

A Work Project, presented as part of the requirements for the Award of a Master's degree in
Finance from the Nova School of Business and Economics

THE EFFECT OF BOARD GENDER DIVERSITY ON CAPITAL STRUCTURE
– AN ANALYSIS OF THE S&P1500

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17-12-2021

Abstract

This study aims to analyze *the effect of board gender diversity on capital structure* and the impact of a change in CEO gender on leverage. Thus, S&P1500 companies are analyzed with a panel regression and difference-in-difference analysis considering complementary propositions of gender theories. The results show a positive relation between board gender diversity and change in CEO gender with leverage, a negative one with maturity and a non-significant one with cost of debt. These findings support other studies claiming that female executives are not more risk-averse than men and that they use leverage as a corporate governance instrument.

Keywords: *Board gender diversity, capital structure, corporate finance, gender, CEO transition, leverage ratio, debt maturity, cost of debt,*

This work used infrastructure and resources funded by Fundação para a Ciência e a Tecnologia (UID/ECO/00124/2013, UID/ECO/00124/2019 and Social Sciences DataLab, Project 22209), POR Lisboa (LISBOA-01-0145-FEDER-007722 and Social Sciences DataLab, Project 22209) and POR Norte (Social Sciences DataLab, Project 22209).

1.0 Introduction

The more traditional capital structure theory mainly focuses on firm-specific factors and largely ignores the effect of individual board member characteristics. However, in recent years, a new research field with a particular focus on the impact of board gender diversity on corporate finance topics such as the capital structure has emerged. This trend has been accelerated by the controversial discussion about women quotas on the board of directors in various countries (International Labour Organization 2020), the continuously increasing political and societal focus on gender equality in the business world (United Nations 2021) and the growing female board presence. For instance, in the majority of the Standard and Poor (S&P) 500 boards a female representation of at least 30% has been reached in 2021 (Green 2021).

Behavioral differences between genders have been intensively studied in psychology and are now further investigated in the context of capital structure. Thus, the findings of gender-specific traits such as higher risk aversion and lower overconfidence of women compared to men (Harris and Jenkins 2006; Eckel and Grossman 2008) are associated with the two predominant capital structure theories *trade-off theory* (Modigliani and Miller 1963; Kraus and Litzenberger 1973) and *pecking order theory* (Myers and Majluf 1984). If these gender differences also apply to executives, financial decisions should be impacted.

Nonetheless, previously conducted studies are ambiguous. While some studies show an inverse relation of gender diversity and capital structure resulting in decreasing leverage ratios, debt maturity and cost of debt (e.g., Faccio, Marchica and Mura 2016; Miah 2019; Garcia and Herrero 2021), other studies claim a positive relation (Nisiyama and Nakamura 2018) or fail to find any statistically significant relation (Detthamrong, Chancharat and Vithessonthi 2017). Additionally, studies argue that besides gender, further director- and board-specific factors need to be considered when analyzing the effect on capital structure (e.g., Malmendier, Tate and Yan 2011). Another aspect that most previous studies neglect is the effect of executive transition on

the capital structure. Thus, this study combines the analysis of the effect of board gender diversity as well as the change in CEO gender on the capital structure under the condition of firm-, personal- and board-specific factors leading to the research question:

Which effect does board gender diversity have on individual capital structure variables?

This question is approached by developing four hypotheses based on a literature review of existing research. The first three hypotheses state the inverse relation between board gender diversity and the capital structure variables: *leverage ratio*, *debt maturity* and *cost of debt*. The fourth deals with the effect of change in CEO gender on the *leverage ratio*. These hypotheses are then tested by analyzing a data sample of 1,191 S&P1500 companies over the period 2007-2020 with a twofold methodology consisting of a panel data regression and a difference-in-difference analysis. The panel data regression reveals a negative relationship with debt maturity, fails to show a statistically significant relation with cost of debt and indicates a positive relation with leverage for the analyzed sample. The difference-in-difference analysis confirms this positive relation with leverage since firms with a change in CEO gender tend to increase their leverage ratio in the following periods.

This study complements existing literature in three ways. First, the influence of board gender diversity is still conflicting; thus, the analysis of a more recent and different data sample allows for new insights, especially since the female ratio continuously increases in the analyzed sample period. Second, the influence is examined for the three variables *leverage ratio*, *maturity* and *cost of debt* and incorporates firm-, board- and director-specific effects to provide a holistic view. Lastly, the applied difference-in-difference analysis examines how the change in CEO gender impacts the capital structure over time which represents a little-studied research field.

The study is structured in 7 sections. Section 2 depicts the current research status and the developed hypotheses. In section 3, the data sample selection process and research methodology are described, and the descriptive statistics are outlined. Section 4 presents the results of the

analyses; these findings are then discussed in context with their implications in Section 5. Section 6 outlines limitations and future research opportunities, and section 7 concludes and summarizes the results.

2.0 Theoretical framework

2.1 Modern capital structure theory

The capital structure and its design are a widely studied research field and an equally important decision issue for every company. The modern capital structure theory is based on the *irrelevance theory* of Modigliani and Miller (1958). The basic assumption is that given a perfect market, "the market value of any firm is independent of its capital structure [...]" (Modigliani and Miller 1958, 268). In 1963, Modigliani and Miller (1963) further developed their model by incorporating taxes and tax-deductibility of debt (tax shields). These market imperfections build the basis for the *static trade-off theory* claiming that choosing the optimal capital structure is a trade-off decision balancing the costs and benefits of tax shields and exposure to default (Kraus and Litzenberger 1973). In contrast, the *dynamic trade-off theory* considers the effect of time causing additional complexity due to uncertainty and adjustment costs (Kane et al. 1984; Brennan and Schwartz 1984; Luigi and Sorin 2009). Furthermore, Jensen (1986) argues that there are agency costs arising from the separation of management and ownership. These costs can be mitigated by employing debt as a measure to reduce the cash flow available for organizational spending. Consequently, the theory is often extended by agency costs.

Another influential theory is the *pecking order theory*, which is often seen as the antithesis to the *trade-off theory* since it postulates that there is no optimal target capital structure but a preferred order of financing sources. It is mainly based on the assumption of asymmetric information between firm internal and external parties. Accordingly, the following hierarchy of financial resources is targeted: *retained earnings, debt, equity*. New equity issuance is perceived as an overvaluation of the firm by investors who expect managers to take advantage of this. This

results in a lower value of the newly issued equity; hence it is the least preferred way of financing (Myers and Majluf 1984; Myers 1984).

Besides these two predominant capital structure theories, the *market timing theory* is also well-recognized. This theory argues that companies issue new equity when they perceive it as overvalued and repurchase it when undervalued. Thus, it has a persistent effect on the capital structure since market asymmetries are exploited (Baker and Wurgler 2002).

Even though the three discussed theories are often considered conflicting, they all contain aspects of the concept of *agency theory* in order to reflect (market) imperfections. The *trade-off theory* focuses more on agency costs when determining the optimal capital structure, whereas *pecking order* and *market timing theory* are based on the principle of asymmetric information between internal and external parties. These represent the main pillars of *agency theory*. Furthermore, the consideration of the *agency theory* is an indicator that managers do not act entirely rational to maximize shareholder value but rather irrational (Dalton et al. 1999; Daily et al. 2003).

