UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

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# The Impact of the Norwegian Gender Quota on Firm Risk


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# Abstract

We investigate the Norwegian gender quota, implemented for Norwegian listed firms' boards in 2006, and its impact on firm risk. Using a difference-in-difference model, we find that the increase in female board representation has little impact on firm risk-taking; if anything, it increases firm risk in the long-run. Our finding supports the view that, although women are more risk averse than men in general, female board members are a group of women with a lower degree of risk aversion compared to the common female population.



**Keywords***:* Norwegian Gender Quota, Gender Effect, Firm Risk-Taking, Difference-in-Difference Model

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# Table of Contents

# 1. Introduction

In 2003, the Norwegian government proposed the first regulated gender quota in the world. It took up until 2006 for the quota to become mandatory by law, from which the firms subject to it had until 2008 to fully implement it. The quota requires all Norwegian public limited firms to have a representation of at least 40 % female board members (Terjesen et al., 2015). Before 2006, the female board representation was about 16% on average in Norwegian public limited firms (see Table 1.1 in Appendix). The quota turned out to be effective in raising female board representation, as after 2006, the average female board representation in Norwegian public limited firms reached almost 40% (see Table 1.2 in Appendix). By sharp contrast, Sweden had no similar quota regulation and the female board representation was only about 20% after 2006 (see Table 1.4 in Appendix).

In this paper, we treat the Norwegian gender quota regulation as a natural experiment to empirically study the gender effect on firm risk. There is a large body of literature on rationality and the gender effect on individual risk-taking, with mixed findings. On the one hand, some papers argue that women are more risk averse than men. For example, Barber and Odean (2001) argue that there is an anomaly from rationality when it comes to the extent to which people take on risk and that this anomaly is related to gender, suggesting that women are more risk averse than men. This gender effect has also been documented by Eckel and Grossman (2002). Grossman et al. (1993) further argue that when in the same situation, men are more prone to feel anger while women are more prone to feel fear. Lerner et al. (2003) argue that fear enhances the perception of risk while anger reduces it and thus suggest an explanation for why women are more risk averse than men in general. On the other hand, some papers provide qualifications for the statement that women are more risk averse than men and argue that the validity of this statement depends on contexts. For example, Holt and Laury (2002) find that although women are argued to be more risk averse than men in general, the gender effect is not present in high-payoff treatments, where women take on the same amount of risk as men.

Given the mixed findings of the gender effect in the literature, we aim to address the following questions in this paper: Does an increase in female board representation caused by the gender quota reduce firm risk-taking as women are in general supposed to be more risk averse than men? Or does such an increase in female board representation have no effect or

even increase firm risk-taking as boardroom women may have a lower risk aversion compared to the common female population?

To examine the implications of the Norwegian gender quota we apply a difference-in-difference model. This approach is used by, among others, Matsa and Miller (2013) and Eckbo et al. (2016), to examine the implications of the gender quota. By using this approach, we can isolate the causal effect of the gender quota on firm risk. We measure firm risk by evaluating the firms' Financial Leverage, Interest Coverage Ratio, Current Ratio and Volatility of Return on Assets (Volatility of ROA). The treatment group consists of Norwegian public limited firms. Swedish public limited firms did not face any similar quota regulation and are thus used as the control group. Further, we include control variables and sector dummies in the regressions. The regressions are run for different time-periods to capture the differences in the short-run and long-run implications respectively. When studying the short-run implications of the quota, we find no strong evidence that the gender quota affect firm risk and thus we argue that the gender quota did not affect the overall firm risk in the short-run. However, when studying the long-run implications we find that there are some statistically significant difference-in-difference estimates, such as that the Financial Leverage increases in the long-run from the gender quota and that the probability of having an Interest Coverage Ratio equal to or greater than 1.5 decreases in the long-run. These results indicate an increased firm risk in the long-run from the gender quota. Thus, we conclude that the increase in female board representation has little impact on firm risk-taking; if anything, it increases firm risk in the long-run. Our finding supports the view that, although women are more risk averse than men in general, female board members are a group of women with a lower degree of risk aversion compared to the common female population.

## Related Literature

This paper relates to three aspects of the literature. First, it relates to the literature studying the gender difference in risk-preferences. Most of the papers in this literature use laboratory experiments involving risk-related decision tasks (see for example Holt and Laury, 2002 and Eckel and Grossman, 2002), with many of them finding that women are less likely to engage in risky gambles than men. In contrast to these laboratory experiments, we analyse the gender effect on firm risk under the natural experiment provided by the gender quota regulation and the involved risk-related decision tasks are much more complicated than the tasks in a laboratory. Our long-run findings support the view that whether women are more risk averse

than men depends on the contexts of the decision. This is in line with Schubert et al. (1999) who argue that it is difficult to determine risk preferences using experimental methods. They find that there is a difference in risk-preferences between men and women in abstract gambling experiments, with men being more risk-taking than women. However though, they also find that there are no differences in risk-preferences between men and women in contextual decisions. Hence, they conclude that even though the gender effect can be found in abstract gambling experiments, it is not present when making contextual decisions such as financial decisions.

