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Female Directors on Corporate Boards of private firms: A study on the impact of board gender diversity on firm performance and corporate risk

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Abstract

This thesis examines whether female board of directors in private firms can influence firm financial performance and corporate risk. First, the study investigates if gender diversity in boards per se has an influence on firm performance and risk. Additionally, we explore whether it is necessary for the board to consists of at least 30% female directors as related to the Critical Mass theory for the women to be able to influence organizational changes and boardroom dynamics. We run a multivariate linear OLS model and firm fixed effects model on an unbalanced panel data set between 2010 and 2019 on middle-sized unlisted firms in Sweden. The findings provided no support for a statistically significant relationship between the fraction of female directors and firm performance regardless of the proportion of female directors. However, we found statistically significant evidence in support for the hypothesis that females can influence the company's governance and lower the firm risk if they reach a critical mass and hold at least 30% of the board seats. In other words, we find no support for a clear relationship between females on boards and firm financial performance, but do find support for a significant relationship between females on boards and firm corporate risk.

Keywords: Gender diversity, Board of Directors, Critical Mass, financial performance, corporate risk

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Table of contents

1. Introduction

1.1 Background

Looking back in history, organizations all around the world have almost exclusively been driven and controlled by men. At the beginning of the twenty-first century, the number of women in executive positions was significantly low on a global scale. Despite advanced developments in science, technology and social conditions, and the good intentions of many policy leaders past decades, the corporate world remains far from gender equal. In 2019, only 4.7% of the CEOs and 33% of the board members were female in the top 600 most highly valued companies in Europe (EWOB, 2019).

Sweden as a country is highly ranked on gender equality, ranking first in the EU on the gender equality index. Furthermore, it is one of the countries in the EU with the highest proportion of women on corporate boards of publicly listed companies, although the country has not yet implemented a board gender quota (EIGE, 2021). However, due to lack of data, we know very little about female representation outside of the large firms, which only represents 0.1% of the total number of companies in the country (SCB, 2019). Our thesis aims to partly fill this gap in knowledge by exploiting panel data on female representation in Swedish mid-sized unlisted companies to analyze whether female board members in private firms influence firm outcomes. We aim to answer two questions: *Does the proportion of women in Swedish boardrooms of private firms affect firm performance and corporate risk? And is the critical mass a crucial level for women to reach to find this relationship?*

The World Bank (2012) states that the underutilization of the skills of highly qualified women constitutes a loss of economic growth potential. The European Commission (2012) argues that, with more gender diverse boards, it is possible to achieve higher and more sustainable rates of economic growth. They emphasize that "The full mobilization of all available human resources will be a key element to addressing demographic challenges, competing successfully in a globalized economy, and ensuring a comparative advantage vis-à-vis third countries". By the turn of the decade, discussions heated up in corporate and political contexts, referring to the lack of females in the corporate world as well as the 'business case' argument that more gender diverse boards result in improved performance and governance. Moreover, the United Nations (UN) addressed the issue in 2016 when implementing Agenda 2030 and presented 17 global sustainable development goals (SDGs), one of them being specifically aimed at increasing gender equality between women and men (UN, 2016). But despite positive prospects, something is keeping the number of women in leading corporate positions low, and the burning question is why.

It is argued that homosociality is a substantial factor influencing the low presence of females on boards (Holgersson, 2013). Homosociality is defined as a mechanism and social dynamic, which explains how men, through relations to other men, uphold and maintain patriarchy by building close teams and defending their privileges and positions (Holgersson, 2013). This phenomenon becomes problematic in combination with the nature of the director-selection process, i.e., that current board members elect who will be further included in the board. Men, with this homosocial desire, tend to choose to take other men onto the board, and consequently, women have been plagued by the closed circles of men.

The board of director's tasks are to accept and determine the strategy for the organization, which in practice can have substantial consequences for the direction of the company and value creation (Forbes and Milliken, 1999; McNulty and Pettigrew, 2016). As a result, increased research attention has been directed at the area, that has tried to examine if and how companies' operations are affected by the board gender composition. The main discussion has been directed towards the business case argument, concerning profitability and value-creation. Nonetheless, other discussions have emerged arguing for other aspects of governance that may be affected by including more females in boards, linked to theories about differences between gender. For example, it is argued that women by nature are less risk-taking compared to men (Eckel and Grossman, 2008), which suggest that females could influence the board's decision-making choices and lower the firm's risk levels. These insights have increased the interest in exploring the impact of gender diversity on various levels in the organization. As a result, many studies have tried to measure the relationship between, not only female board members and firm financial performance, but also risk. Nonetheless, the influence of female directors is yet ambiguous as the studies show disparate results (Adams, 2016; Dale-Olsen et al., 2013; Faccio et al., 2016; Sila et al., 2016).

However, research by scholars and organizations tries to explain this discrepancy by posing support for the "Critical Mass Theory" (Catalyst, 2020). The critical mass theory argues that women as minorities in male-dominate environments will be categorized as "tokens", which will lead them to be stereotyped and ignored by the majority group of males until the size of the sub-group of women reaches a certain threshold. The threshold, or so-called Critical Mass, suggests that women need to hold at least 30% of the seats in the board to influence organizational changes and boardroom dynamics. This would create an environment that leads the board to make more efficient decisions and as a result, perform better (Catalyst, 2020).

The insights obtained from the critical mass theory in combination with the essential global discussions, dedicated to the development of gender equality, has led to increased attention and pressure to implement gender quotas in the business world. Following Norway's initiative to increase the representation of females on boards through a gender quota law of 40% in 2005, the European Commission put forward a proposal (2010) of introducing a quota law at 40% for all large publicly listed companies in the European Union. The goal was to be achieved by 2018, being at a current state of 11.9%, as well as by 2020 for the private sector (EIGE, 2020). Although the proposal was backed by the European Parliament in 2013, the directive was not adopted due to reservations from several Member States. Some express concerns that board quotas would mean that one prioritizes the gender of the candidate before their knowledge and expertise, which may deteriorate firms operational and financial results (Ahern and Dittmar, 2012). Nonetheless, several member countries have taken national actions by implementing national board quotas for public firms due to the importance of integrating women in the business world. Even though Sweden is not one of those countries who have implemented a national board quota, the number of women on publicly listed boards in the country is exceptionally high in comparison to the EU average at 38% and 30% respectively (EIGE, 2021).

However, Renée Adams, Professor of Finance at the University of Oxford, questions the positive figures presented on the development of women's inclusion in the business world. In the online seminar at the Swedish House of Finance in December 2020, Adams referred to the fact that the sample used has a great significance for the statistics. She emphasized that “As soon as you start incorporating the smaller firms in the sample, you get a much lower number” and that “Board representation is much worse outside of the large firms”. Meanwhile, small- and midsized private firms represents 99.9% of all companies in Sweden (SCB, 2019). In this respect, one can question what the main statistics of the Swedish business world really looks like when one starts to include a broader sample. Moreover, how do females influence corporate outcomes in a country where the sexes are considered equal?

This paper will examine the relationship between female directors, firm financial performance, and corporate risk using an unbalanced panel data of Swedish unlisted mid-sized firms over a ten-year period (2010-2019). Performance is measured in terms of the return on equity (*ROE)* and return on assets (*ROA)*, and corporate risk in terms of the *Interest-coverage ratio* and the *Standard Deviation of ROE*. In line with our benchmark paper “Women on boards: The superheroes of tomorrow?” by Renée Adams (2016), the analysis is conducted through quantitative research measuring the linear relation with a multiple ordinary least squares regression model, and a firm fixed effects model. An important observation from our data is the low proportion of females on boards in our sample (15%), which is far below the average for listed firms in the country (38%). This fact contributes with insights into the skewed image of Sweden's equal business environment. The study found no evidence that firms with a higher proportion of women achieve a higher performance, not even when reaching a critical mass. However, the results did show that female directors reduce the firm risk if the proportion of women on the board is at least 30%. As a result, the paper enables interesting observations about women in leading corporate positions as it shows that firms can increase their gender equality by including more female directors on the board without impairing the performance. Moreover, while doing so, they can reduce the firm risk.

1.2 Purpose

Sweden's high ranking on equality makes it a country of interest to study when measuring the impact of female board members on firm financial performance and corporate risk. Moreover, private firms are an unexplored sample in the literature and are not faced by the same market factors as listed firms, which could then have a significant influence on their motivations to include more females as well as the relationship measured in this study.

We argue that a more diverse board leads to a broader view of perspectives and knowledge, which leads us to the hypothesis that this will improve board decisions and hence the performance (Adams and Ferreira, 2009). Furthermore, women are more risk averse than men (Barber and Odean, 2001; Byrnes et al., 1999; Hinz et al., 1996), which leads us to the second hypothesis that a higher fraction of women results in a lower firm risk. Based on the critical mass theory, we believe that these hypotheses are dependent on the fact that representation of women must be at least 30% for the women not to be viewed as tokens. Therefore, we have based our hypotheses on the Critical Mass fraction of 30% to support the relationship between a higher proportion of women in boards with a higher firm performance and lower corporate risk.

1.3 Contribution

Our study contributes to filling the gap in existing literature by studying the relationship between a greater proportion of female board members and firm outcomes in unlisted firms. The topic of our study is of particular interest to the board of directors and owners, who endeavors to maximize returns and minimize risk. The results contribute with insights to whether there are any significant implications on corporate outcomes with respect to the gender of the board members seated. From a broader perspective, the result of our study is also of interest for society by broadening one's point of view from listed firms, and sheds light on the fact that there is still a lot of work to be done within gender equality. Lastly, based on the results of our study, a gender quota for unlisted firms may be equally relevant to discuss as for listed firms in Sweden.

1.4 Limitations

It is of great importance to mention the endogeneity problems of omitted variable bias and causality for research within this area, which is commonly discussed in previous literature (Adams, 2016; Adams and Ferreira, 2009; Hermalin and Weisbach, 2003). However, it is difficult to fully eliminate the problems related to endogeneity, which creates difficulties to draw robust conclusions from the results and thus provide limitations to this paper. This issue is further discussed in section 3.7. Furthermore, it is important to keep in mind that the regression model tests the linear relationship between the fraction of female directors and corporate outcomes. This means that the lack of statistical significance of the independent variables in the fixed effects model does not necessarily mean that there does not exist any relationship between the two variables but indicate that there are no statistically significant linear relationships. Moreover, it is important to emphasize the fact that the female board members in our sample are not random members of the population. They have been through a selection process to arrive at the position of the board and may not only differ from male directors, but also from women that are representative in the population. Therefore, one must be careful when drawing any general conclusions of the relationship between the presence of female directors and their impact on corporate outcomes.

1.5 Disposition

The thesis is structured as follows. First, we introduce the reader to the topic of the study, followed by section two, which is a review of previous literature. The third section presents the methodology used in this study, which is followed by an overview of the empirical data in section four. The results will be presented in section five with a complemented analysis and discussion of the hypotheses in section six. Lastly, we conclude the study in section seven by presenting a summary of our findings, limitations to our study, and suggestions for future research.

2. Theory and Literature review

In the following chapter, an overview of the existing literature in the field related to the study will be presented, which lie as the foundation for our hypotheses formulated at the end of the chapter.

2.1 Corporate Governance Theories

In corporate governance theory, the board of directors is viewed as a critical mechanism that can influence and contribute to the governance and performance of the company (Neville, 2011). There are several corporate governance theories related to the function of the board of directors, with the predominantly used being the agency theory. Agency theory is used to explain the role of the board and addresses the conflict of interest between owners and management (Hermalin and Weisbach, 2003). The board will act as agents to the principal owners without incurring much risk since any losses will be borne by the principal. This relationship may yield conflicts of interest (Fama and Jensen, 1983), causing agency problems as agents maximize utility and may not always act in the best interest of the firm. However, Neville (2011) highlights in his article how ownership and control structures of private firms differ from public firms. This is in particular significant regarding the type of governance problems that arise in private firms and hence for the role of the board. The author suggests that the agency theory is too limited to explain the role and function of the board of private firms. Instead, a multi-theoretical approach is needed, including resource-based theories.

The resource dependency theory suggests that firms are dependent on their environments from which they secure resources to reduce uncertainty and enhance firm performance (Pfeffer, 1972; Taljaard et al., 2015). Except for controlling and monitoring the managers, the board is responsible for providing access to resources needed by the firm through their linkages to the external environment. The board's provision of resources can be linked to firm performance through skills, information, access to key constituents, customers, and policy makers, as well as legitimacy (Hillman and Dalziel, 2003). A diverse board is more efficient in attracting and securing resources from the environment, since it has better access to information and networks. (Taljaard et al., 2015; Bryant and Davis, 2012; Neville, 2011; Pfeffer, 1972). The human capital theory is part of the resource-dependency theories and argues that the diversity of the board affects firm governance and performance through having more nuanced knowledge and skills (Carter et al., 2010). Human capital is defined as "The knowledge, skills, competencies and attributes embodied in individuals that are relevant to economic activity"

(OECD, 2007). Since each member in the board has different levels of experiences, each board member brings unique human capital to the board (Kesner, 1988). A diverse board bring broader perspectives and knowledge compared to a less diversified board, which may enhance the decision making of the board (Fagan et al., 2012). These corporate governance theories provide valuable insights into the governance mechanisms in private firms, as well as an understanding how gender diversity may lead to improved corporate outcomes.

2.2 Firm performance

Financial performance is the firm's ability to use its assets to generate revenue, and is a common measure used in previous literature when analyzing the relationship between different board compositions and performance (Adams and Ferreira, 2009; Adams, 2016; Dale-Olsen et al., 2013; Shrader et al., 2020). The most used firm performance indicators are accounting measures of profitability (Crook et al., 2005), and there are three ratios that have been particularly prosperous in research: return on equity, return on assets, return on capital (Bodie et al., 2013).

