ERASMUS UNIVERSITY ROTTERDAM

Bachelor Thesis

International Bachelor of Economics and Business Economics (IBEB)

The influence of gender diversity in boardrooms on the financial performance of a firm before and after the instalment of a gender quota.

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Abstract

This paper investigates the influence of gender diversity in boardrooms on firm performance with and without a gender quota. The sample consists of Dutch firms listed on the AEX, AMX and AScX indices in the years 2007 – 2012 and 2013 – 2018. OLS regressions lead to positive but insignificant results both time periods. Interesting is that the effect seems to become more positive in the years after the instalment of the gender quota. However, 2SLS regressions suggest a negative but insignificant relationship between gender diversity and firm performance. Lastly, regressions incorporating the interaction effect between a dummy variable for the time period and the gender variable show a significantly more positive effect on Tobin's Q for all variables. Moreover, graphs show an increase in the percentage of women on the board of directors over the years. It is concluded that the gender quota leads to more female directors and higher firm performance.

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1. Introduction

Nowadays gender diversity in companies and equality for women is of great importance in many countries. In the last fifteen years there have been a lot of changes in the legislation focussing on diversity within boardrooms. There are several approaches which governments have taken to achieve more diversity. One of them is a gender quota. Norway was the first European country to introduce such a quota in 2006. Since then, the country achieved the highest percentage of female directors in the world (Wang, 2013). The Norwegian gender quota has become an example for other countries striving to increase the number of women in corporate boardrooms. In 2013, the Netherlands adopted a new enactment on a gender quota for firms. This legislation states that companies must strive to achieve a minimum of 30% of its directors and board members to be female. The goal was that companies had to acquire this target before January 1st, 2016. However, this goal has been postponed to 2020, as the percentage of women was increasing too slowly. The target of 30% applies to all firms with more than 250 employees, net sales of more than 40 million euros and assets worth more than 20 million euros (NOS, 2018). Moreover, companies should explain noncompliance of this percentage in their annual reports (Pande, 2012).

In July 2019, an important group of Dutch investors announced that they decided only to invest in firms with more female top directors. They set a quota of 35% that must be reached within three years. The investors will not set a punishment for firms that do not achieve the quota, as they say that missing out on results is punishment enough. They state that "everybody knows that more diverse teams perform better". The plan for the quota arose after research on the financing of female start-ups resulted in the observation that investors nearly solely invest in start-ups directed by men. One of the initiators of the quota is the Dutch prince Constantijn (NOS, 2019).

Most of the research on gender diversity has not specifically researched the influence of a gender quota. Researching this can lead to up-to-date, new results. Research on the relation between gender and firm performance has already been done in the Netherlands (in combination with Denmark) in the paper 'Gender Diversity and Firm Performance: Evidence from Dutch and Danish Boardrooms' by Marinova et al. (2016). In this paper, there was no relation between gender diversity and firm performance in both countries. However, the sample of this research

included data on firms from 2007. As this was before the gender quota in both countries, there is a lot of new information that can be incorporated in research.

Moreover, the relevance of the research conducted in this paper lies in the outcome of the research. If there is a positive relation between the gender quota and a firm's financial performance, it might become more desirable for companies to strive to reach the quota. This would lead to an increased intrinsic motivation for the company. On the other hand, if the relation turns out to be negative, further research should be conducted on why this is the case. This paper incorporates data after the announcement of the gender legislation in the Netherlands, so that the relation between the gender quota and financial performance can be measured. The relation between the presence of female board members and firm performance after the instalment of the quota will be compared to the same relation before the announcement of the legislation. This leads to the following research question:

'Gender diversity within corporate boardrooms in the Netherlands: do gender quotas improve financial performance?'

The main question will be accompanied by a sub question, which contributes to the answer to the research question. This question researches whether the gender quota works to improve the presence of females on corporate boards. The sub question is as follows:

'What is the effect of the gender quota on the presence of female board chairs?'

The rest of this paper consists of several different parts. This introduction is followed by the theoretical framework. Here, past literature relevant to the subject will be discussed. This literature will be used to answer the research- and sub questions. Several concepts used in this paper will also be explained. Moreover, in this section, possible hypotheses will be drawn to answer the research question. After this chapter, the data and methodology used will be explained. The results obtained from the methods used to examine the data will be discussed in chapter 4. With help of these results a conclusion on the research- and sub questions will be drawn in the last section of this paper. This will be accompanied by a discussion on the research performed.

2. Theoretical Framework

2.1 Corporate Governance Systems & Gender

2.1.1 Corporate governance systems

As this paper examines whether gender diversity in corporate boardrooms improves the financial performance of a firm, it is important to establish the definition of corporate governance and to explain the appropriate corporate governance system used in companies the Netherlands.

Corporate governance is a universally used term which describes the way companies are directed and how firm directors are controlled. The general definition of corporate governance is as follows: '*corporate governance deals with the ways in which suppliers of finance to corporations assure themselves of getting a return on their investment'* (Schleifer and Vishny, 1997). Corporate governance thus reconciles the interests of managers and shareholders. There are different corporate governance systems and approaches applied all over the world. These can be divided into two main, broad systems. The first is a one-tier system, which consists of one single board with executive and non-executive directors. This system can be found in for example the United States and the United Kingdom. Executive directors oversee the daily management of the company, while non-executives have a more supervisory role. The second is a two-tier system consisting of a directory and a supervisory board. Most of Continental Europe employs this system, including the Netherlands (Jungmann, 2006). The Dutch government gives companies the freedom to choose how to implement its corporate governance structure ("Wat is corporate governance?", n.d.). Most companies have a board of directors (Raad van Bestuur) and a supervisory board (Raad van Commissarissen). The board of directors is responsible for the policy and the implementation of the firm's business strategy whereas the supervisory board monitors the board of directors. However, there are Dutch companies which apply a one-tier system in its management as well, for example Unilever ("Ondernemingsbestuur: one-tier vs. two-tier", 2006). This paper focusses on diversity within the board of directors throughout the research done.

The influence of boardrooms on a firm's financial performance is a topic that has been researched by many studies. These studies have focused on different aspects or characteristics of corporate boardrooms. For example, Agrawal and Knoeber (1996) have investigated the influence of the percentage of inside directors on the board. An inside director is a director who

is also an employee, officer or direct stakeholder in the company. Research done by Hermalin and Weisbach (1991) considers the relationship between financial performance and director's and manager's tenure. However, the results of this research imply that there is no relation between board composition and performance. Another article by Weisbach (1988) investigates the share ownership of board members. Lastly, Zahra and Pearce (1989) have researched the relationship between board of directors and corporate financial performance. This article reviews empirical research done on this topic followed by a new model that has not been constructed in the earlier literature. This model links four properties of boardrooms (composition, characteristics, structure, and process) to three possible roles the board should incorporate.

2.1.2 Diversity

Next to corporate governance, the concept of diversity is important to define for the contents of this paper. Van der Walt and Ingley (2003) explain diversity as follows: "the concept of diversity relates to board composition and the varied combination of attributes, characteristics and expertise contributed by individual board members". Diversity can be distinguished into different dimensions; demographic (observable) and cognitive (unobservable). Most of the existing empirical research focusses on demographic diversity, for example on gender, age and ethnicity (Brammer et al., 2007). Gender diversity is the most important form of diversity to consider for the contents of this paper.

The discussion on female presence in boardrooms has been an ongoing debate for many years. Brammer et al. (2007) present arguments why there should be more female representatives in corporate boardrooms. These arguments can be divided into ethical and economic categories. From an ethically point of view, it is stated that individuals should not be excluded from high ranked function regardless of ability purely based on gender. Firms should increase board diversity in order to achieve a fairer outcome for society. Ethical arguments urge firms to regard more female representatives as a desirable end on itself instead of a means to an end. Economic arguments argue that discrimination based on gender is not optimal for the firm. Selection should be based on the most able candidate for the board position. This may also improve the quality of the board as the best candidates will be elected as directors without gender prejudice. Moreover, diversity within a board may lead to the board being more representative for society which can result in a better understanding of the customer. Another argument states that problem-solving

may be enhanced by increasing the level of gender diversity. This might be because there is a larger variety of perspectives on a problem meaning that more possible solutions will be evaluated. Lastly, the image of the firm can be improved by a more diverse boardroom.

2.1.3 Gender Quota

Besides corporate governance and diversity, it is important to understand what a gender quota is and to study some history on this phenomenon. As mentioned in the introduction, a gender quota is an approach to improve the level of gender diversity within a corporate boardroom. Currently, there are 14 countries with a legislated gender quota and 17 with comply and explain systems, such as the system in the Netherlands (Terjesen et al., 2015). These countries are mainly located in Europe. Many followed the example of Norway, which is the country with the highest percentage of female board directors in the world due to the gender quota.

The paper by Wang & Kelan (2013) explores the impact of the gender quota on the presence of female board directors and CEOs in Norway. This is done for a sample of 87 Norwegian listed corporations during the time frame of 2001 up to 2010. The authors first investigate the effect of installing the quota together with the increased number of female directors on demographic characteristics of corporate board chairs and CEOs. They also research the effect of the quota on gender differences in age, education and independence, followed by the effect of those differences on the representation of female top leaders. The methodology of the research involved trend analysis and probit regression models. From the trend analysis it became clear that the instalment of the gender quota in Norway had a consistent and positive effect on the female representation in corporate boardrooms and number of female top leaders. This is also supported by the probit regression outcomes. The quota did affect the gender differences, although the gender differences are nearly equal in 2010 and 2001.