However, studies in behavioral finance show that this irrationality does not sufficiently explain all variations in capital structure. Thus, more recent studies consider personal characteristics (e.g., age, tenure, gender), psychological traits as well as their impact on the extent of asymmetric information, the behavior towards external parties and corporate governance (e.g., overconfidence, risk-aversion) (e.g., Hambrick and Mason 1984; Berger, Ofek and Yermack 1997; Pegels and Yang 2000; Graham and Harvey 2001; Harris and Jenkins 2006; Bertrand and Schoar 2003; Eckel and Grossman 2008; Chen, Hsu and Huang 2010; Strebulaev and Yang 2013; Jacquart and Antonakis 2015; Garcia and Herrero 2021). Hence, this paper aims to analyze the effect of board gender diversity considering complementary propositions of gender theories, as well as personal and board-specific aspects in order to provide a holistic picture.

2.2 Behavioral differences of men and women on the board of directors

Research considering the influence of gender diversity and controlling for other personal characteristics on capital structure is limited and somewhat conflicting. So far, potential differences in financial decisions have often been explained by behavioral and psychological differences between women and men. A substantial number of studies argue that there is a tendency for women to be more risk-averse and less overconfident than men on average (Harris and Jenkins 2006; Eckel and Grossman 2008). However, in this context, literature is also both inconclusive and ambiguous when restricting it to the executive management (Adams and Funk 2012; Yang et al. 2019) and to the effect on capital structure decisions (Adusei and Obeng 2019).

Regarding the risk aversion of female managers, some research papers postulate that an increase in board gender diversity causes a reduction of undertaken risk (Yang et al. 2019), enables better monitoring and improves corporate governance resulting in less risky and overconfident decisions (Adams and Ferreira 2009). In contrast, Adams and Funk (2012) claim that women's risk tolerance is even higher than men's once they reach an executive position. Moreover, other studies focusing on women's financial literacy find evidence that women with a high level of financial education do not demonstrate a different attitude towards risk compared to their male counterparts (Adams and Funk 2012; Adams and Rangunathan 2017).

Even though research is conflicting, there tends to be the consensus that women are indeed more risk-averse. Nonetheless, there is evidence that the differences in financial decisions require the consideration of other personal characteristics such as tenure, age and education (e.g., Bertrand and Schoar 2003; Matemilola et al. 2018).

2.3 Effect of board gender diversity on the capital structure

Under the assumption that women make less risky and overconfident financial decisions, the capital structure composition and its related determinants debt maturity (Fields, Fraser and Subrahmanyam 2012; Li and Zhang 2019) and cost of debt (Lorca, Sanchez-Ballesta and

Garcia-Meca 2011) should also be influenced. However, the relation between capital structure and risk aversion as well as overconfidence is not unambiguous either.

In general, studies provide evidence that a higher risk aversion leads to lower leverage ratios. From the perspective of *trade-off theory*, this can be explained by the fact that a more risk-tolerant manager tends to aim for a higher debt-to-equity ratio to enlarge the benefits of the tax shield. In contrast, a more risk-averse executive rather strives for a lower leverage ratio to limit the default risk to a minimum (Modigliani and Miller 1963).

These theoretical derivations are supported by empirical evidence. Huang and Kisgen (2013) as well as Faccio, Marchica and Mura (2016) examine the effect of female CEOs and CFOs on debt issuance, assuming a higher risk aversion and lower overconfidence and find a negative relation of these variables. Further academics provide evidence for the same negative relation when analyzing the entire board of directors (Alves, Couto and Francisco 2015; Adusei and Obeng 2019; Garcia and Herrero 2021). Nonetheless, other studies fail to find clear evidence for an existent relation (Detthamrong, Chancharat and Vithessonthi 2017) or find a positive relation between leverage and board gender diversity (Nisiyama and Nakamura 2018).

Besides the direct impact of higher risk aversion and less overconfidence on the capital structure, there is evidence that these factors may enforce better corporate governance. Better corporate governance leads to less debt needed as a control instrument since better board supervision can complement or even replace debt (Garcia and Herrero 2021). Moreover, Alves, Couto and Francisco (2015) point out that improved corporate governance leads to fewer information asymmetries resulting in less lever. However, Nisiyama and Nakamura (2018) claim that female directors favor debt as a monitoring instrument leading to more debt issuance. Nonetheless, based on the outlined discussion, more studies provide evidence that women tend to decrease the leverage ratio. Therefore, the first hypothesis H1 to be tested is the following:

H1: Board gender diversity is inversely related to the leverage ratio

The next variable to look at is debt maturity. The decision of its design is related to the selection between short-term and long-term debt. Thus, the higher the proportions of the latter, the higher the maturity. Firms should strive to have a well-balanced composition of debt to mitigate the agency issue (Myers 1977), alleviate asymmetric information (Fama 1990) and optimize the tax shield (Brick and Ravid 1985). Nevertheless, the literature review reveals that studies are scarce and ambiguous in the context of board gender diversity. In general, gender differences are again mainly explained by less overconfidence, higher risk aversion and their influence on the agency problem and asymmetric information.

Under the assumption of less risk aversion, Graham, Harvey and Puri (2013) postulate that firms managed by male managers tend to demonstrate a capital structure with more significant short-term debt proportions than those led by women since short-term debt is riskier. In contrast, Myers (1977) contends a more flexible capital structure due to short-term debt since more frequent renegotiations are required. Hence, the issue of debt overhang is addressed. Based on these findings, other studies find evidence that women prefer a more conservative and flexible capital structure especially during phases of unexpected changes. Thus, they strive for higher short-term debt proportions (Francis, Hasan and Wu 2013; La Rocca, Neha and La Rocca 2020).

In contrast, looking at the debt maturity from the agency theory lens, Briozzo, Cardone-Riportella and García-Olalla (2019) argue that the better monitoring, financial performance and the resulting independence caused by more gender-diverse boards lead to more long-term debt financing. This is supported by Li and Zhang (2019), who claim that more short-term debt is used in poorly governed companies. Au contraire, short-term debt can be applied as a control instrument since the credit contract has to be renewed continuously and thus, is a better lever to reduce cash flow (Jensen 1986). Consequently, if female directors intend to increase monitoring, short-term debt is the means of choice (Nisiyama and Nakamura 2018). Since it is assumed that women prefer short-term over long-term debt, the following second hypothesis H2 is tested:

H2: Board gender diversity is inversely related to debt maturity

The cost of debt is also a critical determinate of capital structure. Whilst past studies postulate that it is negatively related to the duration of the relationship between borrower and lender (Petersen and Rajan 1994; Berger and Udell 1995), more recent research finds evidence that lenders price managers' risk incentive when issuing debt (Beladi and Quijano 2013; Chen and Qui 2017). This should then result in a lower cost of debt for female executives, given their higher risk aversion. Nonetheless, literature is not clear in this context either. Some research papers argue that female managers are subject to general discriminations in the credit market resulting in higher cost of debt (Muravyev, Talavera and Schäfer 2009; Galli and Rossi 2015). Nonetheless, female executives may also benefit from a lower cost of debt than their male counterparts since they demonstrate an enhanced performance, less riskiness, and a more efficient capital allocation (Miah 2019).