2.2.1 Board diversity and firm performance

Previous studies aim to investigate the relationship between female representation in corporate boards and firm performance. However, the empirical literature presents mixed results showing that the link remains unclear. Some studies find a positive relationship between female directors and firm performance, whilst other find a negative relationship, and some do not find a relationship at all. For example, a study on boards of listed firms in Germany showed that women in the boardrooms have a positive effect on firm performance (Joecks et al., 2013), a relationship that could also be found by Soobaroyen and Mahadeo (2012) in an emerging country. Moreover, the report by IMF (2016), links gender diversity in senior corporate positions and financial performance of two million companies in Europe, documenting a positive association between the share of women in senior positions and ROA. Their analysis also revealed that replacing one man by a woman in senior management or on corporate boards is associated with 8-13 basis points higher ROA, which even raises up to 30 basis points higher in knowledge intensive- and high-technology sectors. Nonetheless, a study based on Norwegian listed firms found a negative relation in terms of decreased firm value after the implementation of a gender quota (Ahern and Dittmar, 2012). This negative relationship was also found in studies on U.S. firms (Adams and Ferreira, 2009; Shrader et al., 2020). However, the study by Dale-Olsen et al. (2013), who also measured the impact of the gender quota in Norway on firm performance of Norwegian companies, found no clear relationship. This lack of clear relation between females and firm performance was also highlighted in a study on U.S. firms (Miller and Del Carmen-Triana, 2009). The differences between the results in literature may be due to the use of different performance measures, estimations methods or sample used (Joecks et al., 2013). Nonetheless, very few studies investigate how performance is affected by board gender diversity in unlisted firms. Based on the disparate results and unexplored area of unlisted firms, we see a gap where our research will bring valuable insights and further implications.

2.3 Corporate risk

Potential risk that a company faces can be calculated by looking at different financial ratios, indexes, and proxies. In economic theory, the methodology most generally used is originally mathematical, and given by the notion of standard deviation, which estimates the variation of the outcome around the mean (Taylor and Taylor, 2007). The standard deviation can be used to calculate risk in a company by expressing a measure of the spread of the return. The greater deviation from the mean, the greater is the risk. Other risk measures investigate ratios that assess a firm's capital structure and current risk levels. Whether a firm can manage outstanding debt or not is critical to the company's financial soundness and operating ability.

2.3.1 Gender and risk taking

Previous research acknowledges that there is a significant difference between the genders and risk propensity. Studies in the fields of psychology and economics demonstrate how risk-taking between gender differs by reporting that men are more likely to be engaged in 'risky experiments', 'intellectual risk taking' and 'gambling' than women (Byrnes et al., 1999). Moreover, in experimental settings, men have shown a greater tendency to make more risky choices than women. For example, women exhibit a stronger risk-aversion in experiments using lotteries with known probabilities and monetary outcomes (Fehr-Duda et al., 2006). In the research of Booth and Nolen (2012), they examine the underlying factors to this statement, and present aspects of different nurture and nature of men and women. For example, men are pushed to take risks at an early age, whereas women are encouraged to remain more cautious. Another study argued that women and men have different approaches to risk-taking based on genetic differences (Eckel and Grossman, 2008). The theory of gender differences in risk propensity therefore suggests that females, having a different risk attitude compared to men, could influence the board's decision-making choices, and thus lower the corporate risk.

2.3.2 Risk taking in corporations

In light of the theories on gender and risk taking, studies have tried to investigate these further in a corporate setting. Lenard et al. (2014) conducted a study during the period of the financial crisis in 2008, which showed that companies with more gender diverse boards in fact had lower variability of stock market return. A greater proportion of female directors on the board was associated with less variability of corporate performance in terms of stock return. Risk propensity between genders has also been studied on top management levels in firms and provided results for differences in risk taking and capital allocation efficiency. A study conducted by Faccio et al. (2016) showed that firms run by female CEOs had lower leverage, less volatile earnings, and were more likely to remain in operation compared to firms run by male CEOs. However, other studies convey the lack of strong empirical evidence on the relationship between gender diversity and corporate risk in the boardroom setting (Sila et al., 2016; Adams and Ragunathan, 2015). Adams and Funk (2011) studied a sample of 1,796 female top managers and board members in Swedish publicly traded firms and showed that having a woman on the board did not necessarily lead to more risk-averse decisions. In fact, they found that the women were more risk-taking than male directors. These disparate results within the subject of gender and risk taking are mostly based on listed firms, with market-based measures. There is a gap to investigate this linkage in private firms, which our paper aims to fill.

2.4 Tokens and Critical Mass Theory

The phenomena of tokens were discussed by Kanter (1977), where she defined the members of the majority as “dominants” in a group, and the minority as “tokens”. Kanter (1977) argued that tokens often are perceived as stereotypes, are doubted, and not trusted, something which could interfere with group performance (Torchia et al., 2011). Tokens may face additional performance pressure and might not be seen for their accomplishments and skills due to their distinction from the majority of the group. These characteristics of a token could be referred to women in a larger group of men as in the case of male-dominated corporate boards (Torchia et al., 2011). However, the size of the minority group is of great importance when talking about the degree of influence. When the size of the token group increases, it reaches a point where the group is no longer classified as a token. This threshold is referred to as the critical mass (Torchia et al., 2011). In other words, the critical mass theory refers to the nature of group interaction depending upon size. This tipping point has been suggested to be at 30% (Tarr-Whelan, 2009). If women represent at least one-third of the group, they are able to influence the decision since their ideas will be supported and confirmed by other women. The theory of the critical mass level has been confirmed in previous studies, which found that a larger representation of women in boards was needed to impact firm performance positively (Joecks et al., 2013). The critical mass theory in combination with previous research of corporate governance theories, gender diversity, as well as gender and risk-taking lies as the foundation to our two formulated hypotheses:

Hypothesis 1: If there is a proportion of at least 30% of women on the board, the firm will achieve a higher performance.

Hypothesis 2: If there is a proportion of at least 30% of women on the board, the firm will face a lower corporate risk.

3. Method

In this section, we will present the quantitative method used to determine if there is a statistically significant association between board gender diversity, firm performance and corporate risk in Swedish unlisted firms. First, we will introduce the regression model used in this study, followed by explanations of the variables included, necessary assumptions to the model.

3.1 Research design

The ideal method to investigate the association between the fraction of women in boards and performance and corporate risk would have been to include all potential variables that could have an impact. However, it is almost impossible to be entirely confident that one has included all relevant control variables. Moreover, due to data limitations for the observed firms, some relevant variables we would have wanted to include in our regression are not possible to obtain. For example, the level of education of the board members, board tenure, board member independence and CEO duality have shown to impact firm performance or corporate risk in previous studies (Adams and Ferreira, 2009; Adams, 2016; Sila et al., 2016), variables that cannot be included in this study. This poses a limitation for the research.

This study follows the methodology used by Adams (2016) with standard ordinary least squares (OLS) technique for the regressions. This is a statistical technique that minimizes the distance between the observations and the best-fitting line. The choice of model is based on its intuitive rationality and provision of estimators with good statistical characteristics. More specifically, a multivariate regression model is used as we successively include several control variables related to firm and board characteristics, for example firm size, industry fixed effects, and CEO gender, all of which have shown to have an impact on the main parameters in previous studies. In line with Adams (2016), the control variables are added gradually to check for variable bias between the added control variables and the main independent variable. Like Adams, we use clustered standard errors at the firm level in all OLS regressions.

Subsequently, we control for some of the endogeneity concerns by using a firm fixed effects model (Adams, 2016). Further explanations are stated in section 3.6-3.7. In our study, the dependent variables are regressed on two independent variables based on different fractions of females in the board: (1) *Fraction Female Directors*, (2) *Critical Mass* (1 = boards with at least 30% females). The fraction of female directors is the independent variable used in the benchmark paper. However, we aim to contribute with a more nuanced analysis by also testing for the debated 30% level, the critical mass. We measure the impact on four dependent variables with the motivation to give a broader overview on the effect of female presence in boards on both financial performance and corporate risk measures.

3.2 Final linear OLS model

The final multivariate OLS models for the dependent firm performance variables (1) and corporate risk variables (2) are stated below. They are separated since we control for risk through the variable *D/A-ratio* in regression (1) and for performance through the variable *Operating Margin* in regression (2). The remaining control variables are the same in both final regressions. The subscripts i and t correspond to firm i in year t. It is important to mention that the control variables, except for year fixed effects, are added subsequently to the regressions to control for omitted variable bias. The models stated below are the final OLS models including all control variables.

(1)

$$Y_{j,k} = \alpha + \beta_1 FractionFemaleDirectors + \beta_2 Solvency\ ratio_{it} + \beta_3 LogSales_{it} + \beta_4 FirmAge_{it} + \beta_5 BoardSize_{it} + \beta_2 AgeMember_{it} + \beta_3 LogSales_{it} + \beta_4 FemaleCEO_{it} + \beta_3 FemaleChairman_{it} + feYear_{it} + feIndustry_{it} + \varepsilon_{it}$$

(2)

$$Y_{l,m} = \alpha + \beta_1 CriticalMassdummy + \beta_2 OperatingMargin_{it} + \beta_3 LogSales_{it} + \beta_4 FirmAge_{it} + \beta_5 BoardSize_{it} + \beta_2 AgeMember_{it} + \beta_3 LogSales_{it} + \beta_4 FemaleCEO_{it} + \beta_3 FemaleChairman_{it} + feYear_{it} + feIndustry_{it} + \varepsilon_{it}$$

Where:

$Y_j = ROE$

$Y_k = ROA$

$Y_l = Interest - coverage\ ratio$

$Y_m = Log\ Standard\ Deviation\ of\ ROE$

$$\alpha = Constant$$
$$\beta = Coefficienct\ of\ variable$$
$$fe = Fixed\ Effects$$
$$\varepsilon = error\ term$$

3.3 Dependent variables

Performance Proxies

We include two commonly used accounting-based ratios to determine the financial performance: return on equity and return on assets (Adams, 2016; Adams and Ferreira, 2009). We use ROE as a proxy for firm financial performance in line with our benchmark paper (Adams, 2016). The fundamental difference between the ROE and ROA is the inclusion of leverage in ROA, and hence the total capital base is captured in the ratio. It would therefore be necessary to consider both ratios when evaluating the effectiveness of a company's operation. Previous studies have also used market-based measures, such as Tobin's Q, to measure performance. However, since the sample of this research consists of unlisted firms, we will only use accounting-based methods.

Return on Equity (ROE)

The return on equity ratio measures the management's ability to manage capital effectively. Based on previous research the coefficient of ROE is expected to be positively associated with a higher proportion of women in boards (Adams, 2016; Shrader et al., 2020).

$$ROE = \frac{Net\ income}{Total\ Equity}$$

Return on assets (ROA)

The return on assets ratio measures the firm's operative profitability and how management is using its assets or resources to generate more income. Based on previous research, we expect the coefficient of ROA to be positive (Adams and Ferreira, 2009; Shrader et al., 2020).

$$ROA = \frac{Net\ income}{Equity + Debt} = \frac{Net\ income}{Total\ Assets}$$

Corporate Risk Proxies

Measuring risk in private companies where no stock prices can be used, one is required to broaden their view of risk estimation methods. Therefore, we include measurements calculating both the financial risk and the operative risk and study changes in the key ratios that make up the total risk in corporations. It is also worth mentioning that the benchmark study (Adams, 2016) does not investigate corporate risk and therefore, we follow other well-known journals to find relevant methods to measure the relationship between gender diversity and risk (Sila et al., 2016; Lenard et al., 2014).

Interest-coverage ratio

Solvency ratios are commonly used in previous studies (Feng et al., 2014) to estimate financial risk, based on items in both the balance sheet and income statement. We use the interest-coverage ratio, which has been used as a proxy for financial stability in previous studies on limited liability firms (Daniel, 2015; Riksbanken, 2020). A high ratio indicates a more financially safe company, and if the ratio falls below 1.5, it might imply that the company has difficulty meeting the interest on its debts (Fransisco et al., 2019). Based on the theory that women are more risk averse and hence would not take on as much borrowing, the interest expense is expected to be lower and hence the ratio higher. Consequently, we expect the coefficient of the interest-coverage ratio to be positive.

$$Interest - coverage\ ratio = \frac{EBIT}{Interest\ expense}$$

Log Standard Deviation of ROE

To be able to make assumptions about risk, it is valuable to study the changes in key ratios over time. More specifically, one can study the volatility in ROE, which captures both operative and financial risk, i.e., it reflects the total risk of a company (Johansson and Runsten, 2017). Volatility can be captured by calculating the standard deviation, a common measure shown to provide a good estimate of the uncertainty of future returns (Sila et al., 2016). Based on previous research on diverse boards and risk taking, we expect earnings to be more stable over the time period if the company has a higher proportion of women on the board (Lenard et al., 2014). In other words, ROE is expected to be less volatile and the standard deviation to have a negative coefficient. In line with Faccio et al. (2016), the standard deviation of ROE is calculated over 5-year overlapping windows (2010–2014, 2011–2015, 2012–2016, 2013–2017, 2014–2018, 2015–2019). Consequently, data is missing for the years 2016 – 2019 and the only values that will be included in these regressions will be between the years 2010 – 2016.

$$Standard\ Deviation\ of\ ROE = \sqrt{\frac{\sum(x-\bar{x})^2}{n-1}}$$

After analyzing the data, we realize that the variable is skewed and lacks normal distribution. Therefore, we transform the variable to make it more normally distributed by taking its logarithmic value (see section 5.1 for a more detailed description). Hence, the independent variable we use throughout the study is Log Standard Deviation of ROE.

3.4 Independent variables

Fraction Female Directors

As the study aims to investigate whether the proportion of women in boards have an impact on firm performance and corporate risk, the first independent variable is the fraction of women in boards. The fraction is calculated according to the formula below.

$$Fraction\ Female\ Directors = \frac{Number\ of\ women}{Total\ number\ of\ board\ members}$$

Critical Mass dummy

Secondly, we use an independent dummy variable with a level 30% fraction of females, which is based on the critical mass theory. If the board has at least 30% of women in the board, it takes the value 1. If the board has a lower fraction than 30%, it takes the value 0.

3.5 Control variables

As the study investigates the board structure of companies and how it affects performance and risk, it is vital to consider the optional effects from omitted variables. Consequently, we have included board and firm characteristic control variables in line with previous studies in the area.

Debt – to – Asset ratio

The existence of the relationship between debt financing and firm performance is commonly known. Some find that leverage can be used to boost performance measures whilst others find that leverage has a negative effect on performance measures when measuring the relation in different countries (Weill, 2008; Yazdanfar and Öhman, 2015). Therefore, we have decided to include the debt-to-asset ratio (D/A) as a control variable for the regressions of *ROE* and *ROA*. The ratio is calculated as Short-term and Long-term Debt divided by Total Assets.

Operating margin

The relationship stated above is most likely to also hold the other way around, i.e., that firm risk is affected by firm performance. The operating margin is therefore included as a control variable for the regressions of the dependent risk variables, *Interest-coverage ratio* and *Log Standard Deviation of ROE*. The operating margin is calculated as Operating Income divided by Revenue.

