MASTER THESIS

Board gender diversity and corporate risk-taking

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Abstract

Increasing the proportion of females in the board of directors has become an increasingly contentious topic in the business environment. Quota's and public pressure have resulted in more and more firms adding females to their board. The impact of this change has received attention from multiple scholarly investigations, but the effect remains unclear. In social psychological studies gender differences is a highly investigated topic, concluding that women are more risk averse than men. Based on this the following research questions for this thesis arose: How does board gender diversity impact a firm's risk-taking in corporate financial decisions? Research dependence, human capital, agency and social identity theories argue that female directors can add valuable resources and perspectives to a board, resulting in a firm making better quality decisions and taking less risk. Using data from 164 UK firms from 2013-2017 this thesis investigated the effect of female board representation on stock return volatility, ROA volatility, leverage and R&D expenses. Also, a moderation effect of the presence of a female CEO or CFO is investigated. The overall results of the study show that the proportion of females in the board of directors doesn't have an impact on the level of risk-taking of a firm, but that the relation is influenced by other firm or financial characteristics. However, interesting topics for further research are seen in the samples with manufacturing and trade firms and firms with a female CEO or CFO. The challenges of finding a direct relationship between board gender diversity and firm outcomes are explained.

Table of content

1. Introduction 1

1.1 Background information 1

1.1.1 Board of directors. 1
1.1.2 Board gender diversity. 3
1.1.3 Risk-taking. 5

1.2 Research objective and contribution 6
1.3 Outline of the study 7

2. Literature review and hypotheses development 8

2.1 Underlying theories of board diversity 8

2.1.1 The resource dependence and human capital theory. 8
2.1.3 The agency theory. 10
2.1.4 Social identity theory. 10

2.2 Empirical findings impact of board diversity 11

2.2.1 Impact of gender diversity 12
2.2.2 Impact of other forms of board diversity. 13

2.3 Hypotheses development 16

2.3.1 Effect on corporate risk-taking. 16
2.3.2 Moderating effect of female CEO or CFO. 16

3. Method 18

3.1 Methods used in studied articles 18
3.2 Method for testing the hypotheses 21
3.2 Data 23

4. Results 24

4.1 Descriptive statistics 24
4.2 Stock return volatility 28
4.3 ROA volatility 30
4.4 Leverage 31
4.5 Research and development expenditure 32
4.6 Overall results of effect of female board representation 33
4.7 Moderation effect female CEO or CFO 33

5. Conclusion 37

APPENDIX A 40

1. Stock return volatility 40
2. ROA volatility 42
3. Leverage 44
4. R&D expenses 47

6. References 50

1. Introduction

1.1 Background information

The management is responsible for making the decisions in a firm. The decisions they make have an impact on the performance and the riskiness of a firm. Under a perfect capital market, corporate decisions should be based on maximizing the market value. However, in practice, the decision-making process is influenced by different aspects. One being the level of risk the management is willing to take. To mitigate risk-aversion or risk-taking in the decision making, different corporate governance mechanisms are in place. Corporate governance is the system of rules, practices and processes by which a firm is directed and controlled. It is in place to balance the interests of all the stakeholders of a firm, such as management and shareholders, but also customers, suppliers, financiers, the government and the public (Thomsen & Conyon, 2012). It has an influence on the corporate decisions and the risk-taking in making these decisions (Bennouri, Chtioui, Nagati, & Nekhili, 2018). It controls the management when they take too much risk, to protect the customers or employees of a company. But also, when they should take more risk, for the wealth-creation of shareholders (Sila, Gonzalez, & Hagendorff, 2016). The board of directors is one corporate governance mechanism that influences the decision-making of the management, most of all in strategic decisions (Adams, Hermalin, & Weisbach, 2010; Forbes & Milliken, 1999).

1.1.1 Board of directors. The board of directors is in place to give advice on and monitor decisions of major company issues. The board contains internal and external directors, which represent both the management and shareholders' interests. In doing so they have different functions, including: (1) voting on major proposals, (2) hiring and evaluating managers, (3) monitoring managerial activities, and (4) offering expert advice to top managers (Anderson, Reeb, Upadhyay, & Zhao, 2011). In performing these tasks, the board of directors has a major influence on the final corporate decisions. Due to corporate scandals there is a closer scrutiny of board's decisions and the composition of the board (Adams, de Haan, Terjesen, & van Ees, 2015). The powers of the board and the requirements about the composition are determined by laws and rules, which differ per country (Thomsen & Conyon, 2012). For example, the corporate governance code of the Netherlands sets certain best practices for the board. One being that the chair and the non-executive directors should be independent, this means directors from outside the company (*De Nederlandse corporate governance code*, 2016). Also, revised corporate governance codes states reporting of board diversity as a central issue, reflecting that shareholders value companies with a diverse board. For example, the 2014 UK Corporate Governance Code has articulated this as follows:

"*One of the ways in which constructive debate can be encouraged is through having sufficient diversity on the board. This includes, but is not limited to, gender and race. Diverse board composition in these respects is not on its own a guarantee. Diversity is as much about differences of approach and experience, and it is very important in ensuring effective engagement with key stakeholders and in order to deliver the business strategy*." (*The UK corporate governance code* 2014, p. 2)

Diversity is defined as "any significant difference that distinguishes one individual from another" (Kreitz, 2008, p. 102). Examples of aspects where directors can differ are gender, age, race, culture, educational background, expertise, or board experience (illustrated in figure 1). Diversity in age, gender and race are the most significant corporate issues currently facing managers, directors and shareholder, because this issue has taken a high public profile (Carter, Simkins, & Simpson, 2003).

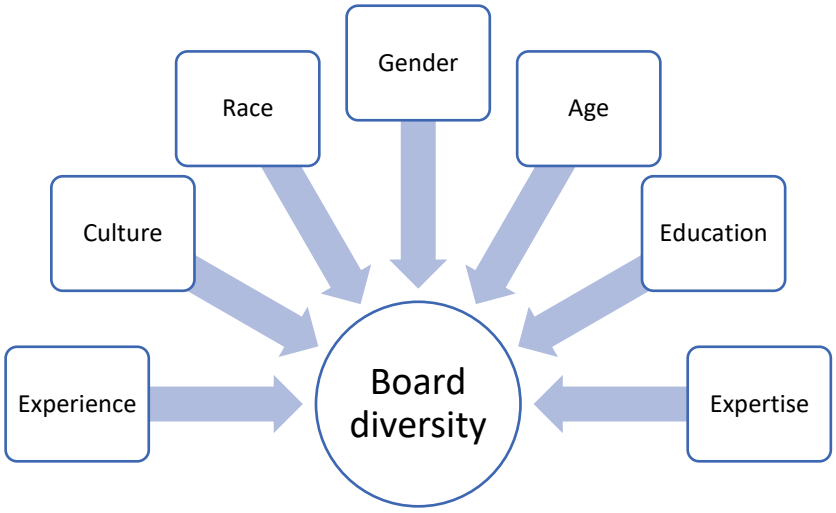

Figure 1. Examples of board diversity

The effects of having a diverse board is a highly researched topic, with divergent results and views. A board of directors is a team working together to decide on major company issues. Social psychology and organizational studies have researched the impact of a diverse team extensively. They see positive and negative effects of having a diversity of perspectives and opinions in a team. The positive side shows that team diversity moderates group decisions (Kogan & Wallach, 1966). A diverse style of decision-making and problem-solving causes a decision to be analysed with different perspectives and the consideration of non-obvious alternatives will be stimulated, making the final decisions of higher quality (McLeod & Lobel, 1992; Williams & O'Reilly, 1998). In homogeneous groups, where preferences, views and

incentives are the same, decisions aren't critically analysed, resulting in more extreme and possibly more risky decisions (Moscovici & Zavalloni, 1969; Sah & Stiglitz, 1986, 1991). However, the negative side says that diversity can also disrupt a team's decision-making process, because multiple opinions may lead to conflicts and a struggle to reach consensus (Arrow, 2012; O'Reilly III, Caldwell, & Barnett, 1989). The costs of communication will increase, and team member turnover will escalate (Arrow, 1998; Lang, 1986; Putnam, 2007). To investigate the effects of diversity within a board of directors this study will focus on gender diversity and its impact on the riskiness of a firm. This because the inclusion of women in the boardroom has become a highly discussed topic in recent years, but the effects of this inclusion remain inconclusive.

1.1.2 Board gender diversity. The main reason to increase the proportion of females in the boardroom is gender equality. Fundamental arguments say that women are equally as capable as men in fulfilling director roles (G. Chen, Crossland, & Huang, 2016). Due to public pressure and/or countries' legislation, firms have increased the proportion of women on their boards. Norway has been the first to implement a quota, stating that the representation of women must be at least 40% among the members of the board of directors (Ahern & Dittmar, 2012). And the European commission is debating a legislation that requires EU public firms to achieve a minimum of 40 percent of female board representation by 2020 or the firms will face heavy sanctions (Ibarra, 2012). Belgium, Italy and France already implemented these binding quotas with sanctions. Germany, Spain and the Netherlands also implemented quotas, but they don't distribute sanctions when the quota isn't met (Smith, 2014). However, increasing the proportion of women on boards can have a major impact on the dynamics and decisions within a board, because differences may exist between men and women in their decision-making processes. Understanding this impact is an important practical matter (G. Chen et al., 2016). It raises questions, for example what is the effect of the increase of women on the decision-making process within a board? Is there a difference between an all-male board or a gender-diverse board in reaching consensus on major corporate decisions?

Gender differences in decision-making has been studied by psychology literature for decades, and they show different behaviours between men and women. In multiple studies men are found to be more confident and take more risk (Byrnes, Miller, & Schafer, 1999; Charness & Gneezy, 2012; Fehr-Duda, De Gennaro, & Schubert, 2006; Hudgens & Fatkin, 1985; Levin, Snyder, & Chapman, 1988; Lundeberg, Fox, & Punćcohaŕ, 1994; Vandegrift & Brown, 2005). Economics studies too show that women are less confident and risk tolerant in making group decisions, investment decisions (retirement or stocks), and they also are less willing to enter a

competition (Arano, Parker, & Terry, 2010; Barber & Odean, 2001; Bernasek & Shwiff, 2001; Croson & Gneezy, 2009; Ertac & Gurdal, 2012; Halko, Kaustia, & Alanko, 2012; Kamas & Preston, 2012; Niederle & Vesterlund, 2007). In an experiment with undergraduates and MBA students a group of three females was less aggressive in its pricing strategy and invested less in research and development compared to groups with less females (Apesteguia, Azmat, & Iriberri, 2012). Other studies try to explain these differences and see biological and environmental influences (A. L. Booth & Nolen, 2012; Edwards & O'Neal, 2009; Sapienza, Zingales, & Maestripieri, 2009). Considering these differences in decision-making behaviour between men and women, increasing the number of female directors could therefore have a major impact on the decision-making process within a board.

Different studies have tried to capture the consequences of adding female directors to a board, but these are not yet well understood (Sila et al., 2016). The focus of the public policy discussion has mostly been on the consequences for firm performance, and there are contrasting views on whether mandatory quotas would be beneficial for firms (Ibarra, 2012; Merchant, 2011). Academic research is inconclusive about the effects on firm performance. Studies show both positive (Carter et al., 2003) and negative (Adams & Ferreira, 2009) effects of female board representation. However, the performance of a firm may not be the right measure to show the effects of board diversity. This because firm performance is often measured with operating performance or market value, but the performance of a firm is realised by the corporate decisions made by the management of a firm. It is possible that firms perform the same but apply different policies. No effects of diversity on firm performance will be found, however the decisions made in the firm could be very different. Focusing on the corporate strategy and policies might therefore give more insights about the impact of board gender diversity on the decision-making process within a firm. Different studies tried to find the answer to the question: does an increase of female board representation affect the decisions made within a firm? One aspect that is investigated is the impact on decisions regarding corporate strategy. For example, Triana, Miller, and Trzebiatowski (2014) investigated the impact of board gender diversity on strategic change in firms, showing that when there is a threat to the firm due to low performance, firms with female directors change their strategy less. S. Nielsen and Huse (2010) found that adding female directors to a board increases involvement in the decisions regarding a firm's strategy. Torchia, Calabrò, and Huse (2011) showed that if there is a critical mass of three female directors or more there is a positive effect on a firm's organisational innovation. Also, firms with female directors tend to focus more on corporate social responsibility and undertake fewer workforce reductions (Matsa & Miller, 2013; Shaukat, Qiu, & Trojanowski, 2016).

