STOCKHOLM SCHOOL OF ECONOMICS
Department of Accounting – Bachelor's Thesis
Fall 2010

THE NORWEGIAN GENDER QUOTA LAW AND ITS EFFECTS – A NATURAL EXPERIMENT

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Abstract: Previous research on the relationship between board gender diversity and the performance and risk-taking of firms show both a positive and negative relationship. These previous studies have suffered from problems of not fully controlling for endogenous factors affecting both gender diversity and firm performance and risk-taking. This has lead to biased estimations of the effects of gender diversity on company boards and has made it difficult to study the cause-and-effect relationship. The Norwegian gender quota law which requires 40 percent women in the board of directors of public companies, being the first of its kind, has created a natural experiment where one can study board gender diversity without the endogeneity problem. We use the natural experiment that the gender quota law entails to study whether the exogenous, sudden increase in the fraction of female board members has had an impact on firm performance, risk-taking and the cost of equity. Our results suggest that performance, risk and the cost of equity of the firms affected by the law has not changed as a consequence of the introduction of the law.

Key Words: Norwegian quota law, natural experiment, board diversity, female board directors, performance, risk taking

Acknowledgments: We would like to thank our tutor Katerina Hellström for her guidance and help in writing this thesis; her support has been very valuable. We would also like to thank Johannes Breckenfelder, for his advice regarding econometrics and the chosen regressions. Thanks also go to the Norwegian Ministry and all the Norwegian companies that gave us their time in answering my questions.

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Presentation date: 2010-06-01

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1. INTRODUCTION

In 2002, March 7, 150 business leaders were summoned to a seminar in Oslo. The Minister of Trade and Industry and the Minister of Family, Equality and Children confirmed that the Centre coalition was prepared to impose a gender quota law that would require public limited companies to include at least 40% women on their company boards. There was uproar among the summoned companies; they were given three years to comply, before the law would be imposed. As companies failed to comply by 2005, the law was imposed in 2006 and took full effect in 2008. By January 2008, 77 companies were non-compliant with the law and were given time until April 2008 to comply or face liquidation. In April 2008 however, all affected companies were in compliance with the law.

Norway is currently the only country in the world with a quota law regarding the proportion of women in listed company boards. Spain has recently decreed, via their Company Board Code, that by 2015 all listed companies must have no less than 40% women in their company boards. The French Senate will soon debate a bill phasing in a gender quota law regarding company boards by 2016, a bill that the National Assembly has approved.

In Sweden, the ruling Moderate Party is reflecting over whether to follow Norway's example by imposing a gender quota law for listed company boards. After being against a quota law, the Moderate party announced via its party secretary Per Schlingmann that it would introduce a gender quota law regulating the fraction of female board members in Swedish company boards by 2014; the law would be imposed if the companies have not increased their fraction of female board members to 50%[1] by that time. The opposing coalition is threatening to do the same if they win the election which will be held in September 2010[2].

Maria Ludvigson at the South Swedish Industry and Trade Chamber has studied boards affected by the gender quota law and followed the discussion in Norway. Ludvigson argues that the Norwegian gender quota law risks making women into alibis in company boards[3].

In light of these events and discussions, it is interesting to study the consequences of such a law. Previous articles and studies related to female board directors have taken several

[1] http://www.va.se/nyheter/2010/01/20/vi-vill-ha-en-forandring-i-aktiebolagslagen/s
[2] http://www.dn.se/ekonomi/norge-bast-pa-k
[3] http://www.svensktnaringsliv.se/fragor/kvotering/kvoteringslag-gor-kvinnor-till-alibin_13523.html

theoretical view points. Studies relating to organization and gender give view to reasons of why the fraction of female board directors is low. Corporate Governance articles investigate the effects of female board members on firms and firm performance. The legislative discussions around the issue of female board members focus on both views; the legislation took an equality approach, advocating diversity in all aspects of society, including company boards. There is also a view that the presence of female board members has a significant positive effect on the corporate governance structures of firms.

The purpose of this thesis is threefold. Firstly, we want to test whether the Norwegian gender quota law regarding company boards has changed firm performance. Secondly, we wish to investigate whether the Norwegian gender quota law has changed firms' risk taking. Thirdly, we wish to study whether the cost of equity of firms has been changed due to the gender quota law.

Our contribution to the research of corporate governance and company board diversity is unique. The Norwegian quota law is new and the only one of its kind in the world. There has thus been practically no research done on the law and the effects it has had on the firms subjected to it. The gender quota law in Norway has, as a natural experiment, opened up a unique opportunity to study corporate governance and the effect of female board directors on firms, without the problem of endogeneity and reverse causality (Hermalin & Weisbach 2003) that previous research, though extensive, has suffered from. The problem of endogeneity mainly arises due to how the fraction of female board members is obtained. Before the Norwegian gender quota law was introduced, individual firms decided themselves how many women to elect as directors. The fraction of female board directors was thus endogenous (internally specified by individual firms). The impact this has had on previous research is that it could not be concluded whether companies performed well due to their fraction of female board directors, or whether good performing firms simply elected more female board directors. In order to find causality, the fraction of female board directors needs to be exogenously given, meaning that it must be specified the same way for all companies.

What the Norwegian gender quota law did was to force all publicly traded firms to have a fraction of female directors at the level of 40%; the fraction of female board directors thus became an exogenously given variable (a variable decided by forces outside of the companies), free from the endogeneity problem.

There is much previous work done on corporate governance and board diversity. Addams and Ferreira (2009) argue that a gender quota law regarding company boards could harm well-governed firms' shareholder value, and thus their performance. McKinsey & Company, the consultancy firm, argue in a study conducted in 2007 that companies where women are strongly represented in top management and in company boards perform better than companies where this is not the case.

In studies concerning risk averseness and risk taking (Jianakopolos & Bernasek, 1998; Ansic & Powell, 1997), the conclusion is that women are more risk averse than men. As mentioned earlier in the text, none of these articles are free from endogeneity problems however, and our contribution to the research community can thus be substantial.

The structure of our thesis will incorporate three sections. In section 1, we will present the different theoretical viewpoints that the gender quota law was built upon and the previous research done in the subject of corporate governance and women in the board rooms. In section 2, we will go through the methodology and the data used. In section 3, we will present my results as well as conclusions and a discussion around the thesis.