Furthermore, it can also be seen in context of *agency theory* when assuming lower asymmetric information due to better corporate governance. Francis, Hasan and Wu (2013) hypothesize that female CFOs insist a more reliable accounting system; thence they demonstrate a more negligible default risk resulting in lower capital costs. Their analysis concludes that female CFOs benefit from 11% lower loan costs on average. Besides, Pandey et al. (2019) come to similar results claiming that increasing gender diversity may decrease agency issues between executives and loaners, and the default risk. Hence, the cost of debt is lower. However, they also argue that this is dependent on a certain critical mass of female directors. Moreover, Benjamin and Biswas (2017) argue that greater gender diversity can intensify the potential of conflicts between men and women, given their diverging viewpoints. Based on this, communication and corporate governance can worsen. Hence, creditors may demand higher capital costs. Nonetheless, in line with the previous argumentation that greater gender diversity leads to improved corporate governance, the third hypothesis to be tested is the following:

H3: Board gender diversity is inversely related to cost of debt

The literature review shows that most studies compare the individual companies' capital structure and the proportion of leverage between management boards that are gender-diverse and those that are gender-homogeneous for a given period (e.g., Adusei and Obeng 2019; Garcia and Herrero 2021). Assuming that women are indeed more risk-averse and cause an actual change in corporate governance, the capital structure in a company should change with the transition from a male-dominated to a more gender-diverse management board. In other words, the impact of female directors on capital structure should be significant over time after a transition. To the best of the author's knowledge, the study of Huang and Kisgen (2013) is the only one that examined the transition effect of male-to-female CEOs and CFOs on the capital structure with the result that "female executives do not (...) make significantly different changes to leverage overall". Nevertheless, the evidence base can be considered fragile with this single study. Thus, in line with the previous discussions about higher risk aversion and better corporate governance, women should recognizably decrease a firm's leverage ratio once they reach a top management position.

Consequently, testing the following fourth hypothesis complements the current state of research by analyzing the consequences of the change in CEO gender over time. This transition analysis is limited to the CEOs as critical personnel influencing financial decisions due to the scope and time frame of the underlying study (Bertrand and Schoar 2003).

H4: The change in CEO gender causes decreasing leverage ratios in the following periods

The literature review of the current state of research shows that the impact of gender diversity on capital structure is unclear and somewhat conflicting. Moreover, it has to be kept in mind that depending on the country, the observed period and other context variables, the outcome of such studies vary significantly. For this reason, the underlying thesis adds to the existing literature in two ways: first, by analyzing a different data sample and second, by considering the time effect based on a CEO transition analysis.

3.0 Sample selection and research methodology

3.1 Sample selection

The objective of the underlying research is to examine if board gender diversity influences companies' capital structure decisions based on a panel regression and a change in CEO gender effect analysis. The initial data sample for these analyses consists of an unbalanced panel of financial and director-level data for S&P500, S&P mid-capitalization 400 and the S&P small-capitalization 600 companies. The reason to include firms of different sizes is that past studies found differences in financial decisions between small and large firms (Frank and Goyal 2003). The financial data is sourced from Compustat North America and the director- and board-level information from Institutional Shareholder Service (ISS) for the period 2007-2020. This timeframe is chosen since the objective is to have a data sample as large as possible, and this time period covers all observations provided by ISS.

The Compustat data sample contains information from firms' past published balance sheets, income and cash flow statements. The data set sourced from ISS consists of director and board characteristics of the firms' management such as name, gender and board composition. However, the following series of filters and modifications are applied to get an analyzable data sample. From the Compustat data sample, all firms that are not an active part of the S&P1500 at the time this study is conducted are excluded. If a particular data point is not available for a firm, it is excluded for this firm in this specific year. In case there is a missing data point for a dependent variable, the total observation is not considered.

Furthermore, following the recommendations of other studies, financial and insurance companies are excluded since they follow unique accounting and capital structure requirements (Bertrand and Schoar 2003; Huang and Kisgen 2013). This classification is based on the Global Industry Classification Standard (GICS) since it was explicitly developed by MSCI and S&P Dow Jones (MSCI 2021). After preparing the financial data set, it is merged with the ISS data

sample by using the company ticker and the year of observation occurrence. For ISS, the same applies as for the financial data; if a particular data point is missing, this specific observation is excluded. The performed data cleaning leads to a final unbalanced data sample of 10,780 individual firm-year observations for 1,191 companies.

As described above, only CEO-specific data is analyzed for the CEO transition analysis, for which reason further modifications and adjustments are made for the second analysis. Besides excluding all other board members, it is required that the remaining observations are consecutive. A further criterion is that the respective CEO is in charge for a minimum of three consecutive years, including the year of transition, and that data for at least one year before the transition is available in order to deduce the transition effect on leverage and to make sure that the CEO impacted the firm's company structure (Huang and Kisgen 2013). In this context, male-to-female and female-to-male CEO transitions are the group of interest, whereas male-to-male transitions are used as control groups. This results in a final sample of 550 male-to-male and 54 male-to-female as well as female-to-male transitions, respectively (see Appendix 1 for female CEO overview).

3.2 Variables

The previously developed hypotheses posit that a firm's capital structure decision is based on the board composition. In order to test these hypotheses, *leverage ratio*, *maturity* and *cost of debt* are defined as dependent variables, whereas board *gender diversity* is considered as the key explanatory variable. Following previous studies and since despite of one observation, there are always less than 50% women which can be neglected for this objective, *gender diversity* is defined as the share of female directors on the board (Bernile, Bhagwat and Yonker 2018). Furthermore, following the approach and findings of previous research, various firm-, board- and director-level control variables are introduced as control variables to isolate the influence

of *gender diversity* on the dependent variables (Garcia and Herrero 2021; Adams and Ferreira 2009). The definition of these control variables can be found in *Table 1* below.

	Abbreviation	Definitions
Dependent variables		
Leverage ratio	LEV	Ratio of total book value of leverage (short- & long-term and other debt) to total assets
Maturity	MAT	Ratio of long-term debt to total leverage
Cost of debt	CoD	Ratio of total financial expenses to total leverage
Explanatory variable		
Gender Diversity	GenDiv	Share of female directors of total directors on board
Firm-specific variables		
Firm size	FS	Logarithm of total assets
Return on assets	RoA	Net income/ loss divided by total assets
Growth	GR	Change in logarithm of total assets of current vs. previous period
Risk	RISK	Standard deviation of RoA (using 5 periods prior to the current period)
Tangibility	TANG	Ratio of net property, plant, and equipment to total asset
Liquidity ratio	LQ	Working capital divided by total asset
Board-specific variables		
Board size	BS	Number of directors on board
Independent ratio	IND_RAT	Share of independent directors of total directors on board
Duality	DUAL	Indicator variable if CEO and Chairman is the same person
Director-specific variables		
Age of men	MALE_AGE	Average age of male directors in certain year
Age of women	FEM_AGE	Average age of female directors in certain year
Tenure of men	MALE_TEN	Average tenure of male directors in certain year
Tenure of women	FEM_AGE	Average tenure of female directors in certain year

Table 1: Definition of variables

On the firm level, the following control variables are used: *firm size*, *return on assets (RoA)*, *tangibility*, *growth*, *risk* and *liquidity ratio*.

Firm size reflects the different financing choices made by firms of different sizes (Frank and Goyal 2003). Larger firms tend to be more diversified, deal with a lower default risk and have more facilitated access to the capital market (Baker and Martin 2011). Besides, they can take out long-term loans more easily due to higher collateral (Ghosh et al. 2011).

