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The impact of gender diversity of boards on Dutch firm performance.

Name student: Simeon Cornelissen
Student ID number: 576801
Supervisor: Dr. Arjun Gupta Second assessor: Date final version: 31/10/2023

Abstract:

In recent years the focus to incorporate females into board rooms has increased dramatically. The Dutch government has even passed bills with quotas in 2013 and 2022 strive for a minimum of 30% of both sexes in the board room. Is increasing the gender diversity also a positive change for the performance of the companies which are held to these standards?

This paper examines the relationship between board gender diversity and performance of Dutch listed firms in the years 2016-2022. Our sample consists of 53 large Dutch Amsterdam stock exchange (Euronext) listed companies. In this paper I use three measures for gender diversity: critical mass, female ratio and diversity index. Three measures are selected as performance measures: Return on Equity (ROE), Return on Assets (ROA) and Tobin's Q.

In this paper I examine various previous literature. I discuss a multitude of relevant theoretical literature explaining how a gender diverse board can outcompete a heterogenous board. The mixed results of the existing empirical literature are presented and discussed.

To examine the effect of board gender diversity and firm performance we use a multiple linear panel regression and the fixed effects model. To further eliminate endogeneity, I use control variables to control for board size and firm size. The control variables are board size, total assets and total employees.

The results show a positive and statistically significant relationship of all gender diversity measures on both ROE and ROA. Tobin's Q is not statistically significant in any of the regression analyses. The effect of the statistically significant relationships can not be interoperated as causal because of the remaining omitted variable bias and reverse causality.

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1. Introduction

Nowadays, government gender diversity quotas increase discussions and speculations about the performance of woman leaders and board members. *Fund of Women-Run Firms Is Beating the S&P 500 Since Launching* (Forte, 2023). If a fund with only women-run firms can outcompete a staple group of companies like the S&P 500 we cannot deny the skills of female leaders. With an ever-increasing number of companies lead by women or with women on their boards, gender diversity in boards becomes an increasingly interesting research field.

As of 2022 Europe is home to 15 of the top 20 companies ranked by female board representation (Matanda et al., 2023). In most European countries there are mandates which help raise the female board representation. In the Netherlands in 2022 the number of women on supervisory boards rose from 33% to 38% (Female Board Index 2022, 2022). This is positive as the quotas that were set in the Netherlands pushed companies to minimally have a representation of 30% in 2013 (Leenders, Pouwels, & Van den Brink, 2019). These positive trends around women and Dutch boards are good news for equal opportunities and female role models. From 2016 to 2022 the average women on boards of large and listed companies in the Netherlands went up from 27,5% to 41,6% according to the OECD database. These are big improvements to gender diversity; they give us data with a lot of gender diverse boards. As the number of women on boards is the highest it has been it begs the question if the companies which abide these quotas even get performance benefits by placing more woman on boards.

The field of research about gender diversity on boards related to firm performance is growing. There are many studies on this topic with varying results. Luckerath-Rovers (2011) concluded that Dutch firms had better performance when there is at least one woman on their boards. She examined 99 Dutch companies from 2005 to 2007. When examining 151 German companies Joecks et al. (2013) also found a positive correlation between women on boards and firm performance. However, he used a different measurement for board gender diversity; “critical mass”. Though these results have had positive effects of female board representation and firm performance there are also studies that found the opposite. Adams and Ferreira (2009) found a negative link between at least one woman in the board and firm performance. This study was large with 1939 U.S.A. based companies in their dataset. This research is from 1996 to 2003 and the representation of females on boards have changed drastically. I use the most recent complete data, from 2016 to 2022.

In this paper I focus on recent data which contain a relatively high female board representation as mentioned before. Based on previous literature and the quotas from the

Dutch government, I derived this research question: *What is the effect of gender diversity in boards on firm performance of Dutch firms in the years 2016-2020?* I will be using three different gender diversity measures and three different performance measures. These are chosen to assure that there is a deep understanding of the data and to combine multiple techniques of measuring gender diversity and performance.

The research which is done in this paper contributes to the current literature in more than one way. Firstly, there are three measures for performance and three measures for gender diversity, most research used either many performance measures or many genders diversity measures. This paper will therefore convey a complete and in depth understanding of the effect of gender diversity in boards on firm performance. Secondly, the "critical mass" theory and the quota's set by the Dutch government indicate that to have enough influence female directors need to be represented adequately. Both the quota and the critical mass theory state 30% or more. The ratio of females on boards in the Netherlands has never been this high according to the OECD database. Therefore, there is more chance firms have reached the "critical mass" of female board representation which according to this theory will enlarge the impact of female board members. Using the most up to date data from 2016 to 2022 we also have the highest female ratio of boards in the Netherlands. This means that women have a good chance to have impact on performance. Lastly, because of the higher number of women in boards in the last years there are instances of women dominated boards which can tell us about the importance of gender diversity and not only the effect of women.

This paper has been structured as follows. In the second and following section national context will be discussed followed by theoretical literature and empirical evidence on the relationship of gender diversity in the board room and firm performance. In the third section of this paper the data and methodology used to gain the results will be clarified. In the fourth section I will describe and display the regression analyses results of our data. The final and fifth section will be the conclusion and discussion about the implications, importance and shortcomings of our research.