2. THEORETICAL BACKGROUND AND PREVIOUS STUDIES

This section of the thesis gives a background to the gender quota law regarding company boards, and the theories it builds upon. These theories have also been the basis of previous research on women in company boards

2.1 ORGANIZATION AND GENDER

The theoretical positioning within the sphere of organization and gender follows a tradition of critical and power structure perspectives regarding questions of leadership and gender (Fritzes offentliga publikationer). These theories follow a historical retrospection on women's possibilities of ownership and business, discussions regarding women's representation in company boards, men as company leaders and the construction of masculinity, young leader's situation and research on development of change in company boards and in the work force in general towards more women on the top.

In a Swedish study focused on nomination committees in corporate groups, Sjöstrand (2002) has observed that the criteria for being nominated to be a part of a company board is mainly focused on previous CEO experience, a fact that according to Sjöstrand has kept women out

of the board rooms. In a follow-up interview based study in 2003 (a year after Sjöstrand's study), Karlberg (2003) observed that the level of women in the board room was in fact increasing, where one of the main reasons being the threat of legislation by the Minister of Equality at the time, Margareta Winberg, in 2002.

Boschini 2004 argues that the main reason there are less women on high positions in companies is due to the lack of economical incentives and societal norms.

This paper will not be focusing on the political and organizational aspects of the Norwegian gender quota law, and these theories will thus not be followed up in the analysis.

2.2 Corporate governance

2.2.1 The role of the Boards of directors

Hermalin & Weisbach (2003) argue in a literature survey that although it can be hard to establish why boards exist, it is easy to see what tasks they carry out. The survey argues that most evidence suggest that boards arise as a consequence of agency problems in governing an organization. They argue that formal theoretical research of how boards work has focused on the questions of how board characteristics such as independence and size affects firm performance, how these characteristics affect the boards' work and what factors that affect the makeup of boards and evolution of boards over time. Reverte (2008) points out that boards differ significantly between different countries. Characteristics that often change are size and composition. For example, Reverte mentions that independent directors are far more common in the US than in Spain.

Higgs (2003) sets up a number of reasons for the interest in corporate governance. He argues that good corporate governance will reduce the risk of scandals within companies and that it will improve accounting information. He further argues that corporate governance structures are of great importance but that they must be complemented by good directors in the boards in order to fulfill their purpose. Consequently he argues that structures and behavior are cross-enhancing.

La Porta, Lopez-de-Silanes, Shleifer & Vishny (1998) argue that corporate governance is a very important factor when trying to explain certain factors in financial markets such as the correlation between the values of companies and their reported assets and to the difference in price between shares with different voting rights. Furthermore, they argue that the legal

tradition and the structures of corporate governance are the most important factors in overcoming the principal-agent problem between shareholders and management.

2.2.2 Characteristics of Norwegian Corporate Governance

The purpose of establishing corporate governance structures, as defined by the Norwegian code of corporate governance, is to create confidence between companies, capital markets and other stakeholders.

The Norwegian Code of corporate governance is the main source of corporate governance regulation for large Norwegian public companies. The code is not established by one single organization, but rather by a mix of interest groups. For companies listed on the Oslo Stock Exchange, it is mandatory to comply or explain by the principles in the code; this means that if a company cannot comply with the code, it must explain why they cannot do so. The code briefly states that a general diversity of directors is necessary in order for a board to sufficiently carry out its duties. The board should represent a broad composition of backgrounds and competences. Furthermore, the code states that in order to fulfill the requirement of representing different backgrounds and competences the board should be comprised of women and men in equal numbers.

All Norwegian companies, both public and private, having more than 200 employees are obliged to have a corporate assembly. Corporate assemblies are not found elsewhere in Western corporate governance structures. It is the duty of this assembly both to elect the board of directors and carry out certain supervision over it. Two thirds of the assembly is elected by the shareholder's general meeting and one third is elected by the employees. However, the requirement to have a corporate assembly can be waived through an agreement with the employees' unions.[4] Corporate assemblies typically convene more than once a year, something that might facilitate the task of changing the composition of the boards of directors.

In Norwegian companies, the CEO and other parts of management rarely serve as directors. By the Law of public limited companies, the CEO and chairman of the board positions must not be held by the same person.

La Porta, Lopez-de-Silanes, Shleifer & Vishny (1998) argue that corporate governance in Norway is of a generally high quality. They use a director index to measure the quality of

[4] Norwegian code of corporate governance. URL: http://www.ecgi.org/codes/documents/cg_norway_en.pdf. Latest check: 2010-04-21.

corporate governance in 49 countries. The index is comprised of several factors within the broad categories of shareholder's rights, creditor's rights, enforcement and ownership. Of these factors, shareholder's rights get the heaviest weight. On a 1 through 6 scale with 6 being the highest, Norway has a score of 4. That score is the best of all Nordic countries and is only surpassed by the United States, South Africa, Canada, Hong Kong and the United Kingdom who have a score of 5.

2.2.3 Corporate governance and firm performance

In a literature survey, Fields & Keys (2003) argues that board characteristics are positively correlated with the performance of companies. They also find that firms with a well functioning governance structure can have excessive returns to equity.

Adams and Ferreira (2009) show in a study based on U.S. companies listed on the Standards & Poor's 500 list, that board diversity has on average a negative impact on firm performance, measured as Tobin's Q. They argue that although there exists a positive correlation between board gender diversity and firm performance, this does not hold when controlling for omitted variables and reverse causality. Wahlsten and Wåhlin (2009) on the other hand show in their study of Swedish listed firms that board diversity, measured as age and gender diversity has a positive effect on firm performance, as measured by Tobin's Q. This is in line with what Erhardt, Werbel and Sharder (2003) showed in a study of 112 U.S listed firms; that diversity in boards of directors as measured in terms of the proportion of female and non-white directors have a positive influence on return on assets and return on investment. As they cannot show how the relationship between board diversity and company performance actually works, they do not know what way causality runs. They also are unsure whether their results can be used when analyzing smaller firms since their sample only consists of very large companies.

Carter, Simkins and Simpson (2003) show in a study of Fortune 1000 firms that a high proportion of women on boards has a positive impact on firm performance as measured in ROA and Tobin's Q.

