Combined Master Thesis

Board composition and capital structure choice

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ABSTRACT

The present study addresses how and the extent to which the composition of the board impacts the capital structure choices made by a firm. In particular, the fraction of independent directors, the degree of gender- and nationality diversity, board size, and CEO duality have been analysed. By using a unique panel dataset, this study shows that firms that have a stronger presence of female directors on the board issue more equity as compared to debt. In particular, the results show that when the presence of female directors in the board is at least 30%, firms (1) hold less internal capital as compared to short-term debt and (2) hold more external equity as compared to long-term debt. The results also provide evidence that firms with a larger fraction of independent directors on the board, a larger board size, or CEO who also holds the position of the chairman, use more risky financing sources in their capital structure. On the contrary, firms that have a more nationality diverse board tend to be less levered, and in particular use less long-term debt. Overall, this study echoes the findings in previous studies that certain board attributes should not be ignored in capital structure models.

Keywords: *Board of directors, board composition, gender diversity, capital structure*

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1. Introduction

In recent years, firms have come under increasing pressure to reform the composition of the board of directors. In particular, the call to firms to promote gender equality within the board is one of the most prominent areas of attention. California is on the forefront of regulating gender equality in the United States, as it is the first state that mandates a gender quota for female directors on corporate boards[2]. In 2018, the Governor of California passed a law that requires any publicly held firm headquartered in California to hold a representative number of female directors on its board by the end of 2019. In Europe, the push for gender diversity already set foot in 2008, when Norway mandated public limited firms that at least 40% of both genders must be represented on their boards (Storvik & Teigen, 2010). Following this example, Iceland enacted a corporate gender quota in 2013, and at this moment the United Kingdom and the Netherlands are contemplating the same (Dobson & Rastad, 2018). Despite that there are certain ethical arguments for the increased regulatory focus on the composition of the board, most arguments are of an economic nature (Campbell, 2008).

First, it must be elucidated that the board of directors has, *inter alia*, the responsibility to oversee the activities and the performance of the firm and has the jurisdiction to sanction or replace executive directors (carter *et al*., 2010). Therefore, it is argued that when the board is composed in such a that it effectively fulfils its duties, corporate governance and consequently firm performance could be improved (Adams & Ferreira, 2009). Over the past decade the inherent role of the board of directors has received considerable interest, resulting in a recent trend of research into the impact of different board composition attributes. For example, there have been studies that test the association between the fraction of female board directors and firm performance (e.g. Adams & Ferreira; Gordini and Rancati, 2017); studies that establish whether board independence reduces earnings management (e.g. Hutchinson *et al*., 2015; Sultana, 2015); and studies that consider the economic consequences of CEO duality[3] (e.g. Adams *et al*., 2005; Tang, 2017).

This study contributes to this growing body of literature by testing whether the composition of the board of directors influences the capital structure of firms. Given that the decision-making

[2] The legislation, formally referred to as the senate Bill No. 826, concerns publicly held corporations headquartered in the state California.

[3] CEO duality occurs when the CEO is the same person as the chair of the board.

on capital structure is influenced by the management team and the board has the responsibility to align the actions of the managers with the interests of the shareholders (Myers, 2001), I expect to find a relationship between the board of directors' composition and the capital structure of firms. The contribution of this study is threefold. First, this study relies on a very recent dataset with board-specific information collected over the period of 2010 to 2017, while the majority of the research builds on a sample from before 2010 (e.g. Adams & Ferreira, 2009; Alves *et al*., 2015). Since the regulatory attention on the unequal distribution of board members has increased considerably in recent years, the present study offers a better insight into the current situation. Second, this study brings the research on board composition to the next level by incorporating several board-specific attributes that are, as per my knowledge, not been examined before in the current context. For example, apart from the inclusion of a wide range of gender-related measures that account for the impact of gender diversity, the present study controls for nationality diversity, a factor that is often ignored due to data limitations. Finally, being one of the first to congregate the pecking order theory with the study on board composition, this study paves the way for further extensive research.

To examine the association between the board of directors' composition and capital structure, this study will build on the assumptions of the pecking order theory (Myers & Majluf, 1984). In short, this theory argues that information asymmetries between managers and outside investors inflate the costs of external financing and restrict firms the access to capital markets. Since managers know more about the future prospects of the firm, outside investors will be cautious when a firm issues external capital and will demand higher returns as the degree of information asymmetry increases. Given this, the theory predicts that because information asymmetries between managers and outside investors are more severe for riskier securities, firms prefer to finance with internal capital[4], and if external financing is needed, primarily with (short-term) debt rather than with external equity in order to avoid issuing securities at high costs.

Nevertheless, according to Alves *et al*. (2015) firms become more inclined to issue external capital, and in particular the riskier securities when information asymmetries are being moderated. In the vein of Amaro de Matos & Mergulhão (2018), the present study conjectures that when the board of directors is composed in such a way that it effectively reduces

[4] Information asymmetries are only relevant for external financing (Myers, 2001).

information asymmetries between the management and outside investors, one could see a shift in the use of financing sources. By using a unique panel dataset that captures a wide range of board-specific characteristics for 504 firms over a period of 10 years, this study addresses how and the extent to which the composition of the board affects the capital structure choices made by a firm. The focus of this study will be on, but not limited to, the role of gender diversity in the board. In particular, the fraction of independent directors, the degree of gender- and nationality diversity, board size, and CEO duality will be analysed.

After controlling for a wide-range of control variables, I find that firms that have a stronger presence of female on the board tend to issue more equity as compared to debt. In particular, the results show that when the presence of female directors gets more substantial[5], firms tend to (1) use less internal capital as compared to short-term debt and (2) hold more external equity as compared to long-term debt. However, this study also reveals that when boards are getting more heterogeneous, firm tend to rely more on safer financing sources such as internal capital. Overall, the results contribute well to the fierce debate about how and whether the composition of corporate boards needs be reformed. At the very least, the empirical results question the recent trend in one-size-fits-all rule-based reform proposals such as strict gender quotas.

This study is organized as follows. Section 2 elucidates the theoretical foundation and existing literature on capital structure and discusses the influence of board composition as found in previous studies. In addition, I will state the research hypotheses that will serve as a guidance throughout this paper. Section 3 deals with the methodology and research design and Section 4 presents the empirical results. In Section 5 several robustness checks are performed and in Section 6 the results and implications are discussed in depth. The main conclusions are summarized in Section 7.

2. Literature Review

The literature on capital structure theory is generally separated in two main streams of thought: (i) the trade-off theory and (ii) pecking-order theory. The theoretical framework of both theories can be used to predict the associations between firm characteristics and the financing choices

[5] In accordance to Joecks *et al*. (2012), this study classifies the presence of women as substantial if at least 30% of board members are female.

made by the firm (Amaro de Matos, 2001). Complementary to both the trade off- and the pecking order-theory is the agency theory. The latter is often used to explain the deviations from the main predictions and provides rationale for the influence of the board composition on financial decision-making (Van der Walt & Ingley, 2003). This section attempts to shed light on the main capital structure theories and reviews the empirical evidence as found in previous studies. In addition, this section elaborates on the association between capital structure and board composition from a theoretical and empirical perspective. Accordingly, the research hypotheses will be stated.

2.1 The irrelevance theorem

Modern thinking on capital structure theory has been originated from the seminal paper of Modigliani & Miller (1958). The authors created a framework through which they explained how the capital structure of a firm is related to the value of a firm. This framework is often cited as the irrelevance theorem and will therefore be named accordingly. The irrelevance theorem states that in a world of perfect capital markets (i.e. in the absence of arbitrage opportunities, taxes, trading costs and bankruptcy costs), the capital structure is irrelevant to the value of a firm. Modigliani & Miller (1958) rationalized this proposition by illustrating that the value of a firm should be equal to the present value of the total expected future cash flows that are generated by the assets of the firm. As such, choosing a certain amount of debt and equity to finance these assets will divide the future cash flows among debt and equity investors but will not alter the total cash flows that are generated by the assets itself (Frank & Goyal, 2009). Since the value of a firm depends solely on the expected future cash flows, the financing mix is irrelevant to the value of the firm. Although theoretically intuitive, the underlying assumptions of the irrelevance theorem do not hold in the real world. Nevertheless, the fundamental ideas were revolutionary and served as a basis for extensive future research on capital structure.

2.3 Trade-off theory

The trade-off theory posits that when market imperfections such as corporate taxes are included in the model, there exists an optimal level of leverage that maximizes the difference between the benefits and costs of debt financing. The benefits of debt are typically linked to the capitalization of tax shields that result from the interest payments to debt holders. In short, since interest is tax deductible, the total cash flows available to debt and equity holders will increase when debt is used in favour of equity. As a result, the total firm value increases when the

fraction of debt in the capital structure increases. However, this does not imply that the optimal capital structure consists out of 100% debt financing. Strictly speaking, the use of leverage comes at a cost. In general, the costs related to debt are commonly referred to as financial distress costs and include the costs of bankruptcy (e.g. Kraus & Litzenberger, 1973; Fama & French, 2002), transaction costs (e.g. Frank & Goyal, 2009) and agency costs (e.g. Jensen & Meckling, 1976). Therefore, when an increasing amount of debt is used in the capital structure, not only the present value of the tax shields will increase but also the present value of the financial distress costs. As such, the optimal level of leverage is reached when the marginal increase in the costs of debt will equal the marginal increase in the benefits of debt.

Notwithstanding the fact that distress costs play a major role in the trade-off between debt and equity funding, also agency costs that arise from the conflicts in interest between debt- and equity holders need to be considered in the trade-off model. Under the assumption that both the capital providers and the managers of a firm are utility maximisers, there is good reason to believe that managers will use their discretionary power on the firm's investment process for personal benefits. Regarding the investment decisions of a firm, it must be mentioned that whilst bondholders are entitled to a predefined claim of the future cash flows of a firm, equity holders are left with the residuals. As stated by Merton (1973), equity can be seen as a call option with an appreciation in value as the upward potential of the underlying asset increases. The shift to more risky investments can cause the expected payoff to equity holders to increase at the cost of the debt holders. However, rational debt holders can limit the divergence in interests by establishing protection mechanisms in the form of debt contracts (e.g. debt covenants) and by taking monitoring measures to control the actions of the management (Jensen & Meckling, 1976). Moreover, debt holders will require a higher rate of return on debt capital to compensate for the potential excessive risk taking by the management. As such, the notion that the costs associated with agency problems typically increase with the amount of debt in the capital structure could explain why the actual levels of leverage that are observed in a firm's capital structure tend to be lower than optimal (Morrelec, 2004).

A plethora of evidence for the trade-off theory is found in existing literature but competing voices criticize the importance of the input variables. With respect to the role of taxation benefits, Fama & French (1998) and Graham (2000) recognize the importance of the tax shields but find no evidence that this tax effect is of great importance for a firm's capital structure. Notably, several studies turned away completely from incorporating taxation as a capital

structure determinant (Jensen & Meckling, 1976; Myers, 1984). With contrasting results, Miller (1977) discussed the relevance of taxation benefits versus the costs associated with bankruptcy. The author claims that the costs of bankruptcy are disproportionately small relative to the tax savings that stem from the use debt. The argument to lower the debt appetite significantly based on expected bankruptcy costs is therefore to be rejected in his view. Morellec *et al.* (2012) developed a model which examined the importance of agency conflicts in the capital structure choice of a firm. According to the study, board independence and insider ownership are effective mechanisms to reduce the conflicts of interests between shareholders and the board of directors and therefore reduce agency costs. Contrarily, CEO power and CEO tenor are positively related to agency costs. Based on their model, there appears to be a strong relation between the capital structure choice of a firm and the presence of agency problems. Notably, firms which are highly sensitive to agency problems tend to issue less debt and restructure less frequently than firms which are less sensitive to agency problems.

2.2 Pecking order theory

The pecking order theory popularized by Myers & Majluf (1984), postulates that there is a preferred order in which funding sources should be used. The theory is based on the notion that there exists a certain degree of information asymmetry between outside investors and firm insiders which inflates the costs of external financing. As such, the pecking order theory presents a model that helps to minimize the financing costs that result from asymmetric information problems. Within the model, there are three sources of funding available: retained earnings, equity, and debt. First, retained earnings are not associated with asymmetric information problems since it is internal capital. As a result, this will be the first source of capital to be used when funding is needed. When a firm needs to enter the capital markets for external financing, either debt or equity can be issued. Debt securities are strictly less risky than equity since it comes with a prioritized claim on the cash flows of the firm and/ or carry collateral (Shleifer & Vishny, 1997). Equity holders are only entitled to the residual claim and are therefore subject to serious adverse selection problems. Therefore, the issuance of debt should be preferred over equity.

The idea behind the pecking order theory is that the management of a firm has more information about the expected cash flows of a company than outside investors and is therefore better able to give an appropriate valuation of the firm (Myers & Majluf, 1984). If the management decides

to sell equity to raise funding instead of debt, rational investors will question why this source of funding is used. According to the adverse selection theory, managers will only issue equity if they believe that the current market value of the firm is overvalued (Myers & Majluf, 1984). On the contrary, if the management believes that the firm is undervalued, it will refuse to give up on the expected future cash flows against a discount and will turn to the debt market to raise funding. Under the consideration that investors are rational and aware of this problem, a higher adverse selection premium is demanded for equity than for debt. The relative increase in financing costs when equity is used instead of debt forms the second financing order consideration. Accordingly, if internal capital is not available, funding must be raised from debt capital. Here we must make a distinction in the seniority of payments between senior debt and junior debt and will prefer senior debt over junior debt since the former is less sensitive to asymmetric information. Moreover, we must make a distinction with regard to the tenor of the debt security. Since the level of information asymmetry is limited for short-term debt relatively to long-term debt, shorter tenors should be preferred. The least preferred source of funding that should be considered is the issuance of equity and should only be used if the firm has reached its debt capacity limit (Fama & French, 2005).

It has become clear that information asymmetry problems and agency costs are key determinants in explaining capital structure choices made by firms. Although there is supporting evidence for several predictions of the pecking order theory (Frank & Goyal, 2003), it does not capture all the variation in the capital structure choices made by firms (e.g. Fama & French, 2002; Lemmon & Zenders, 2010).