Although the Norwegian gender quota had a positive effect on the female representation in boardrooms and top leading functions, there is also criticism on the concept of a gender quota. Terjesen et al. (2016) offer an extensive literature review on the ethical concerns and considerations of gender quotas. They categorize this review in terms of motivations, legitimacy and outcomes. One of the arguments against the gender quota is the thought that it will result in a stigma that women only reach top functions due to the quota instead of their own capability and qualities. The gender quota may also result in lower performance of firms when women are

selected purely because firms must reach a quota. To conclude, the question whether a gender quota is desirable or not will stay a tough debate for governments all over the world.

2.2 Empirical Evidence: Gender and Performance

In this section empirical evidence from previous research on the relation between gender diversity and firm performance will be stated. Several papers researching different countries will be discussed.

Ahern & Dittmar (2012) used cross-sectional data to determine the effect of the Norwegian gender quota on female board representation and firm performance. In this research, two approaches were used to determine a short- and a long-term view on the relation. The first is an event study of the reaction of the stock price at the first announcement of the gender quota legislation. This approach shows a short-term reaction of a large decrease in stock price of 3.547% (significant at a 1% level) for firms without female directors. The difference with firms with female directors is a significant 3.523% as the decline for those firms is only 0.024%. The second approach is an estimation of the relation between the quota and firm performance measured by Tobin's Q. This shows that the gender quota results in a decline of 0.19 in Tobin's Q when the percentage of female directors increases by 10% (significant at a 1% level) in the long run. Because of this decrease, the authors expect that some Norwegian firms may choose to become a private limited firm as they will not be affected by the quota then. They find that the amount of public limited firms in 2009 is 30% lower than the amount in 2001. Contrastingly, the amount of private limited firms increases by 30%.

The paper by Campbell & Minguez-Vera (2008) investigates the relationship between gender diversity within corporate boardrooms and financial performance in Spain. This country had a history of minimal female participation but introduced a gender quota of 40% in 2007. The research in this paper is performed using several measures of female participation in boardrooms: a dummy variable for the existence of female directors, the percentage of female directors and two indices of gender diversity, the Shannon and the Blau index. Regressions with an approximation of Tobin's Q, which is used as the measure for firm performance, were run. Tobin's Q increases by 0.0413 when the percentage of females increases by 10%. The opposite relation was not significant, thus there was no endogeneity. However, the dummy variable showing the presence of one or more women on a board does not have a significant impact on

Tobin's Q. The regressions concerning the Blau and Shannon indices of gender diversity both show a positive and significant effect (+25.653 and +16.621 respectively).

Another paper that tries to determine the relation between gender diversity and corporate firm performance is that by Adams & Ferreira (2009). This research is conducted on a sample of U.S. firms. The authors aim to answer several questions on the effect of gender diversity on corporate governance. They investigate whether input of the board differs per gender, whether governance measures are affected by the gender composition of the board, and whether the effect of gender diversity on governance affects firm performance. The research finds that gender diversity significantly affects input by the board, with a higher percentage of women in the board leading to better attendance behavior for example. Moreover, it is found that more women on the board have a significant effect on governance measures, for example more CEO accountability for lower stock price performance. However, from the results of the research it becomes clear that a more gender diverse board leads to poorer firm performance as the fraction of women in the boardroom leads to a significant decline in Tobin's Q.

Carter et al. (2003) also research the relationship between board diversity and firm value. This is done for a sample of Fortune 1000 firms. In this paper, diversity is researched using variables for gender and race minorities. Both a dummy variable for the presence of women or minorities and a variable for the percentage of women/minorities are incorporated in the regression analysis. Tobin's Q is used as a measure for financial performance. The analysis results in a significant positive relation between a more diverse board and firm value. However, Carter et al. (2010) conducted another research on the relation between gender diversity and firm performance a couple years later. From this statistical analysis no relationship was found as the effect of the number of female directors on Tobin's Q is insignificant with an adjusted R^2 of 0.79. Their evidence suggests that gender diversity and firm performance are endogenous.

A third paper that investigates firms from the U.S. is that by Erhardt et al. (2003). In this paper diversity is defined as the presence of different ethnicities and genders in boardrooms. The data used in this study comes from 112 large public corporations and was investigated by correlation and regression analysis. From the results, the authors state that the effect of greater diversity in boardrooms on financial performance, measured by ROA, is a significant increase of 13.46.

Another paper that investigates the relationship between gender diversity and financial performance is by Smith et al. (2006). This paper observes the 2,500 largest Danish firms from 1993 until 2001 to obtain data to perform this research. The results of this article state that female top CEOs have a significant effect of 0.063 on financial performance of the firm, measured by the gross profit divided by net sales. More significant results are the effects of female top CEOs and vice-directors on firm performance measured by operating income divided by net assets and net income after tax divided by net assets (0.092 and 0.072 respectively). Lastly, another significant result is the effect of the board of directors on the contribution margin divided by net sales of 0.12. From these results, a positive effect of gender diversity on financial performance was concluded for the sample.

The paper by Ionascu et al. (2018) researches the relationship in a sample of Romanian firms. They address problems emerging from endogeneity by using two-stage least squares (2SLS) regressions incorporating type and structure of ownership as the instrumental variable. This research results in a positive relationship in the OLS regressions but a negative and insignificant effect in the 2SLS regressions. The authors conclude that it can be confirmed that more gender diverse boardrooms lead to higher financial performance, but that this is not valid for all companies in Romania.

2.3 Gender in the Netherlands

In this section, hypotheses to the research question and the supporting sub question will be drawn. These hypotheses consist of expectations on the results of the research performed in this paper, which will be based on the past evidence and literature on the relevant topic.

2.3.1 Research question

Marinova et al. (2016) researched the effect of gender diversity of firm performance by investigating Dutch and Danish boardrooms. They included 102 Dutch and 84 Danish listed firms. These countries were chosen by the researchers as they are quite similar in terms of gender equality and corporate governance. The methodology of this research included 2SLS estimation as the variables had to be controlled for endogeneity. The instrumental variables used are the share of women in industries and its square root. Furthermore, OLS regressions were run to determine the relation between firm performance and gender diversity. The authors found a positive but insignificant relation between gender diversity within the boardroom and financial

performance of the firm measured by Tobin's Q with an R^2 of 0.08. Therefore, the article concludes that there is no evidence to state that there is a causal effect.

Another paper that investigates the financial performance of firms in the Netherlands with and without women on their boards is that by Lückerath – Rovers (2013). The sample group in this research consists of 99 Dutch companies listed on the Amsterdam Euronext stock exchange in 2008. From these companies 69% have no women in their boardrooms, while the other 31% has one or more female directors. The paper uses different methods to determine the relationship between firm performance and gender. In conclusion, the results show that firms with more female directors have better performance than firms without female directors on their boards (Lückerath – Rovers, 2013).

The corporate governance structure in the Netherlands can best be compared to the Danish system (Marinova et al., 2010). Based on this fact in combination with the results of the previous conducted research mentioned above, it is expected that the relation between gender diversity and firm performance, measured by an approximation of Tobin's Q, in the Netherlands is positive in the long run. In the short-term it is expected that no significant relation will be found, similarly to the results from the research by Marinova et al. (2010). Moreover, this is expected because the legislation in the Netherlands states that corporations must strive to reach the quota of 30% in 2020. With help of the gender quota, it is expected that the percentage of female directors on boards will increase, thus the instalment of the gender quota in the Netherlands will increase the financial performance of the firm which is in accordance with the results of Lückerath – Rovers (2013). This leads to the following hypothesis to the research question:

H1: In the Netherlands, the introduction of a gender quota positively affects financial performance.

2.3.2 Sub question

The research performed by Wang & Kelan (2013) on the Norwegian gender quota investigates several hypotheses. The first two involve whether the gender quota influences female board presence and whether the percentage of female top directors improves this. The differences in these percentages pre-quota and post-quota have been measured in order to determine this effect. The percentage of female directors before the gender quota was installed in Norway (measured in 2001) was around 7%. This percentage had already increased before the instalment of the

gender quota in 2006 but increased even more between 2006 and 2007 until it reached the enforced level of 40%.

Before 2005, there were no female CEOs in the sample used in this research. After the instalment of the gender quota in 2006, the percentage of female CEOs increased to 5% of the sample. The percentage of firms with a female board chair was 0.01% in 2001 and increased to 5% in 2007. After that it increased even more, reaching over 15% in 2008 and increasing even more after that. These results can be seen in the figure below (figure 1).