2. Literature & Theoretical Background

2.1 National context of Netherlands

In the year 2013 a Dutch law containing gender diversity guidelines took into effect. The law named the "Act on Management and Supervision" requires all "large firms" to aim for a balanced gender distribution in their boards. Firms are "large" if they have one or more of the following characteristics: more than 250 employees, net sales of more than 40 million euros and assets worth over 20 million euros (Leenders, Pouwels, & Van den Brink, 2019).. The companies must strive for an equal distribution of both males and females. In the management and supervisory boards there needs to be at least 30% woman and at least 30% men. If the requirements are not met by the large company, the company must explain the actions it took to increase the gender diversity and why it has not met the standard of at least 30% of both men and woman. (Leenders, Pouwels, & Van den Brink, 2019). This law was passed to combat the male dominated board rooms in the Netherlands. However, in 2019 more than 90% of the companies who are encouraged by this law did not meet the gender distribution standard. 90% of these companies did not explain what they did to improve this gender imbalance. (Leenders, Pouwels, & Van den Brink, 2019). This indicates that this law had little power to force companies into gender equal board rooms. The bill expired in January 2020. (Act on supervision and management)

According to the "gender diversity index of women on boards and in corporate leadership" the Netherlands ranks 9th in Europe with its Gender Diversity index (GDI) in 2021. This GDI is calculated by the share of woman in executive positions, in boards and in the committees. Companies in the Netherlands also only improved our GDI by 1.75% in 2021. The research still points to an underrepresentation of women in the higher-ranking positions of companies in the Netherlands.

A new bill has taken effect the first of January 2022 which mandates large companies to only allow new board members to better the equality. This means if you have only men in the board, you should only acquire women candidates as the next board member. These bills show the dedication of the Dutch government to equality in the board rooms and the importance this issue has.

2.2 Theoretical literature

The theoretical examining of the impact of board structure and gender diversity on firm performance has been done in previous studies. Many board characteristics like age diversity, gender diversity, size of the board etc., have been brought to attention over the years (Carter et al, 2003). Of the many theories there are two prevailing theories about how these factors could affect firm performance. These are the agency theory and the stakeholder theory.

Agency theory

The agency theory focusses on the relationship between the principal and the agent. In the case of boards and firm performance that would be the shareholders (principal) and the management and executives (agent). The theory states that potential conflicts of interest could arise if the motivations and goals between the principal and the agents diverge. In the context of this paper these conflicts of interest could result in expenses or losses incurred due to divergent interests and the need for extensive monitoring and control (Randøy et al. 2006) (Eisenhardt, K. M. 1989). An important task of the board is to monitor the executives. Randøy, Thomson and Oxelheim (2006) argue that the board independence would be improved with greater board diversity. The greater board independence is needed to monitor top management and executives to reduce the agency problems. Increasing the gender diversity therefore would increase the monitoring quality associated with a diverse board. Carter et al. (2003) include that a diverse group has many different ideas and ask different questions because they have a different viewpoint. A person diverging from the most common characteristics is the ultimate outside director to improve the independence of the board. Lückerath-rovers (2010) adds that homogeneity is a threat to the independence of a board. She identifies three risks with a homogenous board: creation of a tunnel vision, a strong group pressure to agree and excessive self-esteem.

Female directors help represent the shareholders in a more complete and valuable manner because they diversify boards with unique characteristics (Carter et al., 2008). Upadhyay and Zeng (2014) argue that the female directors are generally more transparent. Then agency problems will decrease when more female directors are in a board because of more transparency to the principal.

Stakeholder Theory

Another important task of a board is strategic decision making. The stakeholders' theory argues that the stakeholders (shareholders, workers, clients) would want to enhance the quality of decision making to enhance firm performance. Francoeur, Labelle and Sinclair-

Desgagné (2008) argue that the advantages of a heterogenous boards are bigger than those of homogenous boards. Heterogenous boards have advantages in diverse knowledge, perspectives, creativity and judgements, homogenous boards have advantages in smooth communication and coordination.

Most theories are based on the broader range of skills or perspectives a diverse board would be capable of. The resource dependency theory states that a more diverse board would have access to more critical resources. Board diversity might enlarge access to these critical resources such as financial funds, different managerial expertise, and personal network (Stiles, 2001).

Other research indicates that female directors are better at specific skills than their male counterparts. Communication, human resources, and public relations are all skills female directors tend to be better at (Zelechowski and Bilimoria, 2004). According to Zelechowski and Bilimoria (2004) male directors have better operation and marketing skills. An all-male board could use the skills of female directors and vice versa.

2.3 Previous empirical literature

When looking at the literature on gender diversity and firm performance there are different ways to measure the gender equality. This influences the outcome and verdict on the relationship between board gender diversity and firm performance. I will present you with the most used measures and their results.

Lückerath-Rovers (2010d) uses a dummy which is 0 if a firm has no female board members and 1 when there are female board members. There are strong relationships found between firm performance measurements and the dummy variable of 99 Dutch companies. Firm and board size were controlled for. The ROE, ROS and ROIC are all statistically significant and positively correlated with the female dummy. Haslam et al. (2010) tested the same dummy with Tobin's Q as a performance measure and researched 126 British companies. They found a negative link with Tobin's Q and the presence of women on a board.

A concept "critical mass" which more accurately measures the amount of gender diversity is used by Joecks et al. (2013). Their research indicated that when the board contains at least 30% women (The Critical Mass) the relationship between board gender diversity and firm performance turns from negative to positive. This "critical mass" is the same as the quota set by the Act on Management and supervision. Joecks et al (2013) use a dataset of 151 listed German firms from 2000-2005. They find evidence for a "U-shaped"

relationship between gender diversity and firm performance. This means less woman on a board means negative correlation and beyond the "critical mass" a positive relationship is observed. Brahma et al. (2020) also find the largest positive effects on firm performance when boards have 3 or more women. The average board size is 10.5 so this also strengthens the theory.