2.3 Market timing theory

Notwithstanding the fact that the aforementioned theories are the main streams of thought in the realm of capital structuring, the market-timing theory is getting clear attention in recent literature. Baker & Wurgler (2002) argue that the capital structure of a firm is the result of managers attempt to align the firm's funding needs with the conditions on the equity market. In this practise, the firm tends to issue equity when the market capitalization of the firm is considered to be overvalued and will repurchase equity from the market when the shares are considered to be undervalued (Baker & Wurgler, 2002). Clearly, in a world of perfect capital markets as described in Modigliani & Miller (1958) this line of thought is invalid since current market values should reflect the correct price at any time. However, Taggart (1977), Baker &

Wurgler (2002), and Alti (2006) find that the finance decisions of firms are often dependent on the book-to-market ratio of the firm's equity. As such, if this book-to-market ratio is relatively high, firms tend to issue more equity as compared to debt. Furthermore, Graham & Harvey (2001) show that the majority of CFO's admit that market timing plays a significant role in financial decision making.

Evidently, there is no concession or universally accepted theory that explains the capital structure choices made by firms. Study that shows which characteristics drive capital structure decisions is extensive but lacks consistency and is incomplete. A new line of research attempts to fill this gap by linking capital structure theory to corporate governance. Overall, literature evinces that corporate governance features should be present in capital structure models (Alves *et al*., 2015). I will discuss this stream of literature in detail in the following paragraph.

2.4 The board of directors

The initial study on capital structure determinants is mainly focussed on financial and economic factors. However, it has become clear that softer variables such as culture, gender, and corporate governance play an important role in explaining financial decision-making (e.g. Hersch & Farrell, 2005; Adams & Ferreira, 2009; Aggarwal & Goodell, 2014). In particular, the agency theory provides good rationale for the association between the composition of the board and the capital structure choices made by firms. Following the agency theory, it is evident that the separation of ownership and control within firms could lead to strong conflicts of interests between shareholders and managers, conceptualized by the term agency problems. An important mechanism to reduce these agency problems and to align the interests of the managers with the interests of the shareholders is the board of directors. Fama & Jensen (1983) describe the role of the board of directors as a decision control system that serves on behalf of the shareholders and helps to ensure that the managers act in the best interests of the owners. In general, the board has the responsibility to oversee the activities and the performance of the firm but has also the jurisdiction to sanction or replace executive directors. The composition of the board is traditionally divided between the CEO, the chairman, executive directors, and non-executive (independent) directors. However, in the context of corporate governance, board composition is defined in a wider sense and refers to the combination of individual characteristics, attributes and roles of the board members (Van der Walt & Ingley, 2003). The extensive amount of literature that is devoted to the composition of the board usually relies

upon the premise that monitoring by the board can improve the quality of managers' decisions and subsequently, improve corporate performance (Yermack, 1996). However, evidently not all boards are composed in the same way and not all boards are equally effective in monitoring the management and in protecting the interests of the shareholders. Since the concept of agency problems has been a perennial subject in capital structure theory, it can be argued that the effectiveness of the board has a direct influence on the capital structure choices made by a firm. In particular, through the lens of the pecking order-theory and in conjunction with the agency theory, predictions can be made about the associations between the composition of the board and capital structure.

2.4.1 Review of empirical findings

A main issue regarding the effectiveness of the board of directors is the level of board independence (Van der Walt & Ingley, 2003). Theory articulates that independent directors are better able to monitor the management team and hold the potential to improve the corporate performance by giving more objective advice and counsel (Brennan & McDermott, 2004). In particular, independent directors have no executive responsibilities in the firm and can therefore better act in the interests of the shareholders. Alves *et al.* (2015) examined the association between the percentage of independent board members and firm's capital structure. The results provide evidence that board independence is positively related to the use of external financing sources and especially to the use of long-term debt, supporting the conviction that independent directors have a positive effect on reducing agency costs. In addition, Fosberg (2004) finds that when the CEO of a firm is not the same person as the chairman of the firm, agency costs are limited, and higher levels of leverage are used. This result is in line with Fama & Jensen (1983) and supports the notion that the separation of management and control improves the functioning of the board.

Regarding the relation between board size and board effectiveness, the results in previous literature are dispersed. The optimal size of a board can be seen as a trade-off process: it needs to be large enough to provide the firm with the right resources and information, but still must be small enough to promote cohesion and efficiency. Conyon & Peck (1998) find that a large board size may hinder the effectiveness of the management, which results in a decrease in financial performance. As such, the enlargement of boards is argued to increase problems related to information asymmetries and corporate decision-making. In line with this result, Yermack (1996) argues that smaller board of directors have better monitoring and decision-

making qualities and documents that board size and firm performance are inversely related. The intuition is that the costs arising from slow decision-making, poor communication and potential director free-riding outweigh the potential benefits from a greater monitoring capacity as the board size increases (Lipton & Lorsch, 1992). Contradicting however is the study from Coles *et al*. (2008) on the relation between firm value and board structure. The results show that firm performance is positively related to board size, typically driven by the number of independent directors. The notion is that complex firms have greater advisory requirements and are more susceptible to environmental uncertainties, so that independent directors add significant value to the effectiveness of the board.

Besides the aforementioned factors, a multitude of studies have evaluated whether individual characteristics such as gender have an impact on board effectiveness and subsequently on corporate decision-making. Closely related to the present study, Alves *et al*. (2015) examined the relation between the extent of female directors in the board and the firm's capital structure. The authors report that firms with a higher fraction of female directors on the board tend to use more external equity as compared to debt financing. Moreover, firms with more gender diverse boards appear to rely more on long-term financing sources than their gender homogeneous counterparts. However, Faccio *et al*. (2016) document that firms that have a female CEO or have female owners use less risky financing instruments and tend to rely more on internal capital and short-term debt. Adams & Ferreira (2009) provide evidence that gender diversity in the board positively relates to board effectiveness, especially for firms with weak governance structures. The authors report that female directors have a better attendance record in board meetings than men and show that increasing the extent of female directors' results in less attendance problems. As a result, boards are expected to monitor the executive team better when the extent of female directors increases. Gordini & Rancati (2017) examined the relation between firm performance and board gender diversity for Italian listed companies. Results show that the percentage of women on the board has a positive impact on firm performance whilst the presence of one woman on the board on itself does not have a significant effect. This result is closely related to the critical mass theory which claims that a representation of at least 30% of female board members will be associated with better firm performance than for male dominated boards (Joecks *et al*., 2012). This result is confirmed by the study Torchia *et al*. (2011) who argue that the presence of three women in the boardroom will significantly improve firm performance.

Nevertheless, the existing body of literature leaves substantial gaps in understanding the impacts of the composition of the board. Although most of the research builds upon the argument that board effectiveness improves the quality of managers' decisions, several researchers relate the impact of board composition to the signalling theory. For example, Certo et al. (2001) argue that the board operates as a signal mechanism to the market, meaning that when boards consist out of more independent directors, investors may gain greater confidence in the firm's potential. Kaur & Singh (2017) support this argument and provide evidence that board diversity is perceived as a positive quality signal and enhances the reputation of the firm. Petersen & Vredenburg (2009) conducted study on the link between corporate social responsibility (CSR) and corporate financial performance. Although not directly related to the present study, this research provides further insights in how certain variables could act as a signalling mechanism to the market. Of particular interest, the authors argue that CSR-oriented firms appear to signal to the market that they are a secure investment, which could lead to better access to the capital markets and as a result, to better financial performance.

2.5 Hypotheses development

According to the irrelevance theorem of Modigliani & Miller (1958), managers should exploit any investment opportunity if the rate of return is larger is than the cost of capital. Consequently, characteristics of board members should not have an impact on investment and/ or capital structure choices. However, a plethora of empirical evidence has demonstrated the contrary. As previously discussed, it is clear that information asymmetry problems and agency costs are key determinants in explaining capital structure choices made by firms. In particular, the pecking order theory conjectures that information asymmetries between managers and outside investors inflate the costs of external financing and restrict firms the access to capital markets. As such, the theory predicts that since information asymmetry is more severe for riskier securities, firms prefer to finance with internal capital, and if outside financing is needed, primarily with (short-term) debt rather than with external equity. Nevertheless, according to Alves *et al*. (2015) firms become more inclined to issue external capital, and in particular the riskier securities, when information asymmetries are being moderated. As a result, a board of directors composed in such a way that it effectively reduces information asymmetry problems should make it easier and less costly for the firm to issue external equity and (long-term) debt. This research complements on the pecking order theory and examines the extent to which board-specific

factors such as board diversity, board size and leadership structure affect the capital structure choices made by a firm.

First, the relation between board independence and agency costs has received strong attention from researchers (e.g. Brennan & McDermott, 2004; Alves *et al*., 2015). In line with the results that are previously discussed, independent board members hold the potential to decrease the level of information asymmetry between managers and capital providers. Following the pecking order theory, a more independent board is expected to face lower costs of external financing, and thus, firms with higher levels of independent board members should have better and cheaper access to external capital. Throughout this study I will classify the riskiness of (external) securities in accordance to the pecking order theory. As such, a financing source is regarded to be 'safe' when its valuation is independent of the disclosure of managers' inside information (Shyam-Sunder & Myers, 1999). As previously mentioned, this will lead to the classification of four financing sources in which external equity capital is considered to be the riskiest financing source and internal equity to be the safest. Subsequently, long-term debt capital is riskier than short-term debt capital but less risky than external equity. With respect to the aforementioned arguments and clarifications, I predict the following hypothesis:

H1a: *The higher the fraction of independent board members, the higher the fraction of risky securities in the firm's capital structure.*

With respect to board diversity, there are several studies that emphasize on the benefits of gender diversity in the boardroom. Adams & Ferreira (2009) report that gender diverse boards are better in monitoring executive directors and show that women have a better attendance rate in board meetings than men. Moreover, the authors document that diverse boards are more likely to hold the CEO accountable for disappointing stock performance. As such, it could be argued that female directors contribute to lower levels of information asymmetry. Alves *et al.* (2015) document that an increased presence of female directors in the board could improve the effectiveness of the board, reduce information asymmetry between the management and outside investors, and consequently lead firms to have better access to external capital. Moreover, Kaur & Singh (2017) report that board gender diversity could send a positive quality signal to the market and could enhance the corporate reputation. As such, I expect that gender diversity in the board contributes to lower information asymmetry; to better capital market access; and to a greater use of risky financing sources by firms. Hence, I state the following two hypotheses:

H2a: *The higher the level of gender diversity in the board, the higher the fraction of risky securities in the firm's capital structure.*
H2b: *The higher the level of female directors in the board, the higher the fraction of risky securities in the firm's capital structure.*

Most study on nationality diversity on the board is focused on racial differences measured by, *inter alia*, the fraction of racial minorities on the board or by distinguishing between white and non-white board members (e.g. Carter et al., 2010). However, study on nationality diversity instead of racial diversity is limited. Nielsen & Nielsen (2013) show that nationality diversity could reduce external uncertainties, improve firms' transparency and subsequently mitigate information asymmetry issues with the market. Moreover, the authors argue that multinational teams engage more in in-depth discussions, have are more problem-solving approach, and arrive at more creative solutions. Although not equally defined as nationality diversity, Ruigrok et al. (2007) find that foreign board members are more likely to be independent and are more effective in their task to monitor the management. As such, I expect that nationality diversity in the board improves the effectiveness of the board and holds the potential to decrease information asymmetries between the management and outside investors. Hence, I predict the following relation:

H3a: *The higher the level of nationality diversity in the board, the higher the fraction of risky securities in the firm's capital structure.*

Turning to the role of board size, its effect on information asymmetry is unclear. In line with Conyon & Peck (1998) and Yermack (1996), large boards are more likely to experience problems in communication and decision-making, which obfuscates the effectiveness of the board. As a result, the boards' capability to monitor the management and protect the interests of the shareholders may be affected as the board size increases. However, Coles et al. (2008) state that there is a positive relation between the complexity of a firm (i.e. measured by firm size, international exposure, and leverage) and the extent to which the firm benefits from a larger board. In particular interest, the authors argue that since complex firms are facing higher advising requirements, they will benefit from having additional expertise on the board. Hence, since previous studies show dispersed results, and little is known about the complexity of the

firms that are being analysed in the present study, I am not able to predict the relation between board size and the capital structure *a priori*.

H4a: *Board size is positively related to the fraction of risky securities in the firm's capital structure.*
H4b: *Board size is negatively related to the fraction of risky securities in the firm's capital structure.*

CEO duality occurs when the CEO and the chairman of the board are the same person. According to Alves *et al*. (2015), boards with CEO duality are less independent and consequently less effective in controlling the corporate performance. As a result, the costs related to information asymmetries may be higher under the condition of CEO duality, leading firms to rely less on risky financing sources. Moreover, boards that are more independent from the CEO are expected to better fulfil their primary duties such as monitoring and sanctioning the executive directors. Since it is the responsibility of the board to control the CEO, I expect that CEO duality negatively impacts the functioning of the board. In line with the notion that asymmetric information increases the costs of external financing, I state the following hypothesis:

H5a: *CEO duality is negatively related to the fraction of risky securities in the firm's capital structure.*

3. Data and methodology

This study uses a balanced cross-sectional time series dataset based on the constituents of the *S&P 500* index and the *Stoxx Europe 600* index for the period of 2010 to 2017. The *Stoxx Europe 600* is one of the biggest European indices available and provides a good reflection of the European stock market. The *S&P 500* is an American stock market index and is based on the 500 largest companies with a presence in either the *NASDAQ* or the *NYSE*. In order to create a balanced sample set, I excluded all the firms that are not consistently present in either the *S&P 500* or in the *Stoxx Europe 600* during the period of 2010 to 2017. In line with Alves *et al*. (2015), I exclude financial firms from the sample because of their specific capital requirements and regulations.

After filtering the firm sample, I extract the data on board composition from the *BoardEX* database. In order to identify the companies from the sample, I need to convert the ticker codes of the index constituents, as retrieved from *Compustat,* into unique *BoardEX* identification codes. The reason for this is that ticker codes are not unique and can belong to multiple firms, and thus, using them would offer me an incorrect dataset. In converting the tickers into *BoardEX* codes extreme care must be taken. As the ticker code of a firm can belong to multiple firms, *BoardEX* will return a large number of superfluous identification codes. As a result, I will have to verify that the firm that belongs to the identification code is an actual constituent of either the *S&P 500* or *Stoxx Europe 600.* This is done by downloading the Index identification codes along with the country codes and subsequently removing all the firms that do not belong to the initial firm sample. For all the tickers that could not be matched with the *BoardEX* identification codes, correct codes had to be found manually.