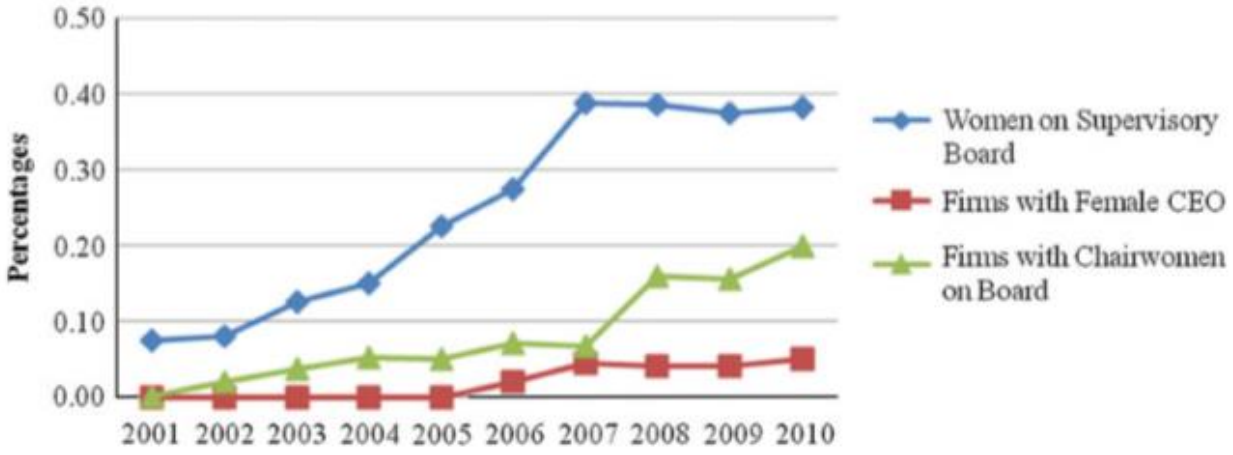

Figure 1 Changes in women's representation on boards in Norway (Wang & Kelan, 2013 p. 458)

As the gender quota in the Netherlands is a comply and explain system instead of a legal obligation similar to the gender quota in Norway, it is expected that the percentage of female board members in Dutch companies will increase, but it will not reach the quota of 30%. The legislation in the Netherlands states that firms must strive to reach the quota of 30% by 2020, thus there are still a couple of years left to achieve this. This leads to the following hypothesis:

H2: The instalment of the gender quota leads to an increase in the percentage of female board members.

3. Data and Methodology

3.1 Data

To determine the influence of the instalment of the gender quota, the effect of gender diversity on firm's financial performance is tested before and after the announcement of the quota. For both moments, a timeframe of six years has been chosen (2007-2012 and 2013-2018, respectively). The legislation on the gender quota in the Netherlands took effect from 2013. A dummy variable (DTIME) indicating the timeframe of the data is constructed. This variable gives the value one if the date is from the years 2013 – 2018 and the value zero otherwise. Relevant data is collected for all possible firms from the Dutch stock market indices AEX, AMX, and AScX.

3.1.1 AEX / AMX / AScX

The Amsterdam Exchange Index (AEX) consists of the 25 leading, listed firms from the Netherlands. The AEX is the most important measure in the Dutch stock market. It shows the weighted average of these 25 firms (Bos, 2019). Trading volume has been the main criteria to record stocks in the AEX for many years. In 2014 this was adjusted, and market capitalization and free-floating stocks have been added to the criteria. This was done to reach a more stable index. Firms with a low amount of free-floating stocks or a low stock market rate are no longer recorded in the AEX, but in the Amsterdamse Midkap Index (AMX) ("AEX-index", n.d.). The AMX consists of 25 medium sized, listed companies from the Netherlands. This index exists since 1995 and can be seen as the AEX's smaller brother. The AMX is more volatile than the AEX as it consists of smaller firms ("Wat is de AMX?", n.d.). Next to the AMX, another smaller index exists: the Amsterdam Small cap Index (AScX). This index again consists of 25 firms which don't match the criteria for the AMX. A seemingly neutral announcement on this stock market can reach a large reaction, as the stocks in the AScX have limited market capitalization ("Wat is de AScX?", n.d.).

In order to collect boardroom data on Dutch firms listed in the AEX, AMX, and AScX the financial database BoardEx is used. This database is a source for academic research concerning corporate governance and boardroom processes. The data in BoardEx is collected yearly in December. Therefore, all data used in this paper is collected in December. Several of the firms from the output by BoardEx are excluded from the dataset for different reasons. First, the

boardroom of the firm Aperam SA consists of all non-executive directors. Therefore, this firm is deleted from the dataset. Moreover, some firms delisted at some point within the timeframe of 2007-2018, thus it is not possible to acquire all data. Therefore, these companies are deleted from the analysis. These firms include Corio NV, Dockwise LTD, Exact Holding NV, Hes-Beheer NV, Macintosh Retail Group NV, Mediq NV, Nutreco NV, SNS Reaal Groep NV, Ten Cate (Koninklijke) NV, Unit4 NV and Ziggo NV. For some firms, data is missing for one or more years that are observed. If so, these years are deleted from the analysis, but the remaining years are included. This leads to a sample of 51 firms in 2007, 52 in 2008, 50 in 2009, 50 in 2010, 51 in 2011, 52 in 2012, 52 in 2013, 52 in 2014, 50 in 2015, 52 in 2016, 52 in 2017 and 45 in 2018.

3.1.2 Gender Diversity

In order to construct an answer to the research question, data on gender diversity within the boardroom is needed. This data is collected from the database BoardEx.

First the total number of directors on the board of each firm is subtracted from BoardEx. After that the gender ratio within the board of directors is collected. BoardEx calculates this ratio as the number of male directors divided by the total number of directors on the board. With help of this ratio the percentage of women on the board is calculated to construct the variable PWOMEN. For example, if the gender ratio given by BoardEx is 0.8, the percentage of women (PWOMEN) is 20%. Moreover, the number of women on the board is calculated by multiplying the gender ratio with the total number of directors. From this a dummy variable (DWOMAN) is constructed which gives the value of one if one or more women are present on the board of the respective firm and zero if there are no female directors. Lastly, the names and functions of all board members are collected from BoardEx. From this it can be seen whether the CEO of the firm or chair of the board is a woman. In order to construct an answer to the sub question, the total percentages of female directors, CEOs and board chairs are needed for each year. To calculate the total percentage of female directors, the total amount of board members and female directors are counted for each year. The number of female directors is divided by the total amount of board members to construct the variable PWOMENTOTAL for each year. To calculate the total percentage of CEOs and board chairs, the total amount of CEOS and chairs and the number of female CEOs and chairs are counted. The number of female CEOs and chairs

is divided by the total amount of CEOs and chairs to construct the variable PFEMCEOTOTAL for each year.

Furthermore, two indices on gender diversity are constructed using the data obtained from BoardEx. These are the Blau index and the Shannon index. These indices take the number of gender categories into account as well as the evenness of the distribution of board members. The calculations of these indices are as follows:

- $Blau\ index = 1 - \sum_{i=1}^{n} {P_i}^2$, measured as the variable BLAU
- $Shannon\ index = -\sum_{i=1}^{n} P_i ln P_i$, measured as the variable SHANNON

In these equations, P_i is the percentage of board members in each category and n is the total number of board members. The Blau index can adopt values between 0 and 0.5. The maximum of 0.5 means that the board consists of an equal amount of men and women. Thus, the higher the index, the more equal the gender diversity in the boardroom is. The Shannon index adopts values from 0 to a maximum of 0.69, where gender diversity is equal. The maximum of this index is higher than that of the Blau index due to the logarithmic nature of the measure. The value given by the Shannon index is more sensitive to small differences in the proportions of males and females in the boards and will always give a higher value than the Blau index (Campbell & Minguez-Vera, 2008).

3.1.3 Financial performance

Next to data on gender diversity, data on the financial performance of firms is needed. Financial performance of a firm can be defined with help of a variation of measures. In this paper an approximation of Tobin's Q (TOBINSQ) is used, similar to Campbell and Minguez-Vera (2008). The formula used to calculate Tobin's Q is defined as follows:

$$Tobin's\ Q = \frac{Market\ value\ of\ stock + Book\ value\ of\ debt}{Book\ value\ of\ total\ assets}$$

Another method to define financial performance that is often used in studies is with accounting measures. Examples of these measures are return on assets, return on investment and return on equity. In this study it is chosen to use Tobin's Q, as the market's expectations of future earnings are reflected better in this measure, which makes it a good proxy for the competitive advantage of a firm (Wernerfelt & Montgomery, 1988). Moreover, Tobin's Q gives a clear benchmark for

firm performance. When the value is equal to one, the market value combined with the book value of debt for the firm is equal to the value of the total assets. When Tobin's Q is above one, the value given to the firm by the market is higher than the value of the firm's assets and vice versa. In other words, a firm with a value greater than one is expected to be capable of using available resources more efficiently in order to create higher value. The value given by Tobin's Q is mostly above one because aspects such as goodwill, monopolistic advantages, high quality managers and growth potential are considered by the market value (Perfect & Wiles, 1994). Another benefit of Tobin's Q is that it takes risk into account and is not liable to distortions in reporting due to tax laws and accounting agreements (Lindenberg & Ross, 1981).

To calculate Tobin's Q, several variables on the firms researched in this analysis are needed. These variables are the market value of stock, the book value of debt and the book value of total assets. In order to obtain these variables, the financial database Bloomberg is used. The data is collected yearly on the 31st of December in the timeframe of 2007 – 2018. In Bloomberg the market value of stock can be found under the name 'Market Capitalization'. To calculate this value, the current share price on the market is multiplied with the firm's outstanding shares.

3.1.4 Control variables

In the analysis of the influence of gender diversity on firm's financial performance, a couple of variables that could influence Tobin's Q are also included to be controlled for. First, the logarithm of the total number of directors of each firm (LOGDIR). This variable is constructed by taking the logarithm of the total number of directors (NDIR) given by BoardEx. Secondly, the debt level of each firm is used as control variable. This is calculated as the ratio of the book value of total debt to the book value of total assets, thus the leverage of the firm (LEVER). These values are all obtained from Bloomberg. Moreover, the return on assets (ROA) is calculated by dividing net income by the book value of total assets. As well as the values to calculate the firm leverage, data to calculate the ROA is collected from Bloomberg. Lastly, the size of each firm is included (SIZE), which is approximated by the natural logarithm of the book value of total assets obtained from Bloomberg.