Second, our paper relates to the literature studying the effect of the Norwegian gender quota on firm behaviour. The effects of the gender quota on firm risk are relatively unexplored. After the implementation of the gender quota in Norway, there has been a modest, yet well cited, literature examining its implications on firm risk. However, previous literature has not been able to conclude the definitive implications on firm risk from the gender quota. Some report that there was no effect on firm risk from the gender quota (see for example Matsa and Miller, 2013) while some report that the firm risk increased (see for example Ahern and Dittmar, 2012). As we do, Ahern and Dittmar (2012) treat the Norwegian gender quota as a natural experiment. They focus on studying its implications on firm value and they only briefly examine its effect on firm risk. Ahern and Dittmar (2012) use a panel of Norwegian public limited firms, subject to the quota, and find that one implication from the gender quota is that financial leverage, measured as Total Liabilities over Assets and Current Debt over Equity, increased. They also report a decrease in the holdings of cash indicating a worsened liquidity hence an increased firm risk. Matsa and Miller (2013) also study the implications from the Norwegian gender quota but find that the quota did not affect corporate decisions to a large extent. Their time-period covers the years 2003 to 2009. They use a difference-in-difference model with a control group consisting of a mix of Scandinavian firms and a mix of public and private limited firms. Using a measure of Debt over Assets, they find no effect on financial leverage in the short-run from the quota. To explain these results, they suggest that individual risk aversion does not matter when women make corporate decisions. This point is also referred to by Sila et al. (2016). Our study distinguishes from Matsa and Miller (2013) in some respects. First, we do not use a triple difference-in-difference model but a first difference-in-difference model. That is, we do not include private limited firms in our control group but include only public limited firms. Second, Matsa and Miller (2013) focuses on the quota's effects on firm value and firm decision making and only briefly discuss its effects on

firm risk. They only examine the quota's impact on firm risk using a measure of Debt over Assets. However, the use of Debt over Assets as a measure of financial leverage is not as commonly used as other measures such as Debt over Equity. Since they solely examine one indicator of firm risk, it is difficult to conclude that their findings would be consistent when testing other indicators of firm risk as well. Finally, their study only examines the short-run effects of the gender quota while we extend the time-period to also study the long-run effects on firm risk. Our short-run results are in line with the findings of Matsa and Miller (2013) indicating that firm risk was unaffected by the quota. However, in line with the findings of Ahern and Dittmar (2012) we find weak evidence that firm risk increased due to the quota in the long-run.

Finally, our paper relates to the literature examining the gender effect on corporate boards. As pointed out by Ahern and Dittmar (2012), most studies examining board structure have a drawback with the issue of endogeneity. That is, it is difficult to separate the features of corporate boards and the features of board members which will influence for example firm value, or as would be the case for our study, which will influence firm risk. Thus, as they mention, the Norwegian gender quota offers a nice natural experiment which we use for testing the gender effect among directors. Due to that the quota is exogenously determined, the issue of endogeneity can be ruled out in our study of the gender effect on corporate boards. Sila et al. (2016) examine how a greater female representation on corporate boards affects firm risk. They investigate gender characteristics further using a sample of U.S firms but do not report any evidence that a greater female board representation affects the firms' equity risk or the volatility of ROA. Hence, they conclude that female board representation does not affect firm risk. They refer to an argument given by Deaves et al. (2009), who suggest that women studying economics, finance and business deviate from women in the common female population. Sila et al. (2016) continue to argue that it is possible that these women, who are drawn to positions and industries previously and currently dominated by men such as female directors, deviate from the common female population. They further refer to the argument given by Matsa and Miller (2013) suggesting that risk-preferences do not matter when women make corporate decisions. The greatest difference between our study and Sila et al. (2016) is that we make use of non-U.S data while they use U.S data. Further, different from Sila et al. (2016) we can with certainty rule out the issue of endogeneity in our study due to that the gender quota is exogenously determined and that we treat the gender quota as a natural experiment. Adams and Funk (2012) also examine the gender effect among

directors. They compare female and male directors, evaluating their similarities and differences. When evaluating Swedish directors, they document a difference between female and male board members. After they control for evident characteristics, it seems as female and male directors have priorities and behaviours that differ and they document that women are different in their values from men. Also, they document that female board members are different from women in the common female population. Adams and Funk (2012) argue that having a higher proportion of women on corporate boards might not lead to less risk-taking decisions. Instead they suggest that female directors are more prone to take on risk than male directors. While Adams and Funk (2012) use data on Swedish firms, we contribute with evidence from Norwegian firms. We find that an increase in female board representation has little impact on firm risk-taking; if anything, it increases firm risk in the long-run.

The rest of the paper is structured in the following way. Section 2 offers more background information on the Norwegian gender quota and discusses how it affects our choice of the control group. Section 3 gives data description and a discussion of our empirical approach. Section 4 shows the results and empirical analysis. Section 5 discusses and concludes the main findings from our study.

# 2. Background

The Norwegian gender quota requires the corporate boards of Norwegian public limited firms to at least have a 40 % female representation among the directors. In 2003, the Norwegian government proposed this quota as the first regulated gender quota in the world. It took up until 2006 for the quota to become mandatory by law, from which the firms had until 2008 to fully implement it (Terjesen et al., 2015). Matsa and Miller (2013) show that by April 2008 all firms subject to the quota fulfilled its requirement. We show that after 2008, the average proportion of female board members was 40 % in Norway (see Table 1.5 in Appendix), consistent with their findings. Matsa and Miller (2013) further explore the reason for why Norway adopted the gender quota by referring to the Norwegian Minister of Trade and Industry. The minister explained that the gender quota is supposed to achieve gender equality on the otherwise male dominated boards and to overcome the issue with female exclusion from the boards. Consistent with the purpose of the gender quota, Matsa and Miller (2013) find that the quota effectively raised gender equality in boardrooms. The quota might have

been effective due to that if the firms, subject to the quota, do not meet this requirement they can be declined to register their boards, charged with penalties, or forced to liquidate (Terjesen et al., 2015).