After optimizing the sample set, data on board size, gender diversity and nationality diversity could be extracted. To extract the data on board independence and CEO duality, additional steps had to be taken. For example, many board members are noted multiple times in the data output during the same year and give therefore incorrect results when the fraction of independent board members is calculated. To circumvent this problem, I downloaded the individual names of all the board members and excluded the duplicates before computing the respective ratios. Regarding CEO duality, information about the role of each individual board member must be extracted. Subsequently, CEO duality is identified when a combination of 'chair' and 'CEO' is found in the title.

With respect to the financial data, Information about firm fundamentals are downloaded from the *Compustat Global: Fundamentals annual* database (at the fiscal year end). Since *BoardEX* identification codes cannot be used for *Compustat,* I converted the *BoardEX* codes into ISIN codes. Because Compustat did not offer all the required data, I requested additional data from the *Bloomberg* database and from the *Orbis Amadeus* database. After matching all the obtained observations with the respective firm, the database was finalized and balanced by excluding all firms with lacking data points. This selection procedure has resulted in a final sample of 504 unique firms with 8 years of data.

3.1 Dependent variables

To investigate the hypothesis that the composition of the board affects the capital structure of a firm, it is essential to define and segregate the financing sources that are available to a firm. Following the pecking order theory as described by Myers & Majluf (1984), there are three primary sources of capital available: internal equity; external equity; and debt capital. subsequently, debt capital can be segregated into short-term debt and long-term debt as a mean to capture the firm's capital structure choice in more detail. Following the work of Alti (2006) and Rashid (2015), internal equity is computed as the book value of retained earnings and external equity is computed as the book value of total equity minus the book value of retained earnings. As indicated, debt capital is segregated into short-term and long-term debt. Short-term debt is defined as the book value of current liabilities and long-term debt as the book value of total liabilities minus the book value of current liabilities. In calculating the leverage ratios, the capital structure variables are scaled by the book value of total assets.

Existing literature on whether book values or market values of capital should be used in the computation of leverage show dispersed results. Thies & Klock (1992) and Fama & French (2002) argue that book ratios of leverage give a better reflection of the firm's target debt ratio. Since market values of debt are not always readily available and market values of equity are subject to high volatility, it is presumed that using book values may better reflect the intentions of the management. Therefore, I will limit the present study to the use of book values of capital and will control for market values in the Robustness section.

3.2 Independent variables

This study measures the female presence on the board with the use of three variables. First, a board gender diversity variable will be included and will be measured by the Blau index[6], one of the most commonly used measures of categorial diversity. Following Blau (1977), board gender diversity is calculated as follows:

$$1 - \sum_{i=1}^{k} p_i^2 \qquad \textbf{(1)}$$

[6] The Blau index is also known as the Herfindahl's index.

Where p_i is the proportion of category i in the group. Regarding board gender diversity, this implies that the Blau index for a board consisting out of six men and three women is calculated as one minus the sum of two thirds squared plus one third squared. Since gender will be categorised into two groups, namely men and women, the maximum value of the Blau index will be 0.50. For the sake of clarity, I transform the Blau index to a standardized form that ranges between zero and one. The standardized form of the Blau index is derived when the original formula (1) is multiplied by the equation $k/(k-1)$, where k is the number of categories.

The second gender related measure is the percentage of female directors in the board. This variable is strongly correlated with the Blau index for gender diversity and will therefore not be tested simultaneously in order to prevent multicollinearity problems. Thirdly, I include a dichotomous variable that takes the value of 1 if the percentage of females in the board is at least 30% and takes the value of 0 otherwise. This follows the work of Joecks *et al*. (2012) who argue that board effectiveness is significantly higher when the presence of female directors on the board is at least 30%. In addition, the respective dichotomous variable will be referred to as the critical mass variable throughout this study.

Besides a variable for gender diversity, this study uses a second diversity measure which accounts for the nationality diversity in the board. This variable will be referred to as the nationality mix and is calculated in a similar way as the Blau index for gender diversity. The value of the variable will range between 0 and 1, with 0 indicating that all board members have the same nationality and 1 indicating that all board members have a different nationality.

In addition, a dichotomous variable is used to account for CEO duality and takes the value of 1 if the CEO of the board is also the chair of the board and takes the value of 0 otherwise. The variable board size is measured by the unit per person and is not subject to any transformation. Lastly, we include the fraction of independent directors as a variable and is expressed as the ratio between the number of independent directors in the board and the total board size.

3.3 Control variables

In order to increase the explanatory power of the model, I will include a set of control variables based on Rajan & Zingales (1995) and Getzman *et al*. (2014). The respective control variables

have proven to be reliable in explaining capital structure decisions made by firms and will consequently help to test the relative relationship between the independent variables and the dependent variables in this study. The approach in this study limits the nature of the control variables to firm-specific factors and ignores macro related determinants as, *inter alia*, market risk, inflation levels, and interest rates. Although existing literature documents that macroeconomic factors may be of relevance in explaining capital structure choices (Baum *et al*., 2015), most researchers ignore it in their models because of data limitations (e.g. Titman & Wessels, 1988; Getzman *et al.*, 2014). I will outline each control variable that is considered in this study and will discuss the motivations and definitions subsequently. Although the exact coefficient sign between the control variables and the dependent variable is not of main interest in this paper, I will document the predictions and underlying intuition of the explanatory power of the variables based on the traditional capital structure theories where relevant. Since the testing procedure requires a normal distribution of the error terms, all control variables are being logarithmized.

(i) Asset tangibility: Prior research documents that the type of assets owned by a firm significantly influences the capital structure choice of a firm (Jensen & Meckling, 1976; Titman & Wessels, 1988). According to the trade-off theory, the collateralization of assets leads to better investor protection and to lower asymmetric information costs. Since the valuation of tangible assets is less volatile than intangible assets and the value of tangible assets can be better determined in times of financial distress, bankruptcy costs will be lower for firms with a larger proportion of tangible assets on their balance sheet. Within the framework of the trade-off theory, the decrease in agency costs resulting from an increase in asset tangibility should result in higher levels of leverage obtained by the firm. Prior research empirically observed this relationship (e.g. Rajan & Zingales, 1995; Alves & Ferreira, 2011) and as such, this present study incorporates asset tangibility as a control variable. I define asset tangibility as the ratio of fixed assets divided by the book value of total assets.

(ii) Profitability: According to the trade-off theory, profitable firms may opt for higher levels of debt in order to benefit from the resulting tax shields. In addition, profitable firms are less likely to get into bankruptcy and will therefore face lower (expected) costs of financial distress. In the absence of information asymmetry, these arguments lead to the prediction of a positive relationship between profitability and leverage. However, the pecking order theory propagates the contrary. As discussed in previous sections, firms will use retained earnings as the first

source of funding in order to avoid asymmetric information costs. Profitable firms generate higher levels of retained earnings and will therefore be less dependent on external financing sources. Within the information asymmetry framework, profitability is expected to be negatively related to leverage. Empirical evidence in existing literature tends to favour the predictions of the pecking order theory over the trade-off theory (e.g. Rajan & Zingales, 1995; Frank & Goyal, 2009). The variable profitability is therefore included in the model in order to extract additional explanatory power and is defined as the ratio of earnings before taxes and depreciation divided by the book value of total assets.

(iii) Growth opportunity: As an approximation for growth opportunities I use the market-to-book value ratio. Firms that have a high market valuation relative to the book value are presumed to hold a strong growth potential (Alves *et al*., 2015). However, the view about the implications of future growth on the capital structure of a firm differ strongly among researchers. Again, I can make a distinction between the trade-off theory and the pecking order theory. According to the former, growth is expected to increase the likelihood of bankruptcy and is related to higher financial distress costs. In addition, firms need to make investments in order to grow, which has a diminishing effect on net profits. *Ergo*, tax shield benefits will be less pronounced and total leverage should be reduced. The latter argues that since growth firms need to make substantial investments, external capital will be needed. Under the plausible assumption that internal capital will not suffice the capital that is demand, external funding needs to be raised. As explicitly proposed by the pecking order theory, debt should be preferred over equity. Consistent with this view, a positive relationship between growth opportunities and leverage is expected. Regarding the measurement of growth opportunities, several metrics can be used. However, as documented by Frank & Goyal (2009), the market-to-book value is the most reliable measure and will therefore be used in the present study.

(iv) Firm size: Firm size has been a perennial subject in capital structure literature and has been strongly related to financial decision-making (e.g. Titman & Wessels, 1988; Baker & Wurgler, 2002). According to the trade-off theory, large firms tend to face relatively lower costs in case of financial distress and are generally more diversified than smaller firms. As a result, larger firms issue more debt than smaller firms and are generally more levered. With respect to the pecking order theory I expect to find a different result. Larger firms tend to have lower information asymmetry problems since they are subject to strong reporting requirements, are typically for a longer period in the market and better monitored by financial analysts. As a result

of lower information asymmetry costs, firms will have better access to equity capital markets and will therefore issue an increasing amount of equity over debt as firm size increases. Empirically, most studies report results that are in line with the trade-off argument where leverage is positively related to firm size (e.g. Frank & Goyal, 2009; Alves *et al.*, 2015). In this study, firm size is measured by the total assets as reported by the firm. For a complete overview of all variables used in this study, please refer to Table A.I, presented in the Appendix.

3.5. Methodology

In order to capture the relationship between the composition of the board and the capital structure choice of a firm, I will set up a linear regression model that follows the work of Alves *et al.* (2015). I employ a cross-sectional time series model on the following baseline regression:

$$Capital\ structure_{i,t} = \alpha_0 + \beta_1\,(\%\ of\ independent\ directors)_{i,t-1} \quad \textbf{(2)}$$
$$+ \beta_2\,(board\ size)_{i,t-1} + \beta_3\,(critical\ mass\ dummy)_{i,t-1} + \beta_4\,(nationality\ mix)_{i,t-1}$$
$$+ \beta_5\,(CEO\ duality\ dummy)_{i,t-1} + \beta_6\,(Blau\ Index\ gender\ diversity)_{i,t-1}$$
$$+ \sum_J \beta_j\,(control\ variables)_{i,t-1} + \varepsilon$$

Where $Capital\ structure$ takes the form of one of the previously defined dependent variables. The index i denotes an individual firm, α_0 is a constant, t = 1, ..., T identifies the time dimension and where ε denotes a mean zero error, or residual term. An overview of the variables $\beta 1$ to $\beta 6$ as well as the control variables can be found in Table A.I, presented in the Appendix. Lagged variables are used in the equation to mitigate problems of endogeneity. Following Getzman *et al.* (2014) and Amaro de Matos & Mergulhão (2018), it is presumed that the decisions made by board members need time to get executed, resulting in a lagged relation between corporate decision-making and the capital structure. In particular, the use of lagged explanatory variables account for dynamic endogeneity problems which would arise if the current capital structure depends on past changes in the composition of the board (Schultz *et al.*, 2010).

Regarding the testing procedure, I will estimate the baseline panel data model with industry-fixed effects and year-fixed effects to circumvent potential problems of dependency in the residuals. In particular, the use of fixed-effects could eliminate unobserved heterogeneity if the effect of the unobserved characteristics is time-invariant (Petersen, 2009). The motivation to include industry-fixed effects instead of firm-fixed effects is twofold. First, existing empirical studies tend to favour industry-fixed effects over firm-fixed effects (Frank & Goyal, 2009; John

& Litov, 2010). Secondly, the inclusion of firm-fixed effects requires significant variation in the explanatory variable across time. However, given the nature of our independent variables (e.g. CEO gender, board size, CEO duality), it is expected to find only limited variation. Therefore, using firm-fixed effects on variables that are nearly time invariant can lead to imprecise estimates. To test the validity of the use of a fixed-effect model compared to a random-effect model, I test the correlation between the unobservable heterogeneity in the error term and the independent variables by using the Hausman test (1978). The Hausman test tests whether a fixed effects or random effects model is more appropriate. The null hypothesis is formulated as follows:

H0: *The fixed effect is not correlated with other independent variables.*

If H0 is rejected, fixed effects must be incorporated in the model, random effects otherwise. I will test for multicollinearity by estimating the correlation coefficients between all variables and will compute the variance inflation factors in case of uncertainty. Large correlation coefficients between any pair of independent variables suggest that the model includes variables that are correlated to both the dependent variable and to each other and should therefore be excluded (Joshi, 2012). Moreover, the baseline model (2) will rely on robust standard errors clustered at firm-level. This follows the approach of Getzman *et al*. (2014) and Faccio *et al*. (2016) and accounts for possible autocorrelation and/ or heteroskedasticity in the error terms, a common problem in panel data regressions. In particular, the lack of variance over time in the corporate governance related variables may lead to strong autocorrelation problems. Therefore, estimating the model with robust standard errors to correct for dependence in the error terms circumvents the problems of autocorrelation and heteroskedasticity in the error terms (Peterson, 2009).

In the baseline model (2), the presence of female directors is indirectly included by the Blau index for diversity and the dichotomous variable critical mass. However, in order to test for the direct relationship between the percentage of female directors in the board and the capital structure choice of a firm, I will augment the baseline regression as follows:

$$Capital\ structure_{i,t} = \alpha_0 + \beta_1\,(\%\ of\ independent\ directors)_{i,t-1} \quad \textbf{(3)}$$
$$+ \beta_2\,(board\ size)_{i,t-1} + \beta_3\,(\%\ of\ female\ directors)_{i,t-1} + \beta_4\,(nationality\ mix)_{i,t-1}$$
$$+ \beta_5\,(CEO\ duality\ dummy)_{i,t-1} + \sum_J \beta_j\,(control\ variables)_{i,t-1} + \varepsilon$$

As shown, model (3) and model (2) are to the utmost extent similar, except for the fact that the variables Blau diversity index and critical mass are excluded and replaced by the variable percentage of female directors. Adding the latter variable in the model while keeping the former two variables would lead to strong multicollinearity problems. Therefore, this study will repeatedly report the results of model (2) and model (3) separately.