Table 1 and 2 show the descriptive statistics for all variables in the period 2007 – 2012 and 2013-2018. It is interesting to observe whether there are differences in the values for both time periods, as this gives us an indication whether a gender quota influences these variables. The mean for

Tobin's Q (TOBINSQ), thus financial performance, is 1.02 in the period before the instalment of the quota and 1.24 in the period after. Thus, it seems that financial performance has increased. The mean percentage of women in the boardroom (PWOMEN) after the instalment of the gender quota is more than twice as large as before (8% and 19%, respectively). This shows that there are more women with positions in corporate boardrooms in the Netherlands. The dummy variable indicating female presence in the boardroom also supports this, as it increases from 0.55 to 0.83, meaning that 83% of the firms have one or more female boardroom director after the instalment of the gender quota.

Table 1 Descriptive statistics for all gender diversity, financial performance and control variables for the period 2007-2012.

	mean	sd	min	max
TOBINSQ	1.02	0.62	0	4
PWOMEN	0.08	0.09	0	0
DWOMAN	0.55	0.50	0	1
BLAU	0.14	0.14	0	0
SHANNON	0.23	0.22	0	1
NDIR	9.42	3.09	3	22
LOGDIR	0.95	0.14	0	1
LEVER	0.24	0.16	0	1
ROA	0.02	0.15	-1	0
SIZE	8.01	2.14	3	14
Observations	307			

Moreover, the Blau index (BLAU) has doubled from 0.14 in the years 2007 to 2012 to 0.28 in the years 2013 to 2018. This means that the distribution of men and women in the boardrooms is more equal in the second period. The Shannon index (SHANNON) supports this by growing from 0.23 to 0.43. The control variables (NDIR, LOGDIR, LEVER, ROA and SIZE) do not differ that much between the two periods.

Table 2 Descriptive statistics for all gender diversity, financial performance and control variables for the period 2013-2018.

	mean	sd	min	max
TOBINSQ	1.24	0.80	0	5
PWOMEN	0.19	0.12	0	1
DWOMAN	0.83	0.38	0	1
BLAU	0.28	0.15	0	1
SHANNON	0.43	0.22	0	1
NDIR	9.07	2.53	4	18
LOGDIR	0.94	0.12	1	1
LEVER	0.23	0.16	0	1
ROA	0.03	0.09	-0	1
SIZE	8.18	2.11	3	14
Observations	302			

3.2 Methodology

To determine the relationship established in all models, the significance of the variables in the estimated regression models will be considered. This will be done on the significance levels of 90%, 95% and 99%. This means that for example, for the relation between Tobin's Q and gender diversity to be significant, the p-values of the regression must be below 0.10 (90% significance), 0.05 (95% significance), or 0.01 (99% significance). All OLS and 2SLS models are established for both timeframes, 2007 – 2012 and 2013 – 2018.

3.2.1 Hausman test

The data used in this analysis can be defined as panel data. An advantage of panel data methodology is that it allows eliminating any unobservable heterogeneity that we may come across among the firms in the sample. The problem with heterogeneity is that when it is correlated with the explanatory variables in the analysis, it leads to biased coefficients. The existence of this correlation can be tested using the Hausman test. The equality of the coefficients of fixed effect estimations and random effect estimations can be examined with this statistical test. The null hypothesis states that the coefficients are similar in both models and the alternative hypothesis states that the coefficients differ significantly. When the null hypothesis is accepted, meaning that unobservable heterogeneity and the explanatory variables are not correlated, the random effects model is used. However, when there is correlation, thus the null hypothesis is rejected, a conditional inference is undertaken by using fixed effects in the estimation (Campbell & Minguez-Vera, 2008).

3.2.2 Ordinary Least Squares

After performing the Hausman test, ordinary least squares (OLS) regression models are constructed. These models show the relationship between the financial performance of the firm and the presence of gender diversity within the board room. In these models, the approximation of Tobin's Q (TOBINSQ) is the dependent variable and the measures for gender diversity (PWOMEN, DWOMAN, BLAU and SHANNON) are the independent variables. The control variables LEVER, ROA and SIZE are also included. The following four models are constructed using OLS regression:

- $TOBINSQ_{it} = \beta_0 + \beta_1 PWOMEN_{it} + \beta_2 LEVER_{it} + \beta_3 ROA_{it} + \beta_4 SIZE_{it} + \varepsilon_{it}$
- $TOBINSQ_{it} = \beta_0 + \beta_1 DWOMAN_{it} + \beta_2 LEVER_{it} + \beta_3 ROA_{it} + \beta_4 SIZE_{it} + \varepsilon_{it}$
- $TOBINSQ_{it} = \beta_0 + \beta_1 BLAU_{it} + \beta_2 LEVER_{it} + \beta_3 ROA_{it} + \beta_4 SIZE_{it} + \varepsilon_{it}$
- $TOBINSQ_{it} = \beta_0 + \beta_1 SHANNON_{it} + \beta_2 LEVER_{it} + \beta_3 ROA_{it} + \beta_4 SIZE_{it} + \varepsilon_{it}$

There is a chance that there is reversed causality in these models, meaning that Tobin's Q influences the measures for gender diversity, instead of the other way around. In order to check whether reversed causality is a problem, four more OLS regression models are constructed incorporating the measures for gender diversity as the dependent variable and Tobin's Q as the independent variable. The control variables in these models are LOGDIR and SIZE.

- $PWOMEN_{it} = \beta_0 + \beta_1 TOBINSQ_{it} + \beta_2 LOGDIR_{it} + \beta_3 SIZE_{it} + \varepsilon_{it}$
- $DWOMEN_{it} = \beta_0 + \beta_1 TOBINSQ_{it} + \beta_2 LOGDIR_{it} + \beta_3 SIZE_{it} + \varepsilon_{it}$
- $BLAU_{it} = \beta_0 + \beta_1 TOBINSQ_{it} + \beta_2 LOGDIR_{it} + \beta_3 SIZE_{it} + \varepsilon_{it}$
- $SHANNON_{it} = \beta_0 + \beta_1 TOBINSQ_{it} + \beta_2 LOGDIR_{it} + \beta_3 SIZE_{it} + \varepsilon_{it}$

3.2.3 Endogeneity and Two-Stage Least Squares

The reversed causality that may be present within the variables in this analysis is a form of endogeneity. Endogeneity is probably the most important issue that may occur in empirical analysis. It can be defined as correlation between the independent variables and the error term of the regression model (Roberts & Whited, 2013). To determine the nature of a relationship between variables, OLS is an often-used method. This method relies on several assumptions which must hold to determine the causal effect between the variables. The most important assumptions are as follows (Roberts & Whited, 2013):

1. A random sample of observations on y and ($x_1, \ldots, x_k$);
2. A mean zero error term ($E(u) = 0$);
3. No perfect multicollinearity; no linear relationships among the explanatory variables;
4. An error term with zero mean conditional on the explanatory variables ($E(u_i|X_i) = 0$).

Endogeneity may occur when assumption four does not hold. There are several causes to why assumption 4 would not hold. The first cause of endogeneity is omitted variable bias. This leads to biased coefficients when variables that do influence the dependent variable are for some reason excluded from the analysis. These so-called omitted variables will then appear in the error term. There is no problem for the analysis if the omitted variables are not correlated with the independent variables; the coefficients will be consistent. The second cause of endogeneity is a measurement error. This may occur because of mistakes in the data or discrepancies between proxies for unobservable or difficult measures and the true variables. Measurement errors can be found in the dependent as well as the independent variables. Another cause for endogeneity is simultaneity bias. This occurs when there is simultaneous causality between the dependent and the independent variables. It is not clear whether x causes y or vice versa (Roberts & Whited, 2013). This cause is thought to be the most problematic for the analysis performed in this paper. It can be argued that firm's financial performance influences the presence of gender diversity in boardrooms instead of the other way around. In order to control for this possibility of endogeneity, the method of two-stage least squares (2SLS) is used. In this method, there are two stages. In the first stage, an instrumental variable which is uncorrelated with the error term is used to determine the coefficients for the explanatory variable that is problematic. In the second stage, these values are used to estimate the regression model with the dependent variable ("Two-Stage Least-Squares Regression", n.d.).

To control for the possible endogeneity in this analysis, 2SLS models are constructed to test the effect of a more gender diverse boardroom on financial performance of a firm. These models incorporate the financial performance of the firm for the corresponding year, measured by Tobin's Q, as the dependent variable (TOBINSQ). The independent variables are the measures of female presence on the board, thus the percentage of women on the board of directors (PWOMEN), the dummy variable for female presence (DWOMAN) and the diversity indices (BLAU and SHANNON). The following control variables are also incorporated in this model:

leverage (LEVER), return on assets (ROA) and size of the firm (SIZE). As the independent variables for female presence on the board, PWOMEN, DWOMAN, BLAU and SHANNON, may be endogenous, an instrumental variable is constructed. There are two conditions that make a variable a good instrumental variable (Ionascu et al, 2018):

1. Instrumental relevance; this means that the instrumental variable must be a good estimator for the endogenous variable, thus the correlation between the variables should not be zero. This can be tested quite easily.
2. Instrumental exogeneity; this means that there is no correlation between the instrumental variable and the error term. The instrumental variable should have no direct effect on the dependent variable, and it may not be related to other variables that influence the dependent variable.