Liu et al. (2014) researches the effect of woman in board rooms by using the number and ratio of woman on a board. Using the number of women on a board is static and does not give a precise insight to the gender diversity of a board. The paper examines Chinese listed firms from 1999-2011. The researchers also find that 3 or more females is needed for the positive effect of females on boards, this is consistent with the critical mass theory. A higher fraction of female board members had a positive effect on firm performance (Liu et al., 2014). This works well to study gender equality when there are no boards dominated by women. Boards dominated by woman would not be gender diverse. Luckerath-Rovers (2011) used women ratio as well to study the effects of female board members on firm performance. The author used data of 99 Dutch companies between 2005 and 2007. She found a positive link between women's ratio and return on equity. Shrader et al. (1997b) researched 200 large firms from the wall street journal in the year 1992 and 1993. They looked at the total percentage of woman top managers and firm performance (ROS, ROA, ROI and ROE). The results are either a small positive coefficient which are not significant or negative but significant coefficients. The authors argue that board diversity increases capacity of decision making, however conflicts between board members increase. Rose (2007) is not able to find a correlation between gender diversity (woman's ratio) and firm performance. She researched Danish firms and measured performance by Tobin's q. Tobin's q measures the market value divided by the replacement costs, this tells you if investors think the value of the firm is higher than its assets. Marinova et al. (2016) researched Danish and Dutch companies using a two-stage least square equation. The authors used Tobin's Q as a performance measure. The authors found no effect of board gender diversity on firm performance and state that this is in line with most European research.

Miller and del Carmen Triana (2009) use the Blau index. This is a way to measure the heterogeneity of the sample by taking the percentage of women per board squared plus the percentage of men squared and subtract that from 1. They find a positive relationship between gender diversity and innovation.

2.4 Hypotheses

Firstly, hypothesis 1: *Having at least 30% women in boards has a positive effect on performance of Dutch listed firms.* This hypothesis evaluates the effect it would have for a company to abide by the Act on Management and supervision. This hypothesis is focused on whether the ideal of having at least 30% women and 30% men on a board has a positive effect on the performance of these firms. The positive effect I hypothesize is chosen on the basis that Joecks et al. (2013) found a positive effect on firm performance when critical mass applied. Other research points to the same explanation. Brahma et al. (2020) also have similar results like I specified in the empirical evidence.

Secondly, hypothesis 2: *The effect of having a higher ratio of women in boards on performance of Dutch listed firms is positive.* A lot of literature is focused on the percentage or number of women on boards (Liu et al., 2014; Shrader et al., 1997b; Rose (2007); Luckerath-Rovers 2011). This is logical because most board rooms are dominated by men. Do strictly more women make a firm perform better? I hypothesize a positive effect of the women's ratio of boards on performance of Dutch listed firms. This stems from the fact that the paper about specifically Dutch listed firms of Luckerath-Rovers (2011) found a positive correlation. I will investigate the hypothesis using the ratio of females on a board as the independent variable.

Lastly, Hypothesis 3: *There is a positive effect of a gender diverse board on performance of Dutch listed firms.* The previous two hypotheses are not focused on the most gender diverse board but the female representation. A variable is used in which the highest gender diversity gets the highest score. This measure more accurately describes gender diversity on which our research question is based. The aim of this hypothesis is to see if the effect changes considerably when firms that are female dominated do not get a higher score than firms that are more gender diverse. Miller and del Carmen Triana (2009) use the Blau index which also is a measure for gender diversity. They find a positive relationship between board gender diversity and innovation. Innovation is one of the key drivers of growth and performance (Lee et al., 2019). Therefore, based on previous research I hypothesize a positive effect.

3. Data and methodology

3.1 Data collection

The Dutch firms which I will use in this paper are all listed on the Euronext Amsterdam stock exchange. Only 53 of the total 100+ firms listed on the Euronext Amsterdam stock exchange are used in this paper. Due to missing board information, missing performance metrics and companies without data from 2016-2022, some data was not complete. This resulted in the sample of 53 firms for which the data was adequate. All the board, gender and performance data were gathered from the Orbis database of the Van Dijk company. The gender data was gathered by identifying the gender of each board member on each board and put in the database. Information that could not be found in the Orbis database was gathered using the official annual reports of the firms. Data of these 53 Dutch firms over the years 2016 to 2022 is used to answer our research question. The most recent data is used to give the most up to date and relevant results. The woman's ratio on the boards increased to the highest ever in 2022 in the Netherlands according to the OECD database. This fact gives us multiple companies which have reached "critical mass" and even boards who are now slightly more female represented in our data like Heineken. The term Board is defined in this paper as the executive board and the supervisory board added together. When board is used the actions, influence and people of these boards are combined and spoken about together.

3.2 Methodology

The hypotheses are constructed on the relationship between gender diversity on boards and firm performance. These hypotheses use the fixed effects model for the robust panel multivariate regression. This is the regression formula:

$$Firm\ performance_{i,t} = \alpha_i + \beta_j G_{i,t} + \sum_{j=1}^{n} \beta_j X_{j,i,t} + \beta_j \gamma_t + \varepsilon_{i,t}$$

Per hypothesis the gender diversity measurement ($G_{i,t}$) will be different to fit the question (Described in "3.3 independent variables"). The performance measurements of the dependent variable will be the same per hypothesis (ROA, ROE and Tobin's Q). The α_i describes the firm specific fixed effects. The γ_t describe time dummies for each year. The $\sum_{j=1}^{n} \beta_j X_{j,i,t}$ term are the effects of the control variables summed. The controls are board size

and firm size. Firm size is measured in total assets and total employees. The $\varepsilon_{i,t}$ is the error term.

By using a panel regression, all time invariant variables are controlled for, this eliminates a big part of the endogeneity. To further eliminate selection bias control variables are used. The control variables board size, total employees and total assets. Brahma et al. (2020) and Carter et al. (2003) also used board size as a control variable.

3.3 independent variables

The gender data was collected from the Orbis database and annual reports. The data was gathered per board member and put in a database to calculate the fraction of females on a board. Per hypothesis there are different ways to measure the gender diversity. In the following section each independent variable will be described per hypothesis they represent.