4. Results

This section displays the estimation results for the cross-sectional time series regression and consists out of two parts. First, I will document the descriptive statistics and the correlation coefficients of the regression variables. Second, the results of the panel data analysis will be presented in order to determine the direct relation between the board composition and the capital structure as predicted by the pecking order theory.

4.1 Descriptive statistics

Table I reports the descriptive statistics for the variables that are used in the cross-sectional time series regression. It shows a balanced panel dataset with both financial and board composition data for 504 unique firms gathered over the period from 2010 to 2017. Regarding panel A, all board composition variables have a maximum range between zero and one except for board size. On average, boards have a gender diversity level, as measured by the standardized Blau index[7], of 0.594. To interpret this number correctly, it is important to recognize that when the presence of female directors in the boardroom is 50%, the Blau index returns a score of one. The percentage of female directors in the board is included in Table I and provides additional insight on the average gender diversity in the board. As documented, the mean percentage of women in the board is 20.2 percent. Regarding nationality mix, Table I documents a value of 0.252. Again, this number must be interpreted with care since it is not a percentage value but a diversity measure that returns the value of one when the board is completely diversified. However, due to data limitations I am not able to give further descriptive information about, *inter alia*, the actual number of different nationalities within the boards.

[7] Referred to as the Blau index hereafter.

To capture potential trends in the composition of the boards, I decomposed the descriptive statistics by year. The results are presented in Table A.II in the Appendix and show that certain board characteristics have changed significantly over time. Most notable is the linear increase in female representation over the period from 2010 to 2017. The percentage of female directors has increased from a mean value of 0.142 (14.2%) in 2010 to 0.266 (26.6%) in 2017. Clearly, the Blau Index for gender diversity has followed the same trend. The critical mass dummy, which equals 1 if more than 30% of the board members are female, increased remarkably from 0.083 (8.3%) in 2010 to 0.386 (38.6%) in 2017. The variables board independence, CEO duality, board size, and nationality mix stayed nearly unchanged over the years.

Presented in the Appendix, Table A.III shows the differences in the board composition between the American firms (reflected by the S&P 500) and the European firms (reflected by the Stoxx Euro 600). First, it becomes clear that CEO duality is more present within American firms than within European firms, with levels of 0.434 (43.4%) and 0.276 (27.6%) respectively. One explanation is that American corporate boards are characterized by having a one-tier structure while two-tier board structures are more common in Europe (Solomon, 2013). Since two-tier boards have a strict separation between the chairman and the CEO, it is cogent to find lower levels of CEO duality for European firms than for American firms. Second, the degree of nationality diversity is smaller for American firms (14.1%) than for European (37.1%) firms. However, this result is a logical consequence of the geographic dissimilarities between America and Europe.

Table I: Descriptive statistics

This table presents the descriptive statistics for the board and firm-financial characteristics of 504 unique firms. All firms are listed and consistently present in either the S&P 500 or in the Stoxx Europe 600 during the period of 2010 to 2017. The variables critical mass and CEO duality are dichotomous. For an extensive description of the variables used in this study, please refer to Table A.I in the Appendix.

Variables	Num. of Obs. Per year	Avg. Mean	Avg. Std. Dev.
Panel A: Board composition			
Nationality mix	504	0.252	0.247
Board size	504	11.8	3.9
Critical mass (dummy)	504	0.207	0.405
Blau diversity index	504	0.594	0.259
% of female directors	504	0.202	0.112
% of independent directors	504	0.734	0.160
CEO duality (dummy)	504	0.358	0.479
Panel B: Control variables			
Tangibility	504	0.264	0.223
Firm size (log)	504	4.199	0.550
Market-to-book ratio	504	1.382	1.285
Profitability	504	0.138	0.076
Panel C: Leverage			
Book values			
Retained earnings	504	0.273	0.495
External equity	504	0.105	0.470
Long-term liabilities	504	0.349	0.175
Short-term liabilities	504	0.259	0.141
Total liabilities	504	0.790	0.232
Market values			
Retained earnings	504	0.259	0.366
External equity	504	0.182	0.386
Long-term liabilities	504	0.544	0.756
Short-term liabilities	504	0.397	0.766
Total liabilities	504	0.938	1.379

Although the percentage of female board members and the size of the board do not show any significant differences between the two subsamples, the critical mass dummy indicates that the presence of female board members is way more diluted among firms listed in the S&P 500 than in the Stoxx Euro 600, with mean values of 0.124 (12.4%) and 0.297 (29.7%) respectively. As prior literature stresses the importance of having a substantial number of female directors in the board for decision effectiveness and transparency (e.g. Joecks et al., 2012), the observed relation between the presence of female board members and capital structure may differ between the subsamples.

Table II provides the correlation coefficients between all variables. As reported in Table II, many explanatory variables are significantly correlated with each other at the 1% significance level. However, the magnitudes of these correlations are predominantly small, except for the variables that are related to gender such as critical mass, percentage of female directors and the Blau diversity index. To test for potential multicollinearity in the model, the variance inflation factors (VIFs) are computed and reported in Table A.IV in the Appendix. As shown, the VIFs are below the commonly used cut-off value of 2 and do not indicate the presence of multicollinearity (Getzman *et al.*, 2014).

4.2 Research results

The tables in this section will persistently display the results of the baseline model **(2)** and the augmented baseline model **(3)**, regressed on various dependent variables. Hausman tests are performed on all regressions in order to test whether fixed- or random-effects are more appropriate in the model. To interpret the results of the estimation coefficients of the board composition variables, it must be recognized that we are dealing with a log-level regression model and that all dependent variables are scaled to the book value of total assets. Special care has to be taken for the dichotomous variables since the interpretation to the dependent variable is asymmetric and depends on whether the dummy equals to the value of one or zero. In this study I will only refer to the situation in which the dummy turns from zero to one and not *vice versa*. Finally, as previously mentioned, the explanatory variables in the model are lagged by one year and the observed effects must therefore be interpreted accordingly. This structure and procedure hold throughout this paper.

Table II: Correlation Matrix

This table presents the (Pearson) correlation matrix of the data sample which consists out of 504 unique firms with observations over the period from 2010 to 2017. The numerical indicators (1) to (12) are defined as: (1) nationality mix, (2) board size, (3) critical mass, (4) Blau index, (5) % of independent directors, (6) CEO duality, (7) leverage, (8) tangibility, (9) firm size, (10) market-to-book ratio, (11) profitability, (12) % of female directors. The variable leverage (7) is defined as the ratio of total liabilities and book value of capital. Subscript * corresponds to statistical significance at the 0.01 significance level.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
(1)	1											
(2)	0.0601*	1										
(3)	0.0958*	-0.0225	1									
(4)	0.0574*	0.0331	0.7027*	1								
(5)	-0.0458*	-0.1386*	0.0409*	0.0212	1							
(6)	-0.1404*	0.1762*	0.0076	0.0161	-0.0477*	1						
(7)	0.3544*	0.0171	0.2005*	0.1523*	-0.0239	-0.1268*	1					
(8)	-0.1076*	0.0693*	-0.0274	-0.0108	0.0256	0.1055*	-0.0018	1				
(9)	0.0338	0.3798*	0.1115*	0.1989*	-0.0479*	0.0846*	-0.1461*	0.1766*	1			
(10)	-0.0696*	-0.3258*	-0.0410*	0.0220	-0.0241	-0.0583*	-0.1800*	-0.2543*	-0.3885*	1		
(11)	-0.1316*	-0.2280*	-0.0620*	-0.0439*	-0.0464*	-0.0137	-0.1518*	0.0354	-0.2763*	0.6698*	1	
(12)	0.0561*	0.0346	0.7025*	0.9996*	0.0214	0.0183	-0.0107	0.2002*	0.0233	0.1488*	-0.0433*	1

4.2.1 Results for leverage

In this subsection, I examine the relation between board composition and leverage. The results are reported in Table III. In column (1), it is documented that nationality diversity and gender diversity (Blau index) are both negatively related to leverage. To be specific, a 10% increase in nationality diversity (gender diversity) will lead to a 0.57% (0.32%) decrease in total leverage. With respect to the extent of female directors in the board, the results in column (2) show that a 10% increase in the percentage of female directors is associated with a 1.37% decrease in total leverage and is statistically significant at the 0.01 significance level.

With respect to the variables board size, board independence and CEO duality, I find a positive relationship to leverage. Most economically relevant is the coefficient of the percentage of independent directors, which indicates that a 10% increase in independent directors is associated with a 0.83% increase in total leverage, which is consistent with the results of Alves *et al*. (2015). However, in order to give a robust interpretation of the estimation results regarding the board composition variables, one must recognize that the dependent variables in Table III do not allow us to make a distinction between the different financing sources that are used in the capital structure and only distinguishes total equity from total liabilities. *Ergo*, based on Table III I am not able to relate the results to information asymmetry arguments and can therefore not state whether the explanatory variables have an impact on the level of information asymmetry within the firm. Following the pecking order theory, an increase in the use of external equity is an indication that information asymmetries have been diminished, while an increase in the use of retained earnings indicates the contrary. Since the total leverage ratio does not distinguish internal equity from external equity and long-term debt from short-term debt, more extensive insights will be provided in later results.

Turning to the control variables, the coefficient estimates show strong statistical significance for the variables tangibility and market expectations. First, the results for tangibility are consistent with prior research and support the notion that asset tangibility leads to better investor protection and should therefore result in higher observed levels of leverage obtained by the firm. Regarding market expectations, I find a negative relation to leverage. This result supports the predictions of the trade-off theory but is inconsistent with the pecking order theory. Baker & Wurgler (2002) offer an alternative explanation for this result based on the market-timing theory. The authors argue that firms tend to issue equity when the market capitalization

Table III: Panel data regression results of leverage (book values)

This table presents the industry-and year-fixed effects panel data regression results, using the sample set consisting out of 504 unique firms during the period of 2010 to 2017. Regression (1) shows the baseline regression results with total leverage, defined as the book value of total liabilities divided by total assets, as dependent variable. Model (2) shows the regression results of the augmented baseline regression where the variables Blau diversity index and critical mass are replaced for the variable percentage of female directors. The independent variables have a one period lag on the dependent variable and all financial variables are logarithmized in order to account for skewness in the data and improve normality in the error terms. Hausman tests are performed to determine whether firm-fixed effects are preferred over random effects. All Hausman tests yield significant results and indicate the use of fixed-effects. ***, **, * Represent significance at the 1%, 5% and 10% levels respectively. T-statistics are adjusted with robust standard errors clustered at firm level. The p-values are shown in the parentheses under the coefficients.

	(1)	(2)
Explanatory variables	**Leverage**	**Leverage**
Nationality mix	-0.0570**	-0.0577**
	(0.0295)	(0.0274)
Board size	0.00407**	0.00403**
	(0.0262)	(0.0277)
% of female directors		-0.137***
		(0.001)
Blau diversity index	-0.0320*	
	(0.0713)	
Critical mass	-0.0155*	
	(0.0985)	
CEO duality	0.0118**	0.0115**
	(0.0664)	(0.0754)
% of independent directors	0.0829**	0.0837**
	(0.013)	(0.012)
Tangibility	0.228***	0.228***
	(9.11e-05)	(9.11e-05)
Firm size	0.0170	0.0180
	(0.387)	(0.360)
Market expectations	-0.0193***	-0.0192***
	(1.22e-05)	(1.39e-05)
Profitability	0.01431*	0.01432*
	(0.091)	(0.091)
Constant	-0.649***	-0.649***
	(5.57e-08)	(5.41e-08)
R-Squared	0.2076	0.2068
Industry effects	Yes	Yes
Year effects	Yes	Yes

of the firm is considered to be overvalued and will repurchase equity from the market otherwise. Assuming that a high book-to-market ratio is an indicator for a relatively high market capitalization, the negative coefficient can be the result of an increase in external equity issues.

With respect to profitability, I find that an increase in profitability is positively associated with an increase in leverage. This result is in line with trade-off theory and supports the conviction that profitable firms can benefit more from tax shields than unprofitable firms and should therefore use more debt. As such, there will be more room for leverage if the operational profitability increases. The estimation coefficients for firm size do not return statistical

significance. In the next paragraph, I attempt to gain a deeper insight into the impact of the board composition on the capital structure by segregating total leverage into four different financing sources. For a further description of these financing sources please refer to Table A.I in the Appendix.

4.2.2 Research results per financing source

Table IV presents the regression results with each of the four financing sources separately considered as independent variable. Columns (1) to (4) show the regression results of the baseline model **(2)** while columns (5) to (8) show the regression results of the augmented baseline model **(3)**. The results show that nationality diversity is negatively related to long-term debt at the 10% significance level, the regressions on the other specifications do not return statistical significance. Combining this result with the results in Table III, the negative relation to leverage could be explained by a lower use of long-term debt. As such, the observed lower level of leverage is likely not the result of an increase in external equity but rather the result of a decrease in long-term debt.

The effect of board size returns statistical significance for the specifications retained earnings and long-term debt. In particular, a one unit increase in board size is associated with a 0.16% (0.11%) decrease (increase) in retained earnings (long-term debt). The shift from internal equity to long-term debt is consistent with the view of Coles *et al*. (2008) and suggests that board size positively influences the quality of the board and in turn mitigates information asymmetry problems.

With respect to gender diversity, I find in column (1) that a 10% increase in gender diversity is associated with a 1.4% increase in retained earnings. Again, in combination with the previous results on leverage, it becomes apparent that the negative relation between gender diversity and leverage is the result of the positive relation between gender diversity and retained earnings. This outcome contradicts with the prediction that gender diversity on the board leads to the use of more risky securities in the capital structure (H2a). One possible justification is that as women are less likely to engage in risky behaviour than men (Eckel and Grossmann, 2008), they prefer to use more internal capital as compared to external capital.