Adams and Ferreira (2009) used the fraction of male directors on a boardroom who sit on other boardrooms on which there are female directors as instrumental variable in their 2SLS regressions. The idea behind this is that if male directors in a boardroom have more connections to women, the rate of female directors within that boardroom should be higher. To perform 2SLS regression in this analysis, the instrumental variable IVNETW is constructed which gives the percentage of male directors on a boardroom who sit on other boardrooms with female directors. In order to define whether the instrumental variable is correlated with the endogenous independent variable, a Sargan – Hansen test can be performed. However, this test only works with two instrumental variables. The null hypothesis of this test states that the instruments are exogenous, thus valid. Marinova et al. (2016) square the instrumental variable used in their paper to perform the test. Therefore, the instrumental variable IVNETWSQ is constructed taking the square root of IVNETW. The descriptive statistics of the variables IVNETW and IVNETWSQ can be found in table 9, 10, 11 and 12 in the appendix.

In the first stage of the different 2SLS regressions, the variable for female presence within boardrooms will be the dependent variable and the instrumental variables will be the independent variables along with the control variables LEVER, ROA and SIZE. This leads to the following regressions:

- $PWOMEN_{it} = \beta_0 + \beta_1 IVNETW_{it} + \beta_2 IVNETWSQ_{it} + \beta_3 LEVER_{it} + \beta_4 ROA_{it} + \beta_5 SIZE_{it} + \epsilon_{it}$

- $DWOMAN_{it} = \beta_0 + \beta_1 IVNETW_{it} + \beta_2 IVNETWSQ_{it} + \beta_3 LEVER_{it} + \beta_4 ROA_{it} + \beta_5 SIZE_{it} + \epsilon_{it}$
- $BLAU_{it} = \beta_0 + \beta_1 IVNETW_{it} + \beta_2 IVNETWSQ_{it} + \beta_3 LEVER_{it} + \beta_4 ROA_{it} + \beta_5 SIZE_{it} + \epsilon_{it}$
- $SHANNNON_{it} = \beta_0 + \beta_1 IVNETW_{it} + \beta_2 IVNETWSQ_{it} + \beta_3 LEVER_{it} + \beta_4 ROA_{it} + \beta_5 SIZE_{it} + \epsilon_{it}$

If the first stage regressions lead to a significant correlation between the instrumental variables and the variables for female presence in the boardroom, the second stage will be performed incorporating the exogenous instrumental variables IVNETW and IVNETWSQ as the independent variables instead of the endogenous variables for female presence in the boardroom.

3.2.4 Interaction Effect

In order to determine whether the estimated models before and after show significant differences, the coefficients of both models will be compared. This is done using an interaction effect between the variables for female presence in the boardroom (PWOMEN, DWOMAN, BLAU and SHANNON) and a dummy variable for the time frame (DTIME, which is equal to 1 for the time period 2013 – 2018 and to 0 for the time period 2007 – 2012). This leads to the following models:

- $TOBINSQ_{it} = \beta_0 + \beta_1 PWOMEN_{it} * DTIME_{it} + \beta_2 LEVER_{it} + \beta_3 ROA_{it} + \beta_4 SIZE_{it} + \varepsilon_{it}$
- $TOBINSQ_{it} = \beta_0 + \beta_1 DWOMAN_{it} * DTIME_{it} + \beta_2 LEVER_{it} + \beta_3 ROA_{it} + \beta_4 SIZE_{it} + \varepsilon_{it}$
- $TOBINSQ_{it} = \beta_0 + \beta_1 BLAU_{it} * DTIME_{it} + \beta_2 LEVER_{it} + \beta_3 ROA_{it} + \beta_4 SIZE_{it} + \varepsilon_{it}$
- $TOBINSQ_{it} = \beta_0 + \beta_1 SHANNON_{it} * DTIME_{it} + \beta_2 LEVER_{it} + \beta_3 ROA_{it} + \beta_4 SIZE_{it} + \varepsilon_{it}$

The results of these regressions show two different coefficients for the variable for presence of female directors: one when DTIME is equal to zero and one when DTIME is equal to one. Using this, the difference between the two time periods can be seen.

3.2.5 Sub Question

To test the second hypothesis and to determine the effect of a gender quota on the presence of females in the boardroom, a graph will be constructed. This graph will consist of the percentage of female board members (PWOMENTOTAL) and the percentage of female CEOs (PFEMCEOTOTAL) against the timeframe. From this graph it can be seen whether this relationship changes.

To control whether the effect of the gender quota is significant, t-tests will be run. In order to test the difference in growth rate over the years 2007 – 2018, the variables D.PWOMENTOTAL and D.PFEMCEOTOTAL are constructed. These variables show the difference between the yearly growth rates for both measures of female presence in the boardroom. Then t-tests are run testing whether the variable growth differs significantly from zero.

4. Results

4.1 Hypothesis 1

In order to determine whether fixed or random effects should be used when running the OLS regressions a Hausman test is run. The results of these tests can be found in table 13 and 14 in the appendix. For the years 2007 – 2012 the Hausman test is only significant for the regression incorporating TOBINSQ as the dependent and DWOMAN as the independent variable. In the second timeframe the test is only significant for the regression controlling for reversed causality between TOBINSQ and DWOMAN. Thus, only these two regressions are run using the fixed effects model. All other OLS regression are constructed using the random effects model. The regressions are all run incorporating robust standard errors. The outcomes of the Sargan-Hansen tests are all insignificant and can be found in table 15 in the appendix. The insignificance of the test implies that the instruments are valid even though they might be weakly correlated with the endogenous independent variables.

Table 3 shows the OLS and 2SLS models for the relationship between the percentage of female board directors and firm performance measured by the approximation of Tobin's Q. From the outcomes of the OLS regressions it can be observed that PWOMEN has a positive effect on TOBINSQ in 2007 – 2012 as well as 2013 – 2018. However, both effects are insignificant. Therefore, there appears to be no relationship between the percentage of female directors and firm performance. It is interesting to notice that the effect of PWOMEN becomes more positive in the second timeframe, suggesting that the gender quota has a positive effect on Tobin's Q. Although the control variable firm size has a significant positive effect on the percentage of female directors, it has a significant negative effect on Tobin's Q. This seems to contrast with what is expected in this hypothesis. Moreover, it can be observed that in 2013 – 2018, Tobin's Q has a positive and significant effect on the percentage of female directors, which implies reversed causality. The logarithm of the number of directors also has positive and significant effect on PWOMEN, suggesting that the probability of a female director being employed is greater for larger boards. This is similar to the results of the paper by Campbell and Minguez-Vera (2008). It is also worth noting that the effect of LOGDIR is more positive for 2013 – 2018 than for 2007 – 2012.

Table 3 OLS and 2SLS regressions for Tobin's Q (TOBINSQ) and the percentage of women on the board of directors (PWOMEN) for the years 2007 – 2012 and 2013 – 2018. The first four columns show the regressions for the years 2007 – 2012 and the last four columns show it for the years 2013 – 2018. The first columns of the 2SLS regressions (columns 3 and 7) show the first stage in which the instrumental variables IVNETW and IVNETWSQ are regressed against the endogenous independent variable PWOMEN. The second columns of the 2SLS regressions (columns 4 and 8) show the second stage in which the endogenous variable PWOMEN is instrumented by the instruments.

	2007 – 2012				**2013 - 2018**			
	OLS		2SLS		OLS		2SLS	
	(1) TOBINSQ	(2) PWOMEN	(3) PWOMEN	(4) TOBINSQ	(5) TOBINSQ	(6) PWOMEN	(7) PWOMEN	(8) TOBINSQ
PWOMEN	0.24			-3.79	0.52			-0.21
	(0.39)			(3.81)	(0.36)			(2.25)
LEVER	-0.28		0.01	-0.37	0.38		-0.15*	-0.32
	(0.52)		(0.04)	(0.30)	(0.53)		(0.08)	(0.55)
ROA	0.46		-0.02	0.31	0.54		0.05	0.26
	(0.45)		(0.04)	(0.27)	(0.88)		(0.06)	(0.37)
SIZE	-0.09***	0.01**	0.03	0.07	-0.08*	0.01*	0.03	0.35**
	(0.04)	(0.01)	(0.02)	(0.15)	(0.04)	(0.01)	(0.02)	(0.14)
TOBINSQ		0.01				0.02*		
		(0.01)				(0.01)		
LOGDIR		0.04				0.17*		
		(0.09)				(0.10)		
IVNETW			-0.11				-0.32**	
			(0.10)				(0.13)	
IVNETWSQ			0.39*				0.75**	
			(0.22)				(0.32)	
Constant	1.81***	-0.07	-0.13	0.85	1.65***	-0.11	-0.04	-1.53
	(0.34)	(0.07)	(0.13)	(0.99)	(0.35)	(0.08)	(0.17)	(0.94)
Observations	306	306	306	306	303	303	303	303
R^2			0.03				0.05	
Adjusted R^2			-0.19				-0.17	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

From the 2SLS regressions a negative effect of the percentage of female directors on Tobin's Q can be observed both before and after the instalment of the gender quota. However, these coefficients are not significant. This is in accordance to research by Ionascu et al. (2018) as they find a positive correlation which becomes insignificant and negative for the 2SLS regressions. On the other hand, it is interesting that the negative effect decreases for the second timeframe, seeming to imply that the gender quota influences the relationship.