2.2.4 Corporate governance and firms' risk taking

Shleifer & Vishny (1997) argue that corporate governance works in several two to mitigate the risks of investors. Firstly, corporate governance provides a legal framework in which

investors can claim the rights to the assets a company invests in. Secondly, corporate governance provides an opportunity to influence the risk-taking of companies by appointing board directors having an influence on the risk decisions of the firms. The board directors can also limit the risk taking by other agents in the firm.

Powell & Ansic (1997) show in an experimental setting, that women are more risk-averse than men when faced with traditional financial decisions. This relationship holds even when controlling for factors that traditionally affect financial risk-taking behavior. They argue that women use different strategies in financial risk-taking behavior. Furthermore, they argue that the results from these experimental settings are fully adaptable to explain women's behavior in real financial decision making in settings such as management.

Asbaugh, Collins & LaFond (2004) show that better corporate governance structures will decrease both the operative and financial risk-taking of the firm.

2.2.5 Corporate governance and the cost of equity

There is strong evidence that a number of corporate governance characteristics matter in the pricing of equity. Reverte (2008) finds in a study of Spanish firms that better governed firms, as measured by a weighted index, have a lower cost of equity. The index in his study is based on board size, board independence, CEO-chairman duality, and the existence of different board committees (audit, remuneration and nomination committees) and the independence of board committees. Reverte suggests that weaker governance structures increases the non-diversifiable risk of equity.

Asbaugh, Collins & LaFond (2004) show that several corporate governance factors affect the cost of equity of firms. In their study, measures of board size, board composition and board structure are used to test for differences in the cost of equity. They show that corporate governance factors affect the cost of equity through changing the company beta.

Garmaise & Giu (2005) argue that effective corporate governance will lower the cost of equity as measured in a capital asset pricing model (CAPM) setting.

A lower cost of equity is associated with a lower firm risk and a lower agency risk between the shareholders and management and is thus a sign of better corporate governance structures (Garmaise & Giu, 2004; Brigham, Shome & Vinson, 1985).

3. HYPOTHESIS AND METHODOLOGY

3.1 HYPOTHESES.

Having outlined the most important theory on the field of corporate governance and looking at previous research we have decided to evaluate the following hypotheses in order to study the effects that the Norwegian gender quota law has had on firms' performance, risk taking and cost of equity:

H1 a) The Norwegian gender quota law has changed the performance of companies, in either a positive or negative direction.

H1 b) The Norwegian gender quota law has changed the risk taking of companies, in either a positive or negative direction.

H1 c) The Norwegian gender quota law has changed the Cost of Equity of companies, in either a positive or negative direction.

3.2 PROXIES FOR FIRM PERFORMANCE

There is no universal measure for firm performance and all measures suffer from some type of bias. We have selected a number of proxies for firm performance that together will give a sufficient indication of the profitability of a company in the sense that it should maximize the shareholder value. When looking at performance from a capital market context it is important to include both accounting based proxies as well as market based proxies. The proxies used for firm performance are Tobin's Q, return on assets (ROA) and return on equity (ROE). The performance proxy variables are defined in table 1.

Table 1 – Performance proxies

Proxy	Description
Tobin's Q	Market value of equity at point t / Book value of equity at point t
ROE	Earnings before interest and taxes / Average total assets
ROA	Net income / Average shareholder's equity

We will now give a brief theoretical motivation why we use each of the proxies defined in table

Prior research on governance and firm value has computed yearly **Tobin's Q** as a measure for firm value (Hermalin and Weisbach, 1991). The economic rationale behind this proxy builds

on the idea that a firm that has a high Tobin's Q has been more successful of building a high economic value of the invested assets. It is a commonly used market based measure when looking at aggregate data on whether the invested capital is sufficiently installed. Due to conservatism in accounting there may be a permanent measurement bias between the economic (market) value of equity and accounting value. It is argued that this bias is industry dependent. It is also very dependent on what accounting regimen that is used (White, Sondhi & Fried, 2003).

The companies in the sample, being registered in Norway and listed at the Oslo Stock Exchange, have all been obliged to follow the IFRS accounting standards since 2005 and onwards[5].

Return on Assets (ROA) measures a firm's operative profitability from an accounting context. It measures the return on the invested capital before equity and debt capital owners are compensated. As a measure it is independent of what financial leverage the firms have chosen, a question that is generally a board issue to decide on.

Return on Equity (ROE) provides an accounting measure of profitability relating to the ability of companies to create returns to the capital invested by their shareholders. We argue that it is interesting to use ROE as a performance proxy since it is a widely used measurement ratio, evaluating the firm performance relating to its shareholder's interest.

3.3 PROXIES FOR RISK

As with the case of firm performance proxies, it is impossible to create a measure for risk that incorporates all aspects of the risk taking of a company. We have included both accounting and market-based measures of risk in order to include potential effects from market behavior that will not be caught by only using accounting measures. The proxies for risk are debt-to-equity (D/E), debt-market-equity (DME), Fixed-to-Total Assets ratio and Cash-to-Total Assets ratio and the Cost of Equity; see Table 2 below.

Table 2 – risk proxy variables

[5] Oslo Stock Exchange regulatory circular. Issued: January, 5th 2005. URL: http://www.osloabm.no/oax_eng/obnewsletter/download/d61d76a7b0a7f94e22224d5821d99150/file/file/Circular_1_2005.pdf . Latest check: 2010-05-06.

Proxy	Description
D/E	Total debt current and long term / Total shareholder's equity
D/ME	Total debt / Equity at market price.
Fixed-To-Total Assets	Fixed assets (tangible and intangible) / Total assets
Cash-To-Total Assets	Cash and cash equivalents / Total Assets
Cost of Equity	$E(R_i) = r_f + \beta*(R_m - r_f)$

All risk proxies focus on different aspects of risk. The **debt-to-equity** proxy has been chosen to describe the overall financial leverage of the company. The **debt-to-market equity** proxy has been chosen in order to incorporate the leverage from a capital market perspective. Both these risk measures were chosen to create a measure of *financial* leverage and should be seen as complement proxies. The **fixed-to-total assets** ratio has been chosen as a proxy of the *operating* leverage of the company; a high ratio indicates that the company has an inefficient use of their working capital and often indicates a low cash reserve. A high ratio will thus inhibit a firm from adjusting to changes in demand putting operative profitability at risk. The **cash-to-total assets** ratio has been chosen to incorporate the liquidity risk of the company. Risk-averse companies tend to own a large cash reserve in order to meet shifts in the demands of payments without having to resort to external financing.