Table IV: Panel data regression results of capital structure (book values)

This table presents the industry-and year-fixed effects panel data regression results, using the sample consisting out of 504 unique firms during the period of 2010 to 2017. In columns (1) to (4) the baseline regression is performed on four different leverage ratios. In particular, the scaled book values of retained earnings, external equity, long-term debt and short-term debt are used as independent variables respectively. Columns (5) to (8) present the results of the augmented baseline model where the variables Blau diversity index and critical mass are replaced for the variable percentage of female directors. The independent variables have a one period lag on the dependent variable and all financial variables are logarithmized in order to account for skewness in the data and improve normality in the error terms. Hausman tests are performed to determine whether fixed effects are preferred over random effects. All Hausman tests yield significant results and indicate the use of fixed-effects. ***, **, * Represent significance at the 1%, 5% and 10% levels respectively. T-statistics are adjusted with robust standard errors clustered at firm level. The p-values are shown in the parentheses under the coefficients.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Explanatory variables	**RE**	**EE**	**LTD**	**STD**	**RE**	**EE**	**LTD**	**STD**
Nationality mix	0.001	-0.150	-0.101*	-0.0175	-0.00756	-0.142	-0.101*	-0.0182
	(0.992)	(0.244)	(0.0617)	(0.655)	(0.937)	(0.269)	(0.0600)	(0.641)
Board size	-0.0162**	-0.00342	0.0109***	0.0007	-0.0152**	-0.00363	0.0109***	0.0007
	(0.0174)	(0.698)	(0.00379)	(0.808)	(0.0255)	(0.680)	(0.00384)	(0.792)
% of female directors					0.184	0.199	-0.134	0.0388
					(0.228)	(0.311)	(0.108)	(0.508)
Blau diversity index	0.135**	-0.00605	-0.0351	0.0286				
	(0.0462)	(0.946)	(0.349)	(0.278)				
Critical mass	-0.0673*	0.0805*	-0.0176	-0.00125				
	(0.0641)	(0.0935)	(0.378)	(0.929)				
% of independent directors	-0.0917	0.184	0.0237	0.0857*	-0.104	0.195	0.0236	0.0859*
	(0.463)	(0.280)	(0.733)	(0.0856)	(0.406)	(0.253)	(0.734)	(0.0849)
CEO duality	-0.0630**	0.0581	-0.00640	0.00889	-0.0630**	0.0566	-0.006	0.0091
	(0.0496)	(0.194)	(0.720)	(0.480)	(0.0497)	(0.206)	(0.724)	(0.471)
Tangibility	-0.524**	0.322	0.602***	-0.139	-0.512**	0.309	0.602***	-0.138
	(0.0115)	(0.234)	(2.12e-07)	(0.111)	(0.0136)	(0.254)	(2.13e-07)	(0.113)
Firm size	0.147**	-0.221**	0.211***	-0.142***	0.146**	-0.223**	0.212***	-0.142***
	(0.0333)	(0.0155)	(4.02e-08)	(1.43e-06)	(0.0342)	(0.0145)	(3.62e-08)	(1.52e-06)
Market expectations	0.0776***	-0.00690	-0.0434***	-0.00416	0.0766***	-0.10729**	-0.0432***	-0.00427
	(1.12e-05)	(0.758)	(2.68e-06)	(0.528)	(1.45e-05)	(0.018)	(2.97e-06)	(0.516)
Profitability	1.809***	-1.472***	-0.162	0.193**	1.805***	-1.461***	-0.163	0.191**
	(0)	(3.98e-09)	(0.136)	(0.0117)	(0)	(5.05e-09)	(0.134)	(0.0124)
Constant	-2.246***	-1.217**	-2.335***	-0.739***	-2.222***	-1.231**	-2.337***	-0.734***
	(1.13e-08)	(0.0233)	(0)	(4.14e-05)	(1.68e-08)	(0.0217)	(0)	(4.68e-05)
R-Squared	0.2654	0.1702	0.3268	0.2960	0.2617	0.1697	0.3265	0.2954
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

To test the relevance of this argument, I must control whether an increase in the level of female directors is positively related to an increase in gender diversity, which is strictly the case if women are under-represented in the boardroom. The correlation coefficient, as reported in Table II, provides evidence that gender diversity and female directors are indeed highly and positively correlated.

With regard to the percentage of independent directors on the board, I find no strong results since only the coefficient for the regression on short-term debt is statistically significant. As documented in column (4), a 10% increase in the fraction of independent directors is associated with a 0.86% increase in short-term debt. Although only significant at the 10% significance level, this result provides some evidence for the hypothesis (H1a) that boards with more independent directors hold the potential to decrease the level of information asymmetry between managers and capital providers and promote the use of external financing sources. However, further tests are needed to control whether the observed increase in short-term debt is positively or negatively related to the use of external capital as compared to internal capital.

With respect to the dichotomous variable critical mass, the results in column (1) show a negative relation to retained earnings and a positive relation to external equity. Following the pecking order theory, retained earnings is the first order consideration of capital while external equity is the last. A shift from the use of retained earnings to external equity is a clear signal that information asymmetries have been reduced and subsequently, the costs of external financing.

In the presence of CEO duality, it is expected that boards are less independent and consequently less effective. Surprisingly, the results in Table IV show that CEO duality is negatively related to internal capital. In comparing the results for CEO duality in Table III with Table IV, I find that the positive relation between CEO duality and leverage can be partly explained by the negative effects on retained earnings. As such, the results stir up the suggestion that CEO duality leads to lower information asymmetry problems.

Turning to the control variables, asset tangibility is negatively related to retained earnings and positively related to long-term debt. Following the pecking order theory, one can argue that tangibility decreases the level of information asymmetry between the firm the and capital investors and causes the firm to use more external financing sources. With respect to market expectations, I find no supporting evidence for the pecking order theory. However, the signs of

the coefficient estimate in column (1) and (3) support the predictions of the trade-off theory and show that a high market-to-book ratio is positively related to retained earnings and negative related to long-term debt. To be more specific, since growth firms are expected to benefit less from tax shields in the coming years, debt issuance should be limited.

Lastly, the effect of firm size is not clear since the results do not show a consistent shift from or towards the use of external capital. As documented, firm size is positively related to retained earnings, negatively to external equity, positive to long-term debt, and negative to short-term debt. Table V provides further insights in the relative use of the four financing sources in a firm's capital structure.

4.2.3 Research results for the relative use per financing source

Table V provides evidence as to whether the capital structure is composed out of more long-term debt or external equity; more long-term debt or short-term debt; more short-term debt or retained earnings; and lastly, more total liabilities or external equity. In column (3) I find that firms with larger boards appear to use more short-term debt as compared to retained earnings. This supports the prediction that firms with a greater board size use more risky financing sources in the capital structure (H4a). This result is in line with Coles *et al.* (2008) and may suggest that the size of the board has a positive effect on the monitoring capabilities, and thus, improves board efficiency.

Regarding board diversity (both gender and nationality), I am not able to find statistical significance in any of the respective coefficient estimates and I am therefore not able to support the predictions made in hypothesis H2a and H3a based on Table V. Notwithstanding the fact that I have found statistically significant results on the relation between board diversity and total leverage in Table III, further research is needed to provide better insights concerning the relation between board diversity and the financing mix used by a firm.

However, by using an alternative measure for gender diversity, namely the percentage of female directors, I find a negative relation to the use of total debt as compared to external equity. In particular, a 10% increase in the percentage of female board directors is associated with a 1.26% decrease in the use of debt as compared to total external capital. This finding supports hypothesis (H2b) and is consistent with the notion of Alves *et al.* (2015) that firms with a higher percentage of females in the board face lower levels of information asymmetry, and thus, have

better access to external equity. In addition, the coefficient estimates for the critical mass variable indicate that firms with at least 30% of female directors in the board hold less long-term debt as compared to external equity; hold more short-term debt as compared to retained earnings; and hold less total debt as compared to external equity. In particular, if the dichotomous variable turns to the value of one, the ratio between the use of total debt and the use of external capital decreases by 4.4% ($e^{(-0.045)} - 1$).

In Column (3) I find that the fraction of independent directors is positively associated to the use of short-term debt over retained earnings. Specifically, a 10% increase in the percentage of independent directors is associated with a 1.70% increase in the ratio between short-term debt and the sum of retained earnings and short-term debt. This supports the hypothesis (H1a) that board independence is positively related to the use of more risky financing sources. Finally, in contradiction to hypothesis 5a, column (4) provides evidence (at the 0.1 significance level) that in the presence of CEO duality, firms are more likely to use external equity as compared to debt financing. If the dichotomous variable turns to the value of one, the ratio between the use of total debt and the use of external capital decreases by 2.66% ($e^{(-0.027)} - 1$).

Turning to the control variables, market expectations appear to be inversely related to external capital. As documented in column (3), market expectations are negatively related to short-term debt as compared to retained earnings. Moreover, the results in column (2) and (4) indicate that firms with a high market-to-book value use less long-term debt as compared to short-term debt and use less external equity as compared to debt. These results are in line with the findings of Rajan & Zingales (1995) and Titman & Wessels (1988) and show supporting evidence for the pecking order theory. Regarding tangibility, the coefficient estimates partially support the prediction that firms with a high level of tangible assets face less information asymmetry with their creditors, and thus, are able to use more external capital. In particular, I columns (2) and (3) I find evidence that tangibility is positively related to the use of long-term debt over short-term debt and to the use of short-term debt over retained earnings. However, inconsistent with the predictions, column (1) and (4) show that tangibility is inversely related to the use of external equity as compared to debt.

Table V: Panel data regression results of financing mix

This table presents the industry-and year- fixed effects panel data regression results, using the sample consisting out of 504 unique firms during the period of 2010 to 2017. In columns (1) to (4) the dependent variables are defined as follows: (1) long-term debt over the sum of external equity and long-term debt, (2) long-term debt over total debt, (3) short-term debt over the sum of retained earnings and short-term debt, (4) total debt over the sum of external equity and total liabilities. All dependent variables are based on book values of capital. Columns (5) to (8) show the results of the augmented baseline model where the variables Blau diversity index and critical mass are replaced for the variable percentage of female directors. The independent variables have a one period lag on the dependent variable and all financial variables are logarithmized in order to account for skewness in the data and improve normality in the error terms. Hausman tests are performed to determine whether fixed effects are preferred over random effects. All Hausman tests yield significant results and indicate the use of fixed-effects. ***, **, * Represent significance at the 1%, 5% and 10% levels respectively. T-statistics are adjusted with robust standard errors clustered at firm level. The p-values are shown in the parentheses under the coefficient estimates.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Explanatory variables	**LTD/(EE+LTD)**	**LTD/TD**	**STD/(RE+STD)**	**TD/(EE+TD)**	**LTD/(EE+LTD)**	**LTD/TD**	**STD/(RE+STD)**	**TD/(EE+TD)**
Nationality mix	-0.0180	-0.0558	-0.0107	-0.0197	-0.0229	-0.0557	-0.00766	-0.0232
	(0.788)	(0.173)	(0.829)	(0.661)	(0.731)	(0.174)	(0.877)	(0.605)
Board size	0.00307	0.00461	0.00684**	0.00339	0.00342	0.00465	0.00649**	0.00363
	(0.506)	(0.105)	(0.0475)	(0.277)	(0.459)	(0.103)	(0.0460)	(0.245)
% of female directors					-0.114	0.00393	-0.0263	-0.126*
					(0.268)	(0.950)	(0.727)	(0.0663)
Critical mass	-0.0617**	-0.00130	0.0311*	-0.0450***				
	(0.0131)	(0.932)	(0.0844)	(0.00620)				
Blau diversity index	0.0380	-0.00442	-0.0396	0.00741				
	(0.415)	(0.877)	(0.242)	(0.811)				
% of independent directors	-0.0967	-0.0445	0.170***	-0.000622	-0.101	-0.0454	0.175***	-0.00321
	(0.263)	(0.399)	(0.00724)	(0.991)	(0.242)	(0.389)	(0.00576)	(0.956)
CEO duality	-0.0304	0.00290	-0.00156	-0.0271*	-0.0295	0.00273	-0.00144	-0.0265*
	(0.177)	(0.830)	(0.923)	(0.0682)	(0.191)	(0.840)	(0.929)	(0.0741)
Tangibility	0.105***	0.0982***	0.0981***	0.0631***	0.107***	0.0981***	0.0972***	0.0642***
	(5.22e-05)	(9.04e-10)	(4.20e-07)	(0.000348)	(4.04e-05)	(9.24e-10)	(5.41e-07)	(0.000278)
Market expectations	0.00773	-0.0619***	-0.121***	0.0428***	0.00773	-0.0620***	-0.120***	0.0429***
	(0.741)	(1.28e-05)	(0)	(0.00583)	(0.741)	(1.24e-05)	(0)	(0.00579)
Profitability	0.113***	0.0121	-0.0792***	0.0448***	0.112***	0.0122	-0.0789***	0.0441***
	(5.27e-07)	(0.380)	(2.05e-06)	(0.00266)	(6.67e-07)	(0.376)	(2.22e-06)	(0.00309)
Firm size	0.211***	0.198***	-0.161***	0.0837**	0.214***	0.197***	-0.162***	0.0856***
	(8.60e-06)	(0)	(9.52e-06)	(0.0105)	(6.44e-06)	(0)	(8.44e-06)	(0.00900)
Constant	-0.749***	-1.435***	-0.225	-0.365*	-0.738***	-1.436***	-0.231	-0.358*
	(0.00479)	(0)	(0.274)	(0.0509)	(0.00555)	(0)	(0.261)	(0.0563)
R-squared	0.2001	0.3216	0.2303	0.1245	0.1978	0.3212	0.2272	0.1216
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

A possible explanation arises from the high negative correlation between tangibility and the market-to-book value. See Table II. Following the market-timing theory, it can be argued that when tangibility is high, the market-to-book value is relatively low, which makes it unattractive for firms to issue equity. As such, I find that when information asymmetry problems are reduced, firms rely more on external capital but prefer long-term debt over external equity.

With respect to profitability, I find some contradicting results. The traditional capital structure theory of Modigliani & Miller (1963) propagates that profitability should be positively related to leverage since it allows for the capitalization of tax shields. In line with this argument, columns (1) and (4) show that profitable firms indeed use more debt as compared to external equity. However, I find contradicting results in column (3) that shows that retained earnings are preferred over short-term debt. Nevertheless, one finds a clear explanation for this if we turn ourselves to the pecking order theory. As such, profitable firms generate more internal capital than unprofitable firms and are therefore more likely to use this capital before they turn to the capital markets.

