*	0.0533*	-0.0747*	0.0906*	-0.0078	0.4234*	1.0000	-0.1341*
(18) <i>pledge</i>	0.0969*	0.0966*	0.0643*	0.0924*	-0.0041	-0.0074	-0.0086	0.0072	0.0118*	-0.0362*	0.1481*	-0.0315*	0.1423*	0.0068	0.0292*	-0.0077	-0.1210*	1.0000

Note. this table reports the Pearson correlation coefficient (lower triangular elements) and Spearman rank correlation coefficient (upper triangular elements) among variables. The data period is from 2007 to 2020. The star means correlation coefficient reaches a significant level of 10%. Please refer to table 1 for the definitions of variables.

#### 4.2 Baseline Regression Result

Table 4 reports the regression estimation results of the effect of board gender diversity on the firm's capital structure (debt ratio, *debt*). The board gender diversity in model (1)~(6) is proxied by dummy of having female director (*fdd*), the number of female director (*fdn*), the ratio of female director (*fdr*), dummy of having female board chairman (*fbcd*), dummy of having female vice board chairman (*fvbcd*) and dummy of having female independent director (*fidd*), respectively. Observing the estimated coefficients corporate board gender diversity variable in models (1)~(6), it is found that the first three are all positive (0.561, 0.381, 0.0564, respectively) and reached at least a 5% level of statistical significance, which is similar to the results of the previous correlation analysis, when a firm has female directors, the higher the number and percentage of female directors, the more likely the firm's debt ratio is to be higher. The first three variables of board gender diversity positively affect the firm's debt ratio.

When observing model 4, it can be found that the estimated coefficient of the main explanatory variable is negative (-1.138) and reaches a statistically significant level, indicating that when the firm's chairperson is female, there is a significant lower phenomenon in the firm's debt ratio. When observing model 5 and model 6, it can be found that although having a female vice-chairperson corresponds to a higher debt ratio, it does not reach statistical significance. Similarly, the variable of whether the independent director is female has a positive coefficient but does not reach statistical significance, indicating that having a female vice-chairperson or independent director does not significantly affect the firm's capital structure policy.

Regarding the interpretation of the estimation results of the six main explanatory variables above, similar to before, overall, the increase in gender diversity in the firm's board of directors contributes to the improvement of corporate governance. Different genders bring different management knowledge, experience, backgrounds, thinking breadth, diverse perspectives, and wisdom, which can be integrated to form better management decisions and governance processes. The gender diversity of the upper levels and leadership structures of the firm also helps the firm to obtain higher social reputation and public evaluation. Overall, the increase in gender diversity in the board of directors helps to enhance the firm's performance and evaluation, increase its repayment ability, and enable the firm to withstand higher debt use. At the same time, it can also gain the favor of fund providers in lending conditions, ultimately allowing the firm to have a higher level of debt. However, when the chairperson of the firm's board of directors, namely the chairman, is female, this power is weakened by the chairman's greater attention to the firm's risk. When the chairman cares more about the stable long-term operation of the firm, he or she will pay more attention to risk management at all levels of the firm, including the financial risks caused by the use of debt. Therefore, when the chairman is female, there are restrictions on the use of debt.

In Table 4, the estimated results of the control variables in each model are roughly as follows: most of the coefficients for asset size are positive and significant, indicating that larger firms tend to have higher debt ratios. The coefficients for market-to-book ratio are mostly positive, indicating that firms with higher growth opportunities as evaluated by the financial markets have higher debt ratios. The coefficients for the percentage of intangible assets to total assets are mostly negative and statistically significant, indicating that when firms have more intangible assets, which are more difficult to value and less tangible, they may not be able to have higher debt capacity, resulting in lower levels of debt. The coefficients for depreciation expenses as a percentage of total assets are mostly positive and significant, representing that when a firm's assets consist mostly of machinery and long-term assets, the firm may be allowed to have higher debt ratios. The coefficients for research and development (R&D) expense ratio are mostly negative, indicating that when a firm has a higher R&D expense ratio, it may have more resources to invest in R&D because it still has more resources for R&D even after paying interest expenses. A possible explanation for the low interest expense is that the firm has a lower level of debt use.

In Table 4, the estimated results of the control variables in each model are roughly as follows: the coefficient of most asset sizes is positive and significant, indicating that larger firms tend to have higher debt ratios. The coefficient of the market-to-book ratio is mostly positive, indicating that firms with higher growth opportunities as evaluated by the financial market tend to have higher debt ratios. The coefficient of the percentage of intangible assets in total assets is mostly negative and statistically significant, indicating that firms with more intangible assets may have lower debt capacity due to the difficulty in evaluating and the lack of specificity of intangible assets. The coefficient of the percentage of depreciation expenses in total assets is mostly positive and significant, indicating that firms with mostly machine equipment and long-term assets can be allowed to have higher debt ratios. The coefficient of the R&D expense ratio is mostly negative, indicating that firms with higher R&D expenses may have more resources available for R&D even while paying interest expenses, possibly due to lower debt costs resulting from lower debt usage by the firm.