According to Terjesen et al. (2015) other countries have followed Norway's initiative and adopted gender quotas for the boards on publicly traded state-owned and corporate firms. The quotas differ with the proportion of female board members ranging from 33 % to 50 %, with different sanctions if not fulfilled. Some Nordic countries, such as Finland and Iceland, have adopted gender quotas to achieve greater board gender equality, with Sweden being an exception. Although there has been some discussion of implementing a gender quota in Sweden, it has not been taken yet. Terjesen et al. (2015) further discuss that there are some countries that have introduced gender quotas that are non-binding but with a principle that the firms must justify the composition of the corporate boards. Due to that some Nordic countries have implemented similar gender quotas as the one in Norway during the past years it is not suitable to use a control group with mixed Scandinavian countries, as done by Matsa and Miller (2013), for our long-run analysis of the gender quota. Thus, we choose to use Swedish public limited firms as our control group for the analysis of the gender quota effect. We use 2006 as the year when the Norwegian gender quota was implemented, since this was the year the quota was made mandatory. Additionally, for one part of our long-run analysis we exclude the years 2006 and 2007, which were the years that the firms had to fully implement the quota.

# 3. Data and Empirical Approach

## 3.1 Data

To conduct our study, we use a sample of Norwegian and Swedish public limited firms covering the period 2003 to 2015. We use this time-period due to the scarcity of data before 2003 and after 2015. To create our sample of Norwegian firms we use the Orbis database and receive a list of all Norwegian public limited firms. From this list of firms, we follow Matsa and Miller (2013) and exclude the banks and the financial institutions due to their different rules of ownership. There must be accessible data on the firms' Financial Leverage, Return on Assets (ROA), Current Ratio and board member characteristics as these variables are essential in conducting our analysis. We collect the financial data from Bloomberg and the data on board characteristics from respective annual report. Based on these criteria, we obtain a

sample of 78 Norwegian public limited firms all subject to the gender quota implementation of 2006. These 78 firms constitute the treatment group and are all listed on the Oslo Børs. To create the control group, we deviate from Matsa and Miller (2013), who use a mix of Scandinavian firms and a mix of private and public limited firms, by using only Swedish public limited firms. We do not use a mix of Scandinavian firms in the control group because of the reasons explained in Section 2. Further, we only include public limited firms in the control group due to the scarcity of data on private limited firms. The control group is created by matching each firm in the treatment group with at least one Swedish firm. We make use of a matching principle that is based on Morningstar's classification of sector peers by market cap. Hence, we construct a control group with a similar sector distribution and similar market cap distribution as the treatment group. A drawback with this matching of firms is that Norway has a large energy sector while Sweden does not. In the cases when our matching suggests the same Swedish firm as previously has been included we have included the firm only once. Further, there must be accessible data on the firms' Financial Leverage, ROA, Current Ratio and board member characteristics. We collect the financial data from Bloomberg and the data on board member characteristics from respective annual report. From these criteria, we obtain a sample of 72 Swedish public limited firms. The firms included in our control group are all listed on the Nasdaq Nordic.

All financial data is collected from Bloomberg in millions of Norske Kroner (NOK). Following Matsa and Miller (2013), we have not corrected for the differences in accounting standards between Norway and Sweden.

The firms in our sample are all classified in one of ten sectors. These sectors are gathered from Morningstar and our classification of firms follows their classification of the firms. All the firms included in our sample are classified within one of the following ten sectors: Industrials, Energy, Technology, Utilities, Consumer Defensive, Healthcare, Real Estate, Basic Materials, Consumer Cyclical and Communication Services.

We run regressions for different time-periods to examine if the gender quota affects the outcome differently in the short-run and in the long-run. The periods we examine are 2003-2009, 2003-2015 and 2003-2015 excluding the years 2006 and 2007. Matsa and Miller (2013) only study the short-run implications from the gender quota. One drawback with this is that their time-period only captures one year after the quota was fully implemented. This could be

one possible explanation to their results indicating no effect on firm risk from the gender quota. Even if the quota was fully implemented by 2009 its implication on firm risk is most likely to linger. Hence, a longer time-period should be considered when analysing the effects of a policy such as a quota. We use a pre-period and post-period to investigate the effects on firm risk-taking in Norway with 2006 as the year of the implementation. However, for one part of our long-run analysis we exclude the years of the implementation (2006 and 2007) as this could possibly capture a more distinct effect of the gender quota on firm risk.

Finally, we winsorize the financial data at the 1st and the 99th percentiles to limit extreme values. If the data is not winsorized, outliers could bias the difference-in-difference estimates. In Table 3.1 in Appendix we briefly give the empirical definition of the theoretical variables used to conduct our study.

### 3.1.1 Measures of Firm Risk - Dependent Variables

There are multiple measures and indicators of firm risk. We test the Norwegian gender quota's implication on the indicators of firm risk explained below. The indicators of firm risk are chosen to best indicate the idiosyncratic risk of the firms. That is, we use accounting measures to indicate firm risk as these indicators are not as affected by systematic risk as market variables such as stock price volatility.

*Financial Leverage*

Financial Leverage is the level of debt that a firm issue. Financial Leverage is commonly defined as Debt over Equity or Long-term Debt over Equity. Long-term debt includes all financial obligations that are interest bearing and have maturity longer than one year. Debt includes all financial obligations that are interest bearing, both with a maturity within one year and with a maturity longer than one year. According to Harris and Raviv (1991) there is a positive relationship between the level of financial leverage and default probability. Hence, a higher level of financial leverage indicates higher firm risk.

*Interest Coverage Ratio dummy*

According to Nguyen (2013) the Interest Coverage Ratio can be used as a proxy for financial strength. He argues that if the Interest Coverage Ratio goes up it indicates that the firm levers less hence take on less risk. The Interest Coverage Ratio is defined as Operating Income over Interest Expenses. Claessens et al. (2003) use an Interest Coverage Ratio of 1.5 as a threshold

of financial distress. A firm's probability of default is higher if its interest coverage ratio is below 1.5 than if above 1.5. Therefore, we create an Interest Coverage Ratio dummy equal to 1 if the firm has an interest coverage ratio equal to or greater than 1.5 and equal to 0 if otherwise.