Finally, the effect of firm size on capital structure choice is debatable. In particular, in columns (1) to (4) it is found that larger firms use more long-term debt than external equity; more long-term debt than short-term debt; and more retained earnings then short-term debt. With respect to the pecking order theory, I find here one area of conflict. In particular, given that the proposed financing order is respected, short-term debt should be preferred over long-term debt since it is less risky and comes with lower information asymmetry costs. However, this conflict could be explained with the trade-off theory. As such, assuming that large firms have a lower likelihood to get into financial distress and have relatively low costs of bankruptcy (Rajan & Zingales, 1995), firms can decide to take on more risk in the capital structure in order to benefit from the interest tax shield.

5. Robustness

Hitherto, the results support the notion that the composition of the board has a significant influence on the capital structure choice of a firm. In this section I will perform several alternative tests to check for robustness in the results.

5.1 Robustness for market values

So far, I have performed all regressions on the book values of leverage. Nevertheless, in line with Titman & Wessels (1988) and Gilson (1997), I will use a second measure of leverage that is based on the market value of common equity to cross-validate the previous results. This implies that external equity will be calculated as the market capitalization of total equity at the end of year t minus the book value of retained earnings at the end of year t. The results on financial leverage are presented in Table VI. The observant reader will notice that the market value-based models have a stronger explanatory power, rested on the R-squared measure (0.77), than the book value-based models (R-squared of 0.20). However, in terms of statistical significance the market value-based model returns very weak results. One possible justification for this is that due to data limitations I used the book values of debt whilst the market values of equity are used. This implies that possible fluctuations in the perceived riskiness of the firm by investors are not reflected in the values of debt but are only reflected in the values of equity. As a result, the leverage ratio can be strongly biased since the denominator will be subject to strong autocorrelation while the value of the numerator changes constantly. Nevertheless, the coefficient estimates for all the four control variables show the same signs as in Table III, supporting the previous findings regarding the effects of tangibility, firm size, market expectations and profitability on financial leverage. Moreover, regressions are performed on the market values of the four different financing sources. The results are reported in Table A.V, presented in the Appendix. In general, the findings appear to be similar to the results on book values and support my previous findings.

5.2 Cross-sectional results

Since the data in this study is not stationary[8], I will analyse the results in a cross-sectional setting for the years 2011 to 2017. The use of a cross-sectional regression excludes by definition the yearly-fixed effects from the model and loses the observations for the year 2010 as I use lagged values. However, to stay consistent with the previous models, industry-fixed effects are still included and validated with the Hausman test. The results are presented in Table A.VI.

[8] Given the nature of the explanatory variables, the statistical properties are unlikely to be constant over time.

Table VI: Panel data regression results of leverage (market values)

This table presents the industry-and year-fixed effects panel data regression results, using the sample set consisting out of 504 unique firms during the period of 2010 to 2017. Regression (1) shows the baseline regression results with total market leverage, defined as the book value of total liabilities divided by the market value of total assets, as dependent variable. Model (2) shows the regression results of the augmented baseline regression where the variables Blau diversity index and critical mass are replaced for the variable percentage of female directors. All dependent variables are based on market values of capital. The independent variables have a one period lag on the dependent variable and all financial variables are logarithmized in order to account for skewness in the data and improve normality in the error terms. Hausman tests are performed to determine whether firm-fixed effects are preferred over random effects. All Hausman tests yield significant results and indicate the use of fixed-effects. ***, **, * Represent significance at the 1%, 5% and 10% levels respectively. T-statistics are adjusted with robust standard errors clustered at firm level. The p-values are shown in the parentheses under the coefficients.

	(1)	(2)
Explanatory variables	**Leverage**	**Leverage**
Nationality mix	0.0111	0.0118
	(0.741)	(0.726)
Board size	0.00600***	0.00587**
	(0.00985)	(0.0115)
% of female directors		-0.107*
		(0.0557)
Critical mass	-0.00109	
	(0.937)	
Blau index diversity	-0.0398	
	(0.117)	
% of independent directors	0.00912	0.0108
	(0.838)	(0.809)
CEO duality	-0.0114	-0.0113
	(0.338)	(0.343)
Tangibility	0.0494***	0.0491***
	(9.26e-05)	(0.000101)
Market expectations	-0.445***	-0.444***
	(0)	(0)
Profitability	0.0233*	0.0235*
	(0.0607)	(0.0582)
Firm size	0.110***	0.111***
	(3.50e-07)	(3.21e-07)
Constant	-1.420***	-1.424***
	(0)	(0)
Industry effects	Yes	Yes
Year effects	Yes	Yes
R-Squared	0.7793	0.7692

Regarding the variables gender diversity, CEO duality, firm size and market expectations I find consistent results over time. In particular, all statistically significant coefficient estimates show consistent signs over the years but are, however, in some cases in contradiction with our previous results. For example, in Table III there is no significant relationship reported between firm size and financial leverage. However, as shown in Table A.VI, there exists a negative and statistically significant relation between firm size and financial leverage for nearly all years. As aforementioned, the effect of firm size on the capital structure choice of a firm has been highly debatable since I find both significant positive associations with the use of internal capital and long-term debt, but also negative associations with the use of short-term debt and external

equity. Moreover, as presented in Table III, the effect on financial leverage has turned out to be insignificant when the dataset is comprised of all years. It remains therefore uncertain what the exact effect of firm size is on the capital structure choice of a firm. However, since firm size does not play a central role in this study, I will leave this point open for further discussion.

With respect to the board composition variables, the most emphatic results come from the variables CEO duality and gender diversity. Regarding the former, for the years till 2014 I find that CEO duality is positively related to the use of leverage. This result supports the previous findings and provides clear evidence that firms with a CEO that is also the chair use more leverage. With respect to gender diversity I find a positive relation to leverage in the years 2017, 2012 and 2011, which is in contradiction to my previous results. To test whether this is the result of an increase in the use of equity or debt, I computed the association between gender diversity and equity for the respective three years. However, the results show no statistical significance and will therefore not be further discussed.[9]

5.3 Separation of indices

To test for potential differences between Europe and the U.S., I analysed the results in a panel data framework for each index separately. In this way I can check whether the implications of the board composition on capital structure differs per market. As aforementioned, the composition of the board differs between American and European firms, and in particular for the variables nationality mix, critical mass and CEO duality. To test whether these differences impact the association between the board composition and the capital structure of a firm, I regress the baseline model (2) and augmented model (3) for the two markets separately. The results are reported in Table VII. In columns (1) and (3) the subsample for the American stock market is used and includes 262 unique firms over the period of 2010 to 2017. In Columns (2) and (3) the subsample for the European stock market is used and includes 242 unique firms over the period of 2010 to 2017.

With respect to the board composition variables, I find in columns (1) and (2) that board size has a significant and positive impact on the use of leverage for European firms, but not for American firms. One possible explanation for this result is that there is not enough variation in the data for the U.S. to be able to determine the relation between the use of leverage and the

[9] The regression results are available on request by the author.

Table VII: Panel data regression results of leverage decomposed by index

This table presents the industry-and year-fixed effects panel data regression results. In columns (1) and (3) a subsample that represents the American stock market is used and includes 262 unique firms over the period of 2010 to 2017. In Columns (2) and (3) subsample that represents the European stock market is used and includes 242 unique firms over the period of 2010 to 2017. The dependent variable is computed as the book value of total liabilities divided by the book value of total assets. The independent variables have a one period lag on the dependent variable and all financial variables are logarithmized in order to account for skewness in the data and improve normality in the error terms. Hausman tests are performed to determine whether fixed effects are preferred over random effects. All Hausman tests yield significant results and indicate the use of fixed-effects. ***, **, * Represent significance at the 1%, 5% and 10% levels respectively. T-statistics are adjusted with robust standard errors clustered at firm level. The p-values are shown in the parentheses under the coefficient estimates.

	(1)	(2)	(3)	(4)
Explanatory variables	**U.S.**	**EU**	**U.S.**	**EU**
Nationality mix	0.00546	-0.0111	0.00375	-0.0108
	(0.903)	(0.717)	(0.933)	(0.723)
Board size	-0.00108	0.00633***	-0.000709	0.00637***
	(0.713)	(0.00297)	(0.808)	(0.00283)
% of female directors			-0.0211	0.0792
			(0.753)	(0.104)
Critical mass	-0.0188	0.0134		
	(0.217)	(0.238)		
Blau index diversity	0.0167	0.0167		
	(0.547)	(0.451)		
% of independent directors	0.0999**	0.0899**	0.0995**	0.0905**
	(0.0384)	(0.0353)	(0.0391)	(0.0342)
CEO duality	0.000268	-0.00103	0.000131	-0.00152
	(0.979)	(0.940)	(0.990)	(0.912)
Tangibility	0.0387**	0.0903***	0.0393**	0.0906***
	(0.0267)	(0)	(0.0243)	(0)
Market expectations	-0.0818***	-0.0483***	-0.0815***	-0.0482***
	(9.99e-10)	(4.15e-05)	(1.15e-09)	(4.28e-05)
Profitability	0.0319***	-0.0123	0.0314***	-0.0122
	(0.00223)	(0.382)	(0.00260)	(0.386)
Firm size	-0.00482	-0.00367	-0.00375	-0.00452
	(0.877)	(0.875)	(0.904)	(0.846)
Constant	-0.291	-0.526***	-0.288	-0.525***
	(0.109)	(1.87e-05)	(0.112)	(2.02e-05)
Number of Companies	262	242	262	242
Industry effects	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
R-Squared	0.2614	0.3830	0.2608	0.3824

size of the board. If we refer back to the descriptive Table III, I find indeed that the standard deviation of board size is much lower for the S&P 500 (2.1) than for the Stoxx Euro 600 (5.1). For the variables percentage of independent directors and tangibility we find matching results between the U.S. and Europe and with the results on the total sample, which supports our previous findings.

Furthermore, regressions are performed on the four different financing sources separately and reported in Table A.VI, presented in the Appendix. As in Table VII, the results show more statistical significance for Europe than for the U.S. Nevertheless, the overall results still provide robust evidence that the composition of the board has a strong impact on the capital structure of a firm.

6. Discussion

The purpose of this chapter is to further discuss the main results of this study and to relate the underlying theoretical argumentation of the proposed hypotheses with the reported observed outcomes. In addition, this section elaborates on the limitations of this study and offers a set of recommendations for future research.

6.1 Main analysis

The findings reveal that firms with more independent boards tend to issue more short-term debt as compared to retained earnings. This result supports the first hypothesis (H1a) which conjectures that independent board members effectively reduce the level of information asymmetry between managers and capital providers and therefore promote the use of more risky financing sources in a firm's capital structure. This result is in line with Alves *et al*. (2015) who document that firms that have a more independent board use more external- than internal capital. Moreover, this result supports the notion of Brennan & McDermott (2014) that independent directors are better able to monitor the management team and significantly improve the effectiveness of the board by giving more objective advice and counsel. Despite the fact that inside directors can supply the board with valuable information about the day-to-day activities and performance of the firm, the results suggest that independent directors tend to act better in the interests of the shareholders than inside directors.

In addition, the results support hypothesis H4a which conjectures that board size is positively related to the use of more risky financing sources. However, this result must be interpreted with caution. As mentioned by Coles *et al*. (2008), the degree of complexity of a firm is determinative for the sign of association between board size and board effectiveness. Since the sample set that is used in this study consists predominantly out of large firms, which are likely to be more complex (Coles *et al*., 2008), it is plausible that the results are to some extent subject to selection bias.

Turning to the implications of gender, the results show that gender diversity in the board is negatively related to leverage and positively related to retained earnings. At a minimum, this result suggests that firms with gender diverse boards are less inclined to take financial risk and are therefore more likely to rely on internal capital as compared to external capital. However, the positive relation to internal capital is in conflict with the hypothesis (H2a) that firms with a more gender diverse board rely more on risky financing sources. One possible justification arises from the nonlinear relation between gender diversity and board effectiveness as argued by Joecks *et al*. (2012). According to the authors, an increase in gender diversity at first has a negative economic impact to the firm and only after a certain threshold of gender diversity is reached, this impact turns positively. This line of thought is supported by Earley & Mosakowski (2000) who document that homogeneous and highly heterogeneous groups outperform moderately diverse groups. The descriptive statistics presented in Table I show indeed that the average level of gender diversity among the analysed firms is notably low.

Since gender diversity is a function of the ratio between men and women in the board, I used a second gender related measure to capture the impact of female board presence on the firm's capital structure. First of all, the results show that female directors have a significant negative impact on the leverage used by the firm. If we take a closer look at the relative use of debt versus external equity, I find that firms that have a higher percentage of female directors in the board prefer to issue equity as compared to debt. This result supports the hypothesis (H2b) that the presence of female directors in the board contribute to lower information asymmetry and consequently promote the use of more risky financing sources. In order to gain a deeper insight into the intuition behind this result, it is important to recognize that the association between gender and information asymmetry is not directly tested but is based on the findings in previous research. As such, Adams & Ferreira (2009) argue that female directors significantly improve the monitoring qualities of the board by tougher monitoring, better attendance records, and by

better alignment with the shareholders. Since this improves the functioning of the board, it is reasonable to argue that female directors contribute to lower information asymmetry between managers and investors. In a similar vein of Certo et al. (2001) and Petersen & Vredenburg (2009, the positive link between female board directors and the use of more risky financing sources could also be a result of market signalling. Previous research reveals that it may not be the qualities of the board members *per se* that lead to better corporate performance, but rather the message that is signalled to the market. Although unverified in the present study, the inclusion of more female board members could improve the reputation of the firm (Kaur & Singh, 2017), attract a different pool of investors, and facilitate access to capital markets.

A third measure for gender diversity is used to test whether the magnitude of the relationship between female directors and the capital structure is linear or increases if at least 30% of the board members are female (critical mass), as predicted by Joecks *et al*. (2012). In this study I find that (1) critical mass is negatively related to the use of internal capital as compared to short-term debt and (2) positively related to the use of external equity as compared to total debt. This result supports the critical mass theory and suggests that the presence of at least 30% of female directors in the board significantly increases boards' effectiveness (Torchia *et al*., 2011; Joecks *et al*., 2012). To conclude, I find that when boards are getting more gender heterogeneous, firms tend to rely more on internal capital. However, an increase in the presence of female directors on itself, and especially under the condition that 30% of the board members are female, can potentially be associated with a decrease in agency problems. Within the framework of the pecking order theory, the use of more external equity is a clear signal that agency problems such as information asymmetry have been decreased. However, since I experience many limitations in the statistical significance of the results, it is ambiguous to make strong arguments as to whether the shift to more external equity is the mere result of an increase in risk-aversion or of a reduction in information asymmetry.