The **cost of equity** reflects the rate of return that shareholders expect to get for their invested capital. The expected cost of equity is calculated using the Capital Asset Pricing Model (CAPM); the CAPM uses the risk free rate and adds on a risk premium which is based on the riskiness of the individual company. According to the CAPM, the cost of equity increases with the riskiness of the company; that is, shareholders expects a higher reward for taking on more risk. Asbaugh, Collins and LaFond (2005) and Garmaise and Giu (2004) argue that the cost of equity is a good indicator of agency cost and agency risk in a corporate governance setting. The CAPM puts a premium on the risk free rate, based on the riskiness of the market and the riskiness of the company that cannot be diversified by holding other instruments in the market. If the company has a high risk, equity holders will require a higher expected return on their investments in the company. Hence, a change in the agency risk or agency cost due to the introduction of the law should be reflected by a change in the cost of equity.

The formula for calculating the cost of equity using the CAPM is as follows:

$$E(R_i) = r_f + \beta*(R_m - r_f)$$

where $E(R_i)$ is the expected cost of equity for firm i, r_f is the risk-free rate , β is the beta of the company and R_m is the return of the market portfolio. We have calculated the cost of equity for each year in the period 2005-2009, for each company in the sample.

The beta of the sample companies were obtained from the Orbis database. The Oslo Stock Exchange was used as a proxy for the market portfolio and NIBOR was used as a proxy for the risk free rate.

3.4 REGRESSION TESTS AND VARIABLES

3.4.1 STANDARD REGRESSIONS

A central focus throughout the study has been to exploit the opportunity that the natural experiment the Norwegian gender quota law has created.

Assume a model describing the financial performance of a firm i at the period t, p_{it} determined by:

$$(1)\ P_{it} = \beta_0 + \beta_1 * FFD_{it} + \beta 2 * after2006 + \boldsymbol{\delta} * \mathbf{o_{it}} + \mathbf{a_i} + \boldsymbol{\mu} * \mathbf{h_t} + u_{it}$$

In this model FFD_{it} is the fraction of female directors in the company board of firm i and at point t, after2006 indicates whether the year observed is before or after the introduction of the law, $\mathbf{o_{it}}$ being a set of observed variables affecting performance and $\mathbf{a_i}$ being a set of unobserved variables that do differ between firms but that does not change between the years studied. An example of this effect could be a superior business culture or a business strategy that will generally improve results for many years to come. $\mathbf{h_t}$ is a set of unobserved factors that do not vary between different companies but vary between the different years. Examples of this may be aggregate demand or supply chocks to the economy or different demand chocks.

Assuming this model and estimating:

$$(2)\ P_{it} = \beta_0 + \beta_1 * FFD_{it} + \beta 2 * after2006 + u_{it}$$

using the ordinary least squares (OLS) method, the estimate of β_1 and β_2 will be biased as we do not account for the observed and unobserved factors described above. In order for the estimation to be consistent we must not estimate the model when having unobserved, endogenous variables in our model. In order to get a consistent approximation of the effects that the law has had we try to, as far as possible, get rid of all possible endogenous factors. One of these endogenous factors is company specific effects.

There are several methods on how to avoid company specific effects, where one of them is to use firm fixed effects (Wooldridge, 2008). We argue that under the assumption that certain factors exist among all companies and that the sample used does not suffer from any larger bias, using fixed effects estimation is the best method to exclude this, firm specific endogenous effect.[6]

Even if we take these firm specific effects into account by using fixed effects estimation, the estimate will not be consistent as we do not account for the endogenous effects that the different years provide. As the panel data includes the information of what year the data has been gathered in, we estimate an equation using year dummies to account for any effect that is specific for that year. Some studies (Erhardt, Werbel and Sharder 2003), (Adams & Ferreira, 2009) do not include year-effects in their estimation and others do (Wahlsten & Wåhlin, 2009). We believe year variables capture year specific events that effect performance, risk and the cost of equity, and it would thus be unwise to exclude them.

Still, estimating equation (2) using a fixed effects estimation and accounting for the different affects that might follow by the different years, the estimates would still not be consistent since we have not accounted for all the effects that follow of the variables in the set $\mathbf{o_{it.}}$ We will thus need further control variables to account for any effects that are neither firm specific across all years studied, nor dependent on what year that is studied. When choosing suitable control variables, I have used previous studies as a basis point. Specifically, since this essay is written within a corporate governance context we have included variables within the corporate governance setting that previous studies in this field have argued to be important when explaining firm performance, risk and the cost of equity.

We assume throughout the thesis that the variation of the fraction of female directors variable has solely been affected by the introduction of the law and that is the law has created a natural experiment. This assumption is supported by Adams & Ferreira, 2009, who albeit not studying the law itself calls the conditions that it has created as a natural experiment.

3.4.2 INDEPENDENT VARIABLES

After2006 is a variable representing the effects of the law. After2006 will be zero if the year is 2005, and 1 if the year is 2006 and above. In order to account for other variables affecting

[6] For a more detailed discussion about the functioning of firm-fixed effects including a mathematical formulation of the model, we suggest chapter 14 of Wooldridge 2008 or another basic textbook of econometrics.

risks and performance other than the law, I will use control variables and other independent variables listed below.

Fraction of Female Directors (FFD) is calculated as the number of female directors divided by the number of female directors plus the number of male directors, i.e. board size. This variable gives us the fraction of female board directors for each year and for each company. The fraction of female board directors was changed in a, to the companies, exogenous way. FFD is thus the thesis's main variable in studying the effects of the gender quota law in Norway on firm performance and firms' risk taking.

The **CEO dummy** is zero if the CEO in the observed firm is male and one if the CEO is female. This variable helps us study whether female top managers such as a CEO are more risk averse than male CEOs (Wahlsten and Wåhlin 2009).

A **Chairman dummy** is used, and is zero if the observed chairman is male and 1 if the observed chairman is female. As the chairman of the board can be seen as exercising large influence on the decisions made by the board they have the power to affect the strategic plans of the firm. These are linked to the firms' performance and risk taking.