*Current Ratio*

According to Cagle et al. (2013), a firm's liquidity is a measure of its ability to meet its obligations when they due, and a weak liquidity increase the risk of bankruptcy. Eljelly (2004) argues that a common indicator of liquidity is the Current Ratio which is defined as Current Assets over Current Liabilities. It is a measure of the firm's short-term ability to turn assets into cash to meet its obligations (short-term solvency) and is thus an indicator of firm risk.

*Volatility of ROA*

Faccio et al. (2016) and Sila et al. (2016) use the volatility of ROA as a measure of firm risk. ROA is defined as Net Income over Total Assets. Volatility (standard deviation) is a common proxy to use in financial literature, where this variable takes investment decision risk into account. Compared to Faccio et al. (2016) and Sila et al. (2016), who use a five-year rolling window to calculate the returns standard deviation, we use a three-year rolling window since we have a shorter time span and the gender quota was implemented during a narrow time-period.

### 3.1.2 Board Characteristics - Independent Variables

*Board Size*

Huang and Wang (2015) argue that a smaller board will lead to a higher level of firm risk when controlling for leverage and investment decisions. Their findings indicate that boards with fewer board members are related to riskier firm policy decisions. Hence, board size is an important characteristic to consider when evaluating firm risk. Thus, we follow Matsa and Miller (2013) and include Board Size as a control variable. The average size of the board has remained relatively the same after the imposition of the quota in Norway (see Table 1.2 in Appendix). The average size of the board has remained relatively the same also in Sweden (see Table 1.4 in Appendix). However, on average the Swedish firms have approximately one more board member than Norwegian firms, both before and after the quota was introduced in Norway (see Table 1.1, Table 1.2, Table 1.3 and Table 1.4 in Appendix).

*Proportion (%) of Board Members Owning Shares*

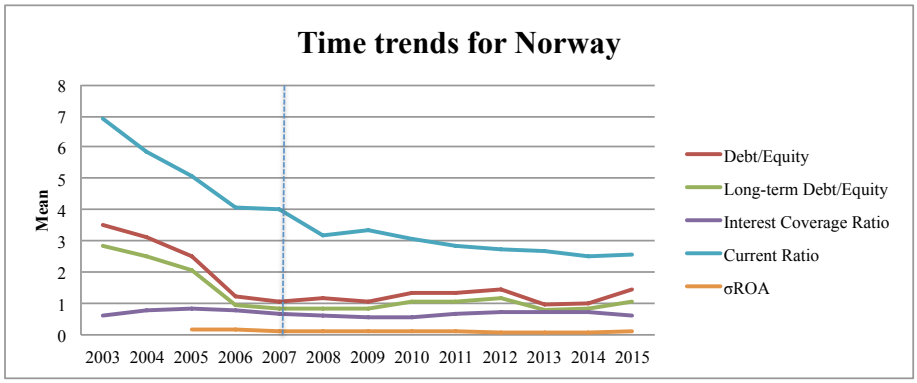
Wright et al. (2007) show that there is a curvilinear relationship between shares held by executives and firm risk taking. They further argue that when managers hold common stock in the company they benefit from upside tail risk, which induce managerial risk-taking. Even though we examine directors and not managers we include a variable indicating the proportion of board members that own shares in the firm. Including this variable as a control variable might be a good idea since the risk level can be affected by the proportion of board members owning shares in the firm as their incentives might be affected by the ownership. The reason for looking at the proportion of board members owning shares instead of total value of shares owned by board members is due to the scarcity of data on the latter one. The average proportion of board members owning shares decreased in Norway after 2006 (see Table 1.2 in Appendix). It decreased at the same magnitude in Sweden as well (see Table 1.4 in Appendix).

## 3.2 Empirical Approach

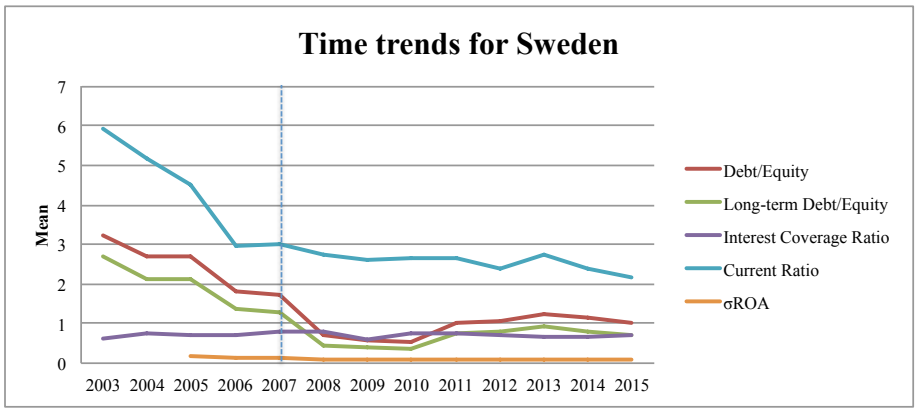
We employ the difference-in-difference model, which has been used by several studies examining the effects of the Norwegian gender quota (see for example Matsa and Miller, 2013 and Eckbo et al., 2016). Blundell and Costa Dias (2000) argue that the advantage of using the difference-in-difference model when evaluating a policy change is that, with both assumptions satisfied, the model excludes individual unobservable effects and common macro effects. However, they further argue that for these effects to be excluded two assumptions must be satisfied. The first assumption is that there across groups must be common time effects. The second assumption is that there within each group can be no composition changes. To assess these assumptions, we start by looking at the pre-policy average time trends for Norway and Sweden. By doing this we can see that Norway and Sweden follows the same pre-policy trends. In Graph 1 and Graph 2 we graph the average time trends for Norway and for Sweden respectively. In these graphs, we see that all indicators of firm risk that we use in our analysis have followed the same pre-policy time trend in Norway and Sweden. Hence, we assess them to, across groups, have common time effects. To assess the second assumption, we ensured that the firms included in our sample have data covering the period before and after the quota was introduced and that no firms were added or removed over time. Hence, we assess both conditions to be satisfied and we can assume that the model itself will exclude individual unobservable effects and common macro effects. For the

specific time-period that we investigate this is a powerful exclusion as we are investigating a period containing a worldwide financial crisis, which is most likely to affect the results if not using a model that corrects for this factor.