With respect to nationality diversity, I find a negative relation to total leverage and long-term debt. The negative relation to long-term debt is in contradiction with the prediction that firm's with nationality diverse boards use more risky financing sources (H3a). A possible justification for this result is that the differences in individual characteristics of the board members could lead to teams experiencing more conflicts, less cohesion and slower decision-making, which could affect their ability to overcome agency problems (Hambrick *et al*., 1998). The results are in conflict with Nielsen and Nielsen (2013), who argue that multinational teams engage more

in in-depth discussions, have are more problem-solving approach, and arrive at more creative solutions. However, the results must be interpreted with caution since I only find weak statistically significant results (0.1 significance level) and only for a limited number of specifications. As such, the negative relation to long-term debt does not in itself provide us with sufficient information about the extent to which information asymmetries are affected.

With respect to CEO duality, I find some striking results. This study demonstrates that CEO duality is associated with the use of more leverage; less internal capital; and a preference for external equity as compared to total debt. From an agency perspective, CEOs may be tempted to pursue their self-interests at the expense of shareholders (Fama & Jensen, 1983). Therefore, entrusting the CEO with the role of chairman of the board could jeopardize the board's functions of monitoring and disciplining the CEO. As a result, in the presence of CEO duality one should expect the board to be less independent and consequently less effective in reducing information asymmetries. However, the results suggest something different. In conflict with our prediction (H5a) and previous studies (e.g. Alves *et al.*, 2015), CEO duality is positively related to the use of more risky financing sources, and in particular, to external equity. Since the use of more risky financing sources signals a reduction in information asymmetries, there appears to be a positive force that is related to CEO duality. One possible justification of this result is that the model is subject to endogeneity bias caused by an omitted variable that is strongly correlated to the variable CEO duality. For example, Fosberg (2004) finds that if the CEO holds a low level of equity ownership in the firm, more debt is used. Therefore, the positive relation between CEO duality and firm leverage can be explained if the CEOs who are also chairman hold low levels of equity in the firm. However, the data availability limits the present study to formally test this argument. The stewardship theory could provide us a second rationale for this outcome. From a stewardship perspective, a potential benefit of CEO duality could arise from the enhanced unity of command at the top, which promotes fast and decisive decision-making (Tang, 2017). As such, the results stir up the suggestion that the benefits arising from stronger authority outweigh the costs associated with the loss of independence.

6.2 Limitations and suggestions for future research

One of the main concerns of this study is that our research procedure is not robust to endogeneity. Although this study partly addresses endogeneity by using lagged independent variables and fixed-effects, it must be acknowledged that there are certainly more factors at

play that could lead to biased estimates. In short, endogeneity occurs when the error term is correlated with an explanatory variable in the model. In our research design, one potential source of endogeneity is related to the direction of causation between the financing sources and the board of directors' composition. As such, there may be a problem of reverse causality when the capital structure of a firm actually affects the composition of the board instead of the other way around. For example, it can be argued that when firms get into financial distress, shareholders get more inclined to intervene in the decisions of the management and consequently may request for a restructuring of the board. In particular, given that highly levered firms are more sensitive to market conditions, changes in the board composition and capital restructuring may be simply caused by financial performance. In line with this thought, Bhagat & Black (1998) showed that poor performing firms tend to increase the number of independent directors in the board. Moreover, Adams & Ferreira (2009) argue that firms that are perceived to be more progressive tend to attract more female directors. Given this, the association between capital structure and level of female directors could be caused by an unobserved variable.

Another point of concern in this study is the implicit assumption that decisions about the capital structure are exclusively induced by the directors on the board. Although it is within the fiduciary duties of the board to engage seriously with the management team to determine the appropriate capital structure, it is plausible to believe that certain choices are made on the discretion of the executive managers only. For example, even though the CFO[10] is obligated to report to the CEO and the board of directors, it is likely that many financial decisions are predominantly influenced by the CFO's control. As I have limited this study to the examination of the board members exclusively, certain relations may actually be caused by managers that are not examined. Moreover, external factors such as the costs of debt capital, market volatility, and macroeconomic policy measures are not included in the models but are often significantly related to capital structure choices (Mokhova & Zinecker, 2013). Although limitations in the data made it infeasible for this study to take external variables into account, I have tried to establish enough explanatory power by including a range of firm-specific variables such as profitability and tangibility.

[10] Despite the chief executive officer (CFO) is not usually a member of the board of directors, this is not excluded.

Further, this study does not account for country-specific effects. Since the variation in our data is much higher for the European sample than for the American sample, the comprised results are hard to generalize. In particular, if the board composition characteristics vary highly across countries but not within countries, the observed results may actually be strongly influenced by country-specific factors such as whether board gender diversity is forced by gender quotas.

Hence, future research could improve the results by controlling and accounting for more forms of endogeneity. One estimation procedure that is commonly recommended is the instrumental variable approach, which restricts the model to only capture the variation in the explanatory variables that is not correlated to the error term. The instrumental variable approach requires a set of instrumental variables (instruments) that have the property to be correlated with the explanatory variable(s) but uncorrelated with the error term. As such, when the right instruments are used, the researcher can uncover the causal effect of the composition of the board on the capital structure. However, it is hard to find valid instrumental variables since the instruments are often still to some extent related to the dependent variable or only weakly correlated to the explanatory variable(s) (Baker *et al*, 1995).

Furthermore, in recent years several countries and states have implemented a (soft-law) gender quota in order to promote the presence of women on the board of directors. However, this practise could have large implications for the actual quality of the board since directors are possibly not always chosen on the basis of their competencies. As such, it would be fascinating to examine whether the relation between board composition and capital structure differs between firms that were forced to restructure the board composition and firms that had the freedom to compose the board at their discretion.

7. Conclusion

By using a unique panel dataset that captures a wide range of board-specific characteristics for 504 firms over a period of 10 years, this study addresses how and the extent to which the composition of the board affects the capital structure choices made by a firm. In particular, the fraction of independent directors, the degree of gender- and nationality diversity, board size, and CEO duality have been analysed. This study conjectures that when the board of directors in composed in such a way that it effectively reduces information asymmetry problems between

managers and outside investors, a higher fraction of risky financing sources will be used in the capital structure. After controlling for a wide-range of variables that have proven to be reliable capital structure determinants, it is shown that firms that have a stronger presence of female on the board tend to issue more equity as compared to debt and are generally less levered. In particular, the results show that when the presence of female directors in the board is at least 30%, firms (1) hold less internal capital as compared to short-term debt and (2) hold more external equity as compared to long-term debt. These results are consistent with the hypothesis that female directors increase the effectiveness of the board, contribute to lower information asymmetry, and consequently promote the use of more risky financing sources. However, this study reveals that when boards are getting more gender heterogeneous, firm tend to rely more on safer financing sources such as internal capital. Overall, the results contribute well to the fierce debate about how and whether the composition of corporate boards needs be reformed. At the very least, from an economic perspective, the empirical results call into question the one-size-fits-all rule-based reform proposals such as strict gender quotas. The question on whether boards should become more gender diverse on the grounds of ethical justification, however, goes beyond the scope of this study. In addition, the results also provide some evidence that firms that have a larger board, more independent directors, or CEO who also holds the position of the chairman, use more risky financing sources in the capital structure. The effect of nationality diversity on capital structure asks for further research, as the regression results in this study are predominantly not statistically different from zero. Overall, this study adds well to the growing body of the literature that examines the impact of board composition on firm's capital structure and echoes the findings in previous studies that certain board attributes should not be ignored in capital structure models.

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9. Appendix

Table A.III: Descriptive statistics decomposed by Index

This table presents the descriptive statistics decomposed by stock market index. Specifically, the descriptive statistics of the firms listed in the S&P 500 and the Stoxx Euro 600 over the period of 2010 to 2017 are separately displayed.

Variables	Num. of Obs. Per year	Avg. Mean	Avg. Std. Dev.
Panel A: Board composition S&P 500			
Nationality mix	262	.141	.176
Board size	262	11.1	2.1
Critical mass (dummy)	262	.124	.330
Blau diversity index	262	.582	.214
% of female directors	262	.189	.088
% of independent directors	262	.739	.155
CEO duality (dummy)	262	.434	.495
Panel B: Board composition Stoxx Euro 600			
Nationality mix	242	.371	.256
Board size	242	11.3	5.1
Critical mass (dummy)	242	.297	.457
Blau diversity index	242	.607	.300
% of female directors	242	.215	.131
% of independent directors	242	.728	.165
CEO duality (dummy)	242	.276	.447

Table A.IV: Variance inflation factors (VIF)

In this table the estimations for the variance inflation factors (VIF) are presented. The VIFs are calculated after the baseline regression (2) is performed against the book value of total liabilities. For a description of the variables used, refer to Table A.1 in the appendix.

Variables	VIF
Nationality mix	1.07
Board size	1.29
Critical mass (dummy)	1.73
Blau diversity index	1.76
% of independent directors	1.04
% of female directors	1.72
CEO duality (dummy)	1.05
Tangibility	1.13
Market-to-book ratio	1.59
Firm size (log)	1.35
Profitability	1.45

Table A.I: Variables description

Variables	Description	Source
Panel A: Board composition		
Nationality mix	A measure of nationality diversity in the board with a value ranging between 0 and 1.	BoardEX
Board size	Total number of directors on the board.	BoardEX
Critical mass	Dichotomous variable that equals 1 if at least 30% of the board members are female and 0 otherwise.	BoardEX
Blau diversity index	A measure of gender diversity in the board with a value ranging between 0 and 1.	BoardEX
% of female directors	The total number of female directors in the board divided by the board size.	BoardEX
% independent directors	The total number of independent directors in the board divided by the board size.	BoardEX
CEO duality	Dichotomous variable that equals 1 if the CEO is also the chair of the board and 0 otherwise.	BoardEX
Panel B: Control variables		
Tangibility (TAN)	Book value of fixed assets (PPE) divided by the book value of capital (at the end of the fiscal year).	Compustat, Bloomberg, Orbis
Firm size (SI)	Total assets as reported by the firm (at the end of the fiscal year).	Compustat, Bloomberg, Orbis
Market expectations (ME)	The ratio of market value of equity and book value of equity (at the end of the fiscal year).	Compustat, Bloomberg, Orbis
Profitability (PR)	EBITDA divided by the book value of capital (at the end of the fiscal year).	Compustat, Bloomberg, Orbis
Panel C: Leverage		
Retained earnings (RE)	Book value of retained earnings divided by the book/market value of capital (fiscal year-end).	Compustat, Bloomberg, Orbis
External equity (EE)	Book value of total equity minus the book value of retained earnings divided by book/market value of capital (fiscal year-end).	Compustat, Bloomberg, Orbis
Long-term liabilities (LTD)	Book value of total liabilities minus the book value of current liabilities divided by book capital/market capital (fiscal year-end).	Compustat, Bloomberg, Orbis
Short-term liabilities (STD)	Book value of current liabilities divided by the book/market value of capital (fiscal year-end).	Compustat, Bloomberg, Orbis
Total leverage (TL)	Book value of total liabilities divided by the book/market value of capital (fiscal year-end).	Compustat, Bloomberg, Orbis
Book capital (BC)	Book value of total assets as reported by the firm (fiscal year-end).	Compustat, Bloomberg, Orbis
Market capital (MC)	Book capital minus the book value of equity plus the market value of equity (fiscal year-end).	Compustat, Bloomberg, Orbis

Table A.II: Descriptive statistics decomposed by year

Descriptive statistics for the board composition characteristics over the period of 2010 to 2017, decomposed by year.

Variables	Num. of Obs.	Mean	Std. Dev.
Nationality mix			
2010	504	.2347	.2359
2011	504	.2425	.2414
2012	504	.2425	.2414
2013	504	.2514	.2460
2014	504	.2575	.2489
2015	504	.2665	.2546
2016	504	.2692	.2560
2017	504	.2732	.2579
Board size			
2010	504	11.8	4.0
2011	504	11.8	4.0
2012	504	11.7	3.9
2013	504	11.7	3.8
2014	504	11.8	3.8
2015	504	11.8	3.8
2016	504	11.9	3.8
2017		12.0	3.8
Blau index for gender diversity			
2010	504	.4483	.2707
2011	504	.4900	.2672
2012	504	.5319	.2570
2013	504	.5663	.2553
2014	504	.6154	.2397
2015	504	.6612	.2207
2016	504	.7063	.2105
2017	504	.7366	.1980

(Continued)

(continued) Table A.II: Descriptive statistics decomposed by year

Descriptive statistics for the board composition characteristics over the period of 2010 to 2017, decomposed by year.