The coefficient of the institutional ownership ratio is mostly negative and statistically significant. Institutional investors, with their professionalism and emphasis on stable and long-term investments, may be unwilling to invest in firms with higher debt ratios to ensure the safety of their investments. The estimated coefficient of director ownership ratio is mostly positive, indicating that the more directors own shares in the firm, the more the firm's performance or stock price aligns with their personal wealth, enabling the firm to make good use of the tax shield benefits of debt to maximize its value. High director ownership helps them fulfill their responsibilities in governing the firm even under high debt ratios. The coefficient of the director share pledge ratio is mostly negative and statistically significant. Firms with higher director share pledge ratios imply that directors have a higher risk preference for debt or a stronger need for funds, which is reflected in their governance of the firm, leading to higher debt ratios.

Finally, the adjusted determination coefficients of each model in Table 4 are all around 8%, and the F-tests for overall significance of the regression models are highly significant with very small p-values, indicating that the specifications of the regression models are appropriate.

The Probit regression results on the impact of board gender diversity on firm debt ratio are presented in Table 5. Probit regression was used because the debt ratio variable was changed to a dummy variable indicating whether a firm's debt ratio was higher than the sample mean (with a value of 1 or 0). Looking at the estimated coefficients of the main explanatory variables in Table 5, we find that under models (1), (2), (3), and (5), the coefficients are all positive and statistically significant at the 5% level or higher. This indicates that when a firm has female directors, a higher number of female directors, a higher proportion of female directors, and a female vice-chairperson, the firm tends to have a higher debt ratio and belongs to the group of firms with relatively higher debt ratios in the entire sample. These results support the hypothesis of this study that board gender diversity positively affects a firm's debt use.

As the level of board gender diversity increases, different perspectives, positions, management knowledge, experiences, backgrounds, breadth of thinking, and different insights and wisdom of different genders interact and integrate to form better management decisions and governance processes. The gender diversity of a firm's upper management and leadership structure also contributes to the firm's higher social reputation and public evaluation. From the perspective of funding providers, lending to firms with these characteristics provides a relatively secure guarantee for the security and use of bank debt, making them more willing to establish lending relationships with this type of firm. Overall, the increase in board gender diversity helps improve a firm's performance and evaluation, increases its repayment ability, and allows it to withstand higher debt use from its own perspective, while also gaining favor from funding providers in lending conditions, ultimately enabling the firm to have a higher level of debt.

Table 6 reports the ordinary least squares regression estimates of the impact of board gender diversity on the leverage ratio of the firm. Similar to the results in Tables 4 and 5, in models (1) to (3), the regression coefficients of board gender diversity variables are all positive (0.561, 0.381, 0.0564, respectively) and statistically significant at least at the 5% level. This indicates that when a firm has female directors, the higher the number and percentage of female directors, the higher the tendency for the firm to have a negative leverage ratio. The first three variables of board gender diversity have a positive impact on the leverage ratio of the firm. Consistent with the previous findings, the gender of the chairman, vice chairman, and independent directors does not significantly affect the leverage ratio of the firm.

Table 7 reports the Probit regression estimates of the impact of board gender diversity on the leverage ratio of the firm. The basic results show that when a firm has female directors, the higher the number and percentage of female directors, the higher the tendency for the firm to have a higher leverage ratio, which belongs to a group of samples with relatively high debt ratios. Similar to the results in Table 6, the gender of the chairman, vice chairman, and independent directors does not significantly affect the relative level of leverage ratio in the entire sample. Increasing board gender diversity can improve the reputation, evaluation, and governance efficiency of the firm, increase the firm's repayment ability, and help the firm to bear higher leverage use. It can also gain the favor of fund providers in loan conditions, ultimately enabling the firm to have a higher level of leverage.

Table 4. Regression result of the effects of board gender diversity on the capital structure (Debt Ratio: *debt*)

Explanatory variables	Explanatory variable ( <i>debt</i> )					
	(1)	(2)	(3)	(4)	(5)	(6)
<i>fdd</i>	0.561** (2.37)					
<i>fdn</i>		0.381*** (2.95)				
<i>fdr</i>			0.0564*** (6.10)			
<i>fbcd</i>				-1.138** (-2.17)		
<i>fvbcd</i>					1.108 (1.33)	
<i>fidd</i>						0.385 (1.19)
<i>asset</i>	3.350*** (28.90)	3.348*** (28.87)	3.383*** (29.17)	3.353*** (28.97)	3.356*** (28.98)	3.359*** (28.98)
<i>mtb</i>	0.171* (1.68)	0.169 (1.64)	0.167 (1.63)	0.179* (1.76)	0.176* (1.73)	0.173* (1.69)
<i>tang</i>	-0.135*** (-22.63)	-0.136*** (-22.66)	-0.136*** (-22.73)	-0.135*** (-22.49)	-0.135*** (-22.61)	-0.135*** (-22.56)
<i>dep</i>	0.411*** (7.34)	0.412*** (7.37)	0.419*** (7.49)	0.405*** (7.23)	0.408*** (7.30)	0.407*** (7.27)
<i>rd</i>	-0.000283*** (-5.42)	-0.000283*** (-5.42)	-0.000283*** (-5.39)	-0.000284*** (-5.46)	-0.000283*** (-5.45)	-0.000284*** (-5.43)
<i>insthold</i>	-0.0624*** (-8.65)	-0.0626*** (-8.68)	-0.0629*** (-8.72)	-0.0620*** (-8.60)	-0.0622*** (-8.63)	-0.0626*** (-8.66)
<i>dirhold</i>	0.0654*** (6.10)	0.0654*** (6.10)	0.0660*** (6.16)	0.0664*** (6.20)	0.0664*** (6.19)	0.0662*** (6.17)
<i>pledge</i>	0.0885*** (12.09)	0.0887*** (12.11)	0.0886*** (12.09)	0.0884*** (12.08)	0.0884*** (12.07)	0.0886*** (12.10)
INDUSTRY dummies	yes	yes	yes	yes	yes	yes
YEAR dummies	yes	yes	yes	yes	yes	yes
constant	-9.126*** (-5.32)	-9.061*** (-5.28)	-9.919*** (-5.77)	-8.883*** (-5.19)	-8.962*** (-5.23)	-9.050*** (-5.27)
No. of Obs.	18,561	18,561	18,561	18,561	18,561	18,561
Adj. $R^2$	0.082	0.082	0.083	0.082	0.081	0.081
Prob. of $F$ -stat.	0.000	0.000	0.000	0.000	0.000	0.000