**Graph 1** - Time trends of the risk indicators in Norway before and after the policy implementation.




**Graph 2** - Time trends of the risk indicators in Sweden before and after the policy implementation.




## 3.3 Regression Model

There are many variations of the difference-in-difference model. Our specification is most similar to the one used by Eckbo et al. (2016). We use the models specified below to estimate the causal effect of the gender quota. Regression model (1) includes both our control variables, Board Size and Proportion of Board Members Owning Shares, and Regression model (2) includes only Board Size. In this specification of the difference-in-difference model, the estimation of interest is $\gamma_1$. The estimation of this coefficient will describe the different effect on the dependent variable in the period after the imposition of the gender quota in Norway compared to the effect on the dependent variable in Sweden for the same period. Hence, this is the isolating effect from the quota on respective indicator of firm risk and the interpretation of this estimation is the focus in this study.

$$Y_{i,t} = \gamma_1 \, Norway_{i,t} * Post\ 2006_{i,t} + \gamma_2 Norway_{i,t} + \gamma_3 Post2006_{i,t} + \gamma_4 Board\ Size_{i,t} + \gamma_5 Proportion\ of\ Board\ Members\ Owning\ Shares_{i,t} + \gamma_6 X_{i,t} + \epsilon_{i,t} \quad (1)$$

$$Y_{i,t} = \gamma_1 \, Norway_{i,t} * Post\ 2006_{i,t} + \gamma_2 Norway_{i,t} + \gamma_3 Post2006_{i,t} + \gamma_4 Board\ Size_{i,t} + \gamma_5 X_{i,t} + \epsilon_{i,t} \quad (2)$$

In both Regression model (1) and Regression model (2), Norway and Post 2006 are indicator variables. If Norway takes the value 1 it indicates that the firm belongs to the treatment group (Norway) and if it takes the value 0 it indicates that the firm belongs to the control group (Sweden). If Post 2006 takes the value 1 it indicates that the time-period is after 2006 hence after the quota was implemented, and if Post 2006 takes the value 0, it indicates that the time-period is before the quota was implemented. The estimates of $\gamma_4$ and $\gamma_5$ represent board characteristics that could affect firm risk. Following Eckbo et al. (2016), we also include a vector $X_{i,t}$ including a set of sector indicator variables each indicating each firm's sector classification. To be able to include all sector dummies we exclude the intercept of the regression model to avoid the dummy trap. The coefficient of interest for our analysis is $\gamma_1$, the coefficient for the interaction term between the treatment group Norway and Post 2006. The estimation of this coefficient will describe the different effect on the dependent variable in the period after the imposition of the gender quota in Norway compared to the effect on the dependent variable in Sweden for the same period. Finally, we run all regressions using robust standard errors to control for heteroscedasticity.

We apply the regression models above to study the effect on each indicator of firm risk, although the interpretation of the Interest Coverage Ratio dummy differs from the interpretation of the other firm risk indicators. To study the effect on the Interest Coverage Ratio we use a dummy variable hence when we run the regression to test the quotas' effect on this indicator of firm risk we specify the models as in Regression (1) and Regression (2) respectively. However, as the dependent variable Interest Coverage Ratio is a dummy variable, taking the value 1 if equal to or greater than 1.5 and 0 otherwise, the estimated coefficients' interpretation is different. As the dependent variable can only take the value 1 or 0, the probability that the dependent variable is 1 is the same as the expected value of the dependent variable. To interpret the impact of the gender quota the coefficient of $\gamma_1$is

interpreted as the impact on the probability of having an Interest Coverage Ratio equal to or greater than 1.5 (Wooldridge, 2014).

# 4. Results and Analysis

This section presents our empirical results along with an analysis of these results. First, we present the short-run implications on firm risk, for the time-period 2003 to 2009. Then we present the long-run implications on firm risk, expanding the time-period up to 2015. Finally, we present the long-run implications on firm risk excluding the years 2006 and 2007, which were the years that the Norwegian public limited firms had to implement the gender quota. We examine different time-periods to analyse the gender quota's implications on firm risk in the short and the long-run respectively. The coefficient of interest for our analysis is the coefficient for the interaction term between the treatment group Norway and Post 2006. The estimation of this coefficient will describe the different effect on the dependent variable in the period after the imposition of the gender quota in Norway compared to the effect on the dependent variable in Sweden for the same period. We start by presenting the short-run implications followed by the long-run implications. Finally, we present the long-run implications excluding the years 2006 and 2007.

## 4.1 Short-run Implications

In Table 4.1 we present the empirical results for the time-period 2003 to 2009. Hence, this part presents the short-run implications on respective indicator of firm risk from the gender quota. The gender quota regulation appears to have no effect on the indicators of firm risk except for on the Interest Coverage Ratio dummy. For this indicator of firm risk, the estimated coefficient is negative and statistically significant at a 10 % level in Regression (2). This indicates that the quota, with statistically significance, decreased the probability of having an Interest Coverage Ratio equal to or greater than 1.5. Thus, the quota induced a higher probability of financial distress hence indicating an increased firm risk. However, there is no evidence of statistical significance for the estimated coefficients on Financial Leverage, Current Ratio or Volatility of ROA. While the former findings indicate that the firm risk increased from the quota, the latter findings indicate that the firm risk was unaffected by the quota. The latter findings are further in line with the findings of Sila et al. (2016), arguing that the financial leverage and the volatility of ROA are unaffected by a greater female representation on corporate boards. One possible explanation for why the Interest Coverage Ratio dummy behaves differently from the other indicators of firm risk could be that this

indicator is affected by the overall interest rate and not solely determined by internal factors within the firm. That is, the denominator of the ratio, Interest Expenses, is not solely determined by the amount of debt that the firm issues. It is also affected by the overall interest rate to which they can lend. Hence, this could be one possible explanation for why this indicator of firm risk behaves differently from the other indicators of firm risk, which are solely determined within the firm.