Log Sales

Firm size has shown to be an endogenous factor when estimating the relationship between the board composition and firm outcomes (Adams, 2016). Larger firms are usually more stable, are less likely to go bankrupt and benefit from economies of scale (Kuncová et al., 2016). In line with Adams (2016), we use the natural logarithm of sales as a proxy for firm size.

Firm age

Older companies have been active for a longer period, which has shown to cultivate experiences from economic cycles and market fluctuations. It is also realistic to think that older companies have more to lose, which may also affect their risk propensity (Lewellyn and Muller-Kahle, 2012). Previous research has also suggested that firm age is negatively associated with profitability, due to organizational rigidity (Loderer and Waelchli, 2015). Therefore, firm age is included as a control variable and is estimated by the number of years the firm has been registered in the Swedish Companies Registration Office (sw: Bolagsverket).

Board size

The size of the board has shown to impact the financial ratios of the firm. Companies with small boards exhibit more favorable values for financial ratios (Yermack, 1996). Thus, we use the board size, calculated as the total number of board members, as a control variable in the regressions.

Board average age

According to Roger et al., (1983), the amount of experience a person possesses is linked to their age, which has also shown to negatively affect the risk propensity. The older you get, the more risk-averse you become due to previous experience and less hunger for new excitement and risks. As a result, we include the age of the board members as a control variable, calculated as the average age for the group for each year.

Female CEO dummy

The CEO is responsible upon deciding major corporate decisions, managing the overall operations and resources of the company, as well as managing communication between the board and corporate operations (Glick, 2011). Results from previous research state that the gender of the CEO has a significant impact on both corporate risk and firm performance (Faccio et al., 2016; Eduardo and Poole, 2016). Therefore, the gender of the CEO is an endogenous factor to control for when measuring the impact of board governance on corporate outcomes.

Female Chairman dummy

The chairman has a vital role in the decision process of the board, ensuring that the board is effective in its mission of implementing the company's direction and strategy (Brickley et al., 1997). Therefore, the gender of the chairman is included as a dummy control variable.

Industry fixed effects

The industry variable is a fixed effects variable, since companies in different industries are exposed to various levels of operational and financial risk (Chicken and Harbison, 1990). Moreover, female representation is not uniform across all types of firms and industries. For example, if females are more highly represented in some industries compared to others, and firms in this industry grow more slowly, one could make a spurious inference. To categorize industries, we derive the European industry classification "NACE revised 1" from the Amadaeus database. The NACE codes are translated into twelve industry classifications. Industry groups that consist of fewer than six companies are grouped into one group named "Other", which results in eight industry groups in total (Appendix 1).

Year fixed effects

To control for year-specific variances, we include year dummy variables in all regressions for the years (2010-2019). This methodology is used in our benchmark study by Adams (2016). This controls for factors changing over time that are common to all companies within the group for a given year.

3.6 Assumptions to the model

The regressions coefficients are computed by the OLS method. This procedure derives estimators that can be applied in the regression model. We use four standard assumptions to make the linear regression model hold (Newbold et al., 2013) and complement with the Gauss

Markov assumptions for the OLS technique.

1. There is a linear, or at least an approximately linear, relationship between the response Y and the regressor X
2. The explanatory variables are uncorrelated with each other
3. The independent variables are uncorrelated with the error term
4. The error term has a zero mean
5. The error term has a constant variance σ2
6. The error terms are uncorrelated
7. The error terms are normally distributed

Subsequently, we conduct analyses to examine the validity of the assumptions to avoid drawing incorrect conclusions based on an ambiguous and dubious model. To test these assumptions, we conduct several tests by studying the residuals to the model. If assumptions are violated, the model must be altered, which can be done through transforming the data or dropping variables. First, the linearity assumption is tested by plotting the standardized residuals of the dependent variable against the independent variable in a scatter plot. The value of the dependent variable (Y) should be reflected as a linear function of the independent variable (X) and the error term. Second, we apply a common procedure, the Shapiro-Wilk, to test the normality assumption. We further check for multicollinearity to see if any of the independent variables are correlated, which would cause problems in the OLS estimators and mean that the model is better off with fewer variables. Both heteroskedasticity, meaning that the variance of the residuals is unequal over a range of measured values, and autocorrelation, serial correlation of the same variables between successive time intervals, are commonly detected in panel data. However, with clustered standard errors in our model provides standard error estimates that are both heteroskedasticity and autocorrelation consistent (Hoechle, 2007). Moreover, there is a consensus in the literature regarding the problem of endogeneity when investigating the relationship between board characteristics and firm outcomes (Adams, 2016). Consequently, we assume the presence of this phenomenon, which we address in the section below.

3.7 Firm Fixed Effects Model

When analyzing the effect of gender equality on performance and corporate risk, it is relevant to address concerns on endogeneity due to omitted unobservable firm characteristics. Omitted variables, which can both affect the director-selection process and governance, may lead to biased and inconsistent coefficient estimators when measuring the association between board gender diversity and the variables measured. For example, it is possible that cultures differ amongst companies and consequently, some firms have better governance as well as more female directors in the board. Under the assumption that corporate culture does not change during the observed period, we apply firm fixed effects to address the concern that omitted variable factors are affecting our results. By including fixed effects, we reduce the heterogeneity from omitted variables as well as the endogeneity problem. Although we initially report results without firm fixed effects for contrasting purposes, we only put emphasis on those results that address the endogeneity issue by being robust to the inclusion of fixed effects.

3.8 Causality

Another important source of endogeneity is reversed causality. When measuring the relationship between board governance and corporate outcomes, there is a possibility of a reverse causal relationship. Sila et al. (2016) mention how a causal relation between the female presence in firms and firm performance can be linked to Corporate Social Responsibility (CSR). High-performing companies with a focus on CSR have shown to be more prone to employ more women. This fact makes it difficult to interpret whether it is the women themselves that improve the performance of the company, or rather that the good performing companies employ more women. There are also studies showing contrasting findings on the causality problem, namely that the likelihood of a female candidate being selected increases when the performance of the organization is poor (Haslam and Ryan, 2008). A procedure to address the causality problem is to re-estimate the models using instrumental variable (IV) techniques. In that case, one would have to find good instruments that are correlated with the independent variables (proportion of females), but uncorrelated with the dependent variables. However, we are not able to control for it in our model given data limitations that does not include any valid instruments that meet these requirements. Hence, we will not fully be able to address the endogeneity problem that arises due to reverse causality. Consequently, our results from the linear OLS model will not be as trustworthy and significant as if we were to have access to good instruments to address the problem and get rid of some biases.

4. Empirical Data

4.1 Sample

The ideal sample to investigate the relationship between female directors and corporate outcomes would have been to include the total population of private firms in Sweden. However, due to lack of data as well as the difficulty of manually composing the datasets of director information and company financials, such a procedure would demand more time than possible for this thesis. Given the limitations that exist, we have tried to produce a sample that can be regarded as suitable for our stated research question.

Our study is based on data from an unbalanced panel sample of Swedish unlisted companies during the period 2010-2019. The data consists of two data sets that have been merged. The financial data and company information is extracted from the database Amadeus. Amadeus is an external database of comparable financial and company information for public and private companies across Europe, with financial history on the company level. The financial data is complemented with company information from the Serrano database that provides information on the composition of board of directors and the chief executive officer for the years 2010-2019 for unlisted firms. The data is collected based on a ten-year horizon, between 2010 to 2019. The time frame is consistent with previous research within this area, which makes our findings more comparable (Adams, 2016; Sila et al., 2016).

This study intends to investigate private limited companies in Sweden. The filtration of companies in our sample was based on various criteria's. Our initial sample consist of 94,268 private companies registered in Sweden that have been active during the whole period of 2010 - 2019. In line with our benchmark study, we exclude companies that operate in the financial and insurance sector, since these have a capital structure incomparable to others (Adams, 2016). Second, we sort for companies not majority owned by a domestic shareholder as these might have other structural - or organizational influences. Third, we exclude all companies not classified as mid-sized companies, which specifies a number of employees between 50 - 249 as well as an operating revenue and total assets of at least 10 million EUR (European Commission, 2019). This is done with regard to the fact that smaller private companies usually do not disclose as much comprehensive financial data and company information for the public, as well as they most likely have boards with fewer than 3 members. Firms with lack of data and a small board would then anyways be excluded from the final sample. The employee criteria make us exclude companies classified as large-sized, which gives a more representative sample to the total population, since these firms only represent 0.1% of the total number of the companies in Sweden (Tillväxtverket, 2021). However, this comes at the expense of imposing a risk that the sample might not be representative to compare the results to similar studies based on public firms, which by nature are classified as large-sized. The filtering results in a sample of 307 companies from Amadeus's list. Lastly, we exclude 70 companies that have a total number of board of directors of less than three members for more than six of the ten years. We exclude these companies as their boards can be considered too small. This results in a final unbalanced random sample of 237 companies. Some observations in the sample have missing data points for certain variables. Consequently, the number of observations will differ among the regressions. We make some adjustments to our variables, including altering outliers which could have a deceptive influence on our results. This is done by winsorizing all dependent variables at the 1 and 99 percentiles to exclude extreme values (Appendix 2 and 3).

4.2 Descriptive statistics

Table 1. Descriptive statistics for all variables in the dataset

Dependent variables	**Observations**	**Mean**	**Std. Dev**	**Min**	**Max**
ROE	2,244	0.1038	0.2699	-1.29	0.8751
ROA	2,251	0.0477	0.0884	-0.7111	0.8233
Interest-coverage Ratio	2,225	0.3357	0.8329	-0.3321	5.276
Log Standard Deviation of ROE	1,371	2.0681	0.9382	0.0752	4.3103
Independent variables	**Observations**	**Mean**	**Std. Dev**	**Min**	**Max**
Fraction Female Directors	2,370	0.1513	0.1690	0	1
Critical Mass dummy (1=at least 30% females)	2,370	n/a	n/a	n/a	n/a
Control variables	**Observations**	**Mean**	**Std. Dev**	**Min**	**Max**
Log Sales	2,248	10.4769	0.7798	4.6889	13.4247
Firm age	2,370	32.5169	22.7788	0	122
Board average age	2,364	54.5428	7.1731	28	90
Board size	2,370	4.9287	1.9453	1	15
Female CEO (1=yes)	1,579	n/a	n/a	n/a	n/a
Female Chairman (1=yes)	2,167	n/a	n/a	n/a	n/a
D/A ratio	2,251	0.4198	0.2085	-0.214	0.9921
Operating margin	2,249	0.0547	0.0952	-0.496	0.7569
Industry dummy (1=industry X)	2,370	n/a	n/a	n/a	n/a
Year dummy (1=year X)		n/a	n/a	n/a	n/a

Notation: Since dummy variables are not measured on the continuous level, no mean, standard deviation, min or max has been reported for these variables.

Table 1 above shows the descriptive statistics for the data that make up the total population for the regression analyzes. In the total amount of data, women make up on average 15.13% of the number of board members, and there is an apparent heft of men. It can be noted that the present level is far from the Critical Mass (30%) level as well as the Swedish government's target of 40% for listed companies. In comparison, the average proportion of females in boards of

Swedish listed companies is currently at 38% (EIGE, 2021). In our sample, some boards consist exclusively of men for some of the years. Nonetheless, we regard this to reflect the gender distribution in boards rather than a limitation in the sample data. One can observe that there also exist observations with boards consisting exclusively of women.

The population of firms in our sample have on average been active for 32 years. However, the firm age varies between 0 years for the youngest company, meaning that they were founded in 2010, and 122 years for the oldest company. The average number of board members are five board members, with an average age of 54 years, both which are lower numbers than the findings made by Adams (2016) who report an average of 9 board members with an average age of 59 years. However, the board size can give a clear depiction of board characteristics across countries and firm types, which may for example explain why Adams (2016) observed a maximum board size of 39 directors on her sample of US listed firms, compared to our sample on Swedish unlisted firms, which had a maximum of 15 directors.

Our sample reports a slightly higher mean for the dependent variable *ROA* (4.77%) compared to the mean sample used in the study by Adams (2016) at 3.19%. In her study, she observes an extreme min value (-577.85%) compared to the min value observed in our sample (-71.11%). However, this could be due to the construction of the sample and that the companies operate in different industries as the use of assets can look different between these, as well as different ways to transform the data. The max values are more similar, 59.59% in her sample, and 82.33% in our sample, respectively. For the second measure of profitability, ROE, an average value of 10.38% is observed for our sample, which is higher compared to Adams who found an average ROE of 8.18%. NYU professor Aswath Damodaran (2021) calculated the average ROE for several industries in the US and concluded that the market averaged an ROE of 8.25% as of January 2021, though some reported values at -47.03% and others 70.64%. However, what makes a good ROE depends on the specific industry of the companies involved. For our independent risk measures, we observe a mean of 0.336 for the *Interest-coverage ratio,* which is lower than the generally considered minimum acceptable ratio at 1.5. This signalizes that there may be a cause for concern for the companies in the sample, and that they might not generate sufficient revenues to satisfy their interest expenses (Fransisco et al., 2019). Furthermore, we report a mean for the *Log Standard Deviation of ROE* 2.068 with a spread of 4.2, meaning that some companies have a very low volatility in ROE, whilst others have a high volatility.

Table 2. Descriptive statistics for the three dummy variables in the final dataset

		Observations	
Independent variable	**Type of variable**	**Female [% of observations]**	**Male [% of observations]**
Critical Mass	Dummy variable	459 [19.37%]	1911 [80.63%%]
Female CEO	Dummy variable	89 [3.75%]	1490 [62.87%]
Female Chairman	Dummy variable	150 [6.33%]	2016 [85.06%]

As shown in the descriptive statistics in table 2, observations that take '1' on the independent variable *Critical Mass* sum to 459, which is 19.37% of the total number of firm-years observations for the full sample (2,370). This indicates that these firm-years have boards where females represent at least 30% of the board seats. There are 89 observations that take '1' on the control variable *Female CEO*, which indicates that there are relatively few women in the role of CEO in the firms studied (3.75%). We can also see that we are missing 791 data points for the variable where we do not know the gender of the CEO. However, we observe that there are more women in the position of board chairman among the companies studied, more specifically 150 firm-year observations that take the value '1'. This indicates that in our sample, in 6.33% of the cases, a female holds the board chairman position.