Note. this table reports the regression estimation results of the effects of board gender diversity on the corporate capital structure, which is proxied by debt ratio (*debt*). The board gender diversity (1)~(6) is proxied by dummy of having female director (*fdd*), the number of female director (*fdn*), the ratio of female director (*fdr*), dummy of having female board chairman (*fbcd*), dummy of having female vice board chairman (*fvbcd*) and dummy of having female independent director (*fvbcd*). The control variables include firm scale (*asset*), market-to-book ratio (*mtb*), fixed assets to total assets (*tang*), depreciation to total assets (*dep*), R&D expense to net sales (*rd*), institutional investor shareholding (*insthold*), directors shareholding (*dirhold*), directors' shareholding pledge ratio (*pledge*), industry dummies vector (INDUSTRY) and year dummies vector (YEAR). The values in brackets are the  $t$ -statistics of estimated coefficients (calculated by the White's heteroscedasticity consistency robust standard error), and \*, \*\* and \*\*\* indicates that the estimated coefficient reaches the significant level of 10%, 5% and 1%, respectively.

Table 5. Probit regression result of the effects of board gender diversity on the capital structure (Dummy of Above-Mean Debt Ratio: *debt*<sub>tab</sub>)

Explanatory variables	Explanatory variable ( <i>debt</i> <sub>tab</sub> )					
	(1)	(2)	(3)	(4)	(5)	(6)
<i>fdd</i>	0.0187*** (2.61)					
<i>fdn</i>		0.0104*** (2.68)				
<i>fdr</i>			0.00156*** (5.63)			
<i>fbcd</i>				-0.0190 (-1.23)		
<i>fvbcd</i>					0.0764*** (2.70)	
<i>fidd</i>						0.00978 (1.00)

<i>asset</i>	0.0804*** (25.20)	0.0804*** (25.20)	0.0813*** (25.48)	0.0806*** (25.26)	0.0806*** (25.27)	0.0807*** (25.28)
<i>mtb</i>	-0.000826 (-0.34)	-0.000851 (-0.35)	-0.000896 (-0.36)	-0.000589 (-0.24)	-0.000724 (-0.30)	-0.000740 (-0.30)
<i>tang</i>	-0.00310*** (-19.21)	-0.00311*** (-19.26)	-0.00311*** (-19.29)	-0.00309*** (-19.07)	-0.00311*** (-19.20)	-0.00309*** (-19.12)
<i>dep</i>	0.00997*** (6.53)	0.00998*** (6.54)	0.0102*** (6.66)	0.00982*** (6.43)	0.00991*** (6.49)	0.00985*** (6.45)
<i>rd</i>	-0.00000426*** (-5.09)	-0.00000427*** (-5.11)	-0.00000426*** (-5.10)	-0.00000428*** (-5.13)	-0.00000426*** (-5.11)	-0.00000429*** (-5.12)
<i>insthold</i>	-0.00184*** (-8.75)	-0.00185*** (-8.78)	-0.00185*** (-8.82)	-0.00183*** (-8.71)	-0.00184*** (-8.74)	-0.00184*** (-8.76)
<i>dirhold</i>	0.00167*** (5.61)	0.00168*** (5.63)	0.00170*** (5.69)	0.00170*** (5.71)	0.00172*** (5.75)	0.00170*** (5.70)
<i>pledge</i>	0.00265*** (12.05)	0.00266*** (12.07)	0.00266*** (12.04)	0.00265*** (12.04)	0.00265*** (12.02)	0.00266*** (12.05)
INDUSTRY dummies	yes	yes	yes	yes	yes	yes
YEAR dummies	yes	yes	yes	yes	yes	yes
constant	-0.596*** (-12.57)	-0.593*** (-12.52)	-0.617*** (-12.98)	-0.589*** (-12.45)	-0.590*** (-12.48)	-0.593*** (-12.50)
No. of Obs.	18,561	18,561	18,561	18,561	18,561	18,561
Adj. R <sup>2</sup>	0.054	0.054	0.055	0.053	0.054	0.053
Prob. of F-stat.	0.000	0.000	0.000	0.000	0.000	0.000