Another aspect of a firm's strategy are the financial decisions a management makes and the level of risk they take in making these decisions.

1.1.3 Risk-taking. When making different financial decisions, for example investments, the management of a firm faces different choices, where a choice will mean taking on some level of risk. Risk-taking decisions of the management have an influence on the market value of a firm. The market value is calculated with the expected future cash flows of a firm, where risk is a factor included in discounting these cash flows. Too much risk can have a negative effect on the future cash flows and will probably decrease the market value. Managers should therefore find a balance between getting high returns and benefits for the growth of the company, without destroying the value of the firm. Some examples will be given to show why financing and investment decisions can make a firm riskier:

Leverage. An example of a financing decision is the reliance on debt capital (Faccio, Marchica, & Mura, 2016). High reliance on debt means high risk, because when there is a shock to the turnover of the company, firm's stay obliged to pay off their interest, resulting in it having a greater effect on the profitability of a firm (Sila et al., 2016). The probability of default will be higher than when, for example, shares are issued. With shares it can be decided to pay no dividends and retain the earnings for the business. Having a large amount of debt capital is therefore seen as making a firm riskier.

R&D investments. An example of an investment decision is the investment in research and development (Bhagat & Welch, 1995; Kothari, Laguerre, & Leone, 2002). This can foster a firm's growth when successful, but there is also a high chance of failure, making the rewards highly uncertain (Bernile, Bhagwat, & Yonker, 2018). Thus, higher investments in R&D means higher risk-taking in the firm.

Acquisitions. Another financial corporate decision is acquisitions. An acquisition can offer major economic benefits for a firm, because of the expansion of scale and scope, however the actual returns can vary substantially from deal to deal. Research even suggests that acquisitions are more likely to destroy than enhance the value of the acquiring firm (Chatterjee, 1992; Haleblian, Devers, McNamara, Carpenter, & Davison, 2009; King, Dalton, Daily, & Covin, 2004). Insufficient due diligence or irritational overconfidence of managers about the potential synergies might be an explanation (Hayward & Hambrick, 1997; Puranam, Powell, & Singh, 2006). Also, the manager may benefit greatly from the acquisition in the short term, through status and compensation, but in the long-term the benefits are highly uncertain, and the acquisition may even be harmful (Haleblian et al., 2009). Also, larger acquisitions pose extra challenges in terms of integration (Ellis, Reus, Lamont, & Ranft, 2011), making smaller

acquisitions often more successful (Moeller, Schlingemann, & Stulz, 2004). Thus, executing large acquisitions or a large amount of acquisitions can make a firm riskier.

Dividend pay-out. Another financial corporate decision is the pay-out of dividends. Dividends can have a corporate governance role, because increasing dividends reduces free cash available to managers. However, it also increases transaction costs, because the firm must rely more on expensive external financing (J. Chen, Leung, & Goergen, 2017). On the other hand, to attract these external investors, the firm will be scrutinized by financial analysts, press and institutional investors (Easterbrook, 1984; Rozeff, 1982). Based on this it can be concluded that paying more dividends means less risk, because less free cash is available, and the firm is closely monitored.

1.2 Research objective and contribution

The general view is that having women in a board has an impact on corporate decision-making, because women are more risk averse. Economics and psychology literature show that women have less risk appetite than men (Arano et al., 2010; Charness & Gneezy, 2012), but it is still unclear whether greater female board representation means that firms engage in less risk-taking (Sila et al., 2016). If it is true that firms with more female board representation, take less risk in their corporate decisions this could have major consequences for the competitiveness of firms in their industries. These consequences could be negative, because due to less risk-taking firms may miss out on opportunities. But the consequences could also be positive, because risky strategies are highly scrutinized and will have a better quality. Adams and Ferreira (2009) show that gender diverse boards have tougher monitoring and greater participation of directors in decision making, which may result in better quality decisions. In addition, it is stated that a diversified board means a greater knowledge base, resulting in more creativity and innovation, which leads to a higher competitive advantage of a company (Gul, Hutchinson, & Lai, 2013). The effects of a board gender diversity on decision-making within a firm is therefore a valuable topic to investigate.

Getting a better understanding of the impact of board gender diversity is important for another reason, because different studies show that there is a discrimination against women in the appointment of board positions (Schubert, Brown, Gysler, & Brachinger, 1999). Firms with more variability in their returns or their performance have fewer female directors on their board (de Cabo, Gimeno, & Escot, 2011). This phenomenon is often explained with reference to an argument from Kanter (2008), that group homogeneity (e.g. a male dominated board) is essential in environments with high uncertainty. Also, the probability of the appointment of

female directors is higher in less risky and better performing firms (Farrell & Hersch, 2005). And when risky firms appoint female directors, it is probably to reduce their risk (Martin, Nishikawa, & Williams, 2009). This shows that firms rely on the stereotype of the female risk aversion, even when it is not yet substantiated by academic research. Based on the mentioned assumptions of the risk-aversion of female directors, a small amount of studies tried to find the effects of board gender diversity on the riskiness of a firm, measured by the volatility of returns, but found no effects (Bernile et al., 2018; Sila et al., 2016). Thus, the view that appointing female directors will reduce the riskiness of a firm is also not substantiated. This all shows that there is a necessity of understanding the impact of female directors on corporate risk-taking. Is it true that female directors take less risk in corporate decisions? As the effects on performance are inconclusive, focusing on corporate decisions will help to get an understanding of the effects of increasing female representation in a board of directors. This thesis will therefore focus on risk-taking in corporate financial decisions to contribute to a better understanding of the impact of female directors on corporate risk-taking within a firm. The following research question is investigated:

How does board gender diversity impact a firm's risk-taking in corporate financial decisions?

1.3 Outline of the study

This thesis contains 5 chapters. The second chapter discusses the different theories that explain the impact of board diversity, the empirical evidence of board diversity and eventually it discusses the hypotheses formulated based on this information. The third chapter explains the methodology that will be used to investigate the different hypotheses. The fourth chapter discusses the results and shows if the hypotheses are confirmed based on the analyses. And in the fifth chapter a conclusion will be drawn, together with limitations of the study and implications for further research.

2. Literature review and hypotheses development

2.1 Underlying theories of board diversity

Theories from the finance, economic and psychology literature are used to explain the impact of a gender diverse board on the risk-taking in corporate decision-making.

2.1.1 The resource dependence and human capital theory. The resource dependence theory states that the external resources affect the behaviour of a firm (Pfeffer & Salancik, 2003). Firms operate in an open system and they need to exchange and acquire certain resources to survive. Diversity in the directors of a corporate board can provide beneficial resources, which is argued to be necessary in today's increasingly complex and uncertain environment (Terjesen, Sealy, & Singh, 2009). Four primary resources are suggested: (1) provision of resources such as information and expertise; (2) creation of channels of communication with constituents of importance to the firm; (3) provision of commitments of support from important organizations or groups in the external environment; and (4) creation of legitimacy for the firm in the external environment (Pfeffer & Salancik, 2003). The human capital theory complements the resource dependence theory by focusing on the first mentioned primary resource, by stating that board diversity will result in a wide array of diverse and unique human capital, like a person's education, experience and skills which can be used for the benefits of an organisation (Terjesen et al., 2009). Hillman, Cannella, and Paetzold (2000) made a categorization scheme based on different resource dependence roles, where different types of directors provide beneficial resources. These are insiders and three different types of outsiders: business experts, support specialists, and community influentials. Where business experts are directors that are CEOs or senior managers in large, for-profit firms, who can provide expertise in decision-making, problem solving and competition. Support specialist give access to specialized expertise in law, banking, public relations, or marketing and they provide vital resources such as legal support or financial capital. And community influentials provide non-business perspectives on issues, like ideas on, expertise of and influence on powerful groups in the community. These influentials include politicians, university representatives, members of the clergy and other community or social leaders.

It is argued that the type of director present in a board has an influence on a firm's corporate strategy and visa versa. For example, a study shows that the breadth of human capital in a board has an impact on the strategic change of a firm (Haynes & Hillman, 2010). J. R. Booth and Deli (1999) conclude that a commercial banker present on a board provide expertise on, and links to, the bank debt market, which results in an increase of the total debt of a firm. Agrawal and Knoeber (2001) see that companies that sell to the government or face government

regulation are more likely to have outside directors with political and legal backgrounds present on their board. Carpenter and Westphal (2001) show that the social network ties of directors with a strategic context affects the board monitoring or advice on strategy. And lastly, a meta-analysis finds that the composition of a board influences critical firm decisions (Deutsch, 2005). Thus, to gain valuable resources or reduce dependency, firms can select directors with valuable skills, influence, or connections. This will probably result in a better performing firm, because it is better able to deal with environmental uncertainty and interdependence (Dalton, Daily, Johnson, & Ellstrand, 1999). In addition, a firm's environmental dependencies and resource needs changes constantly, also changing the need for specific types of directors (Hillman et al., 2000).

When board members are selected from a pool of male and female directors, this can give access to a more diverse pool of valuable resources which enables a firm to better understand and adapt to his environmental conditions. However, before being considered for directorship, individuals must possess unique and extensive stocks of human capital which will benefit the firm (Kesner, 1988). Women are mostly considered inadequate for board positions, because they lack the needed human capital (Burke, 2000). But this view is contradicted by studies that show that women have valuable experiences that are different from male directors. For example, women hold significantly more multiple directorships, making them highly experienced as directors, a result of a shortage of supply of qualified female candidates (Farrell & Hersch, 2005). Women are more likely to come form a non-business background, posses advanced degrees, have international experience and have experience as directors on boards of smaller firms (Hillman, Cannella Jr, & Harris, 2002; Singh, Terjesen, & Vinnicombe, 2008). It is also found that women are more likely than men to be community influentials (Hillman, Shropshire, & Cannella Jr, 2007; Singh et al., 2008). And females have different experience sets, beliefs and perspectives than men, resulting in them linking firms to different constituents (Hillman et al., 2007).

Thus, in making corporate decisions female directors can bring different and sometimes conflicting points of view, because they posses different experiences than male directors. Females bring fresh viewpoints and other professional backgrounds to the "old boys club", delivering valuable advice to top managers (Anderson et al., 2011). This often results in more open and thoughtful consideration of divergent views and more complete information processing, which may result in a broader and deeper consideration of strategic choices (Upadhyay & Zeng, 2014; Van Knippenberg, De Dreu, & Homan, 2004). Strategic opportunities and alternatives will be recognized faster, which in turn has an impact on the

perception of and the propensity to the level of risk-taking needed to be successful (March & Shapira, 1987; Wiersema & Bantel, 1992). When a firm has a diversity of capabilities of strategic management present in its board it may result in having to take less risk to create the same optimal performance (Andersen, Denrell, & Bettis, 2007; Khan & Vieito, 2013). Thus, adding female directors to a board may result in having more access to alternative corporate decisions, this may result in more board scrutiny and better-quality decision-making, where less risk-taking is needed to reach the same successful and stable outcomes.

2.1.3 The agency theory. The agency theory describes the relationship between a principal (e.g. shareholder) and the agent of the principal (e.g. directors and managers), where resolving conflicts and aligning interests across these two groups is the major issue (Fama & Jensen, 1983). The theory states that there is a difference in the level of risk taken by managers and wanted by shareholders. The managers have a lower risk-appetite then the shareholders because of the separation of power between the shareholders that own the firm and the managers that control the firm's assets (Jensen & Meckling, 1976). Shareholders will have a high risk-appetite, because they can diversify their investments and want high returns. Managers on the other hand have a lower risk-appetite, because they have their human capital (and often a large proportion of their financial wealth) tied up in the firm (Fama, 1980; Holmström, 1999). On top of that they are also concerned about their reputation and employment (Amihud & Lev, 1981; Eisenhardt, 1989; Jensen & Meckling, 1976). Because of this, they for example undertake investments that reduce firm risk or forego risky positive net present value projects which may reduce the returns for shareholders. Often shareholders want managers to take more risk, to generate high returns. This results in a principal-agent conflict that causes problems in the use of the resources of the firm. The role of the board of directors in an agency framework is to resolve these problems as a mechanism to control and monitor managers (Carter et al., 2003). This is also shown in a study where it is found that CEO power means increased firm risk, because powerful CEOs can make unchecked decisions, which may not be in the interests of the shareholders (Adams, Almeida, & Ferreira, 2005). A diverse board, with different perspectives results in a higher scrutiny of corporate decisions, making it a form of internal governance (Carter et al., 2003). Increased board gender diversity has been shown to enhance monitoring processes, resulting in stronger corporate governance control (Gul, Srinidhi, & Ng, 2011; Melero, 2011). This enhanced monitoring and scrutiny may result in a focus on less extreme and more efficient financial decisions, delivering more stable returns.