Firstly, to test the first hypothesis a dummy will be created to measure this. If there is at least 30% of women on the board of the firm, it takes the value of one and it takes the value of zero if that is not the case. The condition of 30% men of the Act on Management and supervision is not included because with our data there is no firm that does not meet that standard. With this gender measurement the "critical mass" theory explained earlier is tested (Joecks et al., 2013).

Secondly, I will investigate the second hypothesis using the percentage of females on a board as the independent variable. Siciliano (1996) found a positive link between women's ratio and social performance. This hypothesis differentiates the balancing out of male dominated boards and the board becoming women dominated like Heineken in our data set.

Thirdly, to test the third hypothesis I created a diversity index. The Blau index has already been used by Miller and del Carmen Triana (2009) to create a diversity index. This formula reaches a maximum of 0.5 on the index. The following formula is simple and similar to the Blau index and it does reach 1 at the maximum on the index. This is more intuitive to use in a regression. Multiply the fraction of female board (P_W) members by the fraction of male board ($1 - P_w$) members.

$$Gender\ diversity\ index = 4 \times (P_W \times (1 - P_w)$$

This will create a parabola with the max at 1 when $P_W = 0.5$ so by definition that means the share of woman must equal 50%. This equation will be the independent variable in the regression.

3.4 Dependent variables

I use three firm performance measures Return on Assets (ROA), Return on Equity (ROE) and Tobin's Q. Every hypothesis will be tested with these three performance measures. The use of the three most used performance measure in this field of research gives me different results to analyze what the effect of gender diversity in board rooms is on firm performance.

ROA and ROE are accounting performance measures that describe the performance of the previous year after it has ended and only represents the performance of that previous year. Return on Assets and Return on Equity are both based on net income. Net income is the numerator in both performance measure's division. They both are to be interpreted as a percentage.

ROA is calculated by dividing net income by the total assets of the firm (Shrader et al., 1997). ROA can be interpreted as a variable to measure the amount of income generated with the assets owned by the firm or how effectively does the firm use its assets.

ROE is calculated by dividing net income by the total equity of the firm (Shrader et al., 1997). ROE can be interpreted as a variable to measure the amount of income generated with the equity of that firm or how effectively does the firm use its equity to create income. The formula for ROA and ROE:

$$ROA = \frac{Net\ income}{Average\ Assets} \qquad ROE = \frac{Net\ Income}{Average\ Equity}$$

When these performance measures are high this indicates that the firm uses its resources effectively. These measures were chosen because they estimate how effective a company is relative to other companies. Comparing only net income is not adequate, bigger companies have more resources to use. When net income is divided by the equity or assets the number indicates how effectively resources are used.

Tobin's Q is not an accounting measure like ROE or ROA. I calculate Tobin's Q by dividing the market value by the total assets. Tobin's Q is widely used in this field of research as a proxy for a firm's ability to create shareholders wealth (Rose, 2007). If Tobin's Q is

below 1 the market value is less than the value of the total assets, if Tobin's Q is more than one the market value is higher than the total assets. This is the formula for Tobin's Q:

$$\text{Tobin's Q} = \frac{\text{firm Market Value}}{\text{Assets Book Value}}$$

By using both accounting measures and measures with market elements the specific effect of a gender diverse board on the performance of a firm can more accurately be assessed.

3.5 Control variables

Endogeneity is not entirely solved by the panel regression; time variant variables are not accounted for. With additional control variables the aim is to eliminate more endogeneity. As the control variables time variant variables which are both correlated with gender diversity and firm performance are used. From previous literature firm size and board size have effects on both these variables (Adams & Ferreira, 2009; Carter et al., 2003). Board size is the number of total board members. To account for firm size, total assets and number of employees are added as controls. The total assets and the number of employees were gathered from the Orbis database. The total assets are displayed in Billions of U.S. dollars in the graphs and the total employees per thousand employees. The size of the board is used as a control variable which also represents firm size in some way but also firm structure. Board size has also been used as a control variable in past research (carter et al. 2003). These variables eliminate more omitted variable bias. Lastly, time dummies are included to control for shocks like the corona outbreak or blocking of the Suez Canal. The corona crisis is a shock I want to account for with these time dummies. The time dummies are created for each year that our data includes.

3.6 Descriptive statistics

Table 1 contains the descriptive statistics of our sample. The Table reports the mean, median, standard deviation, maximum and minimum of the variables in our sample from 2016-2022. The year dummies are not included. There are 371 observations for every variable, 7 years of data for 53 firms.

There are on average 21% women (woman ratio) on the boards of my sample with the minimum being 0% women on a board and the maximum 62%. The mean of my sample of firms is not up to the standards of the Dutch gender quota of 30%. The maximum of 62%

gives meaning to the diversity index used for the third hypothesis, this board room is female dominant, this is not optimally equal. the diversity index measurement has an average of 0.61 which is lower than filling in the formula with the average female ratio. This is caused by the years firms had a woman ratio higher than 50%. The diversity index treats ratios of men and woman the same therefore it is not optimal to go over 50%. The critical mass was achieved in 19% of the datapoints.

Furthermore, the *Return on Equity* (ROE) has a mean of 9.79 but a standard deviation of 35.07. this standard deviation is quite high and tells us the data deviates a lot from each other. The maximum is 82.81 and the minimum is -531.90, which is an outlier. Due to it being a natural outlier it is kept in our sample. The *Return on Assets* (ROA) has a mean of 5.01 and a standard deviation of 8.95 and the values range from -51.56 to 37.00. This medians for both Return on Assets and Return on Equity are positive, which together with a positive mean for both indicate most firms have positive net income for the period 2016-2022. Tobin's Q has a mean of 1.04, on average the market value of the companies ia valued almost the same as their book value.