Table 3. Descriptive statistics comparing firms with 30% female directors and firms without 30% female directors

Firm characteristic	**Mean for firm-years with less than 30% female board members**	**Number of observations** (Not firms)	**Mean for firm-years with at least 30% female board members**	**Number of observations** (Not firms)	**Difference**
ROE	0.109	1,815	0.081	429	0.03
ROA	0.048	1,822	0.047	429	0.00
Interest-coverage ratio	0.327	1,803	0.374	422	-0.05
Log Std. Dev. of ROE	2.113	1,133	1.853	238	0.26
Log Sales	10.462	1,819	10.538	429	-0.08
Firm age	32.0	1,911	34.5	459	-2.50
Board average age	54.5	1,911	54.8	453	-0.35
Board size	5.0	1,911	4.6	459	0.40
D/A ratio	0.406	1,822	0.478	429	-0.07
Operating margin	0.056	1,820	0.050	429	0.01

Note: the values are given in decimal form.

When comparing firms with at least 30% female directors to those firms without, one can only observe a few differences. Overall, the characteristics of the firms with at least 30% female directors do not significantly differ from firms with a lower proportion of females, which can be interpreted by the firm age (34.5 versus 32), average age of the board members (54.8 versus 54.5) and the number of board members (4.6 versus 5). Neither do the financial measures differ strongly. Based on statistics from table 3, we suspect that we will not find support for our first hypothesis that firms with at least 30% female directors perform better. However, the results of the risk measures show a higher *Interest-coverage ratio* and lower *Log Standard Deviation of ROE* for the firms with an at least 30% fraction of female directors. This indicates that we might find support for our second hypothesis that female directors are more risk averse and that they can influence corporate outcomes if they sit in at least 30% of the board positions.

5. Empirical results

5.1 Analysis of assumption tests

As mentioned in section 3.6, the multivariate regression model relies on fundamental standard assumptions that should always be met. We have already addressed three common problems proven to arise in similar studies that violate three of the assumptions, namely endogeneity, autocorrelation and heteroskedasticity. These are corrected for through fixed effects and clustered standard errors. In this section, we present the tests performed to validate the remaining assumptions. A significance level of 5% has been chosen for the tests.

First, we test for multicollinearity after the regressions to see if any independent and/or control variables correlate and need to be dropped. More specifically, a variance inflation factor test (VIF-test) is used. As a rule of thumb, this number must not exceed 10 (O'brien, 2007). In addition, a Pearson correlation matrix was performed to provide a clear overview of the variable's correlation to each other. A correlation that exceeds 0.8 may indicate a presence of multicollinearity (Grewal et al., 2004). Not surprisingly, there is a positive correlation of 0.8164 between ROA and ROE. However, these two dependent variables are not included in the same regression and do not affect the robustness of our results. Except for ROE and ROA, neither the VIF-test nor the Pearson correlation matrix indicated the presence of multicollinearity (Appendix 4 and 5). Second, we test for the linearity assumption by plotting the standardized residuals of the regression model against the continuous independent variable. Scatter plots with each dependent variable and the independent variable and signs of non-linearity could not be detected (Appendix 6).

Lastly, we run the Shapiro-Wilk test to test for residual normality, although we have already winsorized our dependent variables as well as logarithmized the *Standard Deviation of ROE* to tackle non-normally distributed residuals. The null hypothesis in the test is that the residuals are normally distributed (González-Estrada and Cosmes, 2019). Based on the results from the Shapiro-Wilk test, we can reject the null hypothesis, meaning that all regressions disclose a lack of normally distributed residuals (Appendix 7). A well-used method of dealing with non-normality is to construct a logarithmic, squared or box-cox transformation of variables (Feng et al., 2014), as already done with the *Log Standard Deviation of ROE*. However, since the other dependent variables in the regressions contain both positive and negative values, such a transformation is not feasible. Consequently, the models lack statistical validity with regard to the normality of residuals, which means that the results should be interpreted with caution.

5.2 Analysis of regression results

This section presents the result of the regression models run on each dependent variable individually. The main observations are done on the independent variables *Fraction Female Director* and *Critical Mass*, however, significant control variables are also commented on. Column I is the linear regression where only the independent, year fixed effects, and dependent variable is included. In Column II, we add the control variable *Log Sales* as a proxy for firm size. Subsequently, we add industry fixed effects in column III and in column IV, we add all remaining control variables. One difference to note is that the regressions of ROE and ROA have the *D/A-ratio* included as a control variable in IV, whilst the regressions on *Interest-coverage ratio* and *Log Standard Deviation of ROE* have *Operating margin* as a control variable in IV. Lastly, we drop the industry fixed effects in V and run a firm fixed effect model with all control variables included. All these regressions are performed based on the total fraction of females in board (1= *Fraction Female Directors*) as well as at least 30% fraction of females in the board (2 = *Critical Mass*).

Regression ROE

Table 4: Regression results ROE

Dependent variable: ROE										
	(I)		**(II)**		**(III)**		**(IV)**		**(V)**	
Independent Variables	1	2	1	2	1	2	1	2	1	2
Fraction Female Directors	-0.089*** (0.03)		-0.086*** (0.03)		-0.079** (0.03)		-0.134*** (0.04)		0.092 (0.08)	
Critical Mass (1=at least 30% females)		-0.028** (0.01)		-0.029** (0.01)		-0.029** (0.01)		-0.055*** (0.02)		0.019 (0.02)
Log Sales			0.028*** (0.01)	0.029*** (0.01)	0.031*** (0.01)	0.031*** (0.01)	0.05*** (0.01)	0.048*** (0.01)	0.069*** (0.02)	0.069*** (0.018)
Firm age							-0.001*** (0.00)	-0.00*** (0.00)	-0.012*** (0.00)	-0.012*** (0.00)
Boardsize							-0.01*** (0.003)	-0.014*** (0.00)	-0.015** (0.01)	-0.014** (0.01)
Board average age							-0.005*** (0.00)	-0.005*** (0.00)	-0.001 (0.00)	-0.001 (0.00)
Female CEO (1=yes)							-0.020 (0.03)	-0.026 (0.029)	0.175*** (0.05)	0.183*** (0.05)
Female Chairman (1=yes)							-0.037** (0.02)	-0.041** (0.02)	-0.005 (0.02)	-0.005 (0.02)
D/A ratio							0.196*** (0.0419)	0.195*** (0.0422)	0.458*** (0.06)	0.455*** (0.06)
Constant	0.163*** (0.02)	0.156*** (0.02)	-0.134 (0.09)	-0.147 (0.09)	-0.171* (0.09)	-0.185** (0.09)	-0.076 (0.13)	-0.103 (0.13)	-0.301 (0.19)	-0.287 (0.19)
Number of Firms	237	237							182	182
Observations	2,244	2,244	2,241	2,241	2,241	2,241	1,379	1,379	1,379	1,379
R^2	0.011	0.009	0.016	0.015	0.025	0.024	0.082	0.082	0.598	0.598
Adjusted R^2	0.0061	0.0049	0.0114	0.0105	0.0170	0.0165	0.0655	0.0659	0.5307	0.5304
Year Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry Fixed Effects	NO	NO	NO	NO	YES	YES	YES	YES	NO	NO
Firm Fixed Effects	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
Regression Type	OLS		OLS		OLS		OLS		FIRM FIXED EFFECTS	

Notes: This table present the results for five regressions with the dependent variable *ROE* and independent variables *Fraction Female Directors* (1) and *Critical Mass* (2). Column I is the linear regression where only the independent, year fixed effects, and dependent variable is included. In Column II, we add the control variable Log Sales as a proxy for firm size. Subsequently, we add industry fixed effects in column III, and in IV, we add all remaining control variables. Lastly, we drop the industry fixed effects in V and run a firm fixed effect model with all control variables included. All regressions include year fixed effects and standard errors are clustered at the firm-level in regressions I - IV. All variables are defined in section 3.3 - 3.5 and described in detail in Appendix 10. Z-scores are presented in parentheses below the coefficients. T statistics are in parentheses; *p<0.05, **p<0.01, ***p<0.001.

By using the model stated we test in table 4 if the return on equity is significantly higher for firms with a higher fraction of women on boards. In column I, we observe that the variable *Fraction Female Directors* is significant at a 1% level and the variable *Critical Mass* at a 5% level. The negative coefficient of both variables implies that the fraction of female directors affects the return on equity negatively, and hence we do not find support for the first hypothesis. When we add *Log Sales* neither the coefficient nor the significance level of the independent variables changes substantially. The firm size, i.e., larger firms, has a positive association with the return on equity at a 1% significance level. Subsequently, when adding industry fixed effects (III), both the independent variables become significant at a 5% level. However, the coefficients are still negative. In IV, we add all remaining control variables and still observe negative coefficients, now even more negative, -0.134 and -0.055 respectively for (1) and (2), and statistically significant at the 1% level. The economic interpretation is that a 10-percentage point increase in the fraction of female board members is associated with a 1.34 and 0.55 percentage point lower return on equity. In the same column, we observe that the *D/A-ratio* is the variable with the largest impact on *ROE*, with a coefficient of 0.196 and 0.195 respectively, and 1% significance level. Lastly, we drop the industry fixed effect and run a firm fixed effects model. Both independent variables now display positive coefficients (0.092 and 0.019), but at statistical insignificant levels. Therefore, none of the regressions (I - V) support our first hypothesis that a board of at least 30% women will perform better with respect to the *ROE*.

Regression ROA

Table 5: Regression results ROA

Dependent variable: ROA										
	(I)		**(II)**		**(III)**		**(IV)**		**(V)**	
Independent Variables	1	2	1	2	1	2	1	2	1	2
Fraction Female Directors	-0.001 (0.01)		-0.00 (0.01)		0.002 (0.01)		-0.035*** (0.01)		0.001 (0.022)	
Critical Mass (1=at least 30% females)		-0.002 (0.00)		-0.001 (0.00)		-0.002 (0.00)		-0.014*** (0.01)		0.004 (0.01)
Log Sales			0.004* (0.00)	0.004* (0.00)	0.01 (0.00)	0.005** (0.00)	0.012*** (-0.00)	0.012*** (-0.00)	0.019*** (0.01)	0.019*** (0.01)
Firm age							-0.000*** (0.00)	-0.00*** (0.00)	-0.03*** (0.00)	-0.003*** (0.00)
Boardsize							-0.003** (0.00)	-0.003*** (0.00)	-0.006*** (0.00)	-0.006*** (0.00)
Board average age							-0.001*** (0.00)	-0.001*** (0.00)	-0.001 (0.00)	-0.001 (0.00)
Female CEO (1=yes)							-0.024** (0.01)	-0.025*** (0.009)	0.027* (0.02)	0.026* (0.02)
Female Chairman (1=yes)							-0.005 (0.00)	-0.006 (0.01)	-0.004 (0.01)	-0.004 (0.01)
D/A ratio							0.143*** (0.01)	0.142*** (0.001)	0.180*** (0.02)	0.180*** (0.02)
Constant	0.057*** (0.01)	0.057*** (0.01)	0.012 (0.02)	0.012 (0.02)	-0.002 (0.02)	-0.002 (0.02)	-0.036 (0.03)	-0.043 (0.03)	-0.101* (0.06)	-1.02* (0.06)
Number of Firms	237	237							182	182
Observations	2,251	2,251	2,248	2,248	2,248	2,248	1,379	1,379	1,379	1,379
R^2	0.008	0.008	0.009	0.009	0.023	0.023	0.177	0.177	0.591	0.591
Adjusted R^2	0.003	0.003	0.004	0.004	0.015	0.015	0.162	0.163	0.523	0.523
Year Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry Fixed Effects	NO	NO	NO	NO	YES	YES	YES	YES	NO	NO
Firm Fixed Effects	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
Regression Type	OLS		OLS		OLS		OLS		FIRM FIXED EFFECTS	

Notes: This table present the results for five regressions with the dependent variable *ROA* and independent variables *Fraction Female Directors* (1) and *Critical Mass* (2). Column I is the linear regression where only the independent, year fixed effects, and dependent variable is included. In Column II, we add the control variable Log Sales as a proxy for firm size. Subsequently, we add industry fixed effects in column III, and in IV, we add all remaining control variables. Lastly, we drop the industry fixed effects in V and run a firm fixed effect model with all control variables included. All regressions include year fixed effects and standard errors are clustered at the firm-level in regressions I - IV. All variables are defined in section 3.3 - 3.5 and described in detail in Appendix 10. Z-scores are presented in parentheses below the coefficients. T statistics are in parentheses; *p<0.05, **p<0.01, ***p<0.001.

Similarly, in table 5 we examine if *ROA* is significantly higher for firms with a higher fraction of women on boards. For the OLS regressions I-III and firm fixed effects model, none of the independent variables showed statistically significant results. The independent variables only showed significant results in regression IV, where all control variables were included. With statistical significance at 1% and coefficients of -0.035 (*Fraction Female Directors*) and -0.014 (*Critical Mass)*, the economic interpretation is that a 10-percentage point increase in the fraction of female board members is associated with a 0.35 and 0.14 respectively decrease in *ROA*. This result contradicts our expectation. With firm fixed effects, the coefficient of the independent variables becomes positive but not statistically significant, and hence we cannot draw any further conclusions from the results. The control variable *D/A-ratio* shows the highest explanatory value on *ROA*, with a coefficient of 0.143 (*Fraction Female Directors*) and 0.142 (*Critical Mass*) at significance levels of 1%. In the firm fixed effects model, the coefficient even increases to 0.180 for both independent variables, with significance remaining at 1%. All remaining control variables also displayed statistical significance, except for *Board average age* and *Female Chairman*, though all with relatively low explanatory values except for *D/A-ratio*. In line with the results from the regressions for *ROE*, none of the regressions support our first hypothesis that a board of at least 30% women will perform better in terms of *ROA*.