As we only find evidence of statistical significance on one indicator of firm risk, we argue that the increase in female board representation caused by the gender quota has no effect on firm risk-taking in the short-run after its implementation. These results are in line with the findings of Matsa and Miller (2013) and Sila et al. (2016), both arguing that a greater female board representation has no effect on firm risk-taking. One possible explanation for these results could be that the short time-period only captures one year after the quota was fully implemented. Even if the quota was fully implemented by 2009, its effect on firm risk is most likely to linger. These findings also support the view that that there are no differences in risk-preferences between men and women in contextual decisions, as argued by Schubert et al. (1999).

**Table 4.1 -** (1) includes both control variables (Board size and Proportion of Board Members Owning Shares). (2) excludes Proportion of Board Members Owning shares.

| **Time-period 2003-2009** | | |
|---|---|---|
| | **(1)** | **(2)** |
| **Debt/Equity** | | |
| Post2006Norway | 0.5439 | -0.0063 |
| | (0.4445) | (0.4051) |
| **Long-term Debt/Equity** | | |
| Post2006Norway | 0.4878 | 0.0509 |
| | (0.3678) | (0.3304) |
| **Interest Coverage Ratio** | | |
| Post2006Norway | -0.0714 | -0.1046 |
| | (0.0768) | (0.0591) * |
| **Current Ratio** | | |
| Post2006Norway | 0.1690 | -0.0125 |
| | (0.6270) | (0.6753) |
| **σROA** | | |
| Post2006Norway | -0.0433 | -0.0114 |
| | (0.0338) | (0.0353) |

*Significantly different from 0 at the 0.1 level, using a two-tailed t-test.

## 4.2 Long-run Implications

We continue to present the empirical results for the time-period 2003 to 2015 in Table 4.2. Hence, this part presents the long-run implications on firm risk from the gender quota. There is, as in the short-run analysis, evidence that the Interest Coverage Ratio dummy is affected

by the gender quota. The estimated coefficient is negative and statistically significant at a 5 % level in Regression (2). This indicates that the quota, with statistically significance, decreased the probability of having an Interest Coverage Ratio equal to or greater than 1.5. Hence, the quota induced a higher probability of financial distress which indicates an increased firm risk. However, as in the short-run analysis, there is no evidence of statistical significance for the estimated coefficients on Financial Leverage, Current Ratio or Volatility of ROA. While the former findings indicate that the firm risk increased from the quota, the latter findings indicate that the firm risk was unaffected by the quota in the long-run, when including the years of the implementation. The latter findings are further in line with the findings of Sila et al. (2016), arguing that the financial leverage and the volatility of ROA are unaffected by a greater female representation on corporate boards. As in the short-run analysis, one possible explanation for why the Interest Coverage Ratio dummy behaves differently from the other indicators of firm risk could be that this indicator is affected by the overall interest rate and not solely determined by internal factors within the firm. That is, the denominator of the Interest Coverage Ratio, Interest Expenses, is not solely determined by the amount of debt that the firm issues. It is also affected by the overall interest rate to which they can lend. Hence, this could be one possible explanation to why this indicator of firm risk behaves differently from the other indicators of firm risk, which are solely determined within the firm.

We only find, as in the short-run analysis, evidence of statistical significance for one indicator of firm risk. Therefore, we argue that an increase in female board representation caused by the gender quota has no effect on firm risk-taking in the long-run after its implementation, when we include the years of the implementation. These results are in line with the findings of Matsa and Miller (2013) and Sila et al. (2016). One possible explanation for these results could be the inclusion of the years of the implementation. Hence, the inclusion of these years could diminish the effect from the gender quota as all firms might not have fully complied with it during these years. These findings though, as in the short-run analysis, support the view that that there are no differences in risk-preferences between men and women in contextual decisions, as argued by Schubert et al. (1999). Hence, when we include the years of the implementation of the quota, the short-run results are robust also in the long-run.

**Table 4.2** - (1) includes both control variables (Board size and Proportion of Board Members Owning Shares). (2) excludes Proportion of Board Members Owning shares.

| Time-period 2003-2015 | | |
|---|---|---|
| | **(1)** | **(2)** |
| **Debt/Equity** | | |
| Post2006Norway | 0.6090 | 0.1520 |
| | (0.4118) | (0.3841) |
| **Long-term Debt/Equity** | | |
| Post2006Norway | 0.5415 | 0.1685 |
| | (0.3408) | (0.3146) |
| **Interest Coverage Ratio** | | |
| Post2006Norway | -0.0621 | -0.1110 |
| | (0.0683) | (0.0525) ** |
| **Current Ratio** | | |
| Post2006Norway | -0.4398 | -0.4382 |
| | (0.5508) | (0.6259) |
| **σROA** | | |
| Post2006Norway | -0.0403 | -0.0152 |
| | (0.0327) | (0.0334) |

**Significantly different from 0 at the 0.05 level, using a two-tailed t-test.

## 4.3 Long-run Implications, excluding the years of the implementation

We present the empirical results for the time-period 2003 to 2015 excluding the years 2006 and 2007 in Table 4.3. Hence, this part presents the long-run implications on firm risk from the gender quota excluding the years of its implementation. From these results, we observe that the gender quota increased Financial Leverage. We obtain positive, statistically significant, estimated coefficients for both Debt over Equity and Long-term Debt over Equity. Both measures of Financial Leverage have statistically significant estimates at a 10 % level in Regression (1). Also, the Interest Coverage Ratio dummy shows a statistically significant effect at a 5 % level in Regression (2). This indicates that the quota, with statistically significance, decreased the probability of having an interest coverage ratio equal to or greater than 1.5. Hence, the quota induced a higher probability of financial distress which indicates an increased firm risk. We find evidence indicating that the Financial Leverage increased because of the gender quota. These findings are in line with the findings of Ahern and Dittmar (2012) who argue that the gender quota increased firm-risk taking. They could additionally be explained by the argument given by Adams and Funk (2012), that female board members are more risk-taking than their male colleagues.