3.4.3 CONTROL VARIABLES

We use control variables in order to avoid biased effects from omitted variables. Although we cannot account for all variables affecting performance and risk taking, these are the variables mainly used in previous research (Adams & Ferreira 2009; Wahlsten & Wåhlin 2009) and that we believe will capture the remaining effects on firm performance and risk taking (other than the effects from the independent variables above). The control variables are presented below.

Industry four digits sic codes are used to categorize firms by industry. We use **industry dummies** to control for industry effects on firm performance and risk, and this variable is thus included as a control variable. We believe that the performance and risk taking behavior a firm has depends on the industry it operates in. We test for **firm fixed effects** using the companies' name; one board composition is not optimal for all firms, and will thus vary among firms (Hermelin 1994, Kole 1997). **Firm size** is included as a control variable in order to capture the impact size has on firm's performance and risk taking. Firm size is defined as the logarithm of the firms' total assets.

As previous research that has focused on the board of directors of companies (Adams & Ferreira 2009; Erhardt, Werbel and Sharder 2003; Bhagat & Bolton, 2008), other board characteristics than the gender of directors are included in the regressions. **Board size** is defined as the sum of directors appointed by the shareholders; maintaining board size at a certain level has been shown (Jensen, 1993; Lipton & Lorch, 1992) to be an important governance decision for companies. As the experience of the board directors is relevant in their decision making, thus affecting the firms' risk taking and performance, we have included an **age** variable. The age variable is calculated as the average age of the board directors.

3.5 DATA GATHERING

The accounting data was obtained from the Orbis database. As the companies report data in different currencies, our data has been exported from Orbis in Norwegian Crowns (NOK). Information on board composition has been gathered from the companies' annual reports and from the board of director's website database proff.no; using this database, we can note the gender of the board members and their age.

I have gathered a set of companies being subject to § 6-11 of the Norwegian Public Companies Act (LOV 1997-06-13 nr 45: Lov om allmennaksjeselskaper) stating that in a public company, where the board of directors consist of two or three directors, both genders must be represented; in a public company whose board of directors consists of four up to five directors, both genders must be represented by at least two directors; if the board of directors consists of six to eight directors, both genders must be represented by at least three directors; if the board consists of nine directors, both genders must be represented by at least four directors. The law also states that the aforementioned regulation is not applicable to directors elected by the employees, if done directly by the employees according to § 6-4 of the same act or as a proportion of the entire election of directors by the corporate assembly as regulated by § 6-37 (1) of the same act; this means that employee elected directors are not included in our sample. Since the regulation being studies is only applicable to directors elected as representatives of the shareholders, we have only gathered data on the gender of those directors and excluded directors elected by the employees[7].

The sample consists of 192 Norwegian public companies, listed on the Oslo Stock Exchange. The choice to use only publicly traded companies is due to the nature of this study, as we are

[7] Lov om allmenaksjeselskaper: URL: http://www.lovdata.no/cgi-wift/ldles?doc=/all/nl-19970613-045.html#6-11a latest check: 2010-04-19 09:57.

looking at factors such as firm market value. We use a panel data consisting of these specific 192 companies from the period 2005-2009.

Due to the accounting standard International Financial Reporting Standards (IFRS) not being implemented until 2004 for Norwegian companies, data from 2005 and onwards will be used. Prior to the implementation of IFRS, most Norwegian listed companies applied the Norwegian Generally Accepted Accounting Standards (NGAAP).

Financial and insurance industries are excluded, due to the nature of their performance and the way it is measured.

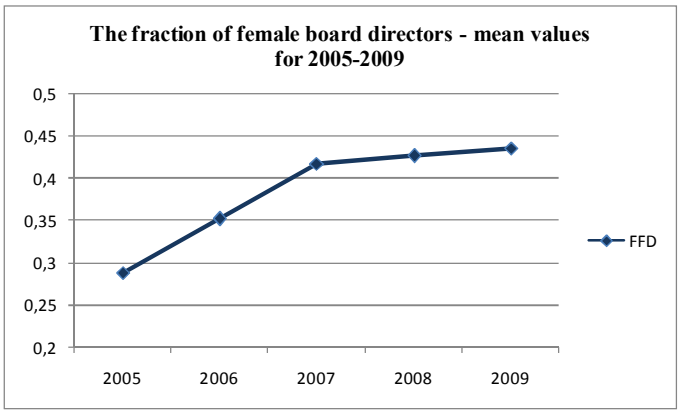
3.6 Summary Statistics

The table below lists our summary statistics for the sample presented in 3.5. This information is useful to get an overview of the data used before I continue with the regressions.

Table 3 – Summary statistics, unspooled data

Variable	Nr of observations	Mean	Std. Dev.	Min	Max
year	960	2007	1.414951	2005	2009
Nr of female CEO:s 2005	960	0	0	0	0
Nr of female CEO:s 2006	960	3	0	3	3
Nr of female CEO:s 2007	960	3	0	3	3
Nr of female CEO:s 2008	960	4	0	4	4
Nr of female CEO:s 2009	960	4	0	4	4
Nr of femalechairmans 2005	960	10	0	10	10
Nr of femalechairmans 2006	960	3	0	3	3
Nr of femalechairmans 2007	960	7	0	7	7
Nr of femalechairmans 2008	960	7	0	7	7
Nr of femalechairmans 2009	960	11	0	11	11
Nr of male directors 2005	187	3.770053	1.184833	0	7
Nr of male directors 2006	190	3.589474	1.018295	1	7
Nr of male directors 2007	190	3.152632	.6609825	2	6
Nr of male directors 2008	189	3.185185	.6462598	0	6
Nr of male directors 2009	190	3.021053	.6742261	1	5
Nr of female directors 2005	187	1.540107	.9958225	0	5
Nr of female directors 2006	190	1.942105	.8111758	0	4
Nr of female directors 2007	190	2.263158	.5186577	0	4
Nr of female directors 2008	189	2.37037	.5363097	1	4
Nr of female directors 2009	190	2.336842	.5655082	0	4
industry	956	425.0743	222.9955	11	874
age	19	54.98947	6.23956	44.5	65.4
Firm size 2005	143	13.521	2.100049	8.379768	19.48186
Firm size 2006	165	13.66847	2.229096	6.54535	19.94418
Firm size 2007	181	13.99024	2.021596	8.712596	19.99598
Firm size 2008	180	14.07845	2.113113	8.728588	20.17582
boardsize 2005	187	5.31016	1.057515	3	8
boardsize 2006	190	5.531579	.9955205	3	8
boardsize 2007	190	5.415789	.9432372	3	8
boardsize 2008	189	5.555556	.9415545	3	8
boardsize 2009	190	5.357895	.958568	3	8
FFD2005	187	.2888719	.1869561	0	1
FFD2006	190	.3520927	.1427147	0	.8
FFD2007	190	.4179887	.0674063	0	.6
FFD2008	189	.4266755	.070367	.2	1
FFD2009	190	.4363722	.0787688	0	.75