The results of the OLS and 2SLS regressions for the effect of the presence of one or more women on the board of directors and Tobin's Q can be found in table 4. It can be observed that there is again a positive but insignificant relationship between the independent variable and Tobin's Q in both time periods. Moreover, the effect of Tobin's Q on the presence of female directors is insignificant. Therefore, it appears that the presence of a women on the board of directors on itself does not have an impact on firm performance and vice versa. However, it is interesting to notice that the effect on Tobin's Q increases from 0.01 to 0.17 in the years 2013 – 2018. The control variables firm size and logarithm of the number of directors have a positive and significant on the presence of female directors in 2007 – 2012, which disappears after the instalment of the gender quota. The 2SLS regressions also show no significant effect between the presence of women and Tobin's Q. However, the effect does change to being negative in contrast to the OLS regressions. Only the control variable firm size has a significant positive effect on Tobin's Q in the years 2013 – 2018, which implies that larger firms have higher financial performance. In conclusion, it appears that there is no significant relationship between the presence of female directors on the board and firm performance. This is in accordance with the results from Carter et al. (2010) as they also found no relationship between the variables.

In table 5 the OLS and 2SLS regressions concerning the relationship between the Blau index and Tobin's Q can be found. The OLS regressions show a positive but insignificant relationship between the two variables. Again, it is interesting that the effect in 2013 – 2018 is more positive than in 2007 – 2012. Due to the insignificance of the coefficients, it can be assumed that there is no relationship between the Blau index of gender diversity and Tobin's Q. Thus, more equal boardrooms with respect to gender do not improve firm performance. The control variable firm size has a significant negative effect on Tobin's Q in the period 2007 – 2012. This implies that larger firms lead to lower financial performance of the firms in this period.

Table 4 OLS and 2SLS regressions for Tobin's Q (TOBINSQ) and the presence of one or more women on the board (DWOMAN) for the years 2007 – 2012 and 2013 – 2018. The first four columns show the regressions for the years 2007 – 2012 and the last four columns show it for the years 2013 – 2018. The first columns of the 2SLS regressions (columns 3 and 7) show the first stage in which the instrumental variables IVNETW and IVNETWSQ are regressed against the endogenous independent variable DWOMAN. The second columns of the 2SLS regressions (columns 4 and 8) show the second stage in which the endogenous variable DWOMAN is instrumented by the instruments.

	2007 – 2012				**2013 - 2018**			
	OLS		2SLS		OLS		2SLS	
	(1) TOBINSQ	(2) DWOMAN	(3) DWOMAN	(4) TOBINSQ	(5) TOBINSQ	(6) DWOMAN	(7) DWOMAN	(8) TOBINSQ
DWOMAN	0.01			-1.15	0.17			-0.67
	(0.08)			(0.78)	(0.14)			(0.74)
LEVER	-0.42		0.17	-0.30	0.36		-0.08	-0.33
	(0.71)		(0.23)	(0.38)	(0.54)		(0.26)	(0.51)
ROA	0.37		-0.14	0.18	0.55		0.17	0.36
	(0.40)		(0.20)	(0.35)	(0.87)		(0.20)	(0.40)
SIZE	-0.02	0.06**	0.15	0.19	-0.07	-0.08	-0.05	0.31**
	(0.11)	(0.03)	(0.09)	(0.20)	(0.05)	(0.07)	(0.07)	(0.14)
TOBINSQ		0.02				0.08		
		(0.06)				(0.05)		
LOGDIR		0.99**				0.31		
		(0.41)				(0.38)		
IVNETW			0.23				-0.48	
			(0.56)				(0.42)	
IVNETWSQ			0.79				2.09**	
			(1.25)				(1.01)	
Constant	1.28	-0.92***	-0.71	0.22	1.57***	1.09**	1.23**	-0.72
	(0.82)	(0.29)	(0.72)	(1.32)	(0.33)	(0.52)	(0.54)	(1.37)
Observations	306	306	306	306	303	303	303	303
R^2	0.02		0.04			0.03	0.03	
Adjusted R^2	0.01		-0.18			0.02	-0.19	

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The regressions concerning the reversed relationship also show no significance, meaning that higher firm performance does not increase gender diversity within the boardroom. In both time periods, the control variable firm size has a positive and significant effect on the Blau index. This implies that larger firms tend to have more equal distributed boardrooms with respect to gender. Moreover, in 2013 – 2018 the logarithm of the number of directors has a positive and significant effect on the Blau index. This implies that larger boardrooms tend to be more equally distributed in gender. From the 2SLS regressions again a negative but insignificant relation with Tobin's Q can be observed. The regression in 2007 – 2012 shows no significant coefficients while the second time period shows that the control variable size is positive and significant, which is similar to the regressions between DWOMAN and Tobin's Q shown in table 4.

Table 6 shows the OLS and 2SLS regressions between the Shannon index and Tobin's Q. It can be observed that the results are quite similar to those obtained in the regressions concerning the Blau index. This is as expected as both indices concern gender diversity (Campbell and Minguez-Vera, 2008). Again, the effect of the index on Tobin's Q is positive but insignificant and the control variable firm size has a significant negative effect. Moreover, the reversed regressions show no significant effect of Tobin's Q on the Shannon index. Firm size has a significant positive effect on gender diversity in the first time period and the logarithm of the number of directors positively increases the Shannon index in the second period. The 2SLS regressions also show the same negative but insignificant effect between the index and Tobin's Q.

When comparing all regressions run to research the relationship between gender and firm performance, it is interesting to notice that all coefficients of the independent variable for gender become more positive in the timeframe after the instalment of the gender quota. Although the results are insignificant, they do seem to imply that the gender quota has a positive effect on firm performance measured by the approximation of Tobin's Q when considering the OLS regressions. However, the 2SLS regressions all show a negative relation. Interestingly, the negative coefficients do become less negative in the years 2013 – 2018. The results are inconclusive on the relationship between gender diversity and firm performance, but it seems that the gender quota has a positive effect.

Table 5 OLS and 2SLS regressions for Tobin's Q (TOBINSQ) and the Blau index (BLAU) for the years 2007 – 2012 and 2013 – 2018. The first four columns show the regressions for the years 2007 – 2012 and the last four columns show it for the years 2013 – 2018. The first columns of the 2SLS regressions (columns 3 and 7) show the first stage in which the instrumental variables IVNETW and IVNETWSQ are regressed against the endogenous independent variable BLAU. The second columns of the 2SLS regressions (columns 4 and 8) show the second stage in which the endogenous variable BLAU is instrumented by the instruments.

	2007 – 2012				**2013 – 2018**			
	OLS		2SLS		OLS		2SLS	
	(1) TOBINSQ	(2) BLAU	(3) BLAU	(4) TOBINSQ	(5) TOBINSQ	(6) BLAU	(7) BLAU	(8) TOBINSQ
BLAU	0.16			-3.16	0.43			-0.65
	(0.26)			(2.52)	(0.32)			(1.86)
LEVER	-0.28		0.01	-0.40	0.38		-0.12	-0.36
	(0.52)		(0.06)	(0.32)	(0.53)		(0.10)	(0.50)
ROA	0.46		-0.04	0.26	0.54		0.06	0.29
	(0.45)		(0.06)	(0.29)	(0.87)		(0.07)	(0.37)
SIZE	-0.09***	0.02**	0.04*	0.12	-0.08	0.02*	0.02	0.35***
	(0.03)	(0.01)	(0.03)	(0.17)	(0.05)	(0.01)	(0.03)	(0.13)
TOBINSQ		0.01				0.02		
		(0.02)				(0.01)		
LOGDIR		0.11				0.25*		
		(0.14)				(0.13)		
IVNETW			-0.11				-0.37**	
			(0.15)				(0.16)	
IVNETWSQ			0.54				0.96**	
			(0.34)				(0.39)	
Constant	1.81***	-0.14	-0.22	0.58	1.62***	-0.11	0.19	-1.41
	(0.33)	(0.10)	(0.20)	(1.12)	(0.35)	(0.10)	(0.21)	(1.01)
Observations	306	306	306	306	303	303	303	303
R^2			0.03				0.04	
Adjusted R^2			-0.19				-0.18	

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6 OLS and 2SLS regressions for Tobin's Q (TOBINSQ) and the Shannon index (SHANNON) for the years 2007 – 2012 and 2013 – 2018. The first four columns show the regressions for the years 2007 – 2012 and the last four columns show it for the years 2013 – 2018. The first columns of the 2SLS regressions (columns 3 and 7) show the first stage in which the instrumental variables IVNETW and IVNETWSQ are regressed against the endogenous independent variable SHANNON. The second columns of the 2SLS regressions (columns 4 and 8) show the second stage in which the endogenous variable SHANNON is instrumented by the instruments.