Regression Interest-coverage ratio

Table 6: Regression results Interest-coverage ratio

	(I)		(II)		(III)		(IV)		(V)	
Dependent variable: Interest-coverage ratio										
	1	2	1	2	1	2	1	2	1	2
Fraction Female Directors	0.266**		0.264**		0.302***		0.392**		-0.110	
	(0.11)		(0.11)		(0.11)		(0.16)		(0.25)	
Critical Mass (1=at least 30% females)		0.046		0.0478		0.0695		0.108*		0.144*
		(0.05)		(0.0460)		(0.0461)		(0.06)		(0.07)
Log Sales			-0.035	-0.0361*	-0.041*	-0.0423*	-0.06**	-0.059**	-0.002	-0.003
			(0.02)	(0.0217)	(0.02)	(0.0221)	(0.03)	(0.03)	(0.07)	(0.07)
Firm age							0.004***	0.004***	0.007	0.006
							(0.00)	(0.00)	(0.01)	(0.01)
Boardsize							-0.008	-0.004	0.008	0.008
							(0.01)	(0.01)	(0.02)	(0.019)
Board average age							-0.011**	-0.011***	0.006	0.008*
							(0.00)	(0.00)	(0.00)	(0.00)
Female CEO (1=yes)							0.113	0.137	-0.039	-0.108
							(0.12)	(0.12)	(0.172)	(0.17)
Female Chairman (1=yes)							-0.140**	-0.117**	-0.011	-0.011
							(0.06)	(0.06)	(0.06)	(0.06)
Operating Margin							2.060***	2.049***	2.200***	2.153***
							-0.27	-0.27	(0.29)	(0.29)
Constant	0.308***	0.337***	0.663***	0.703***	0.613**	0.669***	1.191***	1.277***	-0.335	-0.385
	(0.06)	(0.06)	(0.23)	(0.23)	(0.24)	(0.24)	(0.39)	(0.39)	(0.72)	(0.71)
Number of Firms	237	237							182	182
Observations	2,225	2,225	2,222	2,222	2,222	2,222	1,362	1,362	1,362	1,362
R^2	0.004	0.002	0.005	0.003	0.025	0.022	0.111	0.109	0.572	0.573
Adjusted R^2	0.000	-0.003	0.000	-0.002	0.017	0.014	0.095	0.093	0.499	0.501
Year Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry Fixed Effects	NO	NO	NO	NO	YES	YES	YES	YES	NO	NO
Firm Fixed Effects	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
Regression Type	OLS		OLS		OLS		OLS		FIRM FIXED EFFECTS	

Notes: This table present the results for five regressions with the dependent variable *Interest-coverage Ratio* and independent variables *Fraction Female Directors* (1) and *Critical Mass* (2). Column I is the linear regression where only the independent, year fixed effects, and dependent variable is included. In Column II, we add the control variable Log Sales as a proxy for firm size. Subsequently, we add industry fixed effects in column III, and in IV, we add all remaining control variables. Lastly, we drop the industry fixed effects in V and run a firm fixed effect model with all control variables included. All regressions include year fixed effects and standard errors are clustered at the firm-level in regressions I - IV. All variables are defined in section 3.3 - 3.5 and described in detail in Appendix 10. Z-scores are presented in parentheses below the coefficients. T statistics are in parentheses; *p<0.05, **p<0.01, ***p<0.001.

In table 6, using the model stated for risk, we examine if the *Interest-coverage ratio* is significantly higher for firms with more female directors. In the first two regressions (I-II) as well as the fourth regression including all control variables (IV), the coefficient for the independent variable *Fraction Female Directors* was positive and statistically significant at the 5% level. In the third regression (III) the positive coefficient also displayed statistical significance, but at the 1% level. All regressions indicate that we find support for the relationship between a higher fraction of females and lower risk by a higher interest-coverage ratio. The independent variable *Critical Mass* did not display any significance in the first three regressions (I-III). However, when we add remaining control variables in regression IV, the independent variable did display statistical significance at the 10% level with a positive coefficient of 0.108 that supports our second hypothesis. The economic interpretation is that firms with at least 30% female directors are associated with 1.08 percentage points higher interest-coverage ratio. The share of female board members (*Fraction Female Directors*) is significant at a 5% level for this regression (IV) and has a positive coefficient of 0.392. The economic interpretation is that a 10-percentage point increase in the share of female directors is associated with a 3.92 percentage point higher interest-coverage ratio. The positive coefficients and statistical significance for both independent variables indicate that firms with a higher fraction of female directors are more risk averse by showing a higher interest-coverage ratio. Several of the control variables show statistical significance, which shows the importance of addressing the problems related to omitted variable biases.

In the firm fixed effects model (column V) however, only two control variables remain statistically significant, namely the *Operating Margin* and *Board average age.* The *Operating Margin* has a positive association with the *Interest-coverage ratio* at a 1% significance level, and is noticeably high, namely over 2.0 for both independent variables. *Board average age* is significant at the 10% level and has changed sign to positive from the OLS model. However, the low value of the coefficient indicates that the explanatory value of the variable is relatively low. The independent variable *Fraction Female Directors* suddenly is no longer significant in the firm fixed effects model, and thus we find no support for that including more females reduces the risk. However, the coefficient of the independent variable *Critical Mass* remains positive at 0.144 at a 10% significance level. The economic interpretation is that firms with at least 30% female directors are associated with 1.44 percentage points higher interest-coverage ratios. This result is in line with our expectation and supports our second hypothesis. The results from the firm fixed effects shows that a firm cannot be guaranteed a lower risk only by including more females, but that females need to hold at least 30% of the board seats to influence and lower the corporate risk.

Regression Log Standard Deviation of ROE

Table 7: Regression results Std. Deviation of ROE

	Dependent variable: Log Standard Deviation of ROE									
	1	2	1	2	1	2	1	2	1	2
Fraction Female Directors	-0.742*** (0.17)		-0.635*** (0.18)		-0.597*** (0.17)		-0.460** (0.21)		-0.242 (0.37)	
Critical Mass (1=at least 30% females)		-0.257*** (0.07)		-0.204*** (0.07)		-0.189*** (0.07)		-0.180** (0.09)		-0.140 (0.11)
Log Sales			0.000 (0.03)	0.005 (0.03)	0.01 (0.03)	0.014 (0.03)	0.106** (0.04)	0.114*** (0.04)	0.135 (0.09)	0.133 (0.09)
Firm age							-0.001 (0.00)	-0.001 (0.00)	-0.016 (0.02)	-0.016 (0.01)
Boardsize							-0.014 (0.02)	-0.021 (0.02)	0.048* (0.03)	0.045 (0.03)
Board average age							-0.009* (0.00)	-0.0094* (0.01)	-0.007 (0.01)	-0.007 (0.01)
Female CEO (1=yes)							0.125 (0.16)	0.109 (0.16)	0.263 (0.27)	0.295 (0.27)
Female Chairman (1=yes)							0.134*** (0.05)	0.121** (0.05)	-0.001 (0.06)	-0.002 (0.06)
Operating Margin							-1.787*** (0.39)	-1.748*** (0.39)	-0.466 (0.38)	-0.454 (0.38)
Constant	2.204*** (0.06)	2.147*** (0.06)	2.184*** (0.34)	2.082*** (0.34)	2.147*** (0.34)	2.032*** (0.34)	1.633*** (0.53)	1.534*** (0.54)	1.338 (0.89)	1.371 (0.89)
Number of Firms	237	237								
Observations	1,371	1,371	1,298	1,298	1,298	1,298	791	791	791	791
R^2	0.017	0.012	0.013	0.008	0.042	0.037	0.092	0.092	0.761	0.762
Adjusted R^2	0.013	0.008	0.008	0.003	0.031	0.027	0.068	0.068	0.692	0.693
Year Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry Fixed Effects	NO	NO	NO	NO	YES	YES	YES	YES	NO	NO
Firm Fixed Effects	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
Regression Type	OLS		OLS		OLS		OLS		FIRM FIXED EFFECTS	

Notes: This table present the results for five regressions with the dependent variable *Log Standard Deviation of ROE* and independent variables *Fraction Female Directors* (1) and *Critical Mass* (2). Column I is the linear regression where only the independent, year fixed effects, and dependent variable is included. In Column II, we add the control variable Log Sales as a proxy for firm size. Subsequently, we add industry fixed effects in column III, and in IV, we add all remaining control variables. Lastly, we drop the industry fixed effects in V and run a firm fixed effect model with all control variables included. All regressions include year fixed effects and standard errors are clustered at the firm-level in regressions I - IV. All variables are defined in section 3.3 - 3.5 and described in detail in Appendix 10. Z-scores are presented in parentheses below the coefficients. T statistics are in parentheses; *p<0.05, **p<0.01, ***p<0.001.

In table 7, we test if the *Log Standard Deviation of ROE* is significantly lower for private firms with more female directors. In the first column, both independent show statistical significance at a 1% level with negative coefficients. This result persists even when adding firm size and industry fixed effect. Once again, in regression IV, we observe that four of the control variables are statistically significant, indicating some previous biases in the relationship measured. No control variable remains statistically significant in the firm fixed effects regressions except for *Board size*. In IV, the statistical significance remains for both independent variables, but at a 5% level, which implies that a higher fraction of female directors is associated with a lower volatility in *ROE*, supporting our second hypothesis. A one standard deviation change in the percent of female directors is ten percentage points. The economic interpretation of the coefficient of the *Fraction Female Directors* at -0.460 is that every 1 standard deviation increase in the independent variable will reduce the *Log Standard Deviation of ROE* by 4.6 percent. The coefficient of the *Critical Mass* is -0.180, which can be economically interpreted as every 1 standard deviation increase in the independent variable will reduce the *Log Standard Deviation of ROE* by 1.8 percent. In the firm fixed effects model none of the independent variables show any statistical significance, which implies that we find no statistical association between a higher fraction of female directors and lower volatility in ROE. Hence, we do not find support for our second hypothesis in the regression robust to the inclusion of firm fixed effects.

5.3 Robustness test

The robustness of our models is assessed by doing a robustness test. We perform this by initially running a regression without control variables, and then add them gradually to check for variable bias between the added control variable or variables, and the main variables. Moreover, we conduct an additional robustness check by dropping the variables *Female CEO* and *Female Chairman* from regression (III) to examine whether females as directors in other roles in the firm can impact our results. This would not necessarily mean the model is invalid but might distort the outcome of the regression as it becomes difficult to distinguish whether it is the female CEO/female chairman or female board directors that contribute to the explanatory value of the model. We found no significant changes in the coefficients of our variables from the test (see Appendix 8). Overall, neither the coefficient of the independent variable *Fraction Female Directors* nor the independent variable *Critical Mass* changes significantly throughout the regressions, which signals low omitted variable bias. However, it is worth noting that the small impact could be due to the low number of observations where a female holds a position as a CEO or Chairman, which could have limited relevant interpretations.

5.4 Summary of results

To summarize the results from the regressions stated above, the independent variables, *Fraction Female Directors* and *Critical Mass*, displayed statistically significant coefficients in the final OLS regressions on all dependent variables. However, these coefficients become insignificant in the firm fixed effects model for three of the dependent variables, namely the *ROE, ROA* and *Log Standard Deviation of ROE.* Consequently, the results cannot affirm that there exist a positive or negative association between fraction of females and firm performance, neither on a general level (*Fraction Female Directors)* or on the 30% level (*Critical Mass)*. The only independent variable remaining statistically significant is *Critical Mass* on the regression on the dependent variable *Interest-coverage ratio*, which has a positive coefficient at a statistical significance level of 10%.

The models adjusted R^2 is positive for all regressions, except for the *Interest-coverage ratio* of the linear regression in column I, which means insignificance of explanatory variables in this regression. Initially, the adjusted R^2 is very low for all regressions. To improve our model, we subsequently add control variables, which increases the adjusted R^2 and indicate that the variables add explanatory value for all the dependent variables. However, the adjusted R^2 is still relatively low for all final OLS regressions, which implies that there are more factors explaining the variance of the dependent variables. When we run the firm fixed effects model (V), the adjusted R2 increases dramatically up to 0.5 for all regressions on the dependent variables, indicating that more of the variation can now be explained by the model.

6. Analysis

In the following section, we analyze and discuss the results of the regressions. First, a discussion of omitted variables is conducted, followed by a discussion of the control variables before finishing off with an analysis and economic interpretations of the results.

6.1 Omitted variables

The control variables included are by no means comprehensive regarding their impact on companies' performance and risk-taking. It would be prohibitive to include all such variables in the regressions. Hence, it is important to point out that there are factors that can affect the outcome of the result, but which are not captured by the variables used in the regression models. Fixed effects can be used to reduce the threat of omitted variable bias by controlling for the average differences across firms in any observance or unobservable predictors. In the context of this study, this can translate into time invariant characteristics or characteristics of companies in a particular industry. After controlling for industry effects in the regressions and not finding any sufficient variation in the coefficients, such omitted variable bias has been curtailed. Another brute force way of dealing with unobserved heterogeneity is by a firm fixed effects model, which leaves one with the within-firm variation. Because the firm fixed effects model relies on within-firm variation, you need a reasonable amount of variation of your key variable, in our case board fraction, within each firm. This potentially poses a significant limitation to the model as one cannot assess the effects of variables that have little within-group variation. Consequently, if our independent variable, board fraction, does not vary between the years to a greater extent, this indicates that we need to forgo fixed effects estimation. However, this exposes one to potential omitted variable bias. From the firm fixed effects regressions, we see that 55 companies have been excluded from previous OLS regressions (from 237 to 182 firms), which leaves us with a smaller sample. This is because these companies have had zero variation in the independent variables *Fraction Female Directors* and *Critical Mass* over the observed ten-year period.

6.2 Control Variables

The *Log Sales* had a positive coefficient at a statistically significant level of 1% in the final OLS regressions (III) and for the fixed effects model on our performance measures (*ROE, ROA)*. This result was expected in line with previous literature, which emphasized the impact of the size of the company on performance variables (Adams and Ferreira, 2009; Adams, 2016). For the regressions on the risk variables, *Log Sales* were statistically significant in the OLS model, with a negative coefficient for the regressions on the variable *Interest-coverage ratio*, and positive coefficient for the variable *Log Standard Deviation of ROE*. This implies that larger firms are riskier. However, due to the insignificance of this *Log Sales* in the firm fixed effects regression, we are hindered from drawing any broader conclusion regarding this variable relative to our dependent risk-variables. The variable *Firm age* is statistically significant at the 1% level and negatively associated with the performance measures in the firm fixed effects model. This is in line with previous research suggesting that older firms are more organizationally rigid (Loderer and Waelchli, 2015). The results from the final OLS regressions on risk show significant results, which support that older firms are more risk averse (Lewellyn and Muller-Kahle, 2012). However, this significance disappears in the firm fixed effects model.

Furthermore, *Board size* is statistically significant and has a negative coefficient for our dependent variables *ROE* and *ROA* in both the OLS and firm fixed effects model, a relation also noted in previous studies (Yermack, 1996). We do not find this clear relationship for our risk dependent variables except for the firm fixed effects regression on the *Fraction Female Directors* and *Log Standard Deviation of ROE*, which shows a positive coefficient at the 10% statistical significance level. What can be interpreted from this result is that firms with larger boards have more volatile returns, which be linked to the expected effect mentioned for the performance measures (Yermack, 1996).