As in sections 4.1 and 4.2, we report no statistical evidence that the gender quota affected the Current Ratio and the Volatility of ROA. The latter finding is in line with the finding of Sila et al. (2016) arguing that the volatility of ROA is unaffected by a greater female representation on corporate boards.

In this long-run analysis excluding the years of the implementation of the quota we find evidence of statistical significance on various indicator of firm risk. Financial Leverage and the Interest Coverage Ratio dummy are measures that to some extent interact with each other and they both indicate a higher firm risk-taking after the implementation of the gender quota. However, some estimates still imply that there is no effect on firm risk from the quota. Therefore, we argue that there is weak evidence that the increase in female board representation caused by the gender quota will increase overall firm risk-taking in the long-run after its implementation. These findings are in line with the findings of Ahern and Dittmar (2012), arguing that financial leverage increased after the gender quota was implemented. The findings could further be explained by the argument given by Adams and Funk (2012), that female board members are more risk-taking than their male colleagues. They also support the view that, although women are more risk averse than men in general, female board members are a group of women with a lower degree of risk aversion compared to the common female population.

**Table 4.3** - (1) includes both control variables (Board size and Proportion of Board Members Owning Shares). (2) excludes Proportion of Board Members Owning shares.

| **Time-period 2003-2015 excluding 2006 and 2007** | | |
|---|---|---|
| | **(1)** | **(2)** |
| **Debt/Equity** | | |
| Post2006Norway | 0.7611 | -0.3250 |
| | (0.4165) * | (0.3879) |
| **Long-term Debt/Equity** | | |
| Post2006Norway | 0.6602 | 0.3057 |
| | (0.3447) * | (0.3176) |
| **Interest Coverage Ratio** | | |
| Post2006Norway | -0.0594 | -0.1186 |
| | (0.0694) | (0.0538) ** |
| **Current Ratio** | | |
| Post2006Norway | 0.6117 | -0.5615 |
| | (0.5558) | (0.6268) |
| **σROA** | | |
| Post2006Norway | -0.0399 | -0.0157 |
| | (0.0328) | (0.0334) |

**Significantly different from 0 at the 0.05 level, using a two-tailed t-test.
*Significantly different from 0 at the 0.1 level, using a two-tailed t-test.

# 5. Discussion and Conclusion

The purpose of this study is to examine if a gender quota prescribed by law affects firm risk. We examine if the gender effect is present among directors on corporate boards. In recent years, an increasing number of countries have introduced similar gender quota regulations as the one in Norway. Therefore, the topic of gender quotas' is of current relevance. We investigate the following questions: Does an increase in female board representation caused by the gender quota reduce firm risk-taking as women are in general supposed to be more risk averse than men? Or does such an increase in female board representation have no effect or even increase firm risk-taking as boardroom women may have a lower risk aversion compared to the common female population? By examining these questions in this paper, we contribute to existing literature on gender differences in risk preferences. We further contribute to the existing literature on the effect of the Norwegian gender quota on firm risk. Finally, we contribute to the existing literature examining the gender effect on corporate boards.

Using a difference-in-difference model, we find that the increase in female board representation has little impact on firm risk-taking; if anything, it seems to increase firm risk in the long-run, as it increases the Financial Leverage and decreases the Interest Coverage Ratio in the long-run. On the one hand, our short-run results indicate that the increase in female board representation caused by the gender quota has no effect on firm risk-taking. These findings are in line with the findings of Matsa and Miller (2013) and Sila et al. (2016). From these results, we conclude that whether women are more risk averse than men depends on the contexts of the decision. That is, when men and women are faced with real-world decisions such as corporate decisions, they do not differ in their risk-preferences as they might do in lab experiments. Hence, one possible explanation for the short-run results could be that men and women are not different in their risk-preferences with respect to corporate decisions. On the other hand, one part of our long-run results indicates that there is weak evidence that an increase in female board representation caused by the gender quota increase firm risk-taking. These findings are in line with the findings of Ahern and Dittmar (2012). They also support the view that, although women are more risk averse than men in general, female board members are a group of women with a lower degree of risk aversion compared to the common female population. Hence, one possible explanation for these results is that the women elected onto corporate boards are different from women in the common population in

their risk-preferences. However, another possible explanation is that also men elected onto corporate boards exhibits different risk-preferences from the common male population. Thus, instead of attributing the differences in risk-preferences to gender, it could be that the differences should be attributed to the directors as professionals. That is, it is not solely that women on corporate boards are different from the common female population in their risk-preferences; it could possibly be that that directors overall are different from the common population in their risk-preferences.

From these results, we conclude that the increase in female board representation has little impact on firm risk-taking; if anything, it increases firm risk in the long-run.

By treating the gender quota as a natural experiment, we can rule out the issue of endogeneity in our study, which according to Ahern and Dittmar (2012) is a common issue when evaluating corporate boards. However, there is one limitation to our study as we do not control or correct for differences in accounting standards between Norway and Sweden. We do not assess this limitation to be severe but we could have, as Matsa and Miller (2013), corrected for accounting standards as a robustness check.