2.1.4 Social identity theory. The social identity theory is an established and widely-studied perspective in the social psychology (Tajfel & Turner, 1979). It states that the

interactions and behaviours of individuals are influenced by the different categories to which they belong (Hogg & Reid, 2006; Hogg & Terry, 2000). Individuals categorize themselves in a particular category and are also categorized by others. This process is the strongest when the aspects of an individual are frequently employed, central and valued (Ashforth & Mael, 1989; Yzerbyt & Demoulin, 2010). Gender is, for example, a highly salient category because it is represented cognitively as prototypes. Perceptions of similarities and difference will therefore be maximized (Hogg & Terry, 2000). Through categorization, an ingroup and an outgroup are formed by individuals and they respond differently to the groups. They favour their ingroup and derogate and avoid their outgroup (Hewstone, Rubin, & Willis, 2002; Yzerbyt & Demoulin, 2010). When somebody is categorized in an outgroup by others, and this group is a minority category, they try to avoid confirming negative stereotypes and will be more active in demonstrating their distinctiveness, making them more competitive in the interactions with the ingroup (Branscombe, Schmitt, & Harvey, 1999; Hogg & Reid, 2006). As a consequence, in a board of directors with a minority outgroup, like female directors, the decision-making process will be more thorough, comprehensive and contentious, and less likely to be characterized by groupthink, rapid consensus and acquiescence (Hogg & Terry, 2000). However, it should also be considered that it is possible that minority directors can't influence the group decisions, because of social barriers, and that the differences in a group lowers social cohesion (Westphal & Milton, 2000). In addition, a study shows that if there is high diversity on a board, concerns about the firms' strategy in the light of low firm performance is less often shared with other directors (Westphal & Bednar, 2005). Female directors tend to pursue a path of more prudent risk and are more likely to voice these opinions (because they belong to a minority outgroup) and try to persuade other directors (Perryman, Fernando, & Tripathy, 2016). This may result in the consideration of alternative and less extreme corporate decisions.

2.2 Empirical findings impact of board diversity

When looking at studies that investigated the impact of the board of directors, multiple studies treated the board as a homogeneous group. For example, Cheng (2008) focused on the size of the board, where firms with a smaller board have a higher variance in return on assets or stock returns. Also, Wang (2011) found that firms with smaller boards take lower leverage, but more R&D investments. The studies that treated the board as a heterogeneous group and studied the impact of board diversity on firm outcomes, researched three major firm outcomes: firm performance, firm riskiness and corporate financial decisions. In table 1 an overview of the different studied articles and their findings is given.

2.2.1 Impact of gender diversity

Firm performance. Researchers have tried to capture the impact of gender diversity in measuring the effects on firm performance and found mixed results. Positive effects on Tobin's Q, ROA, ROE and ROS have been found by numerous studies (Bennouri et al., 2018; Campbell & Mínguez-Vera, 2008; Conyon & He, 2017; Dezsö & Ross, 2012; Liu, Wei, & Xie, 2014; Low, Roberts, & Whiting, 2015; Perryman et al., 2016; Smith, Smith, & Verner, 2006). But in some studies it is argued that the gender-performance relationship is impacted by other aspects, like female empowerment in a country (Low et al., 2015), a firm's focus on innovation (Dezsö & Ross, 2012) or a firm's performance (Conyon & He, 2017). However, also negative effects on Tobin's Q and ROA have been found in different studies (Adams & Ferreira, 2009; Ahern & Dittmar, 2012; Bennouri et al., 2018; Bøhren & Strøm, 2010). Different explanations for the negative effects have been given, for example Bennouri et al. (2018) conclude that gender diversity might affect the board's decision-making, which can enhance operational performance, but market investors do not positively perceive board gender diversity. Lastly, no impact of gender diversity on ROI, ROS and Tobin's Q is also seen in different studies (Gregory-Smith, Main, & O'Reilly, 2014; Marinova, Plantenga, & Remery, 2015; Miller & del Carmen Triana, 2009; Rose, 2007). Thus, the effects of gender diversity on firm performance remain inconclusive. This inconclusiveness might be a result of different factors that mediate the diversity-performance relationship, like the influence of the decision-making or the monitoring effectiveness of the board.

Firm riskiness. The impact of gender diversity on firm riskiness is another effect that is investigated by a small amount of studies. Different studies focused on the CEO and found a negative effect of the presence of a female CEO on the volatility of ROA or stock returns (Faccio et al., 2016; Khan & Vieito, 2013). Other studies focused on the executive board and found an negative effect of the increase of female board members on stock return volatility (Baixauli-Soler, Belda-Ruiz, & Sanchez-Marin, 2015; Perryman et al., 2016). Studies that focused on the entire board, meaning executive and non-executive board members, found negative effects, but also no effect of female board members on ROA and stock return volatility (Lenard, Yu, York, & Wu, 2014; Sila et al., 2016). Thus, the effect on firm riskiness seems to be predominately negative.

Corporate financial decisions. The impact of female representation among executive directors has been researched by multiple studies and they found mostly a negative effect on corporate financial decisions. Multiple studies investigated the effect of the presence of a female CEO and they found a negative impact on leverage (Baixauli-Soler et al., 2015; Elsaid & Ursel,

2011; Faccio et al., 2016; Graham, Harvey, & Puri, 2013; Huang & Kisgen, 2013). Negative effects on R&D expenses, cash holdings and acquisitions have been found too (Elsaid & Ursel, 2011; Huang & Kisgen, 2013). Other studies used the total board of directors (executive and non-executive) and found mixed results of female board representation on corporate financial decisions. They found positive effects on R&D expenses, leverage, acquisitions and dividend pay-out (Ahern & Dittmar, 2012; Miller & del Carmen Triana, 2009), negative effects on cash holdings and acquisitions (Ahern & Dittmar, 2012; G. Chen et al., 2016; Levi, Li, & Zhang, 2014), but also no effects on R&D expenses and leverage (Matsa & Miller, 2013; Sila et al., 2016).

2.2.2 Impact of other forms of board diversity. Other forms of diversity in a board, next to gender, that are mostly investigated in finance and economics studies are culture, ethnicity, age, education and experience (Johnson, Schnatterly, & Hill, 2013; Terjesen et al., 2009). Their impact on firm performance and corporate financial decisions has been studied by multiple studies, with mixed results.

Firm performance. In investigating the effects on firm performance different effects have been found. First negative effects of the diversity in age, culture or profession of directors on ROA and Tobin's Q (Frijns, Dodd, & Cimerova, 2016; Kim & Lim, 2010; Masulis, Wang, & Xie, 2012; Richard & Shelor, 2002). In some studies it is argued that other factors influence this relationship, for example Frijns et al. (2016) argue that the complexity or the size of the firm influences the relationship. Secondly, positive effects of diversity of directors' age, ethnicity, education, profession and experience on Tobin's Q and ROA have been found (Anderson et al., 2011; Carter et al., 2003; Erhardt, Werbel, & Shrader, 2003; Miller & del Carmen Triana, 2009; B. B. Nielsen & Nielsen, 2013; Oxelheim & Randøy, 2003). Also these studies report the impact of other factors, like longer tenured boards, highly internationalized firms, munificent environments, a firm's R&D expenses and a firm's reputation (Miller & del Carmen Triana, 2009; B. B. Nielsen & Nielsen, 2013). Lastly, no effects of ethnic, education and cultural diversity on ROA and Tobin's Q have been seen too (Carter, D'Souza, Simkins, & Simpson, 2010; Rose, 2007).

Firm riskiness. Only one study has been found that investigated the impact of board diversity on firm riskiness. Bernile et al. (2018) calculated a diversity index with gender, age, ethnicity, bachelor's degree, financial expertise and busyness in US firms and found a negative effect on stock return volatility.

Corporate financial decisions. The impact of diversity of the board of directors on corporate financial decisions has been investigated less. Positive effects of directors' education,

experience, culture, profession on R&D expenditure, acquisitions, leverage have been found (Dalziel, Gentry, & Bowerman, 2011; Masulis et al., 2012; Minton, Taillard, & Williamson, 2014), also negative effects of age, ethnicity, education, expertise and experience on external financing, leverage and acquisitions have been found too (Bernile et al., 2018; Güner, Malmendier, & Tate, 2008).

Table 1. Overview studied articles

Authors	**Relation**	**Underlying theory**
Board gender diversity and performance		
Low et al. (2015)	+ ROE	RD; A
Dezsö and Ross (2012)	+ Q	HC; SI; GB
Liu et al. (2014)	+ ROS; ROA	RD; A
Smith et al. (2006)	+ ROS; ROA	HC; RD
Campbell and Mínguez-Vera (2008)	+ Q	RD; HC; A
Perryman et al. (2016)	+ Q	RD; HC
Conyon and He (2017)	+ Q; ROA	RD; HC
Adams and Ferreira (2009)	- Q	HC; SI
Ahern and Dittmar (2012)	- Q	A
Bøhren and Staubo (2016)	- ROA	RD; A
Bennouri et al. (2018)	+ ROA; ROE - Q	RD; HC; A; GB
Miller and del Carmen Triana (2009)	*No* ROI; ROS	RD; HC
Rose (2007)	*No* Q	RD; HC; A
Gregory-Smith et al. (2014)	*No* ROA; ROE; Q	HC
Marinova et al. (2015)	*No* Q	A; RD; HC
Female CEO and riskiness		
Faccio et al. (2016)	- ROA	A; GB
Khan and Vieito (2013)	- SR	GB
Executive board diversity and riskiness		
Baixauli-Soler et al. (2015)	- SR	A; GB
Perryman et al. (2016)	- SR	RD; HC
Board gender diversity and riskiness		
Lenard et al. (2014)	- SR	RD
Sila et al. (2016)	*No* SR; ROA	A; GB
Female CEO and corporate financial decisions		
Elsaid and Ursel (2011)	- Lev; R&D; Cash	GB
Faccio et al. (2016)	- Lev	A; GB
Graham et al. (2013)	- Lev	None
Huang and Kisgen (2013)	- Acq; Lev	None
Executive board diversity and corporate financial decisions		
Baixauli-Soler et al. (2015)	- Lev	A; GB
Perryman et al. (2016)	- Lev	RD; HC
Miller and del Carmen Triana (2009)	+ R&D	RD; HC
Board gender diversity and corporate financial decisions		
Ahern and Dittmar (2012)	+ Lev; Acq - Cash	A
Levi et al. (2014)	- Acq	GB
G. Chen et al. (2016)	- Acq	SI
J. Chen et al. (2017)	+ Div	RD; HC; A
Sila et al. (2016)	*No* R&D; Lev	A; GB
Matsa and Miller (2013)	*No* Lev	GB

Other diversity and performance		
Richard and Shelor (2002)	Age - ROA	HC; SI
Masulis et al. (2012)	Ethnicity – ROA; Q	RD
Frijns et al. (2016)	Culture – Q; ROA	RD; HC; SI
Kim and Lim (2010)	Profession - Q	RD; HC; A
	Experience + Q	
	Age + Q	
	Education + Q	
Anderson et al. (2011)	Social + Q	RD; HC; A
	Occupational + Q	
Oxelheim and Randøy (2003)	Ethnicity + Q	RD
B. B. Nielsen and Nielsen (2013)	Ethnicity + ROA	HC; SI
Erhardt et al. (2003)	Gender + ROA	HC
	Ethnicity + ROI; ROA	
Carter et al. (2003)	Gender + ROI; ROA	RD; HC; A
	Ethnicity + Q	
Miller and del Carmen Triana (2009)	Ethnicity + ROS; ROI	RD; HC
Carter et al. (2010)	Gender *No* ROA; Q	RD; HC; A; SI
	Ethnicity *No* ROA; Q	
Rose (2007)	Education *No* Q	RD; HC; A
	Ethnicity *No* Q	
Other diversity and firm riskiness		
Bernile et al. (2018)	Gender - SR	HC
	Age - SR	
	Ethnicity - SR	
	Degree - SR	
	Fin expertise - SR	
	Busyness - SR	
Other diversity and corporate financial decisions		
Dalziel et al. (2011)	Experience -/+ R&D	RD; A
	Education -/+ R&D	
Masulis et al. (2012)	Ethnicity + Acq	RD
Minton et al. (2014)	Expertise + Lev	RD
Güner et al. (2008)	Expertise – Inv; Acq	A
	Expertise + Fund; Bond	
Bernile et al. (2018)	Gender – Lev; + R&D	HC
	Age - Lev; + R&D	
	Ethnicity – Lev; + R&D	
	Degree - Lev; + R&D	
	Fin expertise – Lev; + R&D	
	Busyness – Lev; + R&D	

This table shows and overview of the positive (+), negative (-) and no (No) effects that where found in the different studied articles. Firm performance is measured with return on assets (ROA), Tobin's Q (Q), return on sales (ROS), return on investments (ROI) and return on equity (ROE). Firm riskiness is measured by volatility of ROA (ROA) and volatility of stock returns (SR). The corporate financial decisions that are measured are leverage (Lev), R&D expenses (R&D), cash holdings (Cash), acquisitions (Acq), dividend pay-out (Div), investments (Inv), external funding (Fund) and bond issues (Bond). The underlying theories that the different studies used to explain the relationship are: resource dependence theory (RD), Agency theory (A), Human Capital theory (HC), Social Identity theory (SI) and gender-based differences (GB).