RoA is the profitability variable, which constitutes a negative relation with leverage when following the *pecking order theory* (Titman and Wessels 1988; Baker and Wurgler 2002). However, they tend to prefer short-term debt to signal their confidence, thus a positive relation with this variable is assumed (Ghosh et al. 2011). Additionally, more profitable companies are less prone to default and thus, will benefit from a lower cost of debt (Ertugrul and Hegde 2008).

Tangibility refers to the levels of collaterals that can be offered to creditors. There is evidence that *tangibility* is positively linked to firm leverage (Harris and Raviv 1991; Titman and Wessels

1988; Baker and Wurgler 2002) and inversely related to cost of debt (Pandey et al. 2019). In addition, Li and Zhang (2019) argue that firms are likely to match debt and asset maturity, wherefore a positive relation of these two variables is expected.

Growth is negatively related to leverage due to the increased risk of distress and debt-related agency issues (Frank and Goyal 2009; Ghosh et al. 2011). Moreover, high growth firms may invest sub-optimally, leading creditors to be less willing to issue long-term debt. These two parameters cause a negative relationship between *maturity* and *growth* (Briozzo, Cardone-Riportella and García-Olalla 2019; Li and Zhang 2019).

Firm risk is relevant since creditors are somewhat reluctant to issue debt because this increases financial risk and the probability of insolvency. This is especially the case for long-term debt. Thus, *firm risk* is inversely related to *leverage* and *maturity* (Frank and Goyal 2009).

Liquidity ratio controls for the indebtedness and maturity of firms. It may allow companies to have a greater ability to meet obligations from higher debt levels (Garcia and Herrero 2021). However, following the *pecking order theory*, higher liquidity ratios may be used to repay outstanding debt or as financing instruments of investments (Legesse and Guo 2020).

The following variables are used as executive-specific control variables: *age*, *tenure*, *independent ratio*, *duality* and *board size*.

Executive age is, according to previous findings, inversely related to leverage since older generations tend to make more conservative decisions and thus, issue less debt (Bertrand and Schoar 2003; Frank and Goyal 2006; Serfling 2014). In reverse, *tenure* encourages the executive to use more leverage (Matemilola et al. 2018). For both *age* and *tenure*, a separate male and female variable consisting of the respective averages corresponding to the individual firm-year combination is calculated to be able to control for firm and year-fixed effects (see 3.4 Methodology

Independent ratio is used since previous studies provide evidence that a higher percentage of independent executives is negatively related to risk-taking (Agrawal and Mandelker 1987) and *debt maturity* (Tosun and Senbet 2020). Furthermore, it can reduce the information asymmetries between board and creditors and thus, decrease the *cost of debt* (e.g., Ertugrul and Hegde 2008; Fields, Fraser and Subrahmanyam 2012; Pandey et al. 2019).

CEO duality is incorporated because it may cause higher *debt-to-equity ratios*, *cost of debt* and *maturity* due to more significant information asymmetries (Abor 2007; Ahmed 2019).

Board size is used since the larger the respective board of directors, the higher the probability that a woman is represented. Moreover, there is evidence that a larger board can lead to different skills and more transparency. This may decrease information asymmetries (Alves, Couto and Francisco 2015) and cause less indebtedness (Berger, Ofek and Yermack. 1997; Ahmed 2019) and lower *cost of debt* (e.g., Anderson, Mansi and Reeb 2004; Fields, Fraser and Subrahmanyam 2012). Au contraire, other researchers claim that larger boards can weaken corporate governance causing higher debt levels (Abor 2007; Rehman, Rehman and Raoof 2010).

3.3 Descriptive statistics

The descriptive statistics consisting of three different panels can be found in Appendix 2. Panel A represents the whole sample, whereas Panel B contains gender-diverse and Panel C male-dominated firms. The panels show the three dependent variables, the key explanatory variable *gender diversity*, as well as the firm- and director-specific control variables.

Panel A indicates that the total sample mean *leverage ratio* is 55.8% which is considered relatively common and on the upper limit of the desirable (Adusei and Obeng 2019). However, the prominent gap between the minimum and maximum values indicates relatively significant outliers. The comparison of the mean *maturity* of 40.7% with the additionally created short-term debt variable with a mean of 42.4% indicates that the sample firms use a little bit more short-term over long-term debt on average. The deviation from 100% can be explained with “other liabilities” being part of the total liabilities but not allocatable to short- or long-term debt

positions. Even though the minimum and maximum values also reveal significant differences, the standard deviations for both *leverage ratio* (0.23) and *maturity* (0.25) are considered to be acceptable, and thus, no further adjustments are applied. The *cost of debt* is 2.2% on average, which seems to be relatively low. Looking at the *gender diversity* variable reveals a female share of 16.7% on average. Moreover, the average *board size* is 9.5 directors consisting of 84% *independent* ones. In approximately 45% of the cases, the CEO and chairman is the same person.

Analyzing Panel B and C reveals that in contrast to the literature, boards with at least one woman have a higher average *leverage ratio* than male-dominated boards (58.0% vs 44.4%). The same contradictions can also be observed for *maturity* (41.8% vs 34.9%) and *cost of debt* (2.2% vs 2.1%). Even though this can be seen as a first indicator, it does not allow to draw first conclusions on the influence of gender diversity on the dependent variables since these are only averages. Additionally, in the divided panels, outliers for all three dependent variables can also be unfolded based on the minimum and maximum values. For the firm and director control variables, no significant differences between the two classified board types can be identified, despite that there is a tendency that larger firms are rather gender-diverse (average firm size: 8.5 Bn vs 7.2 Bn). Gender-diverse firms have an average gender diversity share of ca. 20%.

The pairwise correlation matrix (see Appendix 3) reveals that *leverage ratio* and *maturity* seem to be positively correlated with *gender diversity*, whereas *cost of debt* is negatively related. Furthermore, there is a statistical significance at the 1% level for all three variables. Nonetheless, *gender diversity* is also statistically significant correlated with other firm-, director- and board-level variables. Further, significant correlations between the individual dependent variables and other control variables can also be identified. Consequently, a more sophisticated panel analysis is required before drawing any conclusions.

3.4 Methodology

The methodology applied in this study to test the four developed hypotheses is twofold and consists of a more commonly used traditional panel data regression with firm-fixed effects and

a difference-in-difference analysis. The objective of this approach is to achieve robustness, to remove time-invariant unobservable firm effects by comparing the impact of a change in CEO gender, and to mitigate the risk of endogeneity (Huang and Kisgen 2013). In particular, the issue of endogeneity is a vital momentum to consider when developing the appropriate model because it can potentially confound results related to gender diversity due to self-selection of female directors, reverse causality and omitted variables (Parsons and Titman 2007).

Therefore, the combination of a panel data regression with firm- and year-fixed effects is considered to be appropriate since it allows to analyze multi-dimensional data measured over time and to adjust for unobserved time-invariant cofounders. Moreover, in contrast to pooled OLS regressions, this method is less susceptible to heterogeneity originating from unobserved effects (Allison, Williams and Moral-Benito 2017). The decision to apply a fixed effect over a random effect model is based on a Hausman specification test (see Appendix 4). This has a p-value of 0.000 indicating that the null hypothesis can be rejected and that a fixed effect model is more suitable (Hausman 1978). Thus, the following econometric model is proposed:

$$Y_{it} = \alpha + v_i + T_t + \beta_1 * GenDiv + \beta_2 * \chi_{it} + \varepsilon_{it}$$

Y_{it} represents the dependent variable of interest (*leverage, maturity, cost of debt*). α indicates the constant of the model. v_i are firm-fixed effects, and T_t are the time-fixed effects which are included to account for special events such as financial crisis, governmental policy changes or interest rate fluctuations (Sojli, Tham and Wang 2018). *GenDiv* serves as the percentage of gender diversity in a company. χ_{it} include the proposed set of firm-, director- and board-level control variables described in section 3.2. Lastly, ε_{it} is the error term of the regression model. The notation is specified as follows: i stands for the firm index and t for the period.