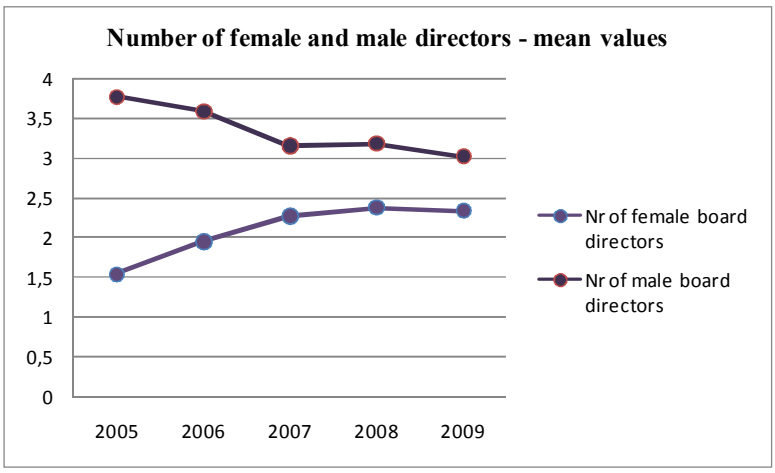
The sample comprises of 960 observations. The mean of the fraction of female board directors (FFD) increased from 28.9% in 2005 to 43.6% in 2009, a natural consequence of the gender quota law.



The board size varied between 3 to 8 directors, with no change between the years 2005-2009. This indicates that the law has not increased the boards' size as might be intuitively expected but has remained unchanged. One plausible explanation is that board size is an important part of the corporate governance structure of firms, and that firms tend to keep to a certain board size. Such an

explanation is in line with previous research indicating that large boards are less effective than smaller ones; Jensen (1993), Lipton & Lorsch (1992) as well as Yermac (1996) empirically confirm these views by regressing Tobin's Q on board size, and confirm a negative correlation between board size and firm performance.

The number of male board directors averaged 3.8 in 2005 and decreased to an average of 3 in 2009. The average number of female board directors on the other hand has increased from 1.5 in 2005 to 2.3 in 2009. The maximum number of male director has decreased from 7 in 2005 to 5 in 2009. For female board directors, the maximum was 5 in 2005 and has stayed at 4 in 2006-2009.



As one can see in the graph above, the women who enter the boards after 2006 simply replace the men who exit the boards the same year. Board size is thus left unchanged.

The number of female CEOs in the sample is small, from zero female CEO among 192 companies in 2005, 3 in 2006 to 4 in 2009. As the number of female CEOs is so low, this variable will be excluded from the regressions. Female chairman were also too few to be included in the regressions; the number of female board chairman has been between 10 in 2005, 3 in 2006 and 11 in 2009.

4. EMPIRICAL RESULTS

In order to test if the gender board quota law and the sudden increase in the fraction of female directors have had any effect on firm performance and risk, we regress firm performance and risk on the fraction of female directors (FFD) and the variable representing the introduction of the law (after2006). We start off with regressions on FFD and after2006 alone, and then add control variables.

4.1 HYPOTHESIS AND REGRESSION ANALYSIS

In this section, we will present the results of the OLS regressions based on the three hypotheses, the first controlling for effects of the gender quota law on firm performance, the second controlling for effects of the law on firms' risk taking and the third controlling for any effects that the law might have had on the cost of equity.

We have used pooled OLS regressions, due to the small sample size.

The following regressions were estimated first, using independent variables alone (excluding control variables):

(3) $P = \beta_0 + \beta_1 * FFD + u$

(4) $P = \beta_0 + \beta_1 * after2006 + u$

(5) $P = \beta_0 + \beta_1 * FFD + \beta_2 * after2006 + u$

where P is the dependent variable of interest.

The subsequent regressions were run to answer our hypotheses; here, control variables were included as well as tests for firm and industry specific effects in order to exclude omitted variable bias. In all these equations year1 represents the fiscal year of 2005, year2 represents the fiscal year of 2006 and so on.

We use the regression below to answer hypothesis 1 a).

(6) $P = \beta_0 + \beta_1 * FFD + \beta_2 * after2006 + \beta_3 * board\ size + \beta_4 * age + \beta_5 * firm\ size + \delta_3 * IndustryID + \delta_4 * IndustryID + \ldots + \delta_n * IndustryID + \delta_{n+1} * year1 + \delta_{n+2} * year2 + \ldots + \delta_{n+5} * year5 + a + u$

where P is the performance and a is the firm specific effect that is removed when using the firm fixed effects estimation.

To answer hypothesis 1 b), we regress risk proxies using the regression model below:

(7) $R = \beta_0 + \beta_1 * after2006 + \beta_2 * FFD + \beta_3 * board\ size + \beta_4 * age + \beta_5 * firm\ size + \delta_3 * IndustryID + \delta_4 * IndustryID + \ldots + \delta_n * IndustryID + \delta_{n+1} * year1 + \delta_{n+2} * year2 + \ldots + \delta_{n+5} * year5 + a + u$

where R is the risk proxy, and a is the firm specific effect that is removed when using the firm fixed effects estimation.

In order to answer the third hypothesis we use a similar regression having the cost of equity as the dependent variable instead. We use the regression:

(8) $Re = \beta_0 + \beta_1 * after2006 + \beta_2 * FFD + \beta_3 * board\ size + + \beta_4 * age + \beta_5 * firm\ size + \delta_3 * IndustryID + \delta_4 * IndustryID + \ldots + \delta_n * IndustryID + \delta_{n+1} * year1 + \delta_{n+2} * year2 + \ldots + \delta_{n+5} * year5 + a + u$

where Re is the Cost of Equity.