Note. this table reports the probit regression estimation results of the effects of board gender diversity on the corporate capital structure, which is proxied by the dummy of above-mean debt ratio (*debt*). The board gender diversity (1)~(6) is proxied by dummy of having female director (*fdd*), the number of female director (*fdn*), the ratio of female director (*fdr*), dummy of having female board chairman (*fbcd*), dummy of having female vice board chairman (*fvbcd*) and dummy of having female independent director (*fvbcd*). The control variables include firm scale (*asset*), market-to-book ratio (*mtb*), fixed assets to total assets (*tang*), depreciation to total assets (*dep*), R&D expense to net sales (*rd*), institutional investor shareholding (*insthold*), directors shareholding (*dirhold*), directors' shareholding pledge ratio (*pledge*), industry dummies vector (INDUSTRY) and year dummies vector (YEAR). The values in brackets are the *t*-statistics of estimated coefficients (calculated by the White's heteroscedasticity consistency robust standard error), and \*, \*\* and \*\*\* indicates that the estimated coefficient reaches the significant level of 10%, 5% and 1%, respectively.

Table 6. Regression result of the effects of board gender diversity on the capital structure (Leverage Ratio: *lev*)

Explanatory variables	Explanatory variable ( <i>lev</i> )					
	(1)	(2)	(3)	(4)	(5)	(6)
<i>fdd</i>	1.767* (1.96)					
<i>fdn</i>		1.304*** (2.65)				
<i>fdr</i>			0.194*** (5.46)			
<i>fbcd</i>				-2.281 (-1.17)		
<i>fvbcd</i>					-0.463 (-0.16)	
<i>fidd</i>						-0.309 (-0.26)
<i>asset</i>	10.67*** (21.30)	10.66*** (21.27)	10.77*** (21.52)	10.68*** (21.36)	10.69*** (21.37)	10.68*** (21.37)
<i>mtb</i>	1.401*** (2.88)	1.391*** (2.85)	1.386*** (2.84)	1.424*** (2.94)	1.422*** (2.93)	1.426*** (2.93)
<i>tang</i>	-0.548*** (-21.23)	-0.549*** (-21.25)	-0.549*** (-21.30)	-0.546*** (-21.18)	-0.547*** (-21.21)	-0.547*** (-21.20)
<i>dep</i>	1.649*** (7.22)	1.655*** (7.24)	1.678*** (7.34)	1.634*** (7.14)	1.639*** (7.17)	1.639*** (7.18)
<i>rd</i>	-0.000717*** (-5.38)	-0.000717*** (-5.38)	-0.000715*** (-5.34)	-0.000718*** (-5.43)	-0.000718*** (-5.42)	-0.000717*** (-5.43)
<i>insthold</i>	-0.168*** (-5.73)	-0.169*** (-5.76)	-0.170*** (-5.80)	-0.167*** (-5.70)	-0.167*** (-5.71)	-0.167*** (-5.69)
<i>dirhold</i>	0.276*** (6.04)	0.276*** (6.03)	0.278*** (6.08)	0.279*** (6.11)	0.278*** (6.10)	0.279*** (6.10)
<i>pledge</i>	0.255*** (8.61)	0.256*** (8.63)	0.256*** (8.62)	0.255*** (8.60)	0.255*** (8.60)	0.255*** (8.58)

INDUSTRY dummies	yes	yes	yes	yes	yes	yes
YEAR dummies	yes	yes	yes	yes	yes	yes
constant	-70.77*** (-9.81)	-70.59*** (-9.79)	-73.54*** (-10.17)	-70.10*** (-9.73)	-70.27*** (-9.75)	-70.20*** (-9.74)
No. of Obs.	18,558	18,558	18,558	18,558	18,558	18,558
Adj. R <sup>2</sup>	0.069	0.069	0.070	0.069	0.069	0.069
Prob. of F-stat.	0.000	0.000	0.000	0.000	0.000	0.000

Note. this table reports the regression estimation results of the effects of board gender diversity on the corporate capital structure, which is proxied by leverage ratio (*lev*). The board gender diversity (1)~(6) is proxied by dummy of having female director (*fdd*), the number of female director (*fdn*), the ratio of female director (*fdr*), dummy of having female board chairman (*fbcd*), dummy of having female vice board chairman (*fvbcd*) and dummy of having female independent director (*fvbcd*). The control variables include firm scale (*asset*), market-to-book ratio (*mtb*), fixed assets to total assets (*tang*), depreciation to total assets (*dep*), R&D expense to net sales (*rd*), institutional investor shareholding (*insthold*), directors shareholding (*dirhold*), directors' shareholding pledge ratio (*pledge*), industry dummies vector (INDUSTRY) and year dummies vector (YEAR). The values in brackets are the *t*-statistics of estimated coefficients (calculated by the White's heteroscedasticity consistency robust standard error), and \*, \*\* and \*\*\* indicates that the estimated coefficient reaches the significant level of 10%, 5% and 1%, respectively.