2.3 Hypotheses development

2.3.1 Effect on corporate risk-taking. According to the resource dependence theory female directors can add valuable resources to a board. The human capital theory also states that females bring unique traits and perspectives to a board, which may be different from male directors. Having male and female directors present in a board therefore enhances the consideration of alternative decisions and the adaptation to a firm's environment, which will have a positive impact on the quality of the decision-making process. Following the agency theory, a gender diverse board enhances monitoring and scrutiny of corporate decisions, which will result in stronger corporate governance control and efficient and less extreme corporate decisions. In addition, the social identity theory states that women categorize themselves and are categorized by others in a certain 'female' category and this influences their behaviour and the interactions within a board. Female directors will be more competitive in their interactions with male directors, because they try to highlight their distinctiveness and opinions. They will probably more often point out the alternatives of financial decisions, decisions that wouldn't be considered in an all male board. Thus, following the theories it is argued that boards with female representation will show better quality decision-making, resulting in having to take less risk to get the same successful outcomes and making the returns more stable. In addition, when the proportion of women in a board of directors increases, their impact and influence on the decision-making will also increase. This results in the hypothesis 1:

Board of directors consisting a higher proportion of female directors will show less risk-taking in corporate financial decisions.

2.3.2 Moderating effect of female CEO or CFO. The board of directors is a corporate governance mechanism that advices and monitors the management, but the management has the final say in corporate decisions. As discussed previously, multiple studies have found a negative effect of female top managers on the riskiness of financial corporate decisions (Elsaid & Ursel, 2011; Faccio et al., 2016; Graham et al., 2013; Huang & Kisgen, 2013; Khan & Vieito, 2013). However, according to the investigation of this thesis this is not yet investigated in combination with the presence of other female directors. When following the social identity theory, in a male dominated environment of a firm, a female CEO or CFO will probably be more sensitive for the divergent views and alternatives highlighted by female directors, because they belong to the same minority group. On the other hand, the impact of female directors on the final corporate decisions will be lower if there is a male CEO or CFO. A positive effect of

the presence of a female CEO or CFO on the relation between female board representation and risk-taking in corporate financial decisions is therefore expected, this results in hypothesis 2:

The effect of female board representation on corporate risk-taking will be strengthened by the presence of a female CEO or CFO.

3. Method

The studied articles used different methods when investigating the impact of board diversity on firm performance, riskiness or corporate financial decisions. The methods are ordinary least squares (OLS) regression, fixed effects (FE) regression, two stage least squares (2SLS) regression, dynamic panel system generalized method of moments (DPS-GMM) regression and propensity score matching.

3.1 Methods used in studied articles

OLS regression. A research method that is often used in studying board diversity effects on risky corporate decisions is the ordinary least square (OLS) regression (Ahern & Dittmar, 2012; Bennouri et al., 2018; Lenard et al., 2014; Sila et al., 2016). This method makes it possible to determine the relationship between one or more independent variables and one dependent variable. These variables should be metric or should be made metric with dummy variables. With this method it is possible to indicate if the proportion of women on a board of directors can predict the level of risk-taking in corporate decisions. In this model control variables can be included, meaning other variables may also have an impact on risky corporate decisions, like the complexity of the firm or investment opportunities. Based on previous research and literature different variables can be included in the model to control for their influence. This is illustrated in the following model:

$$Risk_{it} = \alpha + \beta_1(Female)_{it} + \beta_2(Control\ variables)_{it} + \varepsilon_{it}$$

However, multiple studies argue that there could be an endogenous relationship between female boardroom representation and firm risk and the OLS method doesn't account for this endogeneity (Baixauli-Soler et al., 2015; Sila et al., 2016). In the literature the consensus is that board characteristics are not exogeneous random variables. Instead, it is a choice firms make to meet the needs of their operating and information environments and the needs of various stakeholders. For example, board characteristics are influenced by the scope and complexity of the firm or the level of information asymmetry between insiders and outsiders (Adams & Ferreira, 2007; Coles, Daniel, & Naveen, 2008; Fama & Jensen, 1983; Harris & Raviv, 2006; Linck, Netter, & Yang, 2008). The gender-risk relationship may therefore be influenced by board and firm characteristics and other unobserved factors. To account for this endogeneity issue, other methods are considered like FE regression or 2SLS regression.

FE regression. In finance literature it is common to have a panel data set, which means a data set that contains observations on multiple firms in multiple years. However, when doing the OLS regression the residuals can be correlated across observations, because of changes that

happened within a firm or within a year. This makes the standard errors biased and this will either result in the over- or underestimation of the true variability of the coefficient estimates. In other words, outcomes of risky decisions can be a result of the variability in a firm or a year and not because of female board representation. To account for this problem firm and year fixed effects are often included in the regression model (Adams & Ferreira, 2009; Bennouri et al., 2018; Bernile et al., 2018; Faccio et al., 2016; Levi et al., 2014; Sila et al., 2016). This is illustrated in the following model:

$$Risk_{it} = \alpha + \beta_1 (Female)_{it} + \beta_2 (Control\ variables)_{it} + \beta_3 (Firm)_i + \beta_4 (Year)_t + \varepsilon_{it}$$

2SLS regression. Another method to account for endogeneity is the two stage least-squares (2SLS) regression (Adams & Ferreira, 2009; Ahern & Dittmar, 2012; Baixauli-Soler et al., 2015; Bernile et al., 2018; G. Chen et al., 2016; Faccio et al., 2016; Levi et al., 2014). This is an extension of the OLS method and is very useful when there is an endogeneity problem in the used model, meaning that the independent variable is correlated with the error term. Put differently, there are unobserved determinants of risky decisions that might be correlated with how many women are present in a board. For example, firms who operate in a high-risk market, who must make more risky corporate decisions, might appoint fewer female directors. This means that the beta estimated in the OLS regression is biased. The 2SLS method uses a predictor (the instrument variable) of the independent variable which is not correlated with the dependent variable. It works in two stages: in the first stage a new variable for female board representation is created using the instrument variable Z:

$$Female = \gamma_0 + \gamma_1 Z + \gamma_2 control\ variables + u$$

Creating an unbiased estimate of female board representation, which is uncorrelated with the error term in the first model: In the second stage the model-estimated values from stage one is then used in place of the actual values of the independent variable to compute an OLS model:

$$Risk_{it} = \alpha + \beta_1 (\widehat{Female})_{it} + \beta_2 (Control\ variables)_{it} + \beta_3 (Year)_i + \beta_4 (Industry)_t + \varepsilon_{it}$$

Different instrument variables that should have an impact on female board representation are used in studies, mostly specific for a country the study is conducted. For example, Ahern and Dittmar (2012) used female board representation pre-quota in Norway. Baixauli-Soler et al. (2015) used scores of gender equality status of 50 US states. G. Chen et al. (2016) used the female labour force participation rate, calculated at the US county level. An instrument that is often used by gender diversity studies is the fraction of male board members who serve on other boards with female board members (Adams & Ferreira, 2009; Faccio et al.,

2016; Levi et al., 2014). The absence of women on boards is often attributed to their lack of connections. Board of directors are linked through informal social networks, which consists primarily of men. Thus, when men are more connected to women, it is more likely that they propose a woman for a board position (Adams & Ferreira, 2009). However, it is also stated that in the context of governance, it is often difficult to come up with a valid instrument, because the factors that are arguably most correlated with the endogenous variable are other governance characteristics that should be included in the regression, such as board size, independence etc. (Adams & Ferreira, 2009).

DPS-GMM regression. Another method that is proposed by different studies to mitigate the different endogeneity concerns is the system GMM method. This approach allows the relation between female board representation and risk to be estimated in levels and first differences simultaneously. The level equation presents risk as a function of its past values, observable firm characteristics and the error term including a fixed effect component. The difference equation presents year-to-year differences in the level equation. This method is used by Sila et al. (2016) and Baixauli-Soler et al. (2015) to measure the relation between board gender diversity and firm risk, but also by Bennouri et al. (2018) and Gregory-Smith et al. (2014) to find the effects on performance. By estimating these equations like this, it controls for heterogeneous endogeneity and the dynamic structure of the relationship between risk and board gender diversity, however it is also a very complex method to use.

Propensity score matching. Another method which is used to isolate the impact of gender diversity on specific corporate outcomes is comparing different groups, which can be done with propensity score matching. This is for example used by Matsa and Miller (2013), they matched listed companies in Norway with unlisted companies in Norway and listed and unlisted companies in other countries. They measured different corporate strategies, to see if there is a change between the companies after the implementation of the gender quota. Huang and Kisgen (2013) match firms with a female executive and a male executive to see if there are differences in corporate decisions. Faccio et al. (2016) matched firms with female and male CEOs and measure if there is a significant difference in mean leverage and deviation of ROA. J. Chen et al. (2017) matched firms with female directors and only male directors and compared them on dividend pay-out.

An extension of the propensity score matching is the difference-in-difference (DID) method. The DID method compares the outcomes of two (matched) groups, with and without a treatment, but that would otherwise be subject to similar influence from trending variables. The treatment in diversity studies is often a transition from male-to-female executives or

directors that is compared with a group that had a male-to-male transition. Differences before and after the transitions are measured and the difference between the two groups are measured, hence the difference-in-difference. This is used by different studies, Huang and Kisgen (2013) measured a difference in corporate decisions three years before and after the transition from a male to a female CEO or CFO. Faccio et al. (2016) matched firms that made a transition from male to female and match them with firms that are led by a male CEO the whole time. And lastly, J. Chen et al. (2017) compare firms around the appointment of female directors and matched firms that appointed male directors. This method allows to identify a 'treatment' and a 'control' sample of firms that exhibit no observable differences in characteristics, except for the characteristic that is investigated.