We estimate these equations using robust standard errors in order to get consistent estimates of our coefficients even in cases of heteroskedasticity.[8] We use the Firm ID given by the Orbis database in order to set the fixed effect in the fixed effects regression.

Since some studies have used fixed effects estimation without using year effects we have estimated the following regressions as well:

(9) $P = \beta_0 + \beta_1 * after2006 + \beta_2 * FFD + \beta_3 * board\ size + \beta_4 * age + \beta_4 * firm\ size + \delta_3 * IndustryID + \delta_4 * IndustryID + \ldots + \delta_n * IndustryID + a + u$

for the performance proxies trying to answer the first hypothesis regarding performance.

(10) $R = \beta_0 + \beta_1 * after2006 + \beta_2 * FFD\ \beta_3 * board\ size + \beta_4 * age + \beta_5 * firm\ size + \delta_3 * IndustryID + \delta_4 * IndustryID + \ldots + \delta_n * IndustryID + a + u$

for the risk proxies trying to answer our second hypothesis regarding risk

(11) $Re = \beta_0 + \beta_1 * after2006 + \beta_2 * FFD + \beta_3 * board\ size + \beta_4 * age + \beta_5 * firm\ size + \delta_3 * IndustryID + \delta_4 * IndustryID + \ldots + \delta_n * IndustryID + \delta_{n+2} * year2 + \ldots + \delta_{n+5} * year5 + a + u$

for the estimated cost of equity trying to answer the third hypothesis. These regressions were also performed using robust standard errors and firm fixed effects.

4.2 Findings and interpretations

In this section we will discuss and interpret the findings obtained from the regressions described above. We will begin by exploring the performance regressions and continue with

[8] For a more formal discussion on heteroskedasticity and robust standard errors, please consult chapter 8 in Wooldridge or any other textbook in basic econometrics.

the risk regressions. The focus of the analysis will be on the independent variables, and will include control variables when they are significant.

4.2.1 BASIC REGRESSIONS

We first start by presenting the results of the basic regressions, where we regress the performance and risk proxies on FFD and after2006, without including control variables.

Table 4 – basic regressions, regressing on FFD

Regression number (3), $P = \beta_0 + \beta_1 * FFD + u$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	TobinsQ	ROA	ROE	DebtEquityRatio	DebtMarketEquityRatio	FixedToTotalAssets	CashToTotalAssets	Cost Of Equity
FFD	-2.173*	1.221	-28.73	0.346	0.815	0.0677	-0.0260	-0.0257***
	(-2.00)	(0.22)	(-1.73)	(0.61)	(1.31)	(1.01)	(-0.49)	(-4.26)
constant	3.578***	-0.921	6.031	1.747***	1.289***	0.508***	0.214***	0.0373***
	(7.34)	(-0.42)	(1.07)	(8.41)	(4.92)	(18.29)	(9.91)	(17.99)
N	295	648	650	660	295	661	660	743
R-sq	0,50%	0,00%	0,30%	0,00%	0,10%	0,10%	0,00%	0,90%

t statistics in parentheses
="* p<0.05 ** p<0.01 *** p<0.001"
* p<0.05, ** p<0.01, *** p<0.001

Table 5 – basic regressions, regressing on after2006

Regression number (4), $P = \beta_0 + \beta_1 * after2006 + u$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	TobinsQ	ROA	ROE	DebtEquityRatio	DebtMarketEquityRatio	FixedToTotalAssets	CashToTotalAssets	Cost Of Equity
after2006	-1.098*	-6.647***	-11.77*	0.293	1.548**	0.0452*	-0.0293	-0.0181***
	(-2.33)	(-3.94)	(-2.06)	(1.02)	(3.03)	(2.26)	(-1.68)	(-8.31)
constant	3.346***	2.878*	1.192	1.717***	0.954***	0.509***	0.220***	0.0382***
	(10.85)	(2.38)	(0.29)	(12.93)	(12.30)	(34.09)	(16.66)	(74.69)
N	299	656	658	668	299	669	668	755
R-sq	1,70%	2,30%	0,60%	0,10%	2,30%	0,80%	0,40%	6,00%

t statistics in parentheses
="* p<0.05 ** p<0.01 *** p<0.001"
* p<0.05, ** p<0.01, *** p<0.001

Table 6 – basic regressions, regressing on FFD and after2006

Regression number (5), $P = \beta_0 + \beta_1 * FFD + \beta_2 * after2006 + u$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	TobinsQ	ROA	ROE	DebtEquityRatio	DebtMarketEquityRatio	FixedToTotalAssets	CashToTotalAssets	Cost Of Equity
after2006	-1.025*	-8.266***	-11.01	0.304	1.281***	0.0462*	-0.0277	-0.0179***
	(-1.99)	(-4.60)	(-1.73)	(0.95)	(3.48)	(2.20)	(-1.48)	(-7.66)
FFD	-0.831	12.26*	-14.00	-0.0615	-0.861	0.00544	0.0113	0.000786
	(-0.69)	(2.08)	(-0.76)	(-0.09)	(-1.29)	(0.08)	(0.20)	(0.13)
constant	3.649***	-0.630	6.405	1.736***	1.201***	0.506***	0.215***	0.0379***
	(7.38)	(-0.30)	(1.17)	(8.56)	(4.95)	(18.02)	(9.94)	(18.24)
N	295	648	650	660	295	661	660	743
R-sq	1,80%	3,20%	0,80%	0,10%	3,30%	0,80%	0,40%	5,80%

t statistics in parentheses
="* p<0.05 ** p<0.01 *** p<0.001"
* p<0.05, ** p<0.01, *** p<0.001

In all these regression equations P has been used to symbolize the dependent variable of interest, whether it is a performance, risk or cost of capital proxy.

We note that the after2006 variable has a higher explanatory power than FFD on the performance and risk measures (see tables 4-5 above).

As we use two independent variables we find it useful to study the correlation between FFD and after2006, to study whether it is useful to use both variables in the same regression.

Table 7 – Pair wise correlation between after2006 and FFD

		FFD	After2006
FFD	Pearson Correlation	1	,395**
	Sig. (2-tailed)		,000
	N	946	946

There is a highly significant correlation of 39.5% between the after2006 variable and fraction of female directors. This shows that the proportion of female directors has increased for the years after the law came into force. Correlation between these variables poses some question of whether multicollinearity will be an issue in further regressions. We believe there is still reason to include both FFD and after2006 in the regressions in order to evaluate their individual effects on the performance and risk proxies used

4.2.2 INTERPRETATIONS OF BASIC REGRESSIONS

As seen in table 4, FFD is only significant when regressing Tobin's Q and Cost of Equity.