Finally, the control variables. The mean of the *board size* is 10.84 which is similar to the research of Brahma et al. (2020). The mean of the total assets is 22.33 billion U.S. dollars, and the median is 1.72 billion dollars. The difference is big, there are a couple of relatively big companies, but most companies do not come close to the mean. The average number of employees is 29,508 and the median number is 3,309. This again indicates that there are a couple of big companies which have significantly more resources to use.

Table 1: Descriptive statistics

variables	Observations	Mean	Median	ST. deviation	Minimum	Maximum
ROE	371	9.79	13.12	35.07	-531.90	82.81
ROA	371	5.01	5.32	8.95	-51.56	37.00
Tobin's Q	371	1.04	.76	1.20	.01	9.26
Female ratio	371	.21	.2	0.12	0	.62
Critical Mass	371	.19	0	0.40	0	1
Diversity	371	.61	.64	0.25	0	1
Size board	371	10.84	10	4.63	4	27.00
Total assets	371	22.33	1.71	75.37	.0528	545.90
Total employees	371	29.51	3.31	104.82	.03	70.97

Note: The woman's ratio is a fraction; critical mass is a dummy which makes the mean a percentage; Total assets are given in Billions of U.S. dollars; ROE and ROA are given in percentages; total employees are shown per thousand employees.

In table 2 the sample is split in years in which firms reached the critical mass (1) and years in which they do not (0). The mean Return on Equity (ROE) of critical mass (1) is 15.46 compared to 8.42 for the critical mass (0) sample. This difference is in line with our hypotheses. The years in which firms reach critical mass has an average ROE almost double that of the years in which firms do not reach critical mass. The mean Return on Assets (ROA) of the critical mass (1) sample is 6.68 and for the critical mass (0) is 4.61. The years in which firms reaches critical mass they have a higher ROA on average. The critical mass seems to have a positive effect on both accounting measures.

The mean Tobin's Q for the years in which firms reach critical mass is 0.89 and for the years in which firms do not is 1.07. Tobin's Q is higher when critical mass is not reached. Critical mass seems to have a negative effect on Tobin's Q which represents shareholder value. Lastly, the years in which firms reach critical mass seem to have more employees and more assets on average.

Table 2 Comparing critical mass means

	Critical mass (1)			Critical mass (0)		
variables	Mean	Std. dev	observations	Mean	Std. dev	observations
ROE	15.46	14.77	72	8.42	38.29	299
ROA	6.68	6.13	72	4.61	9.47	299
Size board	11.89	4.28	72	10.60	4.68	299
Female ratio	.39	.07	72	.17	.08	299
Total assets	27.81	65.09	72	21.01	77.68	299
Total employees	71.16	176.19	72	19.48	75.67	299
Tobin's Q	.89	.79	72	1.07	1.13	299
Diversity	.93	.05	72	.53	.22	299

Note: This table splits the sample into two samples; the sample "critical mass (1)" are the years that firms reached critical mass; the sample "critical mass (0)" are the years that firms did not reach critical mass; the woman's ratio is a fraction; critical mass is a dummy which makes the mean a percentage; total assets are given in Billions of U.S. dollars; ROE and ROA are given in percentages; total employees are shown per thousand employees.

4. Results

This chapter presents the empirical results for the relationship between gender diversity in boards and firm performance. For each of the hypotheses three regressions are shown in one table. All regression results are displayed using three decimals as the effects of the assets and the total employees are too small to display in two decimals. Paragraph 4.1 presents the regression analyses (table 3.1 and table 3.2) for hypothesis number one, which estimates the effect between reaching critical mass in boards and firm performance. Paragraph 4.2 contains the regression analyses (table 4.1 and 4.2) for hypothesis number two, which estimates the effect between female ratio in boards and firm performance. Paragraph 4.3 contains regression analyses (table 5.1 and table 5.2) for hypothesis number three, which estimates the effect between diversity index of boards and firm performance.

4.1 Regression analysis first hypothesis.

To start off, in table 3.1 the regression results with critical mass as the independent variable are presented. Each column represents a regression analysis with a different dependent variable for firm performance (ROE, ROA and Tobin's Q). These regression results are used to reject or accept the first hypothesis. Due to space constraints, year dummies were excluded from table 3.1. The full table with year dummies is seen in the appendix (table 3.2).

Firstly, reaching critical mass has a positive and significant effect on ROE and ROA. The effect of critical mass on ROE is positive and statistically significant (β=10.346, P<0.10). Critical mass is a dummy variable, when critical mass is reached, the ROE is estimated to increase with 10.35 percentage points. The effect of critical mass on ROA is positive and statistically significant (β=2.664, P<0.01). When critical mass is reached, ROA increases with 2.66 percentage points. The effect of critical mass on Tobin's Q is positive but relatively small and statistically insignificant (β=0.010, P>0.10). The fact that critical mass has a statistically significant positive effect on both ROE and ROA supports the acceptance of the first hypothesis. These positive effects support the critical mass theory. The relatively small and positive effect of critical mass on Tobin's Q is statistically insignificant and therefore cannot be used to draw a conclusion. The critical mass theory is not supported by the insignificant effect on Tobin's Q.

Secondly, of the control variables only total employees and total assets are statistically significant in one or two regression analyses. The variable total employees has a

statistically significant effect (β=.081, P<0.05) on ROE and ROA (β=.002, P<0.10) which is positive. For every extra thousand employees the ROE increases .081 and the ROA increases .002. Total assets have a significant effect in two columns. The effect of total assets on both ROA (β=-.077, P<0.10) and Tobin's Q (β=-.010, P<0.01) is negative and statistically significant for both. When total assets increase with one billion dollars ROA decreases -.077 percentage points and Tobin's Q decreases -.010. The year dummy variables are all statistically insignificant.