3.2 Method for testing the hypotheses

To test hypothesis 1, OLS regression will be used to test the effects of board gender diversity on multiple measures of firm risk-taking. The following models will be analysed:

$$Risk\ taking_{it} = \alpha + \beta_1(GDiversity)_{it} + \beta_2(Control\ variables)_{it} + \varepsilon_{it}$$

Where the different dependent variable will be risk-taking of firm i in year t, measured by volatility of stock returns (SDS) and ROA (SDR). And risky corporate decisions, measured by leverage (LEV) and R&D expenditure (R&D). Different independent variables will be used to measure the board gender diversity of firm i in year t (GDiversity). The first independent variable will be a measure of the number of female board members on the board divided by total board members (TFD). The second will be a measure of the number of supervisory female directors divided by total board members (SFD). Also, two dummy variables will be used to measure female board representation, one which has a value of one if at least one female director is on the board (GD1) and one that will have a value of one when at least three females will be on the board (GD3). The value of three is chosen because of the critical mass theory mentioned by different studies, where the effect of female board membership will become significant when they are present with at least three females (Bennouri et al., 2018; Schwartz-Ziv, 2017; Torchia et al., 2011). Based on the studied articles, multiple control variables of firm i in year t will be included. First board and CEO characteristics: board size, a large board can lead to compromises and moderated decisions and may result in less risky outcomes (Sah & Stiglitz, 1986, 1991); board independence (IND), because if independent directors are present this can lead to a more shareholder focused board, which can lead to higher risk-taking (Fama & Jensen, 1983). Second, investment and growth opportunities, because when firms have more opportunities, they may take more risk (Guay, 1999). These are measured by sales growth

(SGR) and ROA. And lastly, firm characteristics, because the scope of a firm may have an impact on the level of risk that is taken by a firm. Measured by firm size (FSIZE), firm age (AGE), tangibility (TAN) and past ROA volatility (PRISK). The definitions of the different variables can be found in table 2. To test hypothesis 2 an interaction term between gender diversity (TFD) and gender of the CEO or CFO (FCEFO) is included in the regression.

$$Risk\ taking_{it} = \alpha + \beta_1 (GDiversity)_{it} + \beta_2 (FCFEO)_{it} + \beta_3 (Control\ variables)_{it} + \beta_4 (FCEFO \times TFD)_{it} + \varepsilon_{it}$$

Table 2. Variable definition

Variable	Code	Definition
Risk-taking		
Stock return variability	SDS	Square root of 12 times the standard deviation of monthly stock returns in year t
ROA variability	SDR	Standard deviation of annual ROA following year t. Only measured for year 2013 (2013-2017) and 2014 (2014-2017)
Leverage	LEV	Long-term debt plus short-term debt divided by total assets
R&D expenses	R&D	Research and development expenditure divided by total assets
Gender diversity		
Female board representation	TFD	Number of female directors on the board divided by the number of total directors
Supervisory female board representation	SFD	Number of supervisory female directors on the board divided by the total number of directors
At least 1 female director	GD1	Dummy code 1 when there is at least one female director on the board
At least 3 female directors	GD3	Dummy code 1 when there are at least three female directors on the board
Female CEO or CFO	FCFEO	Dummy code 1 if CEO and/or CFO is a female and 0 otherwise.
Control variables		
Board size	BSIZE	Number of directors on a board.
Independent directors	IND	Number of independent directors divided by total number of directors.
Firm size	FSIZE	The book value of total assets in millions of £.
Firm age	AGE	Number of years since incorporation
Tangibility	TAN	Fixed assets divided by total assets
Past ROA volatility	PRISK	Standard deviation of ROA of the past 5 years of year t
Sales growth	SGR	The ratio of sales in the current year to sales in the last year minus one
Return on assets	ROA	Earnings before interest and taxes divided by total assets

3.2 Data

In this research data is gathered from FTSE 350 firms which are listed on the London stock exchange. Most gender diversity studies are conducted in the US, but there is a very different institutional environment in the UK. There is a comply-or-explain system of corporate governance, also staggered board and dual class shareholdings are avoided. Which results in a more robust market for corporate control (Gregory-Smith et al., 2014). In addition, the representation of women on boards is a highly salient policy issue in the UK. According to the European commission, in 2016 the proportion of women in boards in the UK is increased to 27%. The information about the board of directors is gathered from the BoardEx database and the financial information is gathered form the Orbis database. When there is missing information, it is searched for in the annual reports. One selection criterion for the firms is that they should be in the FTSE 350 in every year from 2013 to 2017. Secondly, financial services and utility firms are excluded from the sample¸ because these are regulated industries, making their corporate decisions different from other firms (Bernile et al., 2018; Perryman et al., 2016; Sila et al., 2016). Lastly, firms that have missing or inconsistent board member information or financial data, were also excluded from the sample. This selection of firms resulted in a total of 164 firms that will be used for this study observed over 5 years. In table 3 the distribution of firms per industry is displayed.

Table 3. Industry classification

NACE main industry	**Number of firms**	**Percentage**
Manufacturing	56	34.15
Wholesale and retail trade	21	12.8
Information and communication	17	10.37
Real estate activities	13	7.93
Administrative and support service activities	12	7.32
Mining and quarrying	11	6.71
Construction	8	4.88
Other	26	15.85
	164	100

4. Results

4.1 Descriptive statistics

In table 4 the descriptive statistics of the variables used in this study are presented. These include the number of observations (N), the minimum (min), the first quartile (Q1), the mean, the median, the third quartile (Q3), the maximum (max) and the standard deviation (SD). Looking at the variability of stock returns (SDS) the mean is 0.239 and the SD is 0.116. This is lower compared to studies from Sila et al. (2016), who found 0.451 and 0.214 respectively and Bernile et al. (2018) who found 0.391 and 0.233. The mean variability of ROA is 0.027, this is also lower compared to Sila et al. (2016) who found 0.055 and Faccio et al. (2016) who found 0.048. The firms have a mean leverage (LEV) of 22.5 percent of their assets, with a maximum of 88 percent, but there also firms with no debt. The mean R&D expenses (R&D) are 1.2 percent of the firm's assets, with more than half of the firms having no R&D expenses. Probably a result of the industries included in the sample, for example real estate and administrative firms do not incur research and development expenses.

The mean female board representation (TFD) is 21.3 percent. This is higher than found in other studies, Sila et al. (2016) found 9.6 percent and G. Chen et al. (2016) found 10 percent. The mean percentage of supervisory female board representation (SFD) is 19.5 percent, showing that the representation of female directors is mostly found within the supervisory directors, executive directors remain mostly male. Female CEOs and CFOs (FCEFO) are also shown to be very scarce, with no females in the first three quartiles. Most firms have at least one female director (GD1), however less than half have more than three female directors (GD3). The average board size (BSIZE) in these firms is 9 directors, with a minimum of 4 and a maximum of 17. The average firm in this sample has a size of 10.7 million pounds in assets (FSIZE) and is incorporated for 48 years (AGE), 6,3 percent of its assets are fixed (TAN), the last 5 years it had a ROA variability of 0.029 (PRISK), its sales grew with 6.9 percent (SGR) and it had a return on assets of 9.3 percent (ROA).

Table 4. Descriptive statistics

Variable	N	Mean	Min	Q1	Median	Q3	Max	SD
Risk-taking								
SDS	813	0.239	0.069	0.173	0.215	0.273	1.573	0.116
SDR	492	0.027	0	0.009	0.017	0.033	0.252	0.031
LEV	820	0.225	0	0.120	0.224	0.307	0.880	0.152
R&D	820	0.012	0	0	0	0.005	0.413	0.036
Gender diversity								
TFD	820	0.213	0	0.14	0.22	0.27	0.5	0.094
SFD	820	0.195	0	0.13	0.20	0.25	0.5	0.087
GD1	820	0.96	0	1	1	1	1	0.194
GD3	820	0.27	0	0	0	1	1	0.446
FCEFO	744	0.124	0	0	0	0	1	0.330
Control variables								
BSIZE	820	9.16	4	8	9	10	17	2.024
IND	820	0.629	0	0.56	0.63	0.71	0.93	0.121
FSIZE (£ mil)	820	10.794	.39	1.107	2.476	5.946	334.315	30.061
AGE	820	48.58	2	17	30	72.75	275	44.15
TAN	820	0.629	0.010	0.509	0.656	0.792	0.990	0.225
PRISK	812	0.029	0.001	0.012	0.022	0.036	0.264	0.029
SGR	820	0.069	-0.873	-0.011	0.060	0.137	1.148	0,169
ROA	820	0.093	-0.578	0.050	0.081	0.129	0.425	0.093

Table 5 shows the correlation coefficients of the different variables. There are multiple significant correlations. When looking at the independent variable female representation in the total board of directors (TFD) is has a significant correlation with two independent variables. First, a negative correlation with stock return volatility, meaning firms with a lower proportion of female directors in their board have more stable stock returns. Second a negative correlation with leverage, meaning firms with higher proportion of female directors have a lower ratio of debt to total assets. Also, multiple control variables are significantly correlated with TFD. Board and firm characteristics seem to have an impact on the number of females in a board.

When looking at the dependent variables, stock return volatility is significantly correlated with board size and firm age. Also, different financial characteristics seem to have an impact. A firms' tangibility (TAN) and return on assets (ROA) are negatively correlated,

thus higher tangibility and return on assets means more stable stock returns. Past risk (PRISK) is positively correlated, meaning that if in the past 5 years the ROA was stable, stock return in the following year will also be more stable. The second dependent variable, ROA volatility is only positively correlated with past risk is, this was expected, because in most firms past ROA volatility will probably be much the same as the future volatility.

The third dependent variable, leverage, is positively correlated with board size, firm size and tangibility. Thus, bigger firms, firms with bigger boards or firms with more fixed assets issue more debt. Different financial characteristics are negatively correlated with leverage: sales growth and ROA. This seems logical, because when a firm's sales are growing, or its ROA is high it can generate enough income and will probably issue less debt. Firm age is also negatively correlated, thus longer incorporated firms issue less debt. The fourth dependent variable, R&D expenses, is negatively correlated with firm size and age, thus bigger or longer incorporated firms seem to spend less on R&D. And of the financial characteristics, past risk is positively correlated, thus when return on assets are more volatile in the past, firms spend more on R&D. Looking at the control variables, multiple variables are correlated with each other, where board size and firm size are highly correlated with the most variables, thus they seem to have a high impact when included in a regression model. The different correlation will be considered when executing the different regression models.

Table 5. Correlation matrix

Variables	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1. TFD												
2. SDS	-0.087*											
3. SDR	-0.073											
4. LEV	0.099**	-0.058	0.066									
5. R&D	0.014	-0.020	0.067	-0.152**								
6. BSIZE	0.173**	-0.121**	0.038	0.219**	-0.062							
7. IND	0.250**	0.005	0.083	0.019	0.041	0.185**						
8. AGE	0.135**	-0.188**	-0.081	-0.096**	-0.186**	0.028	0.035					
9. FSIZE	0.256**	-0.061	0.009	0.232**	-0.081*	0.575**	0.426**	0.157**				
10. TAN	0.020	-0.072*	-0.048	0.211**	0.023	0.105**	0.076*	-0.043	0.080*			
11. PRISK	-0.015	0.168**	0.371**	-0.032	0.176**	-0.003	0.081*	-0.087*	-0.006	0.016		
12. SGR	-0.018	0.040	-0.080	-0.103**	-0.005	-0.114**	-0.104**	-0.078*	-0.072*	-0.033	-0.044	
13. ROA	0.007	-0.144**	-0.041	-0.230**	0.012	-0.140**	-0.139**	-0.039	-0.356**	-0.057	-0.100**	0.088*

4.2 Stock return volatility

Table 6 displays the results of the OLS regression with independent variable female board representation (TFD) and dependent variable stock return volatility (SDS). In model 1 only TFD is included in the model. A significant negative effect of TFD on SDS is found, thus when the proportion of women in a board of directors is higher the stock return volatility is lower. In model 2, two financial characteristics of a firm are included which may have an impact on a firm's risk-taking: tangibility (TAN) and return on assets (ROA). In previous research they both showed to have a significant impact on stock return volatility (Bernile et al., 2018; Lenard et al., 2014; Sila et al., 2016). They both have a significant negative impact on stock return volatility. With the inclusion of these variables the effect of TFD remains significantly negative. In models 3 and 4 the control variables firm size (FSIZE) and firm age (AGE) are included, In previous research they both showed to have a significant impact on stock return volatility (Bernile et al., 2018; Sila et al., 2016). The effect of TFD becomes insignificant when these variables are included. This may indicate that the stock return volatility is mostly impacted by the size of the board or the age of the firm and not on how many women are present in the board of directors. In models 5 and 6 the different control variables are all included together and the effect of TFD on SDS remains insignificant. FSIZE, AGE and ROA remain to have a significant negative effect on SDS. Based on this analysis it can be concluded that when control variables are included TFD doesn't have a significant effect.

For robustness, extra analyses have been executed. First other control variables are included, due to multicollinearity they are included in separate models. Other analyses included the lagged variable of SDS, used a sample of firms with assets larger than 1 million £ and used a sample of manufacturing and trade firms. Results that are different from the first analysis are discussed in this section, the other results are displayed in appendix A. In addition, all the analyses are executed using the different measures of female board representation (GD1, GD3 and SFD), when the effects hold these analyses are not presented. Table 7 displays the results of the regression using the sample of firms with assets larger than 1 million £. TFD remains significantly negative when firm age is included, however when firm size is included TFD becomes insignificant. Table 8 displays the regression of TFD on SDS using the sample of manufacturing and trade firms, here the effect of TFD on SDS remains significantly negative in all the different models. Saying that when the proportion of females on a board increases in this sample, stock return volatility decreases. However, when different measures of female board representation are included in the models, only GD3 holds with one exception (see

appendix A), showing that the threshold of 3 female directors may apply to this case. However, further research is needed to confirm this.