For the difference-in-difference analysis, adjustments to the regression model are made. Instead of a gender diversity variable, the $women_{CEO}$ indicator variable is used in order to indicate whether the respective firm is a male-to-female or female-to-male transition firm. In

this case, the indicator variable takes the value 1; for the male-to-male transition control group, it is 0. This control group is used in order to examine the effect of a male-to-female respectively female-to-male transition on the dependent variable of interest. Moreover, following the proposed approach of Huang and Kisgen (2013), this part of the analysis only considers the data of CEOs. The reasons for that are the study's scope constraints, lack and quality issues of CFO data, and that the CEO is considered to have a significant influence on both investment and financial firm policy (Bertrand and Schoar 2003). Consequently, all changes in other firm characteristics must be independent and have taken place at the same time as the transition to support alternative explanations. Further, the variable *post(before)* is introduced to the model which is 1 for all years after the transition if it is a male-to-female transition, and also for all years before the transition if it is a female-to-male transition. This allows to remove all time-invariant unobservable firm effects by comparing outcomes before and after the change in CEO gender and to isolate the effect of female CEOs. The following econometric model is proposed for the difference-in-difference analysis:

$$Y_{it} = \alpha + v_i + T_t + \beta_1 * womem_{CEO} * post(before) + women_{CEO} + post(before) + \varepsilon_{it}$$

4.0 Empirical results and discussions

4.1 Panel regression with firm-fixed effects

The panel regression results with firm-fixed effects run for the three dependent variables are reported in

Appendix 5. The first hypothesis H1 states that gender-diverse boards are negatively related to firm *leverage*. However, the regression results indicate contrary results by showing a positive gender diversity coefficient of approximately 0.045, which is statistically significant at a 5% significance level. Hence, firms that increase their gender diversity by 1% increase their leverage ratio by 4.5% on average. It also reveals that firms with gender-diverse boards tend to have a higher leverage ratio. Consequently, hypothesis H1 is rejected.

This contradiction confirms Adams' and Funk's (2012) findings that women who break the glass ceiling have a lower or similar risk aversion than men in the same position. Thus, the results of psychological studies about the average women do not apply to executives. Moreover, Adams and Ragnathan (2017) provide evidence that women with a high financial literacy do not differ in their risk preferences. This means that achieving top-management positions is rather correlated with a particular skill set and less with average gender-specific risk associations. This assumption would be supported by the fact that female tenure is statistically significant at a 1% significance level compared to male tenure, which is not significant.

Furthermore, past studies show that women tend to improve firm performance and profitability, which results in increasing taxes (e.g., Adams and Ferreira 2009; Brahma, Nwafor and Boateng 2020). Therefore, increasing leverage is an adequate countermeasure to benefit from higher tax shields regarding the *trade-off theory* (Modigliani and Miller 1963). Moreover, increasing profitability may cause higher agency costs in this context since managers may have more money available to spend on wasteful projects. Consequently, if, according to Nisiyama and Nakamura (2018), female directors favor more leverage as a monitoring and corporate governance instrument, the overall leverage ratio is increased. This is not contradictory to the above claimed improved corporate governance and reduced agency cost but rather confirms that female executives use leverage as a channel to improve corporate governance. Lastly, the board size also has a positive coefficient that is statistically significant (5% level), indicating that the leverage increases with a larger board size.

The second hypothesis H2 deals with the influence of board *gender diversity* on *debt maturity*, stating a negative influence between these two variables. The conducted panel regression has a negative gender diversity coefficient of 0.043 at a 10% significance level, implying that by increasing board gender diversity by 1%, long-term debt decreases by 4.3% on average. Consequently, hypothesis H2 is confirmed and adds to previous findings that females

tend to prefer a more flexible capital structure, and consequently, try to avoid large proportions of long-term debt (Francis, Hasan and Wu 2013; Huang and Kisgen 2013; La Rocca, Neha and La Rocca 2020). Additionally, this hypothesis is further strengthened by a positive short-term debt coefficient of 2.3% for firms with gender-diverse boards, which a second regression on the dependent variable *short-term debt* reveals (Appendix 6).

This result does not necessarily contradict the above-claimed non-existing lower risk aversion of women. A potential explanation is that women entering the board do not directly reduce long-term debt but rather increase short-term debt as a corporate governance and monitoring instrument (Jensen 1986; Nisiyama and Nakamura 2018). This would imply a decreasing maturity and an increasing overall leverage ratio which adds to the previous findings of this study. Further, the existing literature is also controversial on whether more short-term debt is actually a sign of higher risk aversion or even represents the opposite (Graham, Harvey and Puri 2013; Francis, Hasan and Wu 2013). This ambiguity of the perception of short-term debt is also reflected in the director-level control variables. *Age* has a negative, significant coefficient for both genders, for men at a 1% and for women at a 5% level. This confirms past findings that *executive age* is negatively related to maturity (Frank and Goyal 2006; Serfling 2014). Contrariwise, the *independence ratio* has a positive coefficient at a 1% level, which contradicts previous studies (Tosun and Senbet 2020). The consensus that seems to exist is that more short-term debt allows for more flexibility (Myers 1977; Francis, Hasan and Wu 2013).

In addition, if the hypothesis that greater board gender diversity increases firm performance is considered accurate, firms prefer short-term over long-term debt to signal their confidence to meet future liabilities (Ghosh et al. 2011). This is supported by the *RoA* coefficient being negative and statistically significant at a 1% level. Besides, all other firm-specific control variables have a positive coefficient and are all statistically significant at a 1% level.

The third hypothesis H3 states that the *cost of debt* is negatively related to board gender diversity. Even though the panel regression shows a low negative coefficient of 0.0006 for gender diversity, this variable is not statistically significant at no significance level. Consequently, no significant relationship between board *gender diversity* and *cost of debt* can be deduced for this sample, for which reason hypothesis H3 is rejected. If the previously raised hypothesis that female executives do not differ in their risk avoidance compared to their male counterparts, then by implication, the relation of *gender diversity* and *cost of debt* should not be significant. Thus, in contrast to Beladi's and Quijan's (2013) as well as Chen's and Qui's (2017) findings, banks do not have a particular risk incentive to include in their cost of debt calculation.

Additionally, the analysis shows that rather the firm-specific control variables *tangibility*, *risk* and *liquidity ratio* have a statistically significant impact on the *cost of debt* variable at a 1% level. Therefore, the hypothesis can be formulated that banks and lenders rather evaluate a firm's financial status and performance than the composition of the board. Moreover, this result is consistent with Pandey et al. (2019), who claim that a critical mass of board gender diversity needs to be achieved to impact the *cost of debt*. This critical mass is not achieved by the average diversity ratio of gender-diverse firms of 20%. The *independence ratio* is statistically significant (5% level) in this context, as shown in the two previous regressions. This seems to be a factor that strongly influences the dependent variables and provides room for further analyses.