	2007 – 2012				**2013 – 2018**			
	OLS		2SLS		OLS		2SLS	
	(1) TOBINSQ	(2) SHANNON	(3) SHANNON	(4) TOBINSQ	(5) TOBINSQ	(6) SHANNON	(7) SHANNON	(8) TOBINSQ
SHANNON	0.10			-2.22	0.32			-0.68
	(0.17)			(1.63)	(0.23)			(1.34)
LEVER	-0.28		0.03	-0.40	0.37		-0.14	-0.37
	(0.52)		(0.10)	(0.34)	(0.53)		(0.14)	(0.50)
ROA	0.46		-0.06	0.24	0.54		0.09	0.32
	(0.45)		(0.09)	(0.31)	(0.87)		(0.11)	(0.38)
SIZE	-0.09***	0.03**	0.07*	0.15	-0.07	0.02	0.01	0.35***
	(0.04)	(0.01)	(0.04)	(0.18)	(0.05)	(0.01)	(0.04)	(0.13)
TOBINSQ		0.01				0.03		
		(0.03)				(0.02)		
LOGDIR		0.23				0.36*		
		(0.21)				(0.19)		
IVNETW			-0.11				-0.48**	
			(0.24)				(0.23)	
IVNETWSQ			0.75				1.36**	
			(0.54)				(0.55)	
Constant	1.82***	-0.26	-0.36	0.44	1.60***	-0.13	0.40	-1.26
	(0.33)	(0.16)	(0.31)	(1.18)	(0.34)	(0.14)	(0.29)	(1.10)
Observations	306	306	306	306	303	303	303	303
R^2			0.03				0.03	
Adjusted R^2			-0.18				-0.19	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

To determine the effect of a gender quota on firm's financial performance, models containing an interaction effect are constructed. The results of these regression models can be found in table 7. It can be observed that the constants of all models are positive and significant at a 1% level. For the four models, these constants are quite similar and vary between 1.22 and 1.25. The independent variables in all four models (PWOMEN, DWOMAN, BLAU and SHANNON) show a more positive and significant effect (at a 1% level) for the second timeframe than for the first. From this it appears that the gender quota has a positive effect on financial performance measured by the approximation of Tobin's Q. This is in contrast with the results obtained by Ahern & Dittmar (2012) for the gender quota in Norway. The percentage of female directors has the largest effect on Tobin's Q. The difference between the two timeframes is also the largest for this variable. Moreover, the control variable return on assets has a positive and significant effect on Tobin's Q. This implies that higher return on assets lead to a higher Tobin's Q, which is as expected since both variables are measures for firm performance.

In conclusion, the first hypothesis stating that the instalment of a gender quota in the Netherlands positively affects financial performance of Dutch firms can be accepted based on the results of the OLS regressions including the interaction effect. This is not in accordance to earlier research by Ahern & Dittmar (2012) and the criticism stated by Terjesen et al. (2016) that a gender quota may result in lower firm performance when female directors are selected purely for the reason of reaching the quota. Although the results of the OLS regressions are insignificant, they all show an increase in the effect of the gender concerning independent variable on Tobin's Q. However, the 2SLS regressions seem to imply a negative relation, even though all coefficients considered are insignificant.

It should be considered that the Norwegian gender quota lead to a decline in Tobin's Q in the long run according to Ahern & Dittmar (2012) and that because of this decrease, the authors expect that some Norwegian firms may choose to become a private limited firm as they will not be affected by the quota then. However, in the Netherlands this is less of a concern as the gender quota is not compulsory, but it states that firms must strive to reach the percentage.

Table 7 OLS regressions for Tobin's Q (TOBINSQ) and the independent variables for female presence on the board of directors and gender diversity (PWOMEN, DWOMAN, BLAU and SHANNON) including the interaction effect with the dummy variable for time period (DTIME, equaling one for the years 2013 – 2018 and zero otherwise).

		(1) TOBINSQ	(2) TOBINSQ	(3) TOBINSQ	(4) TOBINSQ
LEVER		0.18	0.20	0.19	0.19
		(0.19)	(0.19)	(0.19)	(0.19)
ROA		0.89***	0.88***	0.90***	0.90***
		(0.18)	(0.18)	(0.18)	(0.18)
SIZE		-0.03	-0.04	-0.03	-0.03
		(0.03)	(0.03)	(0.03)	(0.03)
PWOMEN (DTIME=0)		-0.18			
		(0.33)			
PWOMEN (DTIME=1)		0.83***			
		(0.19)			
DWOMAN (DTIME=0)			0.01		
			(0.06)		
DWOMAN (DTIME=1)			0.24***		
			(0.05)		
BLAU (DTIME=0)				-0.08	
				(0.22)	
BLAU (DTIME=1)				0.61***	
				(0.14)	
SHANNON (DTIME=0)					-0.03
					(0.14)
SHANNON (DTIME=1)					0.42***
					(0.10)
Constant		1.24***	1.25***	1.23***	1.22***
		(0.25)	(0.25)	(0.25)	(0.25)
Observations		609	609	609	609
R^2	Within	0.10	0.10	0.10	0.10
	Between	0.11	0.12	0.10	0.09
	Overall	0.09	0.10	0.08	0.08

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.2 Hypothesis 2

To determine the effect of the instalment of the gender quota of 30% in the Netherlands on the presence of female directors and female CEOs a graph has been constructed (figure 2). This graph consists of two lines: one for the total percentage of female board directors against the timeframe of 2007 – 2018 and one for the total percentage of female CEOs against the same timeframe. The total percentage of female directors on corporate boardrooms in the Netherlands increases over time. In 2007 only 7.24% of all boardroom directors were women while in 2018 this percentage has increased to 25.18%. The percentage has been increasing steadily over the years in this timeframe. However, it can be noted that the percentage did not change that much in the years 2008, 2009 and 2010. This may be explained by the financial crisis going on in that period. The average overall percentage has not reached the desired 30% yet, but there are still two years in which this can be accomplished. To control whether the yearly growth of the percentage of female directors is significantly different from zero, a t-test has been run. The results of this test can be found in table 16 in the appendix. This t-test results in a test statistic of 6.586 which is significant at a 1% level. Therefore, the null hypothesis stating that the difference in yearly total percentage of female directors is equal to zero can be rejected.

On the other hand, the total percentage of female CEOs does not change a lot over the years 2007 – 2018. In 2007 this percentage was 3.92% and in 2018 it increased slightly to 4.44%. This could be because the legislation on the gender quota says nothing about the percentage of female CEOs. To statistically prove this, a t-test has been run. This t-test controls whether the difference in yearly growth rate for the percentage of female CEOs is equal to zero. The results of this test can be found in table 17 of the appendix. The test statistic resulting from this test is equal to 0.177 which is not significant at any level. Thus, the null hypothesis cannot be rejected, and it can be assumed that there is no significant difference between the yearly percentages of total female CEOs.

In conclusion, the second hypothesis stating that the instalment of the gender quota leads to an increase in the presence of female board members can be accepted. The percentage of female directors increases significantly over the years 2007 – 2018. However, the percentage of female CEOs shows no significant change over the years. These results are similar to the findings on female presence in corporate boardrooms in Norway of Wang and Kelan (2013).

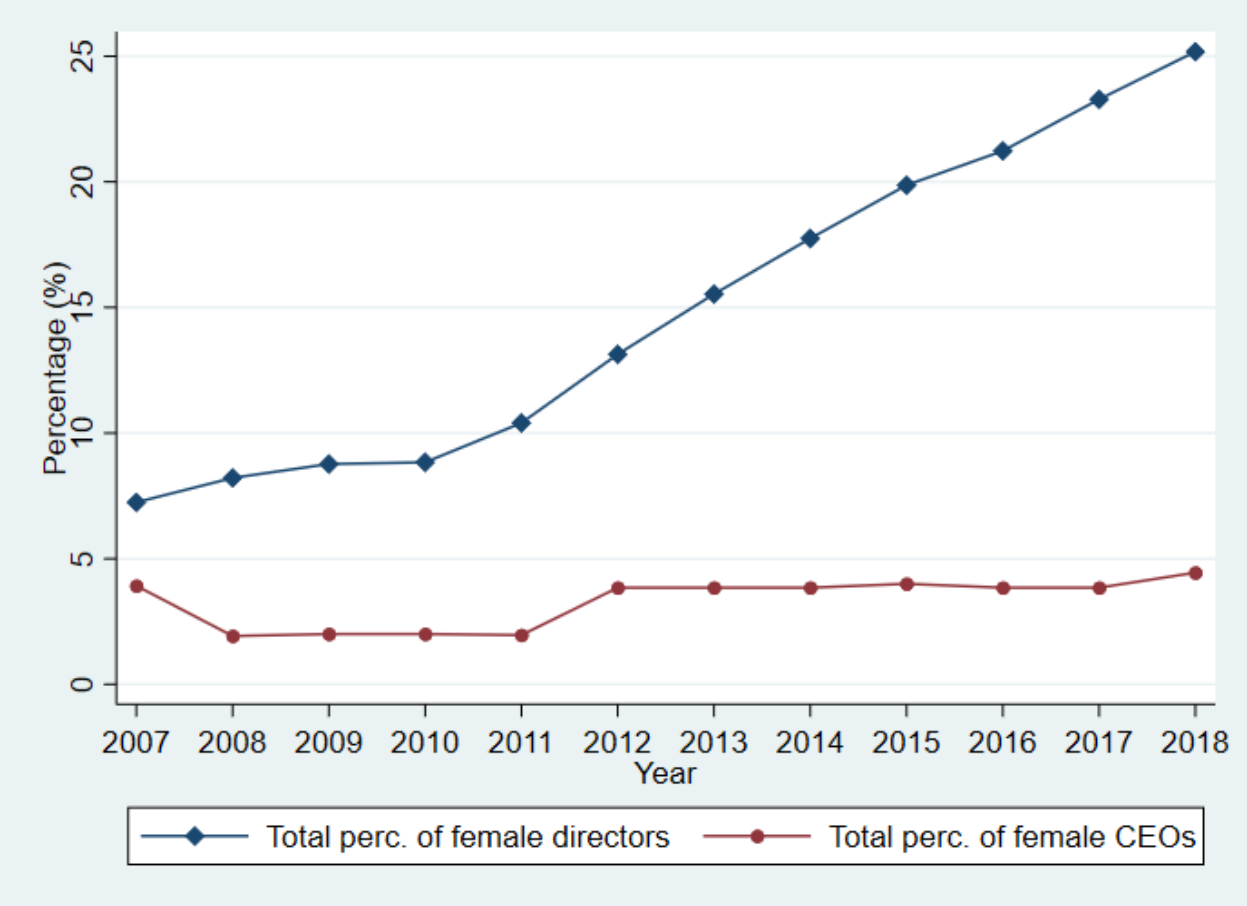

Figure 2 Changes in female presence on boards of directors in the Netherlands for the years 2007 – 2018. The blue line shows the change in the total percentage of female directors for all companies combined. The red line shows the change in the total percentage of female CEOs for all companies combined over the time period.