Table 6. Female board representation (TFD) and stock return volatility (SDS)

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
TFD	-0.077**	-0.077**	-0.022	-0.054	-0.053	0.016
	(-2.156)	(-2.167)	(-0.598)	(-1.519)	(-1.507)	(0.433)
FSIZE			-0.167***			-0.218***
			(-4.539)			(-5.665)
AGE				-0.191***	-0.199***	-0.179***
				(-5.254)	(-5.487)	(-5.009)
TAN		-0.076*			-0.055	-0.033
		(-1.938)			(-1.416)	(-0.866)
ROA		-0.110***			-0.128***	-0.198***
		(-3.303)			(-3.882)	(-5.721)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	813	813	813	813	813	813
Adj. R-squared	0.124	0.138	0.145	0.153	0.169	0.200

Table 7. Female board representation (TFD) and stock return volatility (SDS) using firms with assets larger than 1 mln £

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
TFD	-0.088**	-0.089**	-0.034	-0.069*	-0.070*	0.007
	(-2.272)	(-2.314)	(-0.821)	(-1.769)	(-1.813)	(0.182)
FSIZE			-0.150***			-0.221***
			(-3.702)			(-5.189)
AGE				-0.153***	-0.155***	-0.143***
				(-3.861)	(-3.947)	(-3.696)
TAN		-0.069			-0.050	-0.022
		(-1.567)			(-1.140)	(-0.506)
ROA		-0.130***			-0.137***	-0.209***
		(-3.611)			(-3.852)	(-5.571)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	634	634	634	634	634	634
Adj. R-squared	0.210	0.227	0.226	0.227	0.269	0.276

Table 8. Female board representation (TFD) and stock return volatility (SDS) using manufacturing and trade firms

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
TFD	-0.197***	-0.181***	-0.136**	-0.184***	-0.176***	-0.096*
	(-3.703)	(-3.418)	(-2.440)	(-3.637)	(-3.514)	(-1.833)
FSIZE			-0.171***			-0.223***
			(-3.276)			(-4.142)
AGE				-0.310***	-0.337***	-0.313***
				(-6.594)	(-6.942)	(-6.528)
TAN		-0.102**			-0.015	0.000
		(-2.048)			(-0.307)	(-0.004)
ROA		-0.140***			-0.184***	-0.267***
		(-2.808)			(-3.891)	(-5.288)
Industry dummy	No	No	No	No	No	No
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	378	378	378	378	378	378
Adj. R-squared	0.075	0.096	0.099	0.170	0.198	0.232

4.3 ROA volatility

Table 9 displays the result of the OLS regression with independent variable female board representation (TFD) and dependent variable ROA volatility (SDR). The control variables that are included are based on Faccio et al. (2016) and Sila et al. (2016), who showed an impact of firm size, firm age, tangibility and return on assets. There is no significant effect found of TFD on SDR in all the different models. For robustness the extra analysis described in section 4.2 are executed. Only excluding the analysis with the lagged variable, because SDR is measured over the years following year t. Results that are different from the first analysis are discussed in this section, the other results can be found in appendix A. Table 10 displays the results of the regression of TFD on SDR using the sample of manufacturing and trade firms. Here the effect of female board representation on ROA volatility remains significantly negative in all the different models, meaning that when the proportion of females on a board increases in this sample ROA volatility decreases. However, this effect doesn't hold when different measures of female board representation are included (see appendix A).

Table 9. Female board representation (TFD) and ROA volatility (SDR)

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
TFD	-0.029	-0.030	-0.031	-0.023	-0.024	-0.008
	(-0.615)	(-0.640)	(-0.667)	(-0.489)	(-0.521)	(-0.159)
FSIZE			0.037			-0.051
			(0.814)			(-0.938)
AGE				-0.059	-0.057	-0.052
				(-1.204)	(-1.156)	(-1.045)
TAN		-0.071			-0.066	-0.061
		(-1.353)			(-1.241)	(-1.145)
ROA		-0.039			-0.043	-0.059
		(-0.858)			(-0.948)	(-1.219)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	492	492	492	492	492	492
Adj. R-squared	0.053	0.054	0.052	0.054	0.055	0.054

Table 10. Female board representation (TFD) and ROA volatility (SDR) using only manufacturing and trade firms

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
TFD	-0.155**	-0.152**	-0.149**	-0.152**	-0.152**	-0.184**
	(-2.282)	(-2.243)	(-2.045)	(-2.282)	(-2.267)	(-2.505)
FSIZE			-0.014			0.083
			(-0.195)			(1.063)
AGE				-0.199***	-0.178***	-0.189***
				(-3.103)	(-2.629)	(-2.757)
TAN		-0.079			-0.035	-0.038
		(-1.182)			(-0.517)	(-0.564)
ROA		0.084			0.058	0.090
		(1.261)			(0.872)	(1.233)
Industry dummy	No	No	No	No	No	No
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	231	231	231	231	231	231
Adj. R-squared	0.018	0.025	0.013	0.054	0.050	0.051

4.4 Leverage

Table 11 displays the results of the OLS regressions conducted with independent variable female board representation (TFD) and dependent variable leverage (LEV). Model 1 shows a significant positive effect of TFD on leverage, thus when the proportion of females in a board increases a firm has higher leverage. Different control variables have been included in multiple models. First two financial characteristics of a firm where included: tangibility (TAN) and return on assets (ROA). Both these variables have been found in previous research to have a significant impact on leverage (Elsaid & Ursel, 2011; Faccio et al., 2016; Sila et al., 2016). When considering correlation, both variables are positively correlated with LEV, but not with TFD. When including these variables, the effect of TFD on LEV remains significantly positive. In model 3 firm size (FSIZE) has been included in the model, which has shown in previous research to have a significant effect on leverage (Faccio et al., 2016; Sila et al., 2016) this variable shows to be correlated with both TFD and LEV. The effect of TFD on LEV becomes insignificant when firm size is included in both model 3 and 6, indicating that there may be other firm characteristics that influences a firm's leverage.

For robustness the extra analysis described in section 4.2 are executed. With the addition of the analysis excluding the firms with zero leverage, because firms with no debt might have a different corporate strategy than firms with debt. The results remain the same in the different analyses, TFD becomes insignificant when firm size is included in the models, tables can be found in appendix A.

Table 11. Female board representation (TFD) and leverage (LEV)

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
TFD	0.081**	0.080**	-0.011	0.086**	0.085**	0.015
	(2.432)	(2.495)	(-0.314)	(2.711)	(2.788)	(0.483)
FSIZE			0.282***			0.230***
			(8.539)			(6.542)
AGE				-0.032	-0.062*	-0.083**
				(-0.945)	(-1.871)	(-2.550)
TAN		0.066*			0.072**	0.049
		(1.838)			(2.014)	(1.391)
ROA		-0.211***			-0.217***	-0.143***
		(-6.988)			(-7.168)	(-4.519)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	820	820	820	820	820	820
Adj. R-squared	0.240	0.303	0.269	0.243	0.290	0.326

4.5 Research and development expenditure

Table 12 displays the results of the OLS regressions conducted with independent variable female board representation (TFD) and dependent variable research and development expenditure (R&D). No effect of female board representation has been found. For robustness the extra analysis described in section 4.2 are executed. With the addition of the analysis excluding the firms with zero R&D expenses, this because firms with no R&D expenses might have a different corporate strategy than firms that do have R&D expenses. Results that are different from the first analysis are discussed in this section, the other results can be found in appendix A. Table 13 displays the results of the regression using the sample of manufacturing and trade firms, here TFD has a significant effect in model 1, 4 and 5, however TFD remains insignificant when firm size is included. Saying that the amount of R&D expenses is influenced by other firm characteristics.

Table 12. Female board representation (TFD) and R&D expenses (R&D)

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
TFD	-0.001	-0.002	0.024	0.002	0.002	0.034
	(-0.037)	(-0.051)	(0.627)	(0.050)	(0.064)	(0.867)
FSIZE			-0.080**			-0.102**
			(-2.080)			(-2.443)
AGE				-0.027	-0.036*	-0.026
				(-1.608)	(-0.924)	(-0.683)
TAN		0.087**			0.091**	0.101**
		(2.117)			(2.197)	(2.442)
ROA		-0.002			-0.005	-0.038
		(-0.063)			(-0.152)	(-1.019)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	820	820	820	820	820	820
Adj. R-squared	0.049	0.052	0.053	0.048	0.051	0.057

Table 13. Female board representation (TFD) and R&D expenses (R&D) using only manufacturing and trade firms

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
TFD	0.124*	0.113	0.081	0.154**	0.140*	0.093
	(1.661)	(1.485)	(0.993)	(2.112)	(1.884)	(1.150)
FSIZE			0.099			0.112
			(1.298)			(1.445)
AGE				-0.250***	-0.258***	-0.260***
				(-3.679)	(-3.777)	(-3.821)
TAN		0.062			0.087	0.082
		(0.863)			(1.247)	(1.181)
ROA		0.007			0.011	0.040
		(0.095)			(0.164)	(0.546)
Industry dummy	No	No	No	No	No	No
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	210	210	210	210	210	210
Adj. R-squared	-0.009	-0.016	-0.006	0.049	0.047	0.052

4.6 Overall results of effect of female board representation

Looking at the different models and additional analyses (see appendix A) it can be concluded that in most analyses no effect has been found of female board representation (TFD) on corporate risk-taking. When a significant effect of TFD has been found, this effect becomes insignificant when firm characteristics, other measures of female board representation or different samples are included. The only exceptions are the regressions using the sample of manufacturing and trade firms, with dependent variable stock return volatility. This is an interesting result for further investigation. Overall, considering the results of all the different analyses it is concluded that there is no stable effect of female board representation on corporate risk-taking, thus hypothesis 1 is rejected. Not female board representation, but other firm characteristics, like firm size, firm age, tangibility and ROA have an impact on a firm's risk-taking.

4.7 Moderation effect female CEO or CFO

To investigate the moderation effect of a female CEO and/or CFO, an interaction effect of female board representation (TFD) and the presence of a female CEO and/or CFO (FCEFO) is included in the different models. Table 14 displays the results of the regression using dependent variable stock return volatility (SDS), lagged stock return volatility (LSDS) and ROA volatility (SDR). No effect of the interaction variable has been found. Table 15 panel A displays the results of the regressions with dependent variable leverage (LEV), in panel B zeros are excluded and in panel C leverage is lagged by 1 year. A significant negative effect of the interaction effect has been found in al the different models. Also, the adjusted R squared increases when the interaction variable is included in model 2, meaning that it increases the explanatory power of the model in predicting the amount of leverage in a firm. Thus hypothesis 2 is confirmed for leverage, the effect of female board representation on leverage increases, when a female CEO and/or CFO is present. The relation becomes significantly negative, meaning that when the proportion of females in a board increases and a female CEO and/or CFO is present a firm has less leverage. This relation remains significant when different control variables are included.

Table 16 panel A displays the results of the regressions with dependent variable R&D expenses, in panel B zeros are excluded and in panel C R&D expenses are lagged by 1 year. Only panel B shows a robust negative effect of the interaction variable and the adjusted R squared increases when the interaction variable is included in model 2. Hypothesis 2 is therefore partially confirmed for R&D expenses; only when zeros are excluded the effect of female board representation on R&D expenses increases and it becomes a negative effect. Meaning that when

the proportion of females in a board increases and a female CEO and/or CFO is present a firm has less R&D expenses. This relation remains significant when different control variables are included. However, these results should be interpreted with caution. First because the count of a female CEO or CFO is low, around 10 percent in the different samples. And second, in only 28 firms there is the presence of a female CEO and/or CFO, thus the impact of a single firm is high. Therefore, taking a general conclusion from these analyses is not possible.