Thirdly, the constant is only statistically significant in the regression with Tobin's Q as the dependent carriable and is positive (β=0.974, P<0.05). This means when every other variable is 0 the Tobin's Q is 0.974, this means a firm's market equity is valued lower than its book value.

Lastly, the F-statistic is significant for the three models. This means that there is a significant correlation between some independent variables in each of the three models and the dependent variable. The R-squared value is low, al the models have and R-squared below 0.05.

Table 3.1: linear-regression results about the relationship between critical mass and the 3 performance measures (ROE, ROA and Tobin's Q).

	Performance measures		
Variables	ROE	ROA	Tobin's Q
Critical mass	10.346*	2.664*	.010
	(5.673)	(.916)	(0.124)
Size board	1.481	.092	.019
	(1.886)	(.276)	(0.032)
Total assets	-.093	-.077*	-.010***
	(.077)	(.041)	(.003)
Total employees	.081**	.002*	.000
	(.038)	(.014)	(.003)
Constant	-7.191	4.990	0.974**
	(18.684)	(3.131)	(0.386)
observations	371	371	371
R-squared	.037	.018	.049
F-statistic	3.83***	4.08***	3.69***
	(.000)	(.000)	(.000)

Note: The standard errors are in brackets; the critical mass is a dummy; total assets are given in billions of U.S. dollars; total employees is given in thousands of employees; significance is displayed as * p<0.10, **p<0.05, ***p<0.01.

4.2 Regression analysis second hypothesis.

Furthermore, in table 4.1 the regression results with female ratio as the independent variable are presented. Each column represents a regression analysis with a different dependent variable for firm performance (ROE, ROA and Tobin's Q). These regression results are used to reject or accept the second hypothesis. Due to space constraints, year dummies were excluded from table 4.1. The full table with year dummies is seen in the appendix (table 4.2).

Firstly, Female ratio has a positive and statistically significant effect on ROE and ROA. The positive effect of female ratio on ROE (β=106.641, P<0.10) is relatively large and statistically significant. The effect of female ratio on ROA (β=22.457, P<0.05) is smaller than the effect of ROE but it has a stronger statistical significance of P<0.05. The female ratio variable is a ratio between zero and one, thus when the female ratio improves by one

percentage point (0.01) the ROE increases by 1.07 percentage points and the ROA increases by 0.22 percentage points. The positive effect of female ratio on Tobin's Q is not statistically significant. The effect of the two accountancy measures ROE and ROA is in line with hypothesis number two. The statistically significant correlation between female ratio and the accounting performance measures (ROE and ROA) indicates that female ratio has a positive effect on efficiency and income. The assets and equity are used in a more efficient manner when the ROE and ROA are higher. The results for the effects female ratio on Tobin's Q are positive but cannot be interpreted to accept or reject the hypothesis due to its statistical insignificance.

Secondly, of the control variables only total employees, total assets and the year dummy of 2020 are statistically significant in one or multiple regression analyses. The variable total employees only has a statistically significant effect (β=.081, P<0.10) on ROE which is positive. For every extra thousand employees the ROE increases .081. Total assets have a significant effect in two columns. The effect of total assets on both ROA (β=-.072, P<0.05) and Tobin's Q (β=-.010, P<0.01) is negative and statistically significant for both. The year dummy variables are all statistically insignificant except for 2020 and 2017. The year dummy 2020 has a statistically significant effect on both ROE (β=-9.711, P<0.10) and ROA (β=-2.202, P<0.10). In the year 2020 the corona crisis unfolded which may have affected ROE and ROA negatively. The year 2017 has a statistically significant positive effect on Tobin's Q (β=.208, P<0.10). Therefore, 2017 may have been a good year for the evaluation of Dutch firms.

Thirdly, the constant is only statistically significant (P<0.05) in the regression with Tobin's Q (β=.905, P<0.10) and is positive. This means when every other variable is 0 the Tobin's Q is 0.905, this means a firm's market equity is valued lower than its book value.

Lastly, the F-statistic is significant for the three models. This means that there is a significant correlation between some independent variables in the three models and the dependent variable. The R-squared value is low, al the models have an R-squared below 0.05.

Table 4.1: linear-regression results about the relationship between female ratio and the 3 performance measures (ROE, ROA and Tobin's Q).

	Performance measures		
Variables	ROE	ROA	Tobin's Q
Female ratio	106.641*	22.457**	.494
	(61.680)	(9.415)	(0.936)
Size board	1.341	.070	.017
	(1.645)	(.237)	(.032)
Total assets	-.066	-.072**	-.010***
	(.071)	(.039)	(.003)
Total employees	.070*	-.000	.000
	(.041)	(.015)	(.003)
Constant	-22.196	1.826	0.905**
	(23.745)	(3.506)	(0.356)
observations	371	371	371
R-squared	.037	.025	.048
F-statistic	3.83***	3.07***	3.66***
	(.001)	(.003)	(.001)

Note: The standard errors are in brackets; the female ratio is a fraction; total assets are given in billions of dollars; total employees is given in thousands of employees; significance is displayed as * p<0.10, **p<0.05, ***p<0.01.

4.3 Regression analysis third hypothesis.

Furthermore, in table 5.1 the regression results with the diversity index as the independent variable are shown. Each column represents a regression analysis with a different dependent variable for firm performance (ROE, ROA and Tobin's Q). These regression results are used to reject or accept the third hypothesis. Due to space constraints, year dummies were excluded from table 5.1 The full table with year dummies is seen in the appendix (table 5.2).