Before controlling for firm fixed effects, we find that the variable *Board average age* is negatively correlated with all our dependent variables. This could be interpreted as younger board members deteriorate results. However, for our risk measures, it is ambiguous because a negative coefficient for the variable Interest-coverage ratio indicates higher risk-taking, and a negative coefficient for the variable *Log Standard Deviation of ROE* indicates lower risk-taking. Nonetheless, the only value remaining statistically significant for firm fixed effects model is *Interest-coverage ratio*, where the coefficient is positive and significant at the 10% level. It can be interpreted from the result that older board members are more risk-averse, which is consistent with the theory that risk propensity decreases with age (Roger et al., 1983).

Initially, we observe in column IV that the coefficient of the variable *Female CEO* is negative, though only significant for the regressions on *ROA*. However, when looking at the firm fixed effects model, the coefficient of the *Female CEO* variable becomes positive and statistically significant for *ROA* and *ROE*, with a high explanatory value (0.183) on the regression of *ROE* compared to the remaining control variables. The changed sign in the coefficient between the OLS model and firm fixed effects model may indicate that women are employed as CEOs in less performing companies, but that if a company employs a woman as CEO, their performance actually increases. The independent variable, *Fraction Female Directors*, shows no statistical significance for any of these regressions on *ROE* or *ROA*. The results imply that a female CEO has a greater positive influence on the performance of the company compared to female board members. We do not find any significance for the *Female CEO* variable for our firm fixed effects regressions on the risk variables, and thus cannot draw any further conclusions regarding the gender of the CEO and risk taking in a firm.

We find a statistically significant relationship between *Female Chairman* and dependent variables *ROE, Interest-coverage ratio,* and *Log Standard Deviation of ROE* in our OLS regressions. The coefficient for the performance regression is negative, which indicates that a female chairman negatively affects *ROE*. The coefficient for the *Interest-coverage ratio* is negative and for the *Log Standard Deviation of ROE* positive, implying that female chairmen are more risk taking. This is in line with previous research on Swedish female directors in listed companies (Adams and Funk, 2011). Nevertheless, when controlling for firm fixed effects, the statistical significance of the variable in all regressions disappears, and as a result, we cannot draw any robust conclusions whether this holds true or not for female chairmen in Swedish private firms. The variable *D/A* shows a positive coefficient for both the OLS regressions and firm fixed effects model on *ROE* and *ROA* at a statistically significant level. Thus, we can conclude that a higher debt-to-asset ratio is related with a higher performance, which indicates that a higher risk-taking may lead to a higher result. The variable *Operating Margin*, used solely in the regression models stated in 3.4.1 (2), shows a strongly positive coefficient over 2.1 for the regressions on the dependent variable *Interest-coverage ratio,* and statistical significance at the 1% level. This was however expected as both the *Interest-coverage ratio* and *Operating Margin* are derived from the EBIT. For the regressions on the dependent variable *Log Standard Deviation of ROE*, the statistical significance of the *Operating Margin* disappears and decreases when controlling for firm fixed effects, previously being significant at the 1% level with a strong coefficient of -1.7. The economic interpretation is that firms with a higher operating margin enjoy more stable returns. However, this relation is not as equally strong, rather insignificant, when looking at the within-firm variation rather than between companies. Hence, we cannot conclude that a company can simply expect to have more stable returns only by achieving a higher operating margin.

6.3 Analysis of results

Hypothesis 1

The regression with firm fixed effects (Column V) using the dependent variable *ROE* and independent variable *Critical Mass* displayed a positive coefficient of 0.019, but at a statistical insignificant level. The same result is shown for the coefficient of the independent variable on the dependent variable *ROA*, which was positive at 0.004 and statistically insignificant. Hence, we cannot conclude that female directors affect firm performance positively if they constitute at least 30% of the board seats and fail to reject our first null hypothesis.

Even though we do not find support for our first hypothesis, there are other interesting interpretations to draw from our results. The results from our final OLS regressions (column IV) in table 4 and 5 on *ROE* and *ROA* show significant results at the 1% level for both the independent variables and negative coefficients. However, in the firm fixed effects model (column V), all coefficients become positive though insignificant. The switch from negative to positive coefficients when controlling for within-firm variation may indicate that a reverse causality problem may be present, i.e., that firms that perform worse are the ones that also include a higher fraction of women and not necessarily the other way around, that the women have a negative impact on the firm performance. If anything, we observe that the coefficient for female directors is positive when controlling within-firm variation through the firm fixed effects model, although we are not able to draw any conclusions on the relationship based on our findings being insignificant. These results are contrary to findings by Adams (2016), who saw a change in the fraction of female's coefficient from positive to negative when firm fixed effects are included and omitted factors controlled for. In other words, the reverse causality in their study implies that performance can causally affect the diversity of the board if women choose to join the boards of firms that perform better. One might argue that the different results could be due to the difference in firm character traits between our samples as we investigate private firms and Adams public firms. It might be that better performing public firms are in the spotlight of society, which means that they may face a greater societal pressure to include more women. However, without this societal pressure, which is not as evident for private firms, the firms that women can access or are drawn to are the less performing. This again emphasizes the difficulty for women to reach executive positions and to get a chance in the corporate world. However, these obscure findings further stress the problem of endogeneity present when investigating the relationship between board diversity and corporate outcomes, which makes us cautious when analyzing the results from the OLS regressions.

Hypothesis 2

The regression of the fixed effects model on the dependent variable *Interest-coverage ratio* and independent variable *Critical Mass* displayed a positive coefficient of 0.144 at a statistical significance level of 10%. This implies that a company with at least 30% female directors has shown to have a higher interest-coverage ratio, which mean that they do not take on as much debt relative to their earnings and thus increase the potential to pay back on their debt. These results allow us to reject our second null hypothesis and indicate that if females hold at least 30% of the seats in the board, they can influence the boardroom dynamics and lower the firm's risk level. Moreover, the results support the theory related to the critical mass, indicating that women may not be perceived as tokens when they reach one third of the group.

For the regression on the dependent variable *Log Standard Deviation of ROE,* we do not find any statistically significant support for our hypothesis in the firm fixed effects model. The closest comparison to our finding is the paper by Sila et al. (2016), who found no relationship in their study on the influence of female directors on equity risk. However, we emphasize the above-mentioned limitations to the firm fixed effects model that might have an impact on the low statistical power of the results. This is particularly important to keep in mind regarding the potential low variation in the standard deviation when calculating it over a rolling window. Hence, low within-firm variation may create insignificant results, whilst the OLS model poses potential omitted variable bias. Our results are thus difficult to interpret. In the linear OLS regression (IV), the coefficient is strongly negative, -0.460 for the independent variable *Fraction Female Directors* and -0.180 for *Critical Mass*, both statistically significant at the 5% level. This implies that regardless of the fraction, females on boards will reduce the corporate risk. Since we have support for our second hypothesis given the results from the regression on the *Interest-coverage ratio*, as well as in the OLS regressions on the *Log Standard Deviation of ROE,* we after all decide to reject the second null hypothesis.

7. Conclusion and future research

The study was conducted with the aim to investigate how female board members impact a company's performance and risk taking. More specifically, we intended to investigate whether it is required that women hold at least 30% of the board seats to influence corporate outcomes. To answer the question, we have performed multivariate OLS regressions and firm fixed effects regressions on the performance measures *ROE* and *ROA*, and the risk measures *Interest-coverage ratio* and *Log Standard Deviation of ROE*. We did not find enough evidence in support for our hypothesis that women on the board can positively influence the company's performance by constituting at least 30% of the board seats during the examined period. The results of this test can to some extent be compared to other studies on listed firms who found no relationship (Adams 2016; Dale-Olsen et al., 2013). However, this specific research measuring performance and risk in private firms, with emphasis to the critical mass theory, has not been studied before, which makes our results intricate to compare. Nonetheless, we did find evidence in support of our second hypothesis, namely that female board directors influence the firm to be more risk averse if they hold at least 30% of the board seats. The result was statistically significant for the final multivariate OLS regressions of both risk measures, as well as the firm fixed regression on the dependent variable *Interest-coverage ratio*.

In light of our findings, it is important to interpret the results with caution and question indications that show that female board members influence the corporate outcome in a certain way. First, no support was found for the notion that female directors over-perform or underperform their male peers. However, it can be concluded that female directors do not negatively affect the performance of the firm, neither in general nor firms with a proportion of females higher than 30%. Second, regarding the influence on risk, female directors are shown to reduce corporate risk if they have reached a critical mass of at least 30%.

The study enables interesting observations about women in leading corporate positions as the findings show that female directors can reduce the firm risk without impairing the firm performance. Even though our results do not support the introduction of a gender quota to improve results, we see that female directors do not deteriorate the firm performance, and hence companies that strive to be more gender equal can elect women to the board without the concern of degrading their financial ratios. Furthermore, we do not find support for the resource dependency theories that a gender diverse board leads to improved performance prospects. However, one could argue that a more gender diverse board with different skills, knowledge and experiences can help reduce the company's risk. Moreover, it might be the case that female directors have other influences that are not apparent in this study, but which could positively affect the company in other dimensions. For example, increasing the likelihood that the company will hire a woman for other top manager positions in the company, employee satisfaction, salary compensation or ability to innovate.

The topics of gender equality, female in corporate positions and corporate governance are thoroughly researched areas, where solutions to improve operations are frequently discussed. However, to the best of our knowledge, our study on Swedish private firms within this area and accounting measures are unique. Moreover, as a contribution to previous research, our findings neither contradicts nor supports the twofold claims that females have a negative or positive effect on firm performance but puts us in the middle among the studies that did not find any connection. Moreover, our paper can provide insights about women's actual presence in the corporate world by showing that the Swedish statistics and reputation of being gender inclusive does not necessarily hold true when one starts to include private firms in the sample. The low presence of female directors (15.13%) in our sample indicates that much work needs to be done for Sweden to pride itself to be at the forefront of the gender equal movement in the corporate business world.

7.1 Limitations

There are two primary areas of limitations of the research paper that should be emphasized, the sample selection as well as the measurements. Firstly, only Swedish mid-sized private firms have been included in the sample. This indicates that the results may not hold true for firms in other markets and for smaller or larger firms. A further limitation to our study is the choice of performance and risk measures. Only looking at accounting measures of performance and risk is not exhaustive and there are possible measurements that could further explain the relationship between women in boards and corporate outcomes. Also, the availability of data from private companies prevented us from including drivers that could have an impact on the relationship between board diversity, firm performance, and risk. This lack of data further causes difficulties in addressing the reversed causality problem, since we could not find valid instrumental variables that met the requirements.

7.2 Suggestions for further research

We see ample opportunities for future research on the topic of board diversity and corporate outcomes. First, one could deepen the analysis by adding complementing empirical methods to this study. For example, performing a Piecewise regression that compares different fractions, such as 0-10%, 20-30%, 30-40%, 50-60% and so on, would allow one to compare the relationship between the fraction of females and firm outcomes, as well as to investigate if there is an 'optimal' gender composition. Furthermore, a broader area of research on the topic of diversity and the relationship between the board composition and corporate outcomes would be to investigate how other personal factors affect firm outcomes, such as cultural backgrounds, ethnicity, and experiences. Moreover, it would be interesting to investigate whether the gender distribution in the board of directors influences other areas within the company's operations. This would allow for a more thorough understanding of the impact of diversity, and hence bring additional insights on the resource dependency theories that speaks for enhanced performance and governance based on diversity.

As mentioned in section 6.2, the results from regression of *ROE* and *ROA* imply that a female CEO has a greater influence on the performance of the company compared to a female board member. Therefore, it may be interesting to further investigate this relationship as well as the level of impact that a female CEO or other top management position possesses in private firms. Also, to nuance the findings, one could analyze the possible differences among industries and generate comparative results. Moreover, much of previous research investigating the relationship between female representation in boards, firm performance and risk exclude the financial industry. Hence, an intriguing approach would be to investigate whether the results from previous studies hold for firms in the financial industry. Finally, an interesting approach for future research would be to explore the effects of the present COVID-19 pandemic in relation to firm risk and the presence of women in boards. This analysis could be performed by a cross-sectional analysis studying bankruptcy filings in industries and if the proportion of females in these firms differed comparably to firms that survived.

Although the study has some limitations, we hope that the study has contributed to either insights, inspiration, or suggestions for further studies on this important topic to advance the research on the area to include more women in the executive positions.

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Appendix

Appendix 1. Industry Classifications

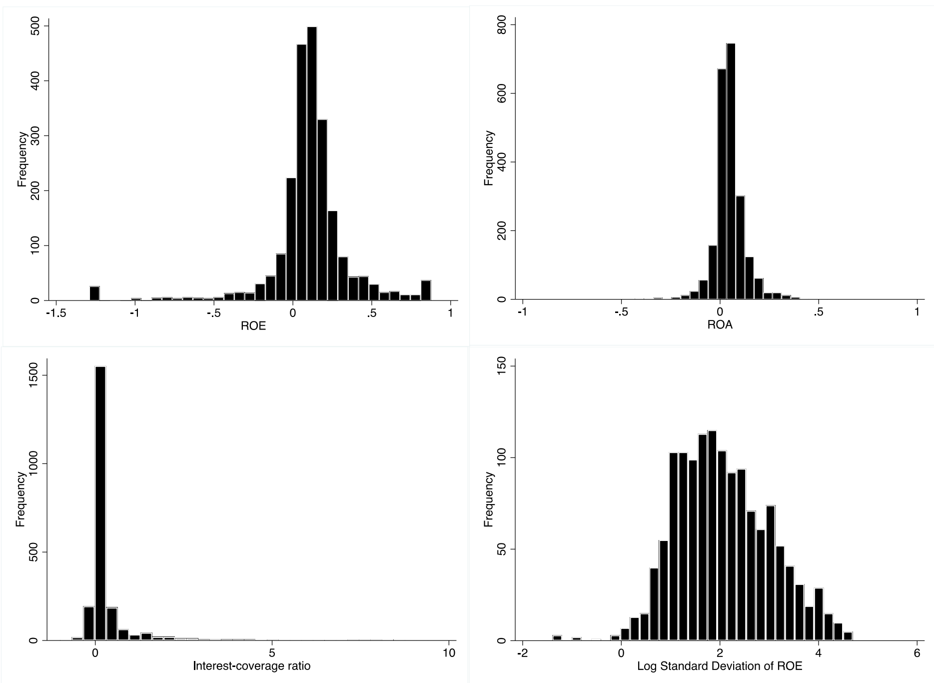
The table defines the industry classifications used in this study, which are identified by using 2-digit NACE codes. The ratios in the column 'Total population' indicate the size of the industry in relation to the total population. 'Women' and 'Men' show the proportion of female respectively male board members in each industry.