Table 14. Moderation effect female CEO and/or CFO on stock return volatility (SDS) and ROA volatility (SDR)

	SDS1	**SDS2**	**LSDS1**	**LSDS2**	**SDR1**	**SDR2**
TFD	-0.048	-0.056	-0.024	-0.024	0.047	0.057
	(-1.165)	(-1.266)	(0.541)	(-0.488)	(0.921)	(1.034)
FCEFO	-0.005	-0.057	-0.030	-0.018	-0.087*	-0.023
	(-0.125)	(-0.509)	(-0.483)	(-0.152)	(-1.769)	(-0.163)
TFDxFCEFO		0.058		-0.003		-0.071
		(0.496)		(-0.023)		(-0.488)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	742	742	595	595	444	444
Adj. R-squared	0.065	0.064	0.071	0.069	0.043	0.041

Table 15. Moderation effect female CEO and/or CFO on leverage (LEV)

Panel A	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
TFD	0.078**	0.138***	0.022	0.139***	0.130***
	(2.126)	(3.501)	(0.567)	(3.505)	(3.412)
FCEFO	-0.055	0.313***	0.242**	0.312***	0.293***
	(-1.612)	(3.166)	(2.568)	(3.146)	(3.061)
TFDxFCEFO		-0.412***	-0.318***	-0.411***	-0.381***
		(-3.963)	(-3.208)	(-3.947)	(-3.784)
FSIZE			0.306***		
			(9.050)		
AGE				-0.008	
				(0.231)	
ROA					-0.226***
					(-7.196)
Industry dummy	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes
Observations	744	744	744	744	744
Adj. R-squared	0.250	0.265	0.339	0.264	0.313
Panel B excluding zeros	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
TFD	0.081**	0.151***	0.071*	0.158***	0.144***
	(2.157)	(3.743)	(1.684)	(3.894)	(3.586)
FCEFO	-0.044	0.363***	0.306***	0.353***	0.358***
	(-1.254)	(3.701)	(3.167)	(3.597)	(3.678)
TFDxFCEFO		-0.458***	-0.390***	-0.451***	-0.443***
		(-4.430)	(-3.815)	(-4.357)	(-4.317)
FSIZE			0.197***		
			(5.481)		
AGE				-0.057	
				(-1.596)	
ROA					-0.116***
					(-3.549)
Industry dummy	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes

Observations	692	692	692	692	692
Adj. R-squared	0.273	0.292	0.321	0.294	0.304
Panel C lagged 1 year	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
TFD	0.096**	0.175***	0.103**	0.181***	0.171***
	(2.340)	(3.993)	(2.229)	(4.099)	(3.889)
FCEFO	-0.039	0.394***	0.342***	0.385***	0.392***
	(-1.009)	(3.813)	(3.335)	(3.727)	(3.800)
TFDxFCEFO		-0.490***	-0.426***	-0.484***	-0.482***
		(-3.515)	(-3.955)	(-4.461)	(-4.449)
FSIZE			0.174***		
			(4.275)		
AGE				-0.058	
				(-1.455)	
ROA					-0.066*
					(-1.794)
Industry dummy	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes
Observations	554	554	554	554	554
Adj. R-squared	0.263	0.289	0.311	0.291	0.292

Table 16. Moderation effect female CEO and/or CFO on R&D expenses (R&D)

Panel A	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
TFD	0.027	0.038	0.071	0.040	0.038
	(0.638)	(0.840)	(1.495)	(0.885)	(0.839)
FCEFO	-0.023	0.047	0.067	0.043	0.047
	(-0.585)	(0.416)	(0.596)	(0.383)	(0.415)
TFDxFCEFO		-0.078	-0.105	-0.075	-0.078
		(-0.655)	(-0.879)	(-0.631)	(-0.654)
FSIZE			-0.088**		
			(-2.159)		
AGE				-0.022	
				(-0.556)	
ROA					0.000
					(0.003)
Industry dummy	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes
Observations	744	744	744	744	744
Adj. R-squared	0.041	0.040	0.045	0.039	0.039
Panel B excluding zeros	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
TFD	0.003	0.045	0.093	0.062	0.058
	(0.042)	(0.643)	(1.222)	(0.883)	(0.822)
FCEFO	0.035	0.474**	0.412*	0.431**	0.543**
	(0.548)	(2.218)	(1.906)	(2.021)	(2.558)
TFDxFCEFO		-0.480**	-0.437*	-0.434*	-0.562**
		(-2.150)	(-1.953)	(-1.951)	(-2.526)
FSIZE			-0.117*		
			(-1.697)		
AGE				-0.133**	
				(-2.203)	
ROA					0.167***
					(2.822)
Industry dummy	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes
Observations	301	301	301	301	301
Adj. R-squared	0.095	0.106	0.112	0.118	0.127

Panel C lagged 1 year	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
TFD	0.035	0.078	0.137	0.080	0.094
	(0.482)	(1.021)	(1.648)	(1.053)	(1.256)
FCEFO	0.035	0.410*	0.350	0.373*	0.480**
	(0.503)	(1.869)	(1.580)	(1.681)	(2.207)
TFDxFCEFO		-0.419*	-0.386*	-0.381	-0.501**
		(-1.802)	(-1.661)	(-1.622)	(-2.175)
FSIZE			-0.136*		
			(-1.716)		
AGE				-0.079	
				(-1.130)	
ROA					0.194***
					(2.882)
Industry dummy	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes
Observations	240	240	240	240	240
Adj. R-squared	0.112	0.121	0.128	0.122	0.148

5. Conclusion

This thesis investigated the effect of female board representation on corporate risk-taking, measured by stock return volatility, ROA volatility, leverage and R&D expenses. Mixed effects on the risk measures were found when different control variables, samples or independent variables were included in the analyses, leading to the conclusion that firm and financial characteristics influence the relationship. In one analysis the effect of female board representation remained significantly negative; when measuring the effect on stock return volatility using a sample of manufacturing and trade firms. However, due to the mixed results in other samples, the small sample size and the fact that the effect only holds when the presence of at least 3 female board members is used as a different measure of female board representation, no general conclusions can be drawn from this. However, this is an interesting topic for further research. Overall the conclusion of this thesis is that female board representation has no effect on corporate risk-taking. Second, a moderation effect of the presence of a female CEO or CFO was included in the analyses. A significant negative effect of the interaction variable on leverage and partly on R&D expenses was found. However, no general conclusion can be drawn, because of the small count of firms that had a female CEO and/or CFO. Further research with a larger sample of firms with a female CEO or CFO may give more insights about these relations. The limitations and challenges of this investigation will be discussed in the following sections, concluded by additional implications for further research.

This thesis examined a direct relation between gender diversity and firm financial outcomes, which is a challenge highlighted by multiple studies (Ferreira, 2015; S. Nielsen & Huse, 2010). Endogeneity issues and the impact of mediating firm processes makes this relation complex. Sila et al. (2016) tried to control for unobserved factors and reverse causality, by executing different estimation techniques that consider the influence of different factors. They conclude that a board with a higher proportion of female directors is no more or less risk-taking than a more male-dominated board. And they even state that the effect is reverse; gender diversity is a choice that firms make based on their operating and information environment. This thesis focused, next to overall firm riskiness, on the individual financial decisions leverage and R&D expenses. This to give insights in a firm's financial corporate decisions that lead to firm riskiness, following other studies which found effects on acquisitions and dividend pay-out (G. Chen et al., 2016; J. Chen et al., 2017; Levi et al., 2014). However, these studies also used different estimation techniques, like fixed effects or instrumental variable regression. In this thesis multiple control variables were included in the OLS regression to control for the

impact of different firm characteristics and for robustness different measures of gender diversity and different samples were used. However, there may still be unobserved factors that influence the gender-risk relation, therefore the results may be biased.

Another limitation of this thesis is that it didn't consider the unique characteristics of individual female board members. Female directors all bring their own characteristics to a boardroom, like experience, education, culture and personality, making their influence highly complex (Torchia et al., 2011). Johnson et al. (2013) see a problem in using archival databases in getting an understanding of the impact of board composition on firm outcomes. When aggregating data on board level the differential effects of individuals or subgroups within the boards are overlooked or confounded. In addition, an important aspect is the level of power that women have on influencing corporate decisions in a firm (Triana et al., 2014). Often female directors that are added to a board get less powerful positions and the possibilities in changing board decisions will be limited (Miller & del Carmen Triana, 2009). The role of board processes is another topic mostly overlooked by gender diversity studies (S. Nielsen & Huse, 2010). For example, boardroom behaviour, frequency of meetings, the attendance of board meetings, the different board tasks and the level of monitoring can all influence the way different corporate decisions are made (Adams & Ferreira, 2009; S. Nielsen & Huse, 2010; Schwartz-Ziv, 2017; Terjesen et al., 2009). Alternative approaches to investigate gender diversity are therefore proposed, like case studies, lab studies, simulations or focusing on single industries (Johnson et al., 2013). An example of a case study is following an individual firm over multiple years, to control for the numerous firm and financial characteristics that influence a firm's decision-making process. An example of focusing on a single industry is investigating manufacturing and trade firms, as previously mentioned, this thesis found an effect in this industry. These are all alternative approaches to find effects in a more controlled environment, but then generalizability will remain a difficulty.

Because of multiple influencing factors of firm characteristics, board processes and individual board members on the gender-risk relationship in combination with mixed effects in previous studies and mixed effects in this thesis, it can be concluded that it is challenging to find a direct relation between board gender diversity and a firm's corporate risk-taking. Although it is asked for by regulators and the public to show an effect of increasing female board representation, the possibility that no general effects exist must be considered. As Sila et al. (2016) stated, gender diversity is merely a case of fairness than based on economic considerations. Also, forcing firms to hire female directors may even be harmful, as the composition of a board may already be optimal based on a firm's needs (Ahern & Dittmar,

2012; Sila et al., 2016). Not in the least because female directors are short in supply and the available directors may lack the managerial characteristics needed (Ferreira, 2015). Future research might be more insightful in focusing on questions like: which board member characteristic are needed to make high-quality financial decisions in a firm? And, how can the supply of female directors with these needed characteristics be increased? As the benefits of increasing female board representation will probably not be reflected in financial outcomes, but in something that goes beyond that; gender equality in society.

APPENDIX A

1. Stock return volatility

Other control variables have been included in the models to see what happens to the significance of TFD. This based on previous research and the correlation table. Table 17 displays the results.

Board size (BSIZE) is seen to be correlated with both TFD and SDS, and is also found by previous research as having a significant effect on SDS (Bernile et al., 2018; Sila et al., 2016). When BSIZE is included in model 1, TFD has no significant effect on SDS.

Board independence (IND) is seen to be correlated with TFD, but only Sila et al. (2016) included IND in their analysis and found no significant effect. When included in model 2 no significant effect of IND on SDS has been found and TFD remains significant.

Past ROA volatility (PRISK) has shown to be correlated with SDS. This variable has been used by J. Chen et al. (2017) to see the effects on dividends pay-out, another measure of a firms' risk-taking. This variable is included in model 3 together with tangibility to see the effect of adding another financial characteristic, it has the same effect on TFD. PRISK and TAN are found to have a significant effect on SDS, TFD remains significant.

Table 17. Female board representation (TFD) and stock return volatility (SDS) including different control variables

	Model 1	**Model 2**	**Model 3**
TFD	-0.040	-0.077**	-0.076**
	(-1.095)	(-2.079)	(-2.130)
BSIZE	-0.144***		
	(-4.216)		
IND		0.001	
		(0.030)	
TAN			-0.080**
			(-2.006)
PRISK			0.103***
			(2.951)
Industry dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
Observations	813	813	805
Adj. R-squared	0.142	0.123	0.136

Table 18 displays the results of the regression using SDS lagged by 1 year, this because the effects of female board member may only become visible in later years. It takes time to have an influence on major corporate decisions. Here, TFD is insignificant in all the different models, FSIZE, AGE and ROA remain important control variables in predicting SDS.

Table 18. Female board representation (TFD) and lagged (1 year) stock return volatility (SDS)

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
TFD	-0.057	-0.058	-0.013	-0.037	-0.038	0.013
	(-1.448)	(-1.499)	(-0.324)	(-0.966)	(-1.014)	(0.313)
FSIZE			-0.129***			-0.163***
			(-3.118)			(-3.723)
AGE				-0.180***	-0.187***	-0.172***
				(-4.457)	(-4.598)	(-4.264)
TAN		-0.072			-0.052	-0.036
		(-1.631)			(-1.200)	(-0.834)
ROA		-0.082**			-0.099***	-0.152***
		(-2.178)			(-2.681)	(-3.871)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	652	652	652	652	652	652
Adj. R-squared	0.129	0.136	0.140	0.154	0.162	0.179

Table 19 presents the results of the regression analysis using a sample of manufacturing and trade firm, with dependent variable at least 3 female directors (GD3). The effects remain significant, except for model 6. However, when the independent variables GD1 or SFD are used, the effects become insignificant (not presented).