Table 7. Probit regression result of the effects of board gender diversity on the capital structure (Dummy of Above-Mean Leverage Ratio: *levab*)

Explanatory variables	Explanatory variable ( <i>levab</i> )					
	(1)	(2)	(3)	(4)	(5)	(6)
<i>fdd</i>	0.0248*** (3.65)					
<i>fdn</i>		0.0132*** (3.57)				
<i>fdr</i>			0.00180*** (6.78)			
<i>fbcd</i>				-0.00412 (-0.28)		
<i>fvbcd</i>					0.0364 (1.32)	
<i>fidd</i>						0.00234 (0.25)
<i>asset</i>	0.0737*** (23.81)	0.0737*** (23.80)	0.0748*** (24.17)	0.0740*** (23.91)	0.0739*** (23.91)	0.0740*** (23.92)
<i>mtb</i>	0.00174 (0.77)	0.00172 (0.76)	0.00170 (0.75)	0.00203 (0.90)	0.00198 (0.87)	0.00200 (0.88)
<i>tang</i>	-0.00377*** (-24.00)	-0.00378*** (-24.06)	-0.00378*** (-24.09)	-0.00376*** (-23.86)	-0.00377*** (-23.92)	-0.00376*** (-23.89)
<i>dep</i>	0.0111*** (7.52)	0.0111*** (7.54)	0.0113*** (7.68)	0.0110*** (7.42)	0.0110*** (7.45)	0.0110*** (7.43)
<i>rd</i>	-0.00000400*** (-5.32)	-0.00000400*** (-5.35)	-0.00000399*** (-5.33)	-0.00000402*** (-5.37)	-0.00000401*** (-5.37)	-0.00000402*** (-5.37)
<i>insthold</i>	-0.00145*** (-7.16)	-0.00146*** (-7.20)	-0.00147*** (-7.24)	-0.00145*** (-7.12)	-0.00145*** (-7.13)	-0.00145*** (-7.13)
<i>dirhold</i>	0.00173*** (6.00)	0.00173*** (6.03)	0.00176*** (6.12)	0.00176*** (6.14)	0.00177*** (6.16)	0.00176*** (6.14)
<i>pledge</i>	0.00260*** (11.78)	0.00260*** (11.79)	0.00260*** (11.76)	0.00259*** (11.75)	0.00259*** (11.74)	0.00259*** (11.75)
INDUSTRY dummies	yes	yes	yes	yes	yes	yes
YEAR dummies	yes	yes	yes	yes	yes	yes
constant	-0.607*** (-13.45)	-0.603*** (-13.38)	-0.630*** (-13.94)	-0.599*** (-13.31)	-0.599*** (-13.32)	-0.600*** (-13.32)
No. of Obs.	18,558	18,558	18,558	18,558	18,558	18,558
Adj. R <sup>2</sup>	0.060	0.060	0.062	0.059	0.059	0.059
Prob. of F-stat.	0.000	0.000	0.000	0.000	0.000	0.000

Note. this table reports the probit regression estimation results of the effects of board gender diversity on the corporate capital structure, which is proxied by the dummy of above-mean leverage ratio (*levab*). The board gender diversity (1)~(6) is proxied by dummy of having female director (*fdd*), the number of female director (*fdn*), the ratio of female director (*fdr*), dummy of having female board chairman (*fbcd*), dummy of having female vice board chairman (*fvbcd*) and dummy of having female independent director (*fvbcd*). The control variables include firm scale (*asset*), market-to-book ratio (*mtb*), fixed assets to total assets (*tang*), depreciation to total assets (*dep*), R&D expense to net sales (*rd*), institutional investor shareholding (*insthold*), directors shareholding (*dirhold*), directors' shareholding pledge ratio (*pledge*), industry dummies vector (INDUSTRY) and year dummies vector (YEAR). The values in brackets are the *t*-statistics of estimated coefficients (calculated by the White's heteroscedasticity consistency robust standard error), and \*, \*\* and \*\*\* indicates that the estimated coefficient reaches the significant level of 10%, 5% and 1%, respectively.

#### 4.3 Additional Tests

This study further considers several other characteristic variables of board members, whether they interfere with or moderate the relationship between corporate board gender diversity and firm's capital structure. First, while a large part of firms in Taiwan's financial market are family controlled firms (Claessens et al., 2000; Yeh et al., 2001; Yeh, 2005), and the impacts of family control on firm's economic consequences were divided into positive views such as stewardship theory (Davis, Schoorman, & Donaldson, 1997; Corbetta & Salvato, 2004a,b) and negative views such as agency theory (Jensen & Meckling, 1976; Fama & Jensen, 1983). Considering the interference effect of family businesses, in family-owned firms, there is a high degree of overlap between ownership and management, and controlling shareholders may pursue their own interests and harm the interests of non-controlling shareholders, known as the core agency problem. In this case, the firm is likely to take on excessive financial risks to enhance its own interests, resulting in a higher debt-to-equity ratio or leverage ratio. However, family-owned firms may also place greater emphasis on the firm's financial risk due to higher family emotions and the so-called stewardship theory, resulting in a lower debt-to-equity ratio or leverage ratio.