5. Conclusion and Discussion

5.1 Conclusion

In this paper, the influence of gender diversity on firm performance was measured. This was researched for two timeframes of six years with and without the legislation of a gender quota. The data consists of panel data obtained from Dutch firms listed on the AEX, AMX and AScX indices. The gender quota in the Netherlands states that firms must strive to reach 30% of their board directors to be female. The research question of this paper is as follows:

'Gender diversity within corporate boardrooms in the Netherlands: do gender quotas improve financial performance?'

To answer the research question, it was expected that there will be a positive relationship between more gender diversity within the boardroom and firm performance in the long run. However, in the short run it was expected that there is no significant effect. Moreover, it was expected that the relationship would be more positive after the instalment of the gender quota. Thus, the hypothesis to the research question is that a gender quota improves the financial performance of Dutch firms. The results of the OLS regressions show that all coefficients concerning the relationship between female presence on the board of directors and firm performance are positive, but insignificant. On the other hand, the 2SLS regressions all show a negative, but again insignificant relationship. Therefore, the results on the effect from the presence of women in boardrooms on the financial performance of firms measured by an approximation of Tobin's Q remain inconclusive. From the results of the regressions containing the interaction effect between the dummy variable for the time period and the variables for female presence and gender diversity it becomes clear that there is a more positive and significant effect for the years 2013 – 2018. Based on these results, it can be concluded that the gender quota leads to a more positive effect on firm performance, measured by an approximation of Tobin's Q, in the years after the instalment of the gender quota. However, it might still be possible that there are other factors which influence the greater firm performance in those years. Moreover, the deadline for the percentage of 30% that must be striven to reach according to the gender quota is not until 2020. By then, the results may have changed again.

To support the research question, the following sub question was also investigated:

'What is the effect of the gender quota on the presence of female board chairs?'

In order to construct an answer to this question, it was expected that there would be an increase in the percentage of female directors on boards following the instalment of the gender quota. To research this hypothesis, a graph was constructed showing the average percentages of female boardroom directors and female CEOs over the years 2007 – 2018. A clear upwards trend has been observed for the percentage of female directors. In 2018 this percentage increased to 25.18%. On the other hand, the graph shows not much change in the percentage of female CEOs over the years. This percentage stays quite stable. To support this, statistical t-tests were run. The results obtained by these tests confirm the assumptions made based on the graphs. Therefore, it can be concluded that the gender quota has a positive effect on the presence of women in the boardroom but not on the appointment of female CEOs.

In conclusion, both hypotheses can be accepted. In the sample of this research the gender quota leads to more female board members being appointed and to greater firm performance. However, there might be some limitations as to why the hypotheses cannot fully be accepted. For example, there could be more factors that could have influenced the increase. Moreover, the possible negative side effects of the gender quota must also be considered when considering the legislation.

5.2 Discussion

From the results in the research performed in this paper it can be observed that all coefficients concerning the relationship between gender diversity within boardrooms and firm performance are insignificant. The main reason for this could be that the sample size was too small. More data must be collected when there is more time and resources to do so. With more data, the probability of significant results is larger. Thus, conclusions on the hypothesis are more certain. Moreover, it is difficult to conclude whether the gender quota by itself has an impact on firm performance. Higher firm performance can be the result of many firm-related characteristics. Thus, there are many factors that must be controlled for in the regressions, which is a lot of work to do in empirical research.

The first stage of the 2SLS lead to mostly insignificant relations between the endogenous variables and the instrumental variable. Based on the Sargan-Hansen tests it was concluded that the instrumental variable used was valid but weak. In result, the 2SLS shows no significant relationship between gender diversity and firm performance. In order to perform an efficient 2SLS regression, a more relevant instrumental variable should be found. This is quite difficult, as in this case the variables are usually corporate governance variables which could influence firm performance.

Another reason for lower firm performance for some years could have had to do with the financial crisis. This crisis lasted from the summer of 2007 until 2011 approximately. This is nearly the same period as the first timeframe (2007 – 2012) that was researched in this paper. Therefore, the impact of the global financial crisis could have led to a lower Tobin's Q. The financial crisis could have also influenced other variables used in this research, such as the debt level or the return on assets.

Further research could include the difference between executive and non-executive female board directors. It could be that there are more women who are a non-executive director, or vice versa. In this paper, this factor was neglected, but it might have an influence on the relationship to firm performance. Moreover, the research could again be performed after the deadline for the gender quota of 30% in 2020. It could be observed whether firms will have reached this quota and what the effect on firm performance is. Besides that, the recent announcement of Dutch investors to only invest in firms with 35% of the top directors being women could also have a large impact on gender diversity within the boardroom. Further research could also be performed on firms who are already more diverse in gender. For this firms it could be investigated whether salaries differ significantly per gender. This adds to the literature on the so-called 'gender pay-gap'.

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Appendix

Table 8 Summary of all variables

Variable	Definition	Computation
Gender diversity		
PWOMEN	Percentage of female directors	The number of female directors on the board divided by the all directors on the board.
DWOMAN	Presence of one or more female directors	Dummy variable giving the value of one when there are one or more women on the board and zero otherwise.
PWOMENTOTAL	Total percentage of female directors per year	Total number of female board directors divided by the total number of board directors.
PFEMCEOTOTAL	Total percentage of female CEOs per year	Total number of female CEOs divided by the total number of CEOs.
BLAU	The Blau index	$1 - \sum_{i=1}^{n} {P_i}^2$
SHANNON	The Shannon index	$-\sum_{i=1}^{n} P_i ln P_i$
Financial performance		
TOBINSQ	An approximation of Tobin's Q	The sum of the market value of stock and book value of debt divided by the book value of total assets.
Control variables		
LOGDIR	The logarithm of the total number of directors	Logarithm of the total number of directors.
LEVER	Debt level of each firm	Ratio of book value of total debt to book value of total assets.
ROA	Return on assets	Net income divided by the book value of total assets.
SIZE	Firm size	Natural logarithm of the book value of total assets.
Instrumental variables		
IVNETW	The fraction of male directors on a boardroom who sit on other boardrooms with female directors.	The number of male directors on a boardroom who sit on other boardrooms with female directors divided by the total amount of male directors.

IVNETWSQ	The square root of the fraction of male directors on a boardroom who sit on other boardrooms with female directors.	The number of male directors on a boardroom who sit on other boardrooms with female directors divided by the total amount of male directors taken squared.

Table 9 Descriptive Statistics for the instrumental variable IVNETW for the years 2007 – 2012

	mean	sd	min	max
IVNETW	0.12	0.12	0	1
Observations	306			

Table 10 Descriptive statistics for the instrumental variable IVNETW for the years 2013 – 2018

	mean	sd	min	max
IVNETW	0.11	0.13	0	1
Observations	303			

Table 11 Descriptive statistics for the instrumental variable IVNETWSQ for the years 2007 – 2012

	mean	sd	min	max
IVNETWSQ	0.03	0.04	0	0
Observations	306			

Table 12 Descriptive statistics for the instrumental variable IVNETWSQ for the years 2013 – 2018

	mean	sd	min	max
IVNETWSQ	0.03	0.05	0	0
Observations	303			

Table 13 Wald chi^2 test statistics for the Hausman test for the years 2007 – 2012

	TOBINSQ	PWOMEN	DWOMAN	BLAU	SHANNON
TOBINSQ		4.05	1.97	3.69	3.34
PWOMEN	4.38				
DWOMAN	11.35(***)				
BLAU	4.32				
SHANNON	4.24				

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 14 Wald chi^2 test statistics for the Hausman test for the years 2013 – 2018

	TOBINSQ	PWOMEN	DWOMAN	BLAU	SHANNON
TOBINSQ		0.81	8.18(**)	2.32	3.65
PWOMEN	-				
DWOMAN	1.03				
BLAU	-				
SHANNON	-				

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 15 Wald Chi2 test statistics and p-values for the Sargan – Hansen test for overidentifying restrictions for the years 2007 – 2012 and 2013 – 2018

	2007 – 2012		**2013 – 2018**	
	Chi^2 – statistic	P – value	Chi^2 – statistic	P – value
PWOMEN	2.520	0.1124	1.408	0.2354
DWOMAN	0.072	0.7881	0.311	0.5772
BLAU	1.373	0.2414	1.238	0.2659
SHANNON	0.851	0.3563	1.039	0.3081

Table 16 Results of the T-test testing the significance of the difference in yearly percentages of total female presence in boardrooms.

	N	Mean	Standard deviation	t-statistic	Critical value	Degrees of freedom	p-value
Growth_pwomen	11	0.0163	0.0082	6.5856	1.98	10	0.0001

Table 17 Results of the T-test testing the significance of the difference in yearly percentages of total female CEOs

	N	Mean	Standard deviation	t-statistic	Critical value	Degrees of freedom	p-value
Growth_pceo	11	0.0005	0.0027	0.1770	1.98	10	0.8631