4.2 Robustness tests of panel data regression

Referring to the summary statistics (see Appendix 2), it can be noted that the average gender diversity ratio of the panel is 16.7% which is below every female quota that is discussed in various countries. These quotas range from 33% to 50%, depending on the country (International Labour Organization 2020). Even though such a quota is not enforced in the US, it is considered to be a valuable add on and robustness check to run the panel data regression with a *gender diversity* threshold dummy variable. The indicator variable is 1 if the gender

diversity is 40% or higher and 0 if lower. Thus, it can be further investigated how the relationship between the dependent variables and *gender diversity* changes if the diversity ratio increases. The results of this robustness test are displayed in Appendix 7.

For *leverage ratio*, the coefficient is 1.5% and statistically significant at a 5% significance level and, thus, the results are robust. As shown in the previous analysis, it indicates the positive relationship between *gender diversity* and *leverage*. However, compared to the gender diversity ratio analysis, the coefficient of the robustness test is approximately 3% lower. This means that once the share of female executives on the board is above 40%, a 1% increase in *gender diversity* results in a 1.5% higher *leverage ratio* on average.

In the case of *maturity*, the robustness test shows that the coefficient of 1.2% is still negative but not significant anymore, wherefore hypothesis H2 is rejected, and the results are not robust. This diminished effect indicates that with increasing gender diversity, the effect on maturity is absorbed by other factors.

For *cost of debt*, the coefficient is -0.1% and statistically significant at 10%. The statistical significance increases with a higher gender diversity ratio compared to previous results. A potential explanation is that banks and lenders start considering the board composition once a certain threshold of gender diversity is achieved. This is consistent with the findings of Pandey et al. (2019), who argue that a critical mass of female board members is needed to influence the capital structure. Thus, hypothesis H3 is supported by the fact that the firm-specific variables *firm size*, *RoA* and *growth* lose their statistical significance.

4.3 CEO transition difference-in-difference analysis

The difference-in-difference analysis of the transition of the gender of the CEOs reveals that between 2007 and 2020, 54 male-to-female respectively female-to-male transitions and 550 male-to-male transitions took place (see Appendix 1). Hypothesis H4 formulated in context with the change in CEO gender states a negative relation between this *transition effect* and the *leverage ratio*. However, the results of the analysis (see Appendix 8) portend a rather positive

relation since the coefficient is positive 0.051 and statistically significant (5% level), wherefore, hypothesis H4 is rejected. This result can be interpreted that the percentage growth of leverage in the years after a change in CEO gender is 5.1% higher than in a firm that changes from a man to another man. This finding is consistent with the previous ones that already indicated that a higher board gender diversity is associated with an increase in leverage and also with the assumption that women are not more risk-averse than men once they reach an executive position. Furthermore, it indicates that women in fact, seem to affect the capital structure and financing decisions, especially since the CEO position is considered one of the main factors influencing these respective decisions (Bertrand and Schoar 2003). Furthermore, the above-formulated hypothesis that women use *leverage* as a channel to enforce corporate governance and monitoring is strengthened with these findings.

5.0 Discussion and implications

The discussion on greater gender diversity on boards of directors remains controversial, as it can be analyzed from different angles, for example, from an organizational and financial perspective or from a societal and equality perspective. Even when focusing on a specific issue, as in this case on capital structure, the results can be ambiguous and contradictory.

In regard to answering the research question, the conducted literature review and the results of this study show that the relation between capital structure variables and board *gender diversity* does exist but is not clear-cut and one-directional. Moreover, it is not sufficient to attribute a statistically relevant relation of these variables only to gender-specific risk associations and the resulting supposed effect on corporate governance. The analysis applied to the underlying data sample results in the rejection of three out of four hypotheses due to a non-existent relation of *cost of debt* and *gender diversity*, and positive relation of *leverage ratio* and gender diversity as well as the change in CEO gender. Only the inverse relation of *maturity* and board *gender diversity* can be confirmed.

These hypotheses are mainly based on the assumption that women are more risk-averse and less overconfident than men and therefore, make different decisions. However, not even the relation between risk aversion and capital structure has been clearly confirmed by research. In addition, there is still a debate if female executives have the same characteristics as the average. For this reason, the results of this work are not to be seen in opposition to existing literature but rather as an extension with new insights that can strengthen the opposing theses. Furthermore, the results cannot be interpreted as an indicator to decrease the share of women on board due to increasing leverage since this is not negative by definition but can be seen as a measure of tax reduction as done by Modigliani and Miller (1963).

Moreover, the study showed that women do affect the capital structure as board members and when they get in charge as CEO. Therefore, this study implies that the current movement of promoting more women into these positions can improve financial decisions and corporate governance since they have different viewpoints and approaches to deal with the same questions and challenges. However, it also showed that the results need to be considered in context with other influential factors such as personal, board and firm characteristics.

6.0 Limitations and further research

Even though the structure and methodology of this study have the objective of providing comprehensive results regarding the influence of board gender diversity on the capital structure, it also has limitations and offers room for further research. The first limitation is that it only refers to the US and a fixed period, making it harder to draw universal conclusions. Moreover, the underlying database does not provide further director-level information (e.g., nationality, education), which could significantly influence the results when also controlling for them. Besides that, the lack of available and consecutive data especially impacts the difference-in-difference analysis because occurred CEO transitions are excluded. In addition, endogeneity issues such as reverse causality, self-selection and omitted variables might occur in this study. Reverse causality may originate from the question of whether the gender determines a firm's

capital structure or whether an executive is hired due to certain personal traits matching the financial strategy (Korkeamäki, Liljeblom and Pasternack 2017). The self-selecting problem may arise if women explicitly decide for a specific industry or low risk-firms (Huang and Kisgen 2013; Faccio, Marchica and Mura 2016). The issue of omitted variables may occur from unobservable factors (Belyakov 2018). A potential omitted variable is that women who achieve board positions are on average better skilled than their male counterparts. Furthermore, given that the author of this study is female, the interpretation of the results may be biased.

This study can be seen as a complement to existing literature, but it does not allow to draw an in-depth conclusion due to its scope and nature. This also provides the opportunity for further research, for example, by considering further personal characteristics or using a more country or size diversified sample. In this context, the investigation of financial firms can also add value. Moreover, a more detailed analysis of the board members' background (e.g., education, ethnics) can lead to different results. Additionally, it can also be of interest not to consider the whole board but to rather focus on specific roles impacting financial decisions. In this study, this is partly covered by the difference-in-difference analysis of CEO transition but still offers room to extend it to a more detailed analysis on more dependent variables.

7.0 Conclusion

This study aimed to investigate if and what effect board gender diversity has on the capital structure. Therefore, a sample of 1,191 firms in the period 2007-2020 was analyzed by a panel regression and difference-in-difference analysis. The result was that board gender diversity and the change in CEO gender are positively related to the leverage ratio. Moreover, based on the results, board gender diversity seems to have a negative relation with debt maturity and no statistical significance relation with cost of debt. Even though these findings led to the rejection of three out of four hypotheses, they also provided evidence that women on the board influence the capital structure. Moreover, the results supported previous studies claiming that female top

managers are not more risk-averse than men and that they use leverage as a channel of corporate governance.