Table 19. Female board representation (GD3) and stock return volatility (SDS) using only manufacturing and trade firms

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
GD3	-0.195***	-0.191***	-0.113*	-0.159***	-0.159***	-0.043
	(-3.842)	(-3.802)	(-1.937)	(-3.257)	(-3.333)	(-0.777)
FSIZE			-0.157***			-0.234***
			(-2.734)			(-3.942)
AGE				-0.299***	-0.324***	-0.308
				(-6.289)	(-6.6200)	(-6.414)
TAN		-0.151***			-0.026	-0.007
		(-3.039)			(-0.531)	(-0.146)
ROA		-0.108**			-0.193***	-0.275***
		(-2.176)			(-4.063)	(-5.397)
Industry dummy	No	No	No	No	No	No
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	378	378	378	378	378	378
Adj. R-squared	0.078	0.103	0.093	0.164	0.196	0.226

2. ROA volatility

Other control variables have been included in the models to see what happens to the significance of TFD. This based on previous research and the correlation table. Table 20 displays the results.

Board size (BSIZE) has been found to be correlated with TFD but not with SDR. When included in Model 1, BSIZE has no significant effect and TFD remains insignificant.

Board independence (IND) has been found to be correlated with TFD but not with SDR. When included in Model 2, IND has no significant effect and TFD remains insignificant.

Table 20. Female board representation (TFD) and ROA volatility (SDR) including different control variables

	Model 1	**Model 2**
TFD	-0.036	-0.047
	(-0.743)	(-0.963)
BSIZE	0.028	
	(0.593)	
IND		0.062
		(1.275)
Industry dummy	Yes	Yes
Year dummy	Yes	Yes
Observations	492	492
Adj. R-squared	0.052	0.054

Table 21 displays the results of the regression using only firms with assets larger than 1 million £. No effects of TFD on ROA volatility have been found.

Table 21. Female board representation (TFD) and ROA volatility (SDR) using only firms with assets larger than 1 mln £

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
TFD	-0.013	-0.015	-0.016	-0.006	-0.008	-0.005
	(-0.240)	(-0.267)	(-0.273)	(-0.115)	(-0.152)	(-0.090)
FSIZE			0.008			-0.009
			(0.137)			(-0.140)
AGE				-0.064	-0.060	-0.060
				(-1.109)	(-1.047)	(-1.033)
TAN		-0.104			-0.099	-0.097
		(-1.636)			(-1.543)	(-1.505)
ROA		-0.083			-0.086	-0.088
		(-1.589)			(-1.629)	(-1.567)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	368	368	368	368	368	368
Adj. R-squared	0.054	0.062	0.052	0.055	0.063	0.060

Table 22 displays the results of the regression using the sample of manufacturing and trade firms, with independent variable at least three female board members (GD3). The effect of GD3 is insignificant. These results hold when GD1 and SFD are used as independent variables.

Table 22. Female board representation (GD3) and ROA volatility (SDR) using only manufacturing and trade firms

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
GD3	-0.095	-0.088	-0.082	-0.074	-0.073	-0.104
	(-1.431)	(-1.323)	(-1.062)	(-1.131)	(-1.106)	(-1.325)
FSIZE			-0.026			0.063
			(-0.340)			(0.732)
AGE				-0.193***	-0.171**	-0.176**
				(-2.971)	(-2.500)	(-2.588)
TAN		-0.084			-0.043	-0.045
		(-1.245)			(-0.624)	(-0.660)
ROA		0.078			0.052	0.076
		(1.153)			(0.777)	(1.016)
Industry dummy	No	No	No	No	No	No
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	231	231	231	231	231	231
Adj. R-squared	0.004	0.011	0.000	0.037	0.034	0.061

3. Leverage

Other control variables have been included in the models to see what happens to the significance of TFD. This based on previous research and the correlation table. Table 23 displays the results.

Board size (BSIZE) has been found to be correlated with TFD and with LEV. When included in Model 1, BSIZE has a significant effect and TFD becomes insignificant.

Tangibility (TAN) and return on assets (ROA) are included in model 2 to see the effects on the inclusion of financial characteristics which are correlated with BSIZE. BSIZE remains significant, TFD remains insignificant and ROA is significant.

Sales growth (SGR) is another financial variable which seems to be correlated with LEV, but not with TFD. This variable is both used by Sila et al. (2016) and Faccio et al. (2016) as a control variable and they both found a significant effect on LEV. When included in model 3 as another financial variable in the place of ROA, TFD remains significantly positive and TAN and SGR both have a significant effect.

Table 23. Female board representation (TFD) and leverage (LEV) including different control variables

	Model 1	**Model 2**	**Model 3**
TFD	0.037	0.009	0.076**
	(1.116)	(0.256)	(2.299)
BSIZE	0.180***	0.222***	
	(5.742)	(6.292)	
TAN		0.041	0.068*
		(1.165)	(1.839)
ROA		-0.138***	
		(-4.349)	
SGR			-0.056*
			(-1.733)
Industry dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
Observations	820	820	820
Adj. R-squared	0.385	0.318	0.244

Table 24, 25, 26 and 27 all show that the effect of female board representation becomes insignificant when firm size is included.

Table 24. Female board representation (TFD) and leverage (LEV) using only manufacturing and trade firms

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
TFD	0.093*	0.098*	-0.023	0.089	0.097*	0.012
	(1.694)	(1.847)	(-0.423)	(1.628)	(1.833)	(0.212)
FSIZE			0.334***			0.244***
			(6.495)			(4.286)
AGE				0.089*	0.029	0.002
				(1.744)	(0.557)	(0.046)
TAN		0.057			0.050	0.033
		(1.153)			(0.976)	(0.651)
ROA		-0.283***			-0.279***	-0.188***
		(-5.677)			(-5.548)	(-3.510)
Industry dummy	No	No	No	No	No	No
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	385	385	385	385	385	385
Adj. R-squared	0.002	0.085	0.099	0.007	0.083	0.124

Table 25. Female board representation (TFD) and leverage (LEV) using firms with assets larger than 1 mln £

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
TFD	0.115***	0.113***	0.004	0.126***	0.125***	0.032
	(2.984)	(3.002)	(0.102)	(3.245)	(3.314)	(0.827)
FSIZE			0.311***			0.269***
			(8.064)			(6.509)
AGE				-0.085**	-0.098**	-0.113***
				(-2.131)	(-2.518)	(-3.010)
TAN		-0.004			0.008	-0.027
		(-0.090)			(0.183)	(-0.639)
ROA		-0.217***			-0.221***	-0.133***
		(-6.179)			(-6.324)	(-3.649)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	640	640	640	640	640	640
Adj. R-squared	0.212	0.255	0.286	0.217	0.262	0.0308

Table 26. Female board representation (TFD) and leverage (LEV) excluding zeros

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
TFD	0.056*	0.056*	0.003	0.066*	0.068**	0.025
	(1.654)	(1.672)	(0.097)	(1.927)	(1.806)	(0.709)
FSIZE			0.165***			0.142***
			(4.680)			(3.840)
AGE				-0.067*	-0.084**	-0.098***
				(-1.918)	(-2.403)	(-2.805)
TAN		0.092**			0.102***	0.085**
		(2.510)			(2.766)	(2.307)
ROA		-0.106***			-0.109***	-0.073**
		(-3.363)			(-3.482)	(-2.253)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	761	761	761	761	761	761
Adj. R-squared	0.263	0.279	0.283	0.266	0.284	0.297

Table 27. Female board representation (TFD) and lagged leverage (LEV) excluding zeros

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
TFD	0.078**	0.078**	0.033	0.086**	0.087**	0.048
	(2.101)	(2.103)	(0.858)	(2.295)	(2.351)	(1.219)
FSIZE			0.138***			0.129***
			(3.487)			(3.076)
AGE				-0.065*	-0.080**	-0.092**
				(-1.652)	(-2.046)	(-2.358)
TAN		0.092**			0.102**	0.086**
		(2.236)			(2.457)	(2.068)
ROA		-0.056			-0.061*	-0.027
		(-1.569)			(-1.702)	(-0.717)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	608	608	608	608	608	608
Adj. R-squared	0.264	0.271	0.278	0.266	0.275	0.286

4. R&D expenses

Other control variables have been included in the models to see what happens to the significance of TFD. This based on previous research and the correlation table. Table 28 displays the results.

Board size (BSIZE) has been found to be correlated with TFD, but not with R&D. Also, Sila et al. (2016) found no effect of board size on R&D expenses. When included in Model 1, BSIZE has an insignificant effect and TFD remains insignificant.

Tangibility (TAN) and return on assets (ROA) are included in model 2 to see the effects on the inclusion of financial characteristics which are correlated with BSIZE. BSIZE becomes significant, TAN is significant, and ROA is insignificant. TFD remains insignificant.

Past ROA volatility (PRISK) has shown to be correlated with R&D expenses, but not with TFD. This variable has been used by J. Chen et al. (2017) to see the effects on dividends pay-out, another measure of a firms' risk-taking. This variable is included in model 3 together with tangibility to see the effect of adding another financial characteristic. PRISK and TAN are found to have a significant effect on R&D, TFD remains significant.

Table 28. Female board representation (TFD) and R&D expenses (R&D) including different control variables

	Model 1	**Model 2**	**Model 3**
TFD	0.011	0.032	0.002
	(0.295)	(0.812)	(0.045)
BSIZE	-0.052	-0.105**	
	(-1.465)	(-2.523)	
TAN		0.099**	0.078*
		(2.393)	(1.919)
ROA		-0.037	
		(-0.984)	
PRISK			0.170***
			(4.716)
Industry dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
Observations	820	820	812
Adj. R-squared	0.050	0.058	0.076

Table 29 displays the results of the regression excluding zeros. The effect of TFD remains insignificant. When looking at the control variables, firm age (AGE) and ROA become significant predictors of R&D. FSIZE even becomes insignificant in Model 6.

Table 29. Female board representation (TFD) and R&D expenses (R&D) excluding zeros

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
TFD	-0.009	-0.013	0.036	0.007	0.000	0.026
	(-0.152)	(-0.223)	(0.573)	(0.115)	(0.007)	(0.418)
FSIZE			-0.122**			-0.077
			(-1.978)			(-1.181)
AGE				-0.104*	-0.098*	-0.088
				(-1.801)	(-1.695)	(-1.518)
TAN		0.057			0.066	0.071
		(1.002)			(1.165)	(1.249)
ROA		0.136**			0.128**	0.108*
		(2.472)			(2.317)	(1.867)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	324	324	324	324	324	324
Adj. R-squared	0.133	0.146	0.141	0.139	0.151	0.152

Table 30 presents the results of OLS regression using R&D expenses lagged by 1 year, this because the effect of decisions about the expenses might have a delayed visibility in the actual financial numbers of a firm. TFD remains insignificant in these analyses, when ROA remains a significant predictor of R&D.

Table 30. Female board representation (TFD) and lagged R&D expenses (R&D) excluding zeros

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
TFD	0.022	0.025	0.074	0.035	0.035	0.065
	(0.345)	(0.405)	(1.080)	(0.545)	(0.559)	(0.953)
FSIZE			-0.134*			-0.084
			(-1.916)			(-1.151)
AGE				-0.100	-0.088	-0.077
				(-1.573)	(-1.389)	(-1.202)
TAN		0.048			0.057	0.063
		(0.744)			(0.884)	(0.962)
ROA		0.170***			0.162**	0.144**
		(2.705)			(2.563)	(2.209)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	258	258	258	258	258	258
Adj. R-squared	0.148	0.167	0.157	0.153	0.170	0.171

Table 31 displays the results of the regression using firms with assets larger that 1 million £. No effects of female board representation have been found, firm age and tangibility remain significant predictors of R&D expenses.

Table 31. Female board representation (TFD) and R&D expenses (R&D) using firms with assets larger than 1 mln £

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
TFD	-0.017	-0.020	0.016	0.002	-0.003	0.017
	(-0.261)	(-0.300)	(0.228)	(0.028)	(-0.038)	(0.252)
FSIZE			-0.087			-0.060
			(-1.337)			(-0.871)
AGE				-0.117*	-0.118*	-0.110*
				(-1.897)	(-1.896)	(-1.753)
TAN		0.114*			0.127**	0.135**
		(1.804)			(2.005)	(2.109)
ROA		0.109*			0.095	0.078
		(1.853)			(1.602)	(1.262)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	265	265	265	265	265	265
Adj. R-squared	0.175	0.189	0.178	0.183	0.197	0.196

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