Firstly, the diversity index has a positive and statistically significant effect on ROE and ROA. The positive effect of the diversity index on ROE (β=56.109, P<0.10) is relatively large and statistically significant. The positive effect of the diversity index on ROA (β=10.67, P<0.05) is smaller than the effect on ROE, however it has a stronger statistical significance of P<0.05. The diversity index is a value between zero and one, thus when the diversity index improves by 0.01 the ROE increases by .56 percentage points and the ROA increases by

about 0.11 percentage points. The positive effect of the diversity index on Tobin's Q is not statistically significant. Gender diversity has a positive effect on ROE and ROA and an insignificant effect on Tobin's Q. The positive and significant effects of the diversity measure on counting measures support the third hypothesis.

Secondly, the only significant control variables are the total assets and the year dummy of 2020. Total assets have a negative significant effect on ROA (β=-.071, P<0.10) and Tobin's Q (β=-.010, P<0.01). This may indicate decreasing returns to scale. The year dummy of the year 2020 is has a negative statistically significant effect on ROE (β=-11.301, P<0.10) and ROA (β=-2.362, P<0.10). This year included the corona crisis which impacted the Dutch economy. The negative effects show that the year dummies control for these time shocks.

Thirdly, the constant is only statistically significant (P<0.05) in the regression on Tobin's Q and is positive. This means when every other variable is 0 the Tobin's Q is 0.917, this means a firm's market equity is valued lower than its book value.

Lastly, the F-statistic is significant for all three regression models. This means that there is a significant correlation between some independent variables in the three models and the dependent variable. The R-squared value is low, al the models have and R-squared below 0.05.

Table 5.1: linear-regression results about the relationship between diversity index and the 3 performance measures (ROE, ROA and Tobin's Q).

	Performance measures		
Variables	ROE	ROA	Tobin's Q
Diversity index	56.109*	10.667**	.135
	(31.573)	(4.895)	(0.448)
Size board	1.141	.037	.018
	(1.475)	(.225)	(0.034)
Total assets	-.065	-.071*	-.010***
	(.071)	(.039)	(.003)
Total employees	-.056	-.001	.000
	(.071)	(.015)	(.003)
Constant	-30.916	.473	.917**
	(26.949)	(3.955)	(0.372)
observations	371	371	371
R-squared	.046	.026	.049
F-statistic	3.64***	3.64***	3.64***
	(.001)	(.009)	(.001)

Note: The standard errors are in brackets; the diversity index is a variable between zero and one; total assets are given in billions of dollars; total employees is given in thousands of employees; significance is displayed as * p<0.10, **p<0.05, ***p<0.01.

5 Discussion and Conclusion

The aim of this study is to provide empirical evidence on the effect of gender diversity in boards on firm performance In Dutch firms in the years 2016-2020. This study investigates Dutch firms as the Dutch government has been incorporating legislation about the gender diversity in Dutch boards. This study uses three ways to measure gender diversity (Female ratio, Critical Mass and Diversity Index) and three ways to measure firm performance (ROA, ROE and Tobin's Q) to create a well-rounded answer. Similar studies have already been executed with much higher frequency in the U.S.A. (Carter et al., 2003; Adams and Ferreira, 2009; Shrader et al., 1997) and the Nordic countries of Europe (Randøyet al., 2006; Rose, 2007) than in the Netherlands (Lückerath-Rovers, 2011). My research therefore tries to grasp the broad effect by using many measures for performance and board gender diversity to add to the literature on Dutch firms.

To start, my analysis first examines the first hypothesis about the effect of having at least 30% females in boards on performance of Dutch listed firms. The results of the three regression analyses in table 3.1 and 3.2 were mixed. The results show a positive and statistically significant effect of reaching critical mass in board rooms on ROA and ROE. There is no statistically significant effect of reaching critical mass in board rooms on Tobin's Q. This can be interoperated that the efficiency in terms of using resources like equity and assets to create net income seem to be positively affected by reaching critical mass. In contrast, the shareholder value which Tobin's Q represents is not affected by reaching critical mass. Taken into consideration that 2 out of three performance measures had a statistically significant positive effect and time fixed effects, yearly shocks, board size and firm size were all controlled for, I conclude that there is a positive effect. However, it cannot be assumed that this effect is causal due to endogeneity that remains due to omitted variable bias. Therefore, the first hypothesis cannot be accepted or rejected.

Secondly, I examine the second hypothesis, the effect of the female ratio on boards on the performance of Dutch listed firms. The results of the three regression analyses in table 4.1 and 4.2 are mixed. A statistically significant and positive effect is observed of female ratio on ROA and ROE. The positive effect on Tobin's Q is not statistically significant. Again, this indicates that the efficiency in terms of using resources like equity and assets to create net income are positively affected by female ratio on boards. The shareholder value which Tobin's Q represents is not affected by female ratio on boards. This result is in line with the previous results. Using the same regression techniques and control variables, again causality cannot be claimed. I cannot reject or accept the second hypothesis.

Thirdly, I test the Third hypothesis, the effect of the diversity index on the performance of Dutch firms. The results in table 5.1 and 5.2 are mixed. A statistically significant positive effect of the diversity index on ROE and ROA is observed. The positive effect of the diversity index on Tobin's Q is not statistically significant. For the third time this indicates that the efficiency in terms of using resources like equity and assets to create net income are positively affected by diversity index of boards. The shareholder value which Tobin's Q represents is not affected by the diversity index of boards. This result is in line with the previous results. Using the same regression techniques and control variables for the third time causality cannot be claimed. I cannot reject or accept the third hypothesis.

My research faces limitations that future research should improve on. To start, even though the panel data that I gathered included seven consecutive years of data with over 370 observations per variable, the sample used in this study is relatively small, only 53 Dutch firms publicly listed firms. Adding that the sample were all big and publicly listed companies. This makes it hard to relate the effect to medium, small, or unlisted firms. A large international sample of big and medium firms would provide better reliability and validity. Future research should include a large sample with big, medium, small, listed and non-listed companies. When using a bigger sample future research could investigate more female dominated companies to see if the effects found are caused by adding females to boards or improving gender diversity.