8.0 References

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9.0 Appendices

Appendix 1: Overview male-to-female and female-to-male transitions

The table shows the company, first and last name as well as the year of transition of all female CEOs included in the difference-in-difference analysis. For male-to-female transitions, the name indicates the woman that follows the male CEO. In case of female-to-male transition, the name represents the female CEO that a man follows. If both types of transitions are named, it implies that the respective woman was in charge as CEO between two men.

Company name	First name	Last name	Year of transition	Type of transition
Abercrombie & Fitch	Joanne	Crevoiserat	2016	male-to-female
Advanced Micro Devise	Lisa	Su	2015	male-to-female
Aerojet Rocketdyne Holdings	Eileen	Drake	2015	male-to-female
Alliant Energy Corp	Patricia	Kampling	2012	male-to-female
Anthem Inc	Gail	Boudreaux	2017	male-to-female
Benchmark Electronics Inc.	Gayla	Delly	2012	male-to-female & female-to-male
Cable One Inc	Julia	Laulis	2017	male-to-female
Campbell Soup Co	Denise	Morrison	2011	male-to-female & female-to-male
Chart Industries Inc	Jillian	Evanko	2018	male-to-female
Clearwater Paper Corp	Linda	Massman	2013	male-to-female
CMS Energy Corp	Patricia	Poppe	2016	male-to-female
Commercial Metals	Barbara	Smith	2017	male-to-female
Duke Energy Corp	Lynn	Good	2013	male-to-female
Hershey Co	Michele	Buck	2017	male-to-female
HP Inc	Margaret	Whiteman	2011	male-to-female & female-to-male
International Business Machines Corp	Virginia	Rometty	2012	male-to-female
Kohl's Corp	Michelle	Grass	2018	male-to-female
Lockheed Martin Corp	Marilyn	Hewson	2013	male-to-female
Mattel Inc	Mary	Georgiadis	2017	male-to-female & female-to-male
Occidental Petroleum Corp	Vicki	Hollub	2016	male-to-female
Oracle Corp	Safra	Catz	2014	male-to-female & female-to-male
PNM Resources Inc	Patricia	Vincent-Collawn	2010	male-to-female
PS Business Parks	Maria	Hawthorne	2016	male-to-female
Red Robin Gourmet Burgers	Denny	Post	2016	male-to-female
Ross Stores Inc	Barbara	Rentles	2014	male-to-female
Ruths Hospitality Group Inc	Cheryl	Henry	2018	male-to-female
Sempra Energy	Debra	Reed-Klages	2011	male-to-female & female-to-male
Signet Jewelers Ltd	Virginia	Drosos	2017	male-to-female
Simpson Manufacturing Inc	Karen	Colonias	2012	male-to-female
Tredegar Corp	Nancy	Taylor	2010	male-to-female & female-to-male
Tupperware Brands Corp	Patricia	Stitzel	2018	male-to-female
United Therapeutics Corp	Martine	Rothblatt	2015	male-to-female & female-to-male
Wex Inc	Melissa	Smith	2014	male-to-female
Archer-Daniels-Midland Corp	Patricia	Woertz	2015	female-to-male
Carpenter	Anne	Stevens	2014	female-to-male
Dine Brands Global Inc	Julia	Stewart	2017	female-to-male
Ingredion Inc	Ilene	Gordon	2018	female-to-male
Jack in the Box Inc	Linda	Lang	2014	female-to-male
Mondelez International Inc	Irene	Rosenfeld	2017	female-to-male
New York Times Corp	Janet	Robinson	2012	female-to-male
Pepsico Inc	Indra	Nooyi	2018	female-to-male
T3X Cos INC	Carol	Meyrowitz	2016	female-to-male
Tegna Inc	Gracia	Mortore	2017	female-to-male
Western Union Co	Christina	Gold	2010	female-to-male
Xerox Holdings Corp	Ursula	Burns	2017	female-to-male
Xylem Inc	Gretchen	McClain	2014	female-to-male

Appendix 2: Summary statistics

The table presents the summary statistics of the entire sample (Panel A), of gender-diverse board companies (Panel B) and male-dominated board companies (Panel C). The summary statistics include the number of observations (N), the mean, the standard deviation as well as the minimum and maximum value of each variable.

	N	Mean	Standard deviation	Minimum	Maximum
Panel A: Total sample					
Dependent variables					
Leverage ratio	10,780	0.55753	0.22583	0.03173	43.502
Maturity	10,780	0.40652	0.24543	0	0.98539
Cost of debt	10,780	0.02177	0.01453	-0.008167	0.26142
Short-term debt*	9,749	0.42435	0.22694	0.01403	1
Explanatory Variable					
Gender Diversity	10,780	0.16684	0.110633	0	0.75
Firm-specific variables					
Firm size	10,780	8.34905	1.54871	3.99730	1.35896
Return on assets	10,780	0.05456	0.08159	-2.28325	1.15170
Growth	9,974	0.01151	0.08738	-0.355511	1.93335
Risk	9,839	0.03347	0.04925	0.0000	1.15667
Tangibility	10,172	0.27249	0.23411	0	0.95250
Liquidity ratio	9,786	0.18247	0.18033	-0.35032	0.88088
Board-specific variables					
Board size	10,780	9.47097	20.6760	3	23
Independent ratio	10,780	0.84094	0.08753	0	1
Duality	10,780	0.44416	0.49689	0	1
Director-specific variables					
Male-age	10,780	63.24488	3.80060	47.3333	81.66667
Female-age	9,029	59.74178	5.93273	31	85
Male-tenure	10,780	9.55929	4.89024	0	33.71429
Female-tenure	9,028	6.77031	4.86604	0	44
Panel B: Gender diverse sample					
Dependent variables					
Leverage ratio	9,033	0.57958	0.22542	0.03173	43.502
Maturity	9,033	0.41766	0.23199	0	0.98539
Cost of debt	9,033	0.02194	0.01376	-0.00817	0.26142
Short-term debt*	8,276	0.40531	0.21419	0.01403	1
Explanatory Variable					
Gender Diversity	9,033	0.19912	0.09045	0.04347	0.75
Firm-specific variables					
Firm size	9,033	8.56839	1.51198	4.59219	1.35896
Return on assets	9,033	0.05464	0.08040	-2.28324	1.15170
Growth	8,362	0.01541	0.08313	-0.32011	1.93335
Risk	8,383	0.03239	0.04674	0.00005	1.15667
Tangibility	8,579	0.28143	0.23641	0	0.95250
Liquidity ratio	8,268	0.16459	0.17158	-0.35032	0.83018
Board-specific variables					
Board size	9,033	9.78922	1.97988	4	23
Independent ratio	9,033	0.84866	0.08284	0	1
Duality	9,033	0.44448	0.49694	0	1
Director-specific variables					
Male-age	9,033	63.2251	3.65476	47.33333	81.66666
Female-age	9,029	59.7418	5.93273	31	85
Male-tenure	9,033	9.41435	4.99364	0	33.71429
Female-tenure	9,028	6.77031	4.86604	0	44
Panel C: Male-dominated sample					
Dependent variables					
Leverage ratio	1,747	0.44355	0.19100	0.03780	1.29584
Maturity	1,747	0.34895	0.29921	0	0.97255
Cost of debt	1,747	0.02088	0.01795	-0.00193	0.09889
Short-term debt*	1,518	0.52812	0.26360	0.02905	1
Explanatory Variable					
Gender Diversity	1,747	0	0	0	0
Firm-specific variables					
Firm size	1,747	7.21491	1.20230	3.99730	1.19355
Return on assets	1,747	0.05411	0.08753	-1.10444	0.45685
Growth	1,612	-0.00869	0.10445	-0.35551	1.49411
Risk	1,456	0.03969	0.06139	0.00013	0.83507
Tangibility	1,593	0.22432	0.21507	0	0.92876
Liquidity ratio	1,518	0.27981	0.19518	-0.27246	0.88088
Board-specific variables					
Board size	1,747	7.82542	1.69727	3	16
Independent ratio	1,747	0.80099	0.09948	0.0625	1
Duality	1,747	0.44247	0.49682	0	1
Director-specific variables					
Male-age	1,747	63.34715	4.47939	49.5	78.66667
Male-tenure	1,747	10.30873	4.23920	0	27.62500

*Short-term debt variable additionally introduced and calculated to compare with maturity

Appendix 5: Panel data regression results

The table presents the results of the panel data regression using the econometric model presented in section 3.4. The values represent the coefficients of each variable. *,**,*** imply the statistical significance at the 10%, 5% and 1% level, respectively. The values in parentheses beneath are the respective standard errors.