Second, Spence's (1973) signal theory suggests that education level is an outward signal of job quality, and directors with higher education levels or professional knowledge can better apply their expertise to the firm's management decisions, leading to improved performance. Directors with higher education levels contribute to the effectiveness of the board (Fairchild & Li, 2005; Nicholson & Kiel, 2004), and they can provide more professional advice and assistance to the firm using their professional knowledge. However, directors with lower education levels can also provide help to the firm through their work experience and social networks. Female directors with higher education levels are better able to understand the financial risks associated with debt and limit the firm's use of debt financing. However, female directors with higher education levels can also improve the quality of management decisions and performance, thereby enhancing the firm's repayment ability and allowing it to assume higher financial risks with a higher debt-to-equity ratio or leverage ratio.

Third, if board members have professional knowledge backgrounds, they can provide more professional insights into firm production and management (Gîrbină, Albu, & Albu, 2012). The more diverse the professional backgrounds of directors are, the more capable they are in responding to external environmental changes and supervising managers. They can also provide more comprehensive advice to managers (Yermack, 1996; Klein, 2002). Carcello, Hollingsworth, Klein, and Neal (2006) investigated the relationship between the financial expertise of audit committees, corporate governance mechanisms, and earnings management. They found that in firms with weaker corporate governance mechanisms, audit committees with accounting or financial expertise can reduce the degree of earnings management, especially independent audit committee members with financial expertise. Fama (1980) and Fama and Jensen (1983) believe that external directors with professional knowledge can protect shareholders' interests and enhance firm value through their supervisory duties. The more independent directors with financial expertise and supervisory experience, the better the supervision results, and the more effective they are in curbing management's earnings management. However, some scholars have found that the more independent the supervisors, the more directors with financial expertise, and the more voluntary independent directors and supervisors are set up, the more likely the firm will engage in earnings management (Chen, Elder, & Hsieh, 2007). Bhagat and Black (1999) believe that the impact of directors' professional knowledge and experience on firm performance is more important than independence. Female directors with financial, legal, and accounting backgrounds may be more likely to manipulate firm financial decisions, resulting in higher debt ratios. However, female directors with financial, legal, and accounting backgrounds can contribute to shaping better financial decisions and corporate governance outcomes, leading to better firm performance and the ability to withstand higher debt or leverage ratios.

Fourth, existing research suggests that board members holding multiple positions can enhance their reputation, expertise, experience, and network, thereby increasing their ability to supervise and advise the management team. This can help firms reduce agency costs, increase firm value, and mitigate risks (Fama & Jensen, 1983; Carpenter & Westphal, 2001). However, Harris and Shimizu (2004) argue that busy directors holding multiple positions may compromise their independence and weaken their ability to supervise and govern, making it difficult for them to effectively fulfill their responsibilities as watchdogs of management on behalf of shareholders. Similar studies include Ferris, Jagannathan, and Pritchard (2003) and Shivdasani and Yermack (1999). When female directors have a higher attendance rate, it indicates that they are more able to focus on fulfilling their supervisory and advisory responsibilities, which can improve the quality of management decisions and enhance firm performance, as well as increase the firm's debt capacity.

In order to test the moderating effect of family control, female directors' attendance rate of board meeting, female directors' education background and professionals (finance, law or accounting) on the negative

relationship between board gender diversity and capital structure, this study incorporates the cross-product term of board gender diversity variables and dummy of family-controlled-firm (*family*), female directors' average board meeting attendance rate (*attend*), dummy of whether female directors have master (and above) degree (*masphd*), and dummy of whether female directors have professionals on finance, law or accounting (*fla*), and re-estimates the regression equation.

The estimated results of moderating effect on the relationship between board gender diversity and capital structure (debt) are reported in the models (1)~(4) in Table 8. The coefficients of the interaction terms between the female directors ratio and family control (*fdr\*family*) is negative and significant at 10% level, means that although board gender diversity increases debt ratio, but in family firms, the positive effect of board gender diversity on debt ratio is weakened. As mentioned above, family-controlled firms may also place greater emphasis on the firm's financial risk due to higher family emotions and the so-called stewardship theory, resulting in a lower tendency of using debt financing.

However, coefficients on cross-product terms of the female directors ratio and the average attendance rate of female directors (*fdr\*attend*), the female directors ratio and female directors with master's and doctoral degrees (*fdr\*masphd*), and the female directors ratio and the female directors with finance, law or accounting professions (*fdr\*fla*) did not reach statistical significance. This indicates that factors such as the average attendance rate of female directors, whether female directors have master's and doctoral degrees, and whether female directors have financial, legal, and accounting expertise do not significantly strengthen or weaken the relationship between gender diversity on the board and the firms' debt and leverage ratios. Possible explanations are that the preference of female directors for using debt in the firm is not enhanced or weakened by their attendance at board meetings, their educational background, or whether they have a background in finance, law, or accounting. However, when we observe the estimation results of models (5)~(8), we can find that the cross-product coefficients of the proportion of female directors and the master's or doctoral degree, as well as the proportion of female directors and the background in finance, law, and accounting, are both positive and reach a statistically significant level. This indicates that female directors with higher educational backgrounds and those with a background in finance, law, and accounting will place the firm in a group of firms with high debt-to-equity ratios. Although the educational background and expertise of female directors do not increase the firm's debt-to-equity ratio, they place the firm in a group with a higher debt-to-equity ratio in the entire sample of firms.