Industry #	Definition	# Companies	Total population	Women	Men
Industry 1	Manufacturing	41	17.3%	19.2%	80.8%
Industry 2	Construction	15	6.3%	15.9%	84.1%
Industry 3	Wholesale and retail trade; repair of motor vehicles and motorcycles	46	19.4%	13.9%	86.1%
Industry 4	Transportation and storage	21	8.9%	9.6%	90.4%
Industry 5	Real estate activities	19	8.0%	15.5%	84.5%
Industry 6	Professional, scientific and technical activities	72	30.4%	15.0%	85.0%
Industry 7	Administrative and support service activities	10	4.2%	10.6%	89.4%
Industry 8	Other*	13	5.5%		
Total		**237**	**100%**		

*Electricity, gas, steam and air conditioning supply, Water supply; sewerage, waste management and remediation activities, Accommodation and food service activities, Information and communication, Human health and social work activities.

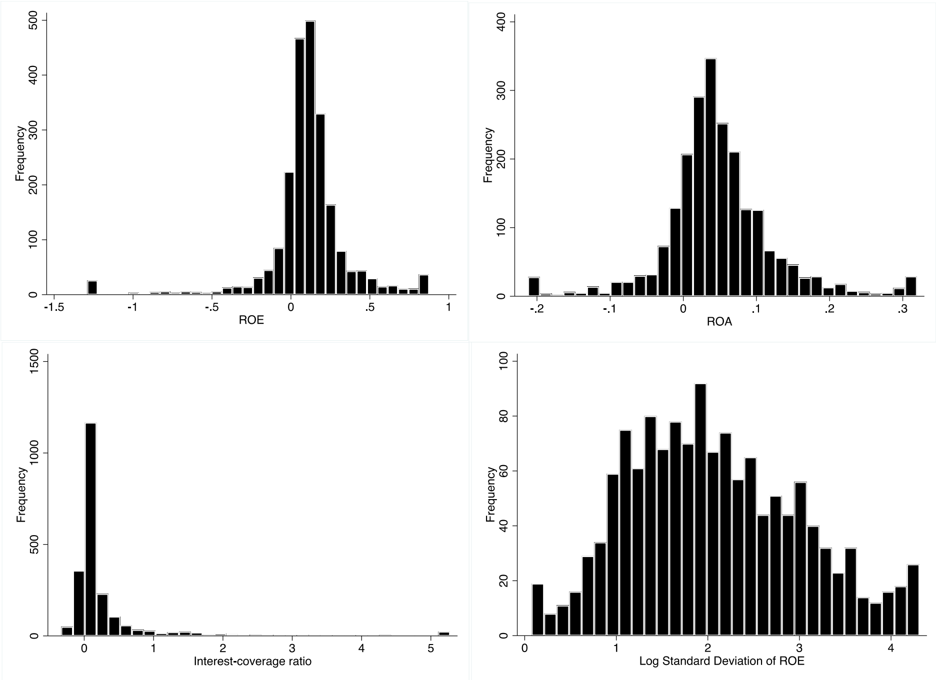
Appendix 2. Data before winsorizing

Histograms of the dependent variables including all observations in the initial dataset, before winsorizing.



Appendix 3. Winsorized data

Histograms of the dependent variables including the observations that remains after winsorizing one and 99th percentile



Appendix 4. Variance inflation factor (VIF) test

Variance inflation factor values and tolerance values for each variable in the final OLS regression models (model 3.2.1). The risk measures are separated in two tables since Log Standard Deviation of ROE only have data for the years 2010-2016, and hence shows different VIF values than the Interest-coverage ratio. Variance inflation factors below 10 are considered acceptable.

Regressions	**ROE & ROA**		**Interest-Coverage Ratio**		**Log Standard Deviation of ROE**	
Variable	**VIF**	**1/VIF**	**VIF**	**1/VIF**	**VIF**	**1/VIF**
Log Sales	1.07	0.9329	1.06	0.9490	1.06	0.9490
Firm age	1.12	0.891	1.13	0.8821	1.13	0.8821
Board size	1.09	0.9071	1.10	0.9088	1.10	0.9088
Board average age	1.10	0.9308	1.06	0.9399	1.06	0.9399
Female CEO (1=yes)	1.11	0.8973	1.11	0.9012	1.11	0.9012
Female Chairman (1=yes)	1.15	0.8582	1.17	0.8562	1.17	0.8562
D/A ratio	1.13	0.8786	1.05	0.9389	1.05	0.9389
dummy2011	1.98	0.5045	1.99	0.5026	1.82	0.5480
dummy2012	1.99	0.5027	2.00	0.5008	1.83	0.5453
dummy2013	2.01	0.4985	2.01	0.4968	1.85	0.5410
dummy2014	2.02	0.4962	2.02	0.4944	1.86	0.5381
dummy2015	2.06	0.4866	2.07	0.4837	1.89	0.5287
dummy2016	2.10	4.772	2.12	0.4715	n/a	n/a
dummy2017	2.10	0.4766	2.12	0.4716	n/a	n/a
dummy2018	2.13	0.4687	2.16	0.4633	n/a	n/a
dummy2019	2.07	0.4824	2.10	0.4765	n/a	n/a
Ind2	1.33	0.7530	1.33	0.7525	1.32	0.7571
Ind3	1.74	0.5739	1.73	0.5765	1.73	0.5797
Ind4	1.33	0.7520	1.32	0.7561	1.32	0.7568
Ind5	1.34	0.7451	1.34	0.7452	1.34	0.7450
Ind6	1.84	0.5447	1.80	0.5563	1.81	0.5528
Ind7	1.23	0.8160	1.22	0.8198	1.22	0.8226
Ind8	1.22	0.8203	1.21	0.8237	1.22	0.8175
Mean VIF	**1.56**		**1.56**		**1.40**	

Appendix 5. Correlation Matrix

Showing the correlation between each of the dependent variables and independent variables included in the final regression.

	Fraction Female Directors	Critical Mass dummy	ROE	ROA	Interest-coverage ratio	Std. Of ROE	Log Sales
Fraction Female Directors	1						
Critical Mass dummy	0.7047	1					
ROE	-0.1212	-0.0377	1				
ROA	-0.0496	0.0169	0.8164	1			
ICR	0.0695	0.0369	0.2337	0.3241	1		
Std. Dev of ROE	-0.0667	-0.0742	-0.1508	-0.1681	-0.0742	1	
Log Sales	0.0128	0.0907	0.1127	0.0711	-0.0868	0.1071	1
Firm age	-0.0411	-0.0384	-0.0372	0.0188	-0.004	-0.011	0.1296
Board average age	-0.0169	-0.0039	-0.1198	-0.1069	-0.1366	-0.0562	-0.0503
Board size	0.0702	-0.1246	-0.0953	-0.0529	0.008	-0.0321	0.0255
Female CEO dummy	0.1818	0.1361	-0.062	-0.0972	-0.0159	0.0766	0.085
Female Chairman dummy	0.2505	0.1903	-0.0606	-0.037	-0.0048	0.0331	0.107
D/A ratio	0.1453	0.1514	0.0749	0.3286	0.269	-0.4311	-0.0931
Operating margin	-0.0094	0.0429	0.4662	0.6223	0.2029	-0.1601	-0.0373
Industry dummy	-0.046	-0.0226	0.0323	-0.0014	-0.012	0.0166	0.1048

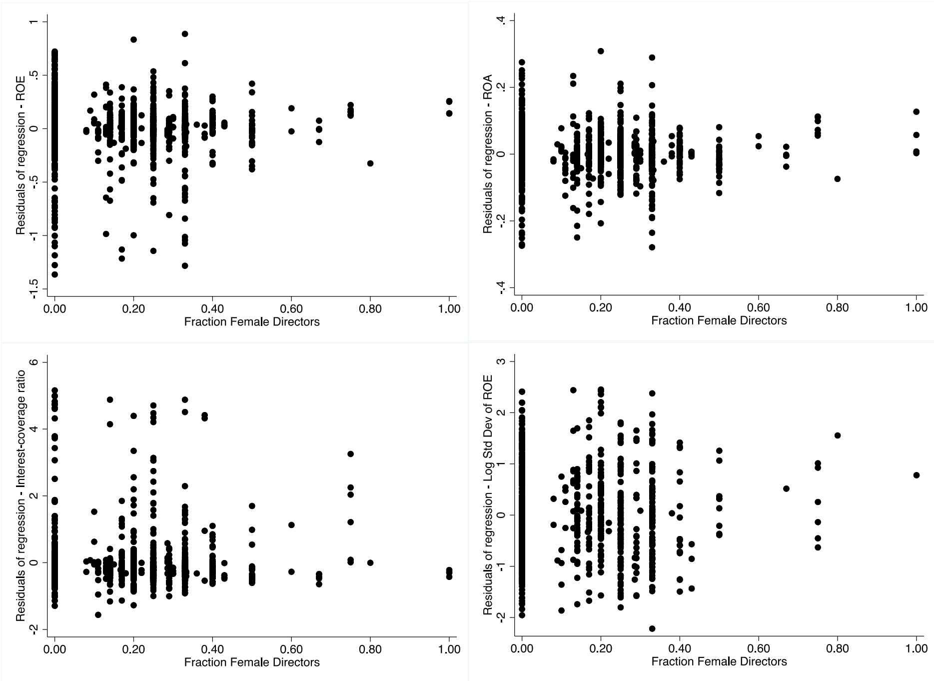
Appendix 5. Correlation matrix continued

Showing the correlation between each of the dependent variables and independent variables included in the final regression.

	Firm age	Board average age	Board size	Female CEO	Female Chairman	D/A ratio	Operating margin	Industry dummy
Fraction Female Directors								
Critical Mass								
ROE								
ROA								
ICR								
Std. Dev of ROE								
Log Sales								
Firm age	1							
Board average age	0.1351	1						
Board size	0.02	-0.1364	1					
Female CEO	-0.0049	-0.0038	-0.0407	1				
Female Chairman	0.0248	0.0542	-0.0661	0.2313	1			
D/A ratio	0.1594	0.11	0.0269	0.1096	0.0325	1		
Operating margin	-0.0091	-0.0559	-0.0511	-0.101	0.0593	0.2575	1	
Industry dummy	0.1181	0.0276	-0.0215	-0.0159	-0.0184	-0.164	0.0896	1

Appendix 6: Linearity

Plotting the residuals of the final regression (IV) for each independent variable against the Fraction Female Directors. No scatterplots for the dummy independent variable (Critical Mass) have been included since they are not measured at the continuous level.



Appendix 7. Shapiro-Wilk test

Output from Shapiro-Wilk W test, testing for normally distributed residuals. The null hypothesis in the test implies normally distributed residuals. The Prob < W value listed in the output is the p-value. The results indicate that we can reject the null hypothesis at a 5% significance level, meaning that the data lacks normally distributed residuals.

	ROE	ROA	ICR	Std. Dev of ROE
W	0.7873	0.8447	0.4707	0.9864
V	280.0260	205.0650	691.6010	11.4300
z	14.3940	13.5990	16.6980	6.1090
Prob > z	0.0000	0.0000	0.0000	0.0000
Normally distributed residuals	NO	NO	NO	NO

Appendix 8. Robustness check

Robustness check for the OLS model by dropping Female CEO and Female Chairman

	ROE		ROA		Interest-coverage Ratio		Log Std.Dev of ROE	
Independent Variables	1	2	1	2	1	2	1	2
Fraction Female Directors	-0.101***		-0.02***		0.308***		-0.564***	
	(0.03)		(0.01)		(0.11)		(0.17)	
Critical Mass		-0.044***		-0.012***		0.09*		-0.196***
		(0.01)		(0.00)		(0.04)		(0.07)
Log Sales	0.038***	0.04***	0.009***	0.009***	-0.036*	-0.039*	0.013	0.02
	(0.01)	(0.01)	(0.00)	(0.00)	(0.02)	(0.02)	-0.03	-0.03
Firm age	-0.001**	-0.001**	-0.000***	-0.000***	0.002***	0.002***	0.001	0.001
	(0.00)	(0.00)	(0.001)	(0.000)	(0.00)	(0.00)	0	0
Boardsize	-0.009***	-0.01***	-0.001*	-0.002**	0.009	0.013	-0.027**	-0.035***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	-0.01	(0.01)
Board average age	-0.003***	-0.003***	-0.001***	-0.001***	-0.009***	-0.009***	-0.012***	-0.012***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
D/A ratio	0.164***	0.162***	0.138***	0.138***				
	(0.03)	(0.03)	(0.01)	(0.01)				
Operating Margin					2.235***	2.238***	-1.913***	-1.907***
					(0.24)	(0.24)	(0.28)	(0.28)
Constant	-0.082	-0.097	-0.034	-0.038	0.825***	0.873***	2.942***	2.849***
	(0.10)	(0.10)	(0.03)	(0.03)	(0.27)	(0.27)	(0.39)	(0.39)
Observations	2,235	2,235	2,242	2,242	2,215	2,215	1,291	1,291
R^2	0.050	0.051	0.158	0.159	0.099	0.097	0.090	0.087
Adjusted R square	0.041	0.041	0.149	0.150	0.090	0.088	0.077	0.075
Year Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES
Firm Fixed Effects	NO	NO	NO	NO	NO	NO	NO	NO
Regression Type	OLS		OLS		OLS		OLS	

Notes: This table present the results for our robustness check on the regressions with each dependent variable and the two independent variables *Fraction Female Directors* (1) and *Critical Mass* (2). The regressions include all mentioned control variables except for *Female CEO* and *Female Chairman.* Standard errors are clustered at the firm-level in regressions. All variables are defined in section 3.3 - 3.5 and described in detail in Appendix 10. Z-scores are presented in parentheses below the coefficients. T statistics are in parentheses; *p<0.05, **p<0.01, ***p<0.001.

Appendix 9. Company list

List of all companies included the final sample.