	Leverage ratio	Maturity	Cost of debt
Gender diversity	0.045** (0.023)	-0.043* (0.025)	-0.00063 (0.0012)
Firm size	-0.035*** (0.005)	0.096*** (0.006)	-0.00009 (0.0004)
Return on assets	-0.226*** (0.189)	-0.262*** (0.021)	0.00096 (0.0014)
Growth	0.019 (0.198)	0.058*** (0.022)	-0.00090 (0.0015)
Risk	0.334*** (0.034)	0.099*** (0.037)	0.04111*** (0.0025)
Tangibility	-0.170*** (0.027)	0.185*** (0.029)	-0.00485*** (0.0020)
Liquidity ratio	-0.368*** (0.186)	0.126*** (0.020)	-0.00981*** (0.0014)
Board size	0.002** (0.001)	0.0005 (0.001)	0.00010** (0.0001)
Independent ratio	0.095*** (0.026)	0.073*** (0.028)	0.00476 (0.0019)
Duality	-0.004 (0.004)	-0.003 (0.004)	0.00010* (0.0003)
Male_age	-0.002*** (0.0006)	-0.003*** (0.0007)	-0.00009 (0.0005)
Fem_age	-0.002*** (0.0004)	-0.0009** (0.0005)	0.00002 (0.0003)
Male_tenure	0.0003 (0.0003)	-0.0003 (0.0003)	0.00003 (0.00002)
Fem_tenure	0.002*** (0.0005)	-0.0001 (0.0005)	0.0000 (0.00004)
Constant	1.088*** (0.067)	-0.2815***(0.073)	0.02184*** (0.0049)
Firm-fixed effects	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes
Observations	7,076	7,076	7,076
R ²	0.8482	0.7953	0.7512
Within R ²	0.1201	0.1007	0.0549

Appendix 6: Additionally performed panel regression on short-term debt variable

The table reports the results of the additionally run panel data regression on the *short-term debt* variable using the econometric model presented in section 3.4. The values represent the coefficients of each variable. *, **, *** represents statistical significance at the 10%, 5% and 1% level, respectively. The values in parentheses beneath are the respective standard errors.

	Short-term debt
Gender Diversity	0.023 (0.021)
Firm size	-0.085***(0.005)
Return on assets	0.218***(0.018)
Growth	-0.052***(0.019)
Risk	-0.081***(0.032)
Tangibility	-0.166***(0.025)
Liquidity ratio	-0.154***(0.017)
Board size	-0.0007 (0.001)
Independent ratio	-0.050** (0.024)
Duality	-0.0006 (0.004)
Male_age	0.002***(0.001)
Fem_age	0.00004 (0.0003)
Male_tenure	0.0007***(0.0002)
Fem_tenure	-0.0001 (0.0005)
Constant	1.124***(0.063)
Firm-fixed effects	Yes
Year-fixed effects	Yes
Observations	7.076
R ²	0.8518
Within R ²	0.1029

Appendix 7: Panel data regression robustness test results

The table reports the results of the robustness test of panel data regression. The gender diversity ratio is replaced by the GenDiv_40 indicator variable having the value 1, if the board gender diversity is 40% or larger and 0 otherwise. The values represent the coefficients of each variable. *,**,*** represents statistical significance at the 10%, 5% and 1% level, respectively. The values in parentheses beneath are the respective standard errors.

	Leverage ratio	Maturity	Cost of debt
GenDiv_40	0.015* (0.008)	-0.012 (0.009)	-0.001* (0.001)
Firm size	-0.035*** (0.005)	0.096*** (0.006)	0.0001 (0.0004)
Return on assets	-0.225*** (0.019)	-0.262*** (0.021)	0.001 (0.001)
Growth	0.019 (0.020)	0.058*** (0.022)	-0.001 (0.001)
Risk	0.335*** (0.034)	0.100*** (0.037)	0.041*** (0.003)
Tangibility	-0.171*** (0.027)	0.186*** (0.029)	-0.005** (0.002)
Liquidity ratio	-0.367*** (0.019)	0.126*** (0.020)	-0.010*** (0.001)
Board size	0.002* (0.001)	0.001 (0.001)	0.0001 (0.0001)
Independent ratio	0.095*** (0.026)	0.072*** (0.028)	0.005** (0.002)
Duality	-0.004 (0.004)	-0.003 (0.004)	0.0001 (0.0003)
Male_age	-0.002*** (0.0006)	-0.003*** (0.001)	-0.0001* (0.00005)
Fem_age	-0.002*** (0.0004)	-0.001** (0.0005)	0.000002 (0.00003)
Male_tenure	0.0003 (0.0003)	-0.0003 (0.0003)	0.00003 (0.00002)
Fem_tenure	0.0017*** (0.0005)	0.0001 (0.001)	0.00001 (0.00004)
Constant	1.0963*** (0.067)	-0.290*** (0.073)	0.0220*** (0.005)
Firm-fixed effects	Yes	Yes	Yes
Year-fixed effects	Yes	Yes	Yes
Observations	7,076	7,076	7,076
R ²	0.8482	0.7953	0.7514
Within R ²	0.1201	0.1005	0.0554

Appendix 8: Difference-in-difference analysis results

The table reports the results of the difference-in-difference analysis on the variable leverage ratio. The values represent the coefficients of each variable. *,**,*** represents statistical significance at the 10%, 5% and 1% level, respectively and the value in parentheses beneath are the respective standard errors.

Note: *Women_CEO* is absorbed by firm-fixed effects and *Post(before)* is absorbed by year-fixed effects. Therefore, both variables are reported as "omitted".

	Leverage ratio
Transition	0.051** (0.002)
Women_CEO	Omitted
Post (before)	Omitted
Firm size	-0.078*** (0.014)
Return on assets	0.005 (0.051)
Growth	0.016 (0.052)
Risk	0.282*** (0.098)
Tangibility	-0.412*** (0.060)
Liquidity ratio	-0.328*** (0.046)
Board size	0.002 (0.003)
Independent ratio	0.257*** (0.062)
Duality	-0.032*** (0.010)
Age	0.002 (0.001)
Tenure	-0.0001 (0.001)
Constant	1.123*** (0.140)
Firm-fixed effects	Yes
Year-fixed effects	Yes
Observations	4,095
R ²	0.8257
Within R ²	0.0894