Table 8. Regression result of the effects of board gender diversity (Female Director Ratio: *fdr*) on the capital structure—moderating effects of family control, board meeting attendance, education background and professionals

Explanatory variables	Explained variables (capital structure)							
	<i>debt</i> (1)	<i>debt</i> (2)	<i>debt</i> (3)	<i>debt</i> (4)	<i>debt</i> (5)	<i>debt</i> (6)	<i>debt</i> (7)	<i>debt</i> (8)
<i>fdr</i>	0.0411*** (2.95)	0.0218** (2.30)	-0.0185 (-0.51)	0.0196* (1.91)	0.00273** (2.29)	0.00212*** (2.60)	-0.00757** (-2.44)	0.00140 (1.58)
<i>fdr*family</i>	-0.0273* (-1.83)				-0.000721 (-0.57)			
<i>fdr*attend</i>		0.000271 (0.02)				0.000696 (0.45)		
<i>fdr*masphd</i>			0.000522 (1.30)				0.000126*** (3.70)	
<i>fdr*fla</i>				0.00618 (0.44)				0.00234* (1.94)
<i>asset</i>	3.143*** (27.46)	3.151*** (27.52)	3.198*** (22.40)	3.149*** (27.50)	0.213*** (22.50)	0.214*** (22.52)	0.222*** (18.57)	0.213*** (22.45)
<i>mtb</i>	0.526*** (7.11)	0.527*** (7.16)	0.458*** (4.96)	0.527*** (7.15)	0.0210*** (3.78)	0.0211*** (3.79)	0.0284*** (4.30)	0.0210*** (3.79)
<i>tang</i>	-0.112*** (-16.86)	-0.112*** (-16.89)	-0.108*** (-13.51)	-0.112*** (-16.89)	-0.00763*** (-14.37)	-0.00763*** (-14.39)	-0.00715*** (-11.03)	-0.00764*** (-14.42)
<i>dep</i>	0.826*** (15.49)	0.824*** (15.45)	0.751*** (11.03)	0.823*** (15.44)	0.0560*** (12.83)	0.0559*** (12.82)	0.0471*** (8.45)	0.0559*** (12.80)
<i>rd</i>	-0.000244*** (-5.36)	-0.000243*** (-5.39)	-0.000310*** (-3.40)	-0.000243*** (-5.39)	-0.0000290 (-1.14)	-0.0000289 (-1.14)	-0.00106 (-1.39)	-0.0000288 (-1.14)
<i>insthold</i>	-0.0832*** (-12.19)	-0.0832*** (-12.19)	-0.0786*** (-9.56)	-0.0832*** (-12.18)	-0.00629*** (-10.80)	-0.00630*** (-10.80)	-0.00635*** (-9.01)	-0.00629*** (-10.79)
<i>dirhold</i>	0.0397*** (3.86)	0.0401*** (3.90)	0.0365*** (2.88)	0.0402*** (3.90)	0.00267*** (3.24)	0.00269*** (3.27)	0.00301*** (2.95)	0.00271*** (3.29)



<i>pledge</i>	0.0756*** (10.52)	0.0753*** (10.47)	0.0839*** (9.46)	0.0753*** (10.48)	0.00667*** (10.56)	0.00666*** (10.54)	0.00736*** (9.42)	0.00667*** (10.57)
INDUSTRY dummies	yes	yes	yes	yes	yes	yes	yes	yes
YEAR dummies	yes	yes	yes	yes	yes	yes	yes	yes
constant	-3.880** (-2.14)	-4.041** (-2.23)	-4.229* (-1.86)	-4.005** (-2.21)	-2.784*** (-18.98)	-2.789*** (-19.01)	-2.913*** (-15.67)	-2.777*** (-18.92)
Num. of obs.	18,558	18,561	12,423	18,561	18,550	18,553	12,388	18,553
Adj. R-square (Pseudo R <sup>2</sup> )	0.187	0.186	0.185	0.186	0.094	0.094	0.098	0.094
Prob. of F-stat. (X <sup>2</sup> -stat.)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note. this table reports the regression estimation results of the effects of board gender diversity (proxied by female director ratio: *fd\_r*) on the capital structure (proxied by *debt* and *debtab*) and further considers the moderating effects of family control, board meeting attendance, education background and professionals. The control variables include firm scale (asset), market-to-book ratio (*mtb*), fixed assets to total assets (*tang*), depreciation to total assets (*dep*), R&D expense to net sales (*rd*), institutional investor shareholding (*insthold*), directors shareholding (*dirhold*), directors' shareholding pledge ratio (*pledge*), industry dummies vector (INDUSTRY) and year dummies vector (YEAR). The values in brackets are the t-statistics of estimated coefficients (calculated by the White's heteroscedasticity consistency robust standard error), and \*, \*\* and \*\*\* indicates that the estimated coefficient reaches the significant level of 10%, 5% and 1%, respectively.