As the topic of gender quotas has gained further relevance in recent years, we believe that there is reason for further studies on the subject. One suggestion for further studies on this topic could be to examine the implication on firm risk in the other countries that have implemented a similar gender quota regulation.

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# Appendix

**Table 1.1 -** Descriptive statistics for Pre-Policy in Norway

| Pre-Policy in Norway 2003-2006 | | | |
|---|---|---|---|
| | **Mean** | **Std. Dev.** | **Observations** |
| *Financial measurements* | | | |
| **Debt/Equity** | 303.7098 | 368.3015 | 219 |
| **Long-term Debt/Equity** | 248.3359 | 301.9442 | 219 |
| **Current Ratio** | 5.9419 | 6.7399 | 219 |
| **Interest Coverage Ratio** | 0.7489 | 0.4347 | 219 |
| **σROA** | 0.1769 | 0.2113 | 72 |
| *Board characteristics* | | | |
| **Board Size** | 6.1165 | 1.8600 | 206 |
| **Female Board Members** | 0.1619 | 0.1529 | 206 |
| **Board Members Owning Shares** | 0.6361 | 0.2436 | 97 |

**Table 1.2 -** Descriptive statistics for Post-Policy in Norway

| Post-Policy in Norway 2007-2015 | | | |
|---|---|---|---|
| | **Mean** | **Std. Dev.** | **Observations** |
| *Financial measurements* | | | |
| **Debt/Equity** | 120.7234 | 196.3932 | 730 |
| **Long-term Debt/Equity** | 94.5602 | 160.1241 | 730 |
| **Current Ratio** | 3.1074 | 4.1874 | 730 |
| **Interest Coverage Ratio** | 0.6630 | 0.4730 | 730 |
| **σROA** | 0.1021 | 0.1419 | 729 |
| *Board characteristics* | | | |
| **Board Size** | 6.6137 | 1.8692 | 730 |
| **Female Board Members** | 0.3898 | 0.0909 | 729 |
| **Board Members Owning Shares** | 0.5534 | 0.2156 | 567 |

**Table 1.3** - Descriptive statistics for Pre-Policy in Sweden

| Pre-Policy in Sweden 2003-2006 | | | |
|---|---|---|---|
| | **Mean** | **Std. Dev.** | **Observations** |
| *Financial measurements* | | | |
| **Debt/Equity** | 287.7648 | 381.3923 | 216 |
| **Long-term Debt/Equity** | 233.2396 | 312.9611 | 216 |
| **Current Ratio** | 5.2107 | 6.3581 | 216 |
| **Interest Coverage Ratio** | 0.7037 | 0.4577 | 216 |
| **σROA** | 0.1577 | 0.1763 | 72 |
| *Board characteristics* | | | |
| **Board Size** | 7.2013 | 2.3636 | 154 |
| **Female Board Members** | 0.1331 | 0.1408 | 154 |
| **Board Members Owning Shares** | 0.7533 | 0.1955 | 118 |

**Table 1.4** - Descriptive statistics for Post-Policy in Sweden

| Post-Policy in Sweden 2007-2015 | | | |
|---|---|---|---|
| | **Mean** | **Std. Dev.** | **Observations** |
| *Financial measurements* | | | |
| **Debt/Equity** | 108.2626 | 223.3784 | 720 |
| **Long-term Debt/Equity** | 78.9885 | 179.2319 | 720 |
| **Current Ratio** | 2.6304 | 3.3640 | 720 |
| **Interest Coverage Ratio** | 0.7208 | 0.4489 | 720 |
| **σROA** | 0.1027 | 0.1444 | 720 |
| *Board characteristics* | | | |
| **Board Size** | 7.0043 | 2.2611 | 703 |
| **Female Board Members** | 0.1986 | 0.1536 | 703 |
| **Board Members Owning Shares** | 0.7414 | 0.2009 | 599 |

**Table 1.5** - Descriptive statistics for post 2008 in Norway

| Post-Policy in Norway after 2008 | | | |
|---|---|---|---|
| | **Mean** | **Std. Dev.** | **Observations** |
| *Board characteristics* | | | |
| **Board Size** | 6.6267 | 1.8973 | 584 |
| **Female Board Members** | 0.4061 | 0.0724 | 583 |
| **Board Members Owning Shares** | 0.5506 | 0.2156 | 478 |

**Table 3.1** - A summarized description of the dependent and independent variables that are used in the regressions along with its empirical definition.

| **Theoretical Variables** | **Empirical Definition** |
|---|---|
| *Dependent Variables* | |
| **Debt/Equity** | Total debt divided by total shareholder's equity. Calculated as: Short and Long-term Debt/Shareholder's Equity |
| **Long-term Debt/Equity** | Long-term debt as a percentage of total equity. Calculated as: Long-term Borrowings/Total Shareholder's Equity |
| **Interest Coverage Ratio dummy** | Operating income as a percentage of interest expenses. Calculated as: Operating Income/Interest Expense. Identified as a dummy variable which takes the value 1 if ICR $\geq$1.5 and the value 0 if ICR$<$1.5. |
| **Current Ratio** | Calculated as: Current Assets/Current Liabilities |
| **σROA** | The volatility of the firm's operating ROA. ROA is defined as net income divided by total assets. The volatility is the standard deviation calculated over a 3-year rolling window. |
| *Independent Variables* | |
| **Board Size** | The number of board members |
| **Proportion of Board Members Owning Shares** | The proportion of board members who own shares in the firm |
| **Sector Dummies** | 0/1 dummy variable which is 1 if firm belongs to certain sector and 0 otherwise not. The sectors are categorized into Industrials, Energy, Technology, Utilities, Consumer Defensive, Healthcare, Real Estate, Basic Materials, Consumer cyclical, Communication services |