	Company name
1	BRIGHTSTAR 20:20 (SWE) AB
2	KORAB INTERNATIONAL AKTIEBOLAG
3	RETURPACK SVENSKA AB
4	OMNICOM MEDIA GROUP AB
5	EXERTIS CAPTECH AKTIEBOLAG
6	SC MOTORS SWEDEN AKTIEBOLAG
7	MASERFRAKT AKTIEBOLAG
8	BRA BIL SVERIGE AB
9	SCHNEIDER ELECTRIC BUILDINGS AB
10	BORAAS BIL FORVALTNING AB
11	REAXCER AB
12	ENVIROTAINER AKTIEBOLAG
13	HSB BOSTAD AB
14	WIBAX GROUP AB
15	HENKEL NORDEN AKTIEBOLAG
16	SUNDFRAKT AKTIEBOLAG
17	EUROPEISKA MOTORBOLAGEN AB
18	ALD AUTOMOTIVE AB
19	OMYA AKTIEBOLAG
20	BERGSTROM INVEST I NYKOPING AB
21	REBTEL OWNERS AB
22	RO-GRUPPEN FORVALTNING AB
23	ALWEX TRANSPORT AB
24	AXIMA AB
25	KAAKAA AKTIEBOLAG
26	BAVERBACKEN FORVALTNING AB
27	REMI AB
28	MARENOR AB
29	SCANDBIO AB
30	SVENSTIGS BIL AB
31	MOBILITY MOTORS SWEDEN AB
32	ACO HUD NORDIC AB
33	XR BOLAGEN AB
34	BYGGNAVET AB
35	ROLF ERICSON BIL I FALUN AKTIEBOLAG
36	VWR INTERNATIONAL AB
37	AMOKABEL AB
38	INVESTUM FORVALTNING AB
39	MAARTENSSONS PARTIAFFAR AB
40	NORRLANDS ETANOLKRAFT AB
41	LUNDAGROSSISTEN BO JOHANSSON AKTIEBOLAG
42	GOINGE BIL INVEST AKTIEBOLAG
43	AKTIEBOLAGET ZELDA
44	BILAB KUNGALV AB
45	SCANDSTICK AKTIEBOLAG
46	LOTUS MASKIN & TRANSPORT AB
47	BERTEGRUPPEN AKTIEBOLAG
48	ALLTRANSPORT I OSTERGOTLAND AB
49	FRESKS FORSALJNING AB
50	VASTKUSTSTUGAN AB
51	HAGLOFS AB
52	BOXHOLMS AB
53	OLOV LINDGREN AB
54	SPECSAVERS SWEDEN AB
55	GALLO TIMBER AB
56	OUTNORTH AB
57	BEIJER HOLDING AB
58	KIVIK HOLDING AB
59	SVETRUCK AKTIEBOLAG
60	AB HOGLANDBOLAGEN
61	MAARDSKOG & LINDKVIST AB
62	TUREBERGS AAKERI AB
63	BIM KEMI AKTIEBOLAG
64	UNIVERSAL MUSIC AKTIEBOLAG
65	KRISTIANSTADS AUTOMOBIL AB
66	FISKARHEDENVILLAN AB
67	BYREDO AB
68	PRIORITET GROUP AKTIEBOLAG
69	HANNELLS HOLDING AB
70	INDUSTRIMODELL AKTIEBOLAG
71	LINOTOL AB
72	AKTIEBOLAGET AXEL GRANLUND
73	FURETANK REDERI AKTIEBOLAG
74	VOLITO AKTIEBOLAG
75	LBC BORAAS AKTIEBOLAG
76	TRANSPORTAKTIEBOLAGET I JONKOPING
77	MINEDRILL GVE AB
78	CEBON GROUP AB
79	KOENIGSEGG AUTOMOTIVE AB
80	LBC - FRAKT I VARMLAND AB
81	PETAINER LIDKOPING AB
82	JOHNSON MATTHEY FORMOX AB
83	MJOBACKS ENTREPRENAD AB
84	HNT SCHAKT & TRANSPORT AB
85	TUJO AKTIEBOLAG
86	MEPOL AB
87	EXTENDO AB
88	TEAM BACKSTROM AB
89	DRAGON PORT FOODS AB
90	B-REEL INTRESSENTER AB
91	ASPELIN-RAMM FASTIGHETER AB
92	TEKNOS AKTIEBOLAG
93	AHLSTROM-MUNKSJO STALLDALEN AB
94	SVEN JINERT AKTIEBOLAG
95	AKTIEBOLAGET VAXJO BILAFFAR
96	KNORR-BREMSE NORDIC RAIL SERVICES AB
97	ROSLAGSVATTEN AKTIEBOLAG
98	CEOS AB
99	AKTIEBOLAGET MASKINSPAARET
100	GN TRANSPORT I HALMSTAD AB
101	IKEA INDUSTRY AB
102	S-BOLAGEN AKTIEBOLAG
103	ESBE AKTIEBOLAG
104	KAALLTORPSGRUPPEN AB
105	HLL HYRESLANDSLAGET AB
106	OLJIBE AKTIEBOLAG
107	SEGERBERG FORVALTNING AB
108	CRANAB AB
109	HEDBERGS BIL AKTIEBOLAG
110	ALVIKS SERVICE AKTIEBOLAG
111	OSTP SWEDEN AB
112	AATTA.45 TRYCKERI AB
113	SWISSLOG AB
114	TEG AB
115	NMI GROUP AB
116	BAKELS SWEDEN AB
117	HEDLUNDS TRAVARU AKTIEBOLAG
118	JARNKILEN AB
119	ATA HILL & SMITH AB
120	VARMEVARDEN AB
121	HOLGERS STUGMATERIAL AKTIEBOLAG
122	NORD DDB STOCKHOLM AB
123	ALFORT & CO AB
124	MATTSSONFORETAGEN I UDDEVALLA AB
125	C. HALLSTROMS VERKSTADER AKTIEBOLAG
126	WARNESTAD INVEST AB
127	BYGGNADSINGENJOR NILS SKOGLUND AB
128	PRIMULA BYGGNADS AKTIEBOLAG
129	SWEDISH POWERTRAIN AB
130	ROY ANDERSSON BILBOLAGET AB
131	MAZARS AB
132	KAJ JOHANSSON GRUPPEN AB
133	S O LARSSON FINANS AB
134	LISA CASSELS MODEHUS AKTIEBOLAG
135	HXH INTERNATIONAL AB
136	CAB GROUP AB
137	FRANKENIUS EQUITY AB
138	AKTIEBOLAGET ANDERSSON & SJOBERG
139	GOLDER ASSOCIATES AKTIEBOLAG
140	UDDETORP INVEST AB
141	CASALL AKTIEBOLAG
142	NEOPLAN VAST AKTIEBOLAG
143	LAITIS HANDELS AKTIEBOLAG
144	KAELUS AB
145	NORMA PRECISION AKTIEBOLAG
146	ECOSYSTEM I SCANDINAVIEN AB
147	SMAALANDS MOTOR AB
148	KUNGALVS TRAVARUAKTIEBOLAG
149	AKTIEBOLAGET SVENSKT KONSTSILKE
150	STOCKHOLM LIVE AB
151	OTTO BOCK SCANDINAVIA AKTIEBOLAG
152	BACKAHILL AB
153	HOTELL AKTIEBOLAGET DRAUPNER
154	NYDRON INVEST AKTIEBOLAG
155	PRESSO HOLDING AB
156	NORDHYDRAULIC AB
157	NDA GROUP AB
158	SPM INTERNATIONAL AB
159	SKENE JARN AB
160	AKTIEBOLAGET FUTURITAS
161	AKTIEBOLAGET KEMISTEN
162	GLASLINDBERG AKTIEBOLAG
163	TABERG MEDIA GROUP AB
164	TACTON SYSTEMS AB
165	TAAGAAKERIET I BERGSLAGEN AB
166	SWED HANDLING AB
167	P.AA. HELLSTROMS BYGG AKTIEBOLAG
168	LIVIO AB
169	J'A' GOTHES AB
170	ARKITEKT MAGNUS MAANSSON AKTIEBOLAG
171	BYGGMASTARE S.A. ENGLUND AKTIEBOLAG
172	ATRACCO AB
173	JOHN BOHLMARKS MEKANISKA VERKSTADS AKTIEBOLAG
174	PARS PLAATGRUPPEN AB
175	ROSENQVIST GRUPPEN AB
176	EKNAS GAARD AKTIEBOLAG
177	GUSTAV R. JOHANSSON AKTIEBOLAG
178	PURMO GROUP SWEDEN AB
179	JS COMPANIES AB
180	AKTIEBOLAGET DENDERA HOLDING
181	LILJAS PLAST AKTIEBOLAG
182	AMB INDUSTRI AKTIEBOLAG
183	WINDY SCANDINAVIA AB
184	KONGAMEK AB
185	GNOSJOPULS AKTIEBOLAG
186	EM NORDIC AB
187	BILSPEDITION TRANSPORTORER FORVALTNINGS AB
188	MYRINA INVEST AKTIEBOLAG
189	SWEDE SHIP MARINE AKTIEBOLAG
190	KOCKUMATION AB
191	FAGERSTROMBOLAGEN AB
192	LEKSANDS KNACKEBROD AB
193	MATTSSONS I ANDERSTORP AKTIEBOLAG
194	AURENA LABORATORIES HOLDING AB
195	GLASGRUPPEN I SVERIGE AB
196	PETER DAHLQVIST AKTIEBOLAG
197	AVARN SECURITY SOLUTIONS AB
198	TEAM ET AB
199	TRANSPORTAKTIEBOLAGET GOTEBORG-MARSTRAND
200	ERIK LARSSON BYGG AB
201	FLEXTRONICS INTERNATIONAL SWEDEN AB
202	A PERSSON AFFARSUTVECKLING AB
203	SAKON AB
204	MPA MAALERIPRODUKTION AKTIEBOLAG
205	BAKERS AKTIEBOLAG I LESSEBO
206	CHINAX GROUP AB
207	SMAALANDSSTENARS AAKERI AKTIEBOLAG
208	FERGAS GROUP AB
209	NEP SWEDEN AB
210	REPRO-SERVICE FORSALJNING FALKOPING AB
211	KRISMA AB
212	C4 HUS AB
213	MEKANOTJANST HOLDING CF AB
214	FOYEN INTRESSENTER ADVOKATFIRMA AB
215	EKSTIGEN AB
216	HKC HOTELS HOLDING AKTIEBOLAG
217	HOLFAST AB
218	ALFAPAC ACON AB
219	KRONLEINS BRYGGERI AKTIEBOLAG
220	AKTIEBOLAGET GYLLSJO TRAINDUSTRI
221	LUNDSTAMS AATERVINNING AB
222	FORVALTNINGSAKTIEBOLAGET MOTORN
223	BENZLERS SYSTEMS AB
224	AKTIEBOLAGET SKAANSKA DAGBLADET
225	EKSTRAND & SON AKTIEBOLAG
226	FREYS FORVALTNINGS AKTIEBOLAG
227	BERG & BYGGTEKNIK I NORBERG AB
228	ROBUR SAFE AKTIEBOLAG
229	BNP PARIBAS CARDIF NORDIC AB
230	EWAB ENGINEERING AKTIEBOLAG
231	ICEHOTEL AKTIEBOLAG
232	ATRIA SWEDEN AKTIEBOLAG
233	STEBRO PLAST AB
234	SITT I NORRKOPING AKTIEBOLAG
235	BYSTAD HOLDING AB
236	EDBERGS HOTELL OCH GOLF AKTIEBOLAG
237	SKI INVEST SALEN AB

Appendix 10. Definition of all variables

Variables	**Description**	**Source**
ROE	Return on equity, calculated as net income/equity. Net income is the amount of income, net of expenses and taxes that a firm generates for a given full fiscal year. Equity is derived from the balance sheet and is a running balance of the firm's total history of changes in assets and liabilities.	Amadeus
ROA	Return on assets, calculated as EBIT/total assets. The closing balance for assets is used. The EBIT is per end of the following fiscal year and calculated as revenues minus cost of goods sold and the regular costs of running a business, excluding interest and taxes.	Amadeus
Interest-coverage Ratio	The interest-coverage ratio may be calculated as EBIT/interest expense. The EBIT is per end of the following fiscal year and calculated as revenues minus cost of goods sold and the regular costs of running a business, excluding interest and taxes. Interest expense is during a given period. The lower the ratio, the more the burdened is the company by debt expense.	Amadeus
Log Standard Deviation of ROE	The Log Standard Deviation of ROE is calculated in different steps. First, the mean value is calculated by adding five consecutive years data on the ROE (2010-2014, 2011-2015, 2012-2016, 2013-2017, 2014-2018, 2015-2019) and dividing each by five. Second, the variance for each data point is calculated by subtracting the mean from the value of each data point. The resulting values are squared and results summed. Subsequently, the result is divided by four. The next step is to square the root of the variance, which gives the standard deviation. Lastly, we take the natural logarithm of the value.	Amadeus
Log Sales	Log Sales is calculated by taking the natural logarithm of Sales value.	Amadeus
Firm age	The number of years a firm has been registered in the Swedish Companies Registration Office (sw: Bolagsverket). Firm age is a discrete variable that assumes that the registration date is the 1st of January in the specific observation year.	Amadeus
Board size	The size of the board in total number board members seated for the observed year.	Serrano
Board average age	An average of the age of the board members seated for the observed year, calculated as the sum of all ages of the board members/total number of board members.	Serrano
Female CEO	Dummy variable which takes 1 if the CEO is female, and 0 otherwise.	Serrano
Female Chairman	Dummy variable which takes 1 if the Chairman of the board is female, and 0 otherwise.	Serrano
Debt-to-Assets ratio	A leverage ratio measuring how much the company's assets that are financed by debt rather than equity. The figures are taken from the company's balance sheet. The formula for the ratio is given by (Short-term + Long-term debt)/Total assets.	Amadeus
Operating Margin	The operating margin is calculated as EBIT/Revenue. The EBIT is per end of the following fiscal year and calculated as revenues minus cost of goods sold and the regular costs of running a business, excluding interest and taxes.	Amadeus
Year fixed effects	To control for year fixed effects, year dummies are included in all regressions. Each year during the studied period 2010-2019 is a dummy variable, which takes 1 if the variable matches the observation year, and a 0 otherwise.	Amadeus
Industry fixed effects	To control for industry fixed effects, industry dummies are included in certain regressions. Each industry group in the sample during the studied period 2010-2019 is a dummy variable, which takes 1 if the variable matches the observation industry, and a 0 otherwise.	Amadeus