## 5. Conclusion and Suggestion

There have been numerous academic studies on corporate board gender diversity, with most of the research focusing on the effects of increased female director participation in the corporate board on firm's financial and non-financial consequences. However, there is relatively less research on how the presence and degree of female directors affect a firm's capital structure policy. The capital structure policy is a crucial financial policy because different capital structures can affect a firm's cost of capital, value, and risk, particularly financial risk. If a firm overly relies on equity financing, it may face higher funding costs and concerns over equity dilution and corporate control. On the other hand, although debt financing provides tax shield benefits, it can also lead to financial risk or bankruptcy risk if the firm cannot pay the interests. Therefore, unless the firm can plan and understand the use and risk of debt instruments well, or improve its debt-paying ability, and risk management ability, actively using debt will increase the firm's financial risk and negatively affect its stock market performance, value, and sustainability.

Many academic studies on corporate board gender diversity or female directors have mentioned many unique or relatively stronger traits that the female possess compared to the men, including risk aversion, conservatism, prudence, and greater emphasis on ethical conduct. These traits may make firms more cautious and prudent in their use of debt, as using debt can cause bankruptcy risk and affect sustainability. Therefore, if the level of board gender diversity in a firm increases, it may make the firm's debt ratio or capital structure lean more towards using equity financing. However, on the other hand, if a board with more women can help a firm achieve better performance and earn more public trust and greater valuation, and has better management monitoring and decision-making (more understanding of the risks of using debt and better risk management tools), then the cost of the firm's debt is expected to decrease. Financial market fund supplier are more likely to provide favorable credit conditions to firms with a higher level of board gender diversity, which may encourage firms to use more debt. At this time, the level of board gender diversity may be positively correlated with the firm's debt ratio, and the capital structure may tend to use debt financing instead of equity financing.

In order to understand and examine which of the two opposing views is closer to the facts in the Taiwan financial market, this study is based on the data of 1,590 listed non-financial-industry firms from 2007 to 2020, examining the relationship between board gender diversity and capital structure. Board gender diversity is measured by whether the firm has female directors, the number of female directors, the ratio of female directors, whether the board chairman or board vice chairman is female, and whether the independent directors are female, for a total of six variables. The firm's capital structure is measured by debt ratio, leverage ratio, whether the firm's debt ratio is higher than the average, and whether the firm's leverage ratio is higher than the average. Through correlation analysis and regression estimation, it was found that the increase in board gender diversity corresponds to an increase in the firm's debt and leverage ratios. Firms with high levels of gender diversity also tend to have high debt and leverage ratios, supporting the view that board gender diversity helps firms use more debt-financing. In addition, this study also found that female directors in family-controlled firms have relatively weaker ability to increase the firm's debt ratio, while female directors with higher education level and finance, law, and accounting backgrounds tend to make the firm have a higher debt ratio. This implies that female directors with higher education and professional backgrounds may have a better understanding of debt risk and are more willing to put the firm in a high debt state.

The implication of the study has three folds. First, for investors, firms with high debt-to-equity ratios may not

necessarily be high-risk firms that should be avoided. Investors should comprehend that even firms with high debt-to-equity ratios, if they have higher levels of gender diversity on their board of directors, may have better performance, higher payment capacity, more sound corporate governance, and greater social reputation. Therefore, such firms may not necessarily be poor investment targets. Second, the increase in gender diversity on the board of directors may lead to an increase in a firm's debt-to-equity ratio. Government regulators should pay attention to female directors' educational and professional backgrounds to ensure that they meet the firm's needs, rather than simply considering gender diversity without regarding to their qualifications. Government regulators should still focus on the quality of directors with diverse backgrounds. Third, although board diversity is in line with the trend of corporate governance in today's advanced financial markets, the board of directors is still the most critical governance body and a leadership organization that concerns the interests of the firm's stakeholders. Therefore, when selecting directors, their professionalism, independence, and qualifications should be considered, rather than solely seeking diversity for diversity's sake, even if the candidate does not have sufficient expertise and ability.

Regarding the limitations of the study, first, the impact of gender diversity on the board of directors on capital structure may take a longer time to take effect. In other words, it may take several years for the diversity of the board of directors to adjust the firm's capital structure policy. After all, the adjustment of capital structure policy requires a longer period of time, including the planning, decision-making, and securities issuance process for determining whether to issue equity or debt securities. Therefore, it may be possible to consider using a 5-year average as a measure of capital structure policy in the future study.

Second, there is a self-selection problem in the sample of gender diversity on the board of directors. The degree of diversity in the firm's board of directors may be influenced by some pre-determined factors, such as firm size, profitability, the specific industry the firm belongs to, and the level of diversity in the same industry, affecting the degree of board diversity. Therefore, firms with higher levels of board diversity may have significant differences in their pre-determined variable compared to firms with lower levels of corporate board gender diversity. This self-selection problem in the sample can be corrected through Heckman's (1979) two-stage least squares estimation or propensity score matching (Rosenbaum & Rubin, 1983, 1985a,b).

Third, different industries may have different levels of gender diversity on the board of directors, which may also apply to the capital structure policy. Therefore, both gender diversity on the board of directors and capital structure policy should be adjusted for the industry. For example, the degree of diversity should be defined as high if it is higher than the average level for a specific industry, and vice versa. Only by predicting the degree of gender diversity on the board of directors adjusted for industry can the predicted debt ratio or leverage ratio adjusted for industry diversity reduce the impact of industry factors on the relationship between board gender diversity and capital structure.

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