Variables	Num. of Obs.	Mean	Std. Dev.
Critical mass (dummy)			
2010	504	.0833	.2767
2011	504	.0972	.2966
2012	504	.1230	.3288
2013	504	.1607	.3676
2014	504	.2063	.4051
2015	504	.2599	.4390
2016	504	.3413	.4746
2017	504	.3869	.4875
CEO duality (dummy)			
2010	504	.3710	.4836
2011	504	.3810	.4861
2012	504	.3631	.4814
2013	504	.3571	.4796
2014	504	.3571	.4796
2015	504	.3492	.4772
2016	504	.3472	.4766
2017	504	.3452	.4760
% of independent directors			
2010	504	.7230	.1635
2011	504	.7319	.1625
2012	504	.7311	.1608
2013	504	.7322	.1584
2014	504	.7355	.1634
2015	504	.7354	.1584
2016	504	.7371	.1565
2017	504	.7423	.1593
% of female directors			
2010	504	.1424	.1004
2011	504	.1583	.1041
2012	504	.1732	.1015
2013	504	.1878	.1050
2014	504	.2082	.1052
2015	504	.2275	.1023
2016	504	.2510	.1068
2017	504	.2669	.1072

Table A.V: Panel data regression results of capital structure (market values)

This table presents the industry-and year- fixed effects panel data regression results, using the sample consisting out of 504 unique firms during the period of 2010 to 2017. In columns (1) to (4) the dependent variables are defined as follows: (1) retained earnings, (2) external equity, (3) long-term debt, (4) short-term debt. All dependent variables are based on market values of capital. Columns (5) to (8) show the results of the augmented baseline model where the variables Blau diversity index and critical mass are replaced by the variable percentage of female directors. The independent variables have a one period lag on the dependent variable and all financial variables are logarithmized in order to account for skewness in the data and improve normality in the error terms. Hausman tests are performed to determine whether fixed effects are preferred over random effects. All Hausman tests yield significant results and indicate the use of fixed-effects. ***, **, * Represent significance at the 1%, 5% and 10% levels respectively. T-statistics are adjusted with robust standard errors clustered at firm level. The p-values are shown in the parentheses under the coefficient estimates.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Explanatory variables	**RE**	**EE**	**LTD**	**STD**	**RE**	**EE**	**LTD**	**STD**
Nationality mix	0.106	-0.107	-0.0461	0.0920**	0.0995	-0.0986	-0.0457	0.0924**
	(0.282)	(0.429)	(0.441)	(0.0323)	(0.314)	(0.466)	(0.446)	(0.0314)
Board size	-0.0128*	-0.00299	0.00811*	0.00299	-0.0121*	-0.00324	0.00802*	0.00294
	(0.0664)	(0.746)	(0.0508)	(0.317)	(0.0828)	(0.725)	(0.0534)	(0.324)
% of female directors					0.0897	0.182	-0.124	0.0435
					(0.569)	(0.377)	(0.190)	(0.510)
Blau diversity index	0.0908	-0.0200	-0.0479	0.0130				
	(0.194)	(0.831)	(0.263)	(0.664)				
Critical mass	-0.0618*	0.0851*	-0.00635	0.0113				
	(0.0998)	(0.0930)	(0.782)	(0.477)				
% of independent directors	-0.0907	0.144	-0.0234	0.0141	-0.100	0.155	-0.0226	0.0155
	(0.480)	(0.422)	(0.764)	(0.799)	(0.435)	(0.386)	(0.772)	(0.780)
CEO duality	-0.0656**	0.0367	-0.0130	6.61e-05	-0.0656**	0.0351	-0.0130	0.000173
	(0.0472)	(0.435)	(0.522)	(0.996)	(0.0470)	(0.456)	(0.520)	(0.990)
Tangibility	-0.0583	-0.00117	0.165***	0.0239	-0.0565	-0.00362	0.165***	0.0238
	(0.132)	(0.982)	(0)	(0.155)	(0.145)	(0.943)	(0)	(0.157)
Firm size	0.312***	-0.175*	0.313***	-0.00766	0.313***	-0.178*	0.314***	-0.00767
	(1.01e-05)	(0.0677)	(0)	(0.804)	(9.77e-06)	(0.0630)	(0)	(0.804)
Market expectations	-0.0445	-0.401***	-0.480***	-0.340***	-0.0450	-0.400***	-0.479***	-0.340***
	(0.211)	(0)	(0)	(0)	(0.206)	(0)	(0)	(0)
Profitability	0.196***	-0.183***	0.0367*	0.0188	0.195***	-0.181***	0.0370*	0.0187
	(8.17e-09)	(4.46e-05)	(0.0771)	(0.198)	(9.43e-09)	(5.16e-05)	(0.0748)	(0.200)
Constant	-2.931***	-2.354***	-2.814***	-1.787***	-2.913***	-2.370***	-2.820***	-1.787***
	(0)	(1.24e-05)	(0)	(0)	(0)	(1.07e-05)	(0)	(0)
R-Squared	0.1737	0.2371	0.6082	0.5362	0.1715	0.2362	0.6082	0.5355
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table A.VI: Panel data regression results decomposed by index

This table presents the industry-and year- fixed effects panel data regression results. Columns (1), (3), (5) and (7) represent the American stock market (U.S.) and includes 262 unique firms. Columns (2), (4), (6) and (8) represent the European stock market (EU) and includes 242 unique firms. The period from 2010 to 2017 has been analysed. The abbreviations RE, EE, LTD and STD stand for retained earnings, external equity, long-term equity and short-term equity respectively. The independent variables have a one period lag on the dependent variable and all financial variables are logarithmized in order to account for skewness in the data and improve normality in the error terms. Hausman tests are performed to determine whether fixed effects are preferred over random effects. All Hausman tests yield significant results and indicate the use of fixed-effects. ***, **, * Represent significance at the 1%, 5% and 10% levels respectively. T-statistics are adjusted with robust standard errors clustered at firm level. The p-values are shown in the parentheses under the coefficient estimates.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Explanatory variables	**RE / U.S.**	**RE / EU**	**EE / U.S.**	**EE / EU**	**LTD / U.S.**	**LTD / EU**	**STD / U.S.**	**STD / EU**
Nationality mix	0.0454	-0.00958	-0.310	-0.202	0.00278	-0.0251	-0.00495	-0.0351
	(0.794)	(0.934)	(0.281)	(0.142)	(0.976)	(0.704)	(0.942)	(0.442)
Board size	-0.00266	-0.0178**	-0.00996	-0.00364	0.00529	0.0143***	-0.00573	5.10e-06
	(0.817)	(0.0330)	(0.595)	(0.699)	(0.395)	(0.00159)	(0.195)	(0.999)
Critical mass	-0.0743	-0.101**	0.0827	0.0527	-0.0201	0.0233	-0.0203	0.0145
	(0.231)	(0.0202)	(0.415)	(0.294)	(0.536)	(0.354)	(0.375)	(0.383)
Blau diversity index	0.00843	0.117	-0.0457	-0.106	-0.0408	0.0589	0.128***	-0.0116
	(0.939)	(0.170)	(0.793)	(0.276)	(0.489)	(0.225)	(0.00218)	(0.721)
% of independent directors	-0.0474	-0.141	-0.0633	0.152	-0.0407	0.141	0.159**	0.0435
	(0.799)	(0.388)	(0.839)	(0.430)	(0.689)	(0.128)	(0.0291)	(0.494)
Board duality	0.0899**	-0.0275	0.0480	0.0102	0.0147	-0.0174	0.000847	0.0526***
	(0.0267)	(0.616)	(0.484)	(0.865)	(0.505)	(0.562)	(0.957)	(0.00956)
Tangibility	-0.0565	-0.101**	0.000720	0.0453	0.109***	0.208***	0.0325	0.0541***
	(0.367)	(0.0252)	(0.994)	(0.383)	(0.00224)	(0)	(0.228)	(0.00241)
Market expectations	0.265***	0.313***	-0.151*	-0.0843	-0.178***	-0.103***	0.0379*	-0.00948
	(5.67e-07)	(0)	(0.0730)	(0.108)	(2.63e-10)	(6.01e-05)	(0.0616)	(0.588)
Profitability	0.216***	0.106*	-0.210***	-0.109*	0.0530**	-0.0181	0.0241	-0.00365
	(2.56e-07)	(0.0522)	(0.000745)	(0.0743)	(0.0173)	(0.558)	(0.129)	(0.860)
Firm size	0.0799	0.308***	-0.0760	-0.338***	0.223***	0.129***	-0.133***	-0.0893**
	(0.475)	(0.000668)	(0.681)	(0.00142)	(0.000399)	(0.00721)	(0.00556)	(0.0139)
Constant	-1.001*	-2.787***	-2.722**	-0.738	-1.514***	-2.030***	-1.058***	-0.650***
	(0.0992)	(2.00e-09)	(0.0135)	(0.190)	(2.29e-05)	(0)	(0.000231)	(0.000890)
Observations	1,656	1,464	1,201	1,465	1,818	1,686	1,817	1,686
R-squared	0.3676	0.3747	0.2825	0.1830	0.3669	0.4575	0.3935	0.2996
industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table A.VI: Cross-sectional regression results

This table presents the cross-sectional estimation results, using the sample consisting out of 504 unique firms during the period of 2010 to 2017. The use of lagged values eliminates the estimations from the year 2010. In columns (1) to (8) the dependent variable is defined as the total book value of liabilities divided by the total book value of assets at the end of the year. The independent variables have a one period lag on the dependent variable and all financial variables are logarithmized in order to account for skewness in the data and improve normality in the error terms. Hausman tests are performed to determine whether fixed effects are preferred over random effects. All Hausman tests yield significant results and indicate the use of fixed-effects. ***, **, * Represent significance at the 1%, 5% and 10% levels respectively. T-statistics are adjusted with robust standard errors clustered at firm level. The p-values are shown in the parentheses under the coefficients.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Explanatory variables	**2017**	**2017**	**2016**	**2016**	**2015**	**2015**	**2014**	**2014**
Nationality mix	-0.0408	-0.0354	-0.0478	-0.0428	-0.0870	-0.0876	-0.0527	-0.0515
	(0.472)	(0.531)	(0.452)	(0.503)	(0.165)	(0.166)	(0.348)	(0.360)
Board size	0.00568	0.00500	0.00867*	0.00842*	0.00595	0.00607	0.00334	0.00306
	(0.176)	(0.235)	(0.0565)	(0.0651)	(0.193)	(0.188)	(0.396)	(0.438)
Blau diversity index		0.208**		0.129		-0.00901		0.0498
		(0.0285)		(0.169)		(0.912)		(0.445)
Critical mass		-0.0477		-0.0144		0.00272		-0.0309
		(0.268)		(0.755)		(0.955)		(0.485)
% of female directors	0.191		0.197		-0.0312		0.0260	
	(0.144)		(0.194)		(0.832)		(0.844)	
% of independent directors	-0.000646	0.00394	-0.0566	-0.0601	-0.0422	-0.0424	0.0602	0.0579
	(0.994)	(0.965)	(0.559)	(0.535)	(0.644)	(0.643)	(0.472)	(0.490)
CEO duality	0.0711**	0.0728**	0.0462	0.0462	0.0761**	0.0758**	0.0678**	0.0670**
	(0.0178)	(0.0152)	(0.162)	(0.162)	(0.0176)	(0.0182)	(0.0161)	(0.0175)
Tangibility	0.00106	0.000288	0.0251	0.0247	0.0372*	0.0372*	0.00406	0.00316
	(0.957)	(0.988)	(0.246)	(0.255)	(0.0874)	(0.0875)	(0.831)	(0.869)
Firm size	-0.107***	-0.111***	-0.139***	-0.140***	-0.0785**	0.0209	-0.144***	-0.147***
	(0.000104)	(6.45e-05)	(9.17e-06)	(7.77e-06)	(0.0114)	(0.518)	(4.83e-08)	(3.72e-08)
Market expectations	0.115***	0.115***	0.123***	0.124***	-0.0308	-0.0782**	0.0198	0.0215
	(0.000901)	(0.000891)	(0.00369)	(0.00355)	(0.481)	(0.0122)	(0.559)	(0.527)
Profitability	0.0569*	0.0502	0.0335	0.0307	0.0209	-0.0308	0.0497*	0.0480*
	(0.0652)	(0.106)	(0.318)	(0.361)	(0.518)	(0.482)	(0.0869)	(0.0979)
Constant	-0.595***	-0.645***	-0.417**	-0.438**	-0.440**	-0.468**	-0.696***	-0.699***
	(0.00109)	(0.000456)	(0.0285)	(0.0225)	(0.0187)	(0.0119)	(3.43e-05)	(3.29e-05)
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-Squared	0.256	0.261	0.255	0.256	0.243	0.243	0.313	0.314

(Continued)

(continued) Table A.VI: Cross-sectional regression results

This table presents the cross-sectional results, using the sample consisting out of 504 unique firms during the period of 2010 to 2017. The use of lagged values eliminates the estimations from the year 2010. In columns (1) to (8) the dependent variable is defined as the total book value of liabilities divided by the total book value of assets at the end of the year. The independent variables have a one period lag on the dependent variable and all financial variables are logarithmized in order to account for skewness in the data and improve normality in the error terms. Hausman tests are performed to determine whether fixed effects are preferred over random effects. All Hausman tests yield significant results and indicate the use of fixed-effects. ***, **, * Represent significance at the 1%, 5% and 10% levels respectively. T-statistics are adjusted with robust standard errors clustered at firm level. The p-values are shown in the parentheses under the coefficients.

	(1)	(2)	(3)	(4)	(6)	(7)
Explanatory variables	**2013**	**2013**	**2012**	**2012**	**2011**	**2011**
Nationality mix	-0.00994	-0.0108	0.00632	0.00900	0.0416	0.0453
	(0.866)	(0.854)	(0.921)	(0.887)	(0.502)	(0.467)
Board size	0.00358	0.00299	0.00503	0.00449	0.00503	0.00503
	(0.369)	(0.453)	(0.228)	(0.282)	(0.198)	(0.199)
Blau diversity index		0.0731		0.152**		0.112*
		(0.263)		(0.0207)		(0.0764)
Critical mass		-0.0682		-0.0599		0.0153
		(0.173)		(0.294)		(0.791)
% of female directors	0.0323		0.251*		0.296*	
	(0.820)		(0.0895)		(0.0508)	
% of independent directors	0.0545	0.0585	-0.0463	-0.0389	-0.0751	-0.0733
	(0.519)	(0.489)	(0.596)	(0.657)	(0.371)	(0.383)
CEO duality	0.0473	0.0474	0.0530*	0.0520*	0.0569*	0.0564*
	(0.103)	(0.102)	(0.0810)	(0.0863)	(0.0524)	(0.0546)
Tangibility	0.00926	0.00676	0.00483	0.00357	-0.00755	-0.00791
	(0.644)	(0.737)	(0.817)	(0.864)	(0.702)	(0.689)
Firm size	-0.173***	-0.175***	-0.183***	-0.186***	-0.218***	-0.219***
	(0)	(0)	(0)	(0)	(0)	(0)
Market expectations	0.0340	0.0351	0.0612	0.0622	0.0790**	0.0798**
	(0.322)	(0.307)	(0.137)	(0.131)	(0.0207)	(0.0195)
Profitability	0.0338	0.0328	0.0134	0.00994	0.000897	-0.00133
	(0.253)	(0.266)	(0.667)	(0.749)	(0.976)	(0.965)
Constant	-0.645***	-0.660***	-0.538***	-0.552***	-0.442***	-0.445***
	(0.000109)	(7.67e-05)	(0.00222)	(0.00167)	(0.00784)	(0.00756)
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
R-Squared	0.320	0.323	0.322	0.326	0.3453	0.346