The second limitation, our results could not be interpreted as causal because of the probability of endogeneity influencing our results. Other factors could still influence both the gender diversity and firm performance. To add to the possible endogeneity there could be reverse causality in which the performance of a firm increases the board diversity. Future research should use different and improved methods to eliminate the endogeneity that remained in my results.

The third limitation stems from a multivariate linear panel regression. The results are shown to be positive for ROE and ROA, but this is a linear relationship. If the actual relationship is not linear the estimation of the effect is not accurate. Previous literature such as Joecks et al (2013) finds a "U-shaped" relationship. Future research should test for different relationships.

Lastly, in this study I only use financial performance measures. Although this is not a limitation of this study. Future research should investigate the effects of gender diversity of boards on social performance and environmental performance. A firm is more than just the financial numbers and has impact on both their employees and their surroundings.

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7 Appendix

Table 3.2: linear-regression results about the relationship between critical mass and the 3 performance measures (ROE, ROA and Tobin's Q).

	Performance measures		
Variables	ROE	ROA	Tobin's Q
Critical mass	10.346*	2.664*	.010
	(5.673)	(.916)	(0.124)
Size board	1.481	.092	.019
	(1.886)	(.276)	(0.032)
Assets	-.093	-.077	-.010***
	(.077)	(.041)	(.003)
Employees	.081**	.002*	.000
	(.038)	(.014)	(.003)
Year (2017)	-6.760	-.302	.212
	(9.873)	(1.250)	(.130)
Year (2018)	2.210	.869	-.092
	(3.385)	(1.183)	(0.082)
Year (2019)	-1.329	.059	.129
	(3.992)	(1.275)	(.102)
Year (2020)	-4.042	-1.069	-.02
	(4.290)	(1.298)	(.103)
Year (2021)	1.169	1.195	.194
	(5.119)	(1.262)	(.155)
Year (2022)	-1.230	-.225	-.09
	(5.636)	(1.481)	(.124)
Constant	-7.191	4.990	0.974**
	(18.684)	(3.131)	(0.386)
observations	371	371	371
R-squared	.037	.018	.049
F-statistic	3.83***	4.08***	3.69***
	(.000)	(.000)	(.000)

Note: The standard errors are in brackets; the critical mas variable is a dummy; total assets is given in billions of dollars; year variables are dummy variables; total employees is given in thousands of employees; significance is displayed as * p<0.10, **p<0.05, ***p<0.01.

Table 4.2: linear-regression results about the relationship between female ratio and the 3 performance measures (ROE, ROA and Tobin's Q).

	Performance measures		
Variables	ROE	ROA	Tobin's Q
Gender	106.641*	22.457**	.494
	(61.680)	(9.415)	(0.936)
Size board	1.341	.070	.017
	(1.645)	(.237)	(.032)
Assets	-.066	-.072**	-.010***
	(.071)	(.039)	(.003)
Employees	.070*	-.000	.000
	(.041)	(.015)	(.003)
Year (2017)	-7.817	.060	.208*
	(10.322)	(1.291)	(.124)
Year (2018)	.813	.589	-.100
	(3.697)	(1.223)	(0.075)
Year (2019)	-5.663	-0.838	.108
	(4.668)	(1.234)	(.121)
Year (2020)	-9.711*	-2.202*	-.051
	(5.700)	(1.257)	(.109)
Year (2021)	-6.491	-.333	.151
	(8.321)	(1.487)	(.162)
Year (2022)	-9.856	-1.952	-.138
	(9.601)	(1.881)	(.143)
Constant	-22.196	1.826	0.905**
	(23.745)	(3.506)	(0.356)
observations	371	371	371
R-squared	.037	.025	.048
F-statistic	3.83***	3.07***	3.66***
	(.001)	(.003)	(.001)

Note: The standard errors are in brackets; the gender variable is a ratio; total assets is given in billions of dollars; total employees is given in thousands of employees; significance is displayed as * p<0.10, **p<0.05, ***p<0.01.

Table 5.2: linear-regression results about the relationship between diversity index and the 3 performance measures (ROE, ROA and Tobin's Q).

	Performance measures		
Variables	ROE	ROA	Tobin's Q
Diversity Index	56.109*	10.667**	.135
	(31.573)	(4.895)	(0.448)
Size board	1.141	.037	.018
	(1.475)	(.225)	(0.034)
Assets	-.065	-.071*	-.010***
	(.071)	(.039)	(.003)
Employees	-.056	-.001	.000
	(.071)	(.015)	(.003)
Year (2017)	-8.410	.040	.208
	(10.598)	(1.332)	(.121)
Year (2018)	.448	.554	-.097
	(3.817)	(1.233)	(0.074)
Year (2019)	-6.818	-0.961	.115
	(5.016)	(1.254)	(.124)
Year (2020)	-11.301*	-2.362*	-.040
	(6.450)	(1.300)	(.109)
Year (2021)	-8.321	-.488	.168
	(8.321)	(1.577)	(.160)
Year (2022)	-11.663	-2.080	-.120
	(10.283)	(1.947)	(.144)
Constant	-30.916	.473	0.917**
	(26.949)	(3.955)	(0.372)
observations	371	371	371
R-squared	.046	.026	.049
F-statistic	3.64***	3.64***	3.64***
	(.001)	(.009)	(.001)

Note: The standard errors are in brackets; the diversity index is a variable between zero and one; total assets are given in billions of dollars; total employees is given in thousands of employees; year-dummy 2016 is excluded as reference year; significance is displayed as * p<0.10, **p<0.05, ***p<0.01.