When using after2006 as a lone independent variable, a high significance is seen when regressing Tobin's Q, ROA, ROE, D/ME, Fixed-To-Total Assets and Cost of Equity.

When regressing our performance and risk proxies using both FFD and after2006, FFD looses all significance except for when regressing ROA (where the significance is small at a t-value of 2.08); this loss of significance is not seen for the after2006 variable when using it in the regression together with FFD.

One can also observe that for the Tobin's Q and D/ME, more than 300 observations were dropped for regression (3), (4) and (5).This indicates an effect on the significance of these specific regressions, due to the small amount of observations.

We would expect to see in the subsequent regressions using control variables that FFD will continue to be insignificant whilst after2006 will continue to be significant; this is because control variables are mainly used to avoid omitted variable bias. This indicates that the fraction of female board directors has no significant impact on company performance and firm's risk taking. These results also indicate that the years following the introduction of the law have had a significant impact on the performance and risk taking of firms.

The control variables thus should not change the significance of FFD and after2006. The control variables should also not affect the coefficients of the independent variables in a major way.

4.2.3 RESULTS ON PERFORMANCE REGRESSIONS

Presented below are the performance regression results, where performance has been estimated using the proxies: Tobin's Q ((1) in the table), ROA (2) and ROE (3).

When using firm fixed effects, the industry dummies were automatically dropped from the regression by the statistical package used.

Table 7 – regressions for performance variables

(9) $P = \beta_0 + \beta_1$*after2006 + β_2*FFD + β_3*board size + β_4*age + β_5*firm size + δ_3*IndustryID+ δ_4*IndustryID + … + δ_n*IndustryID + δ_{n+1}*year1 + δ_{n+2}*year2 + … + δ_{n+5}*year5 + a + u

	(1)	(2)	(3)
	Tobin's Q	**ROA**	**ROE**
after2006	-1.524***	(dropped)	(dropped)
	(-4.37)	.	.
FFD	-1.440	5.131	-19.58
	(-1.33)	(0.69)	(-0.82)
boardsize	-0.0688	-0.746	0.314
	(-0.41)	(-0.81)	(0.09)
age	0.00824	-0.0417	0.393
	(0.21)	(-0.15)	(0.36)
firmsize	-1.751***	6.798***	27.29**
	(-4.31)	(3.72)	(3.30)
year1	-0.493	(dropped)	(dropped)
	(-1.04)	.	.
year2	(dropped)	-1.031	-9.206
	.	(-0.55)	(-1.31)
year3	1.160***	-6.239*	-16.43*
	(4.48)	(-2.53)	(-2.03)
year4	(dropped)	-14.05***	-43.55***
	.	(-5.01)	(-3.85)
year5	(dropped)	(dropped)	(dropped)
	.	.	.
constant	29.57***	-84.95**	-380.3**
	(4.64)	(-2.76)	(-3.03)
N	293	645	647
R-sq	27,80%	14,30%	11,20%

t statistics in parentheses
="* p<0.05 ** p<0.01 *** p<0.001"
* p<0.05, ** p<0.01, *** p<0.001

Table 8 – regressions excluding the year variables

	(1)	(2)	(3)
	Tobin's Q	**ROA**	**ROE**
after2006	-0.754**	-8.974***	-21.97**
	(-2.94)	(-5.21)	(-3.18)
FFD	-1.221	4.251	-29.03
	(-1.05)	(0.61)	(-1.25)
boardsize	-0.0968	-1.258	-1.946
	(-0.53)	(-1.30)	(-0.55)
age	0.00241	-0.00181	0.526
	(0.05)	(-0.01)	(0.48)
firmsize	-1.665***	6.127***	24.68**
	(-4.38)	(3.70)	(3.11)
constant	28.47***	-75.51**	-341.9**
	(4.68)	(-2.64)	(-2.86)
N	293	645	647
R-sq	22,50%	9,00%	7,00%

t statistics in parentheses
="* p<0.05 ** p<0.01 *** p<0.001"
* p<0.05, ** p<0.01, *** p<0.001

(1) Tobin's Q: The findings show that the after2006 time variable, when regressing Tobin's Q, is highly statistically significant with a t-value of 4.37, and has a negative coefficient of -1.524.

This indicates a general consistent drop in performance after 2006. This gives support for hypothesis 1 a), that the law has affected performance, in this case negatively. Including control variables, and taking into effect that the financial crisis did not break out until the end of 2008, this finding is still statistically significant.

FFD is not statistically significant, even when not accounting for year fixed effects. This result does not support hypothesis 1 a), as the sudden increase of female directors has not significantly affected company performance in terms of Tobin's Q. This result contradict the results of Adams & Ferreira (2009) who suggest that the fraction of female directors has a negative impact on Tobin's Q. They further argue that this relationship should hold even in the case of a gender quota law. The results also contradict Carter et al. (2003) and Field & Keyes (2003) suggesting that board diversity has a positive impact on Tobin's Q.

Taking the effects of after2006 and FFD together, we can only partly support the first hypothesis that the market based performance of the company is affected by the gender quota law.

Firm size is highly statistically significant at a t-value of -4.31 and with a coefficient of -1.751. This indicates that bigger firms have suffered the most after 2006 and the introduction of the law.

Board size and age where both statistically insignificant. This contradicts the results in a previous study by Wahlsten & Wåhlin (2009) that found board size and age to be significant in explaining Tobin's Q. However, it is reasonable to believe that the variation in these factors have not been very large in the time period that is being studies. It is thus possible that a lot of the variation can in fact be described by firm fixed effects and that we due to controlling for them have lost significance among the control variables. Also, we note that the sample size for Tobin's Q is smaller than for the accounting variables (293 compared to all accounting variables above 645) which could further reduce our explanatory power. Consistent with our results are the findings of Adams & Ferreira 2009 showing no significance of board size when using firm fixed effects.

Year 2, 4 and 5 (2006, 2008 and 2009) were dropped, probably due to correlation with the other year variables.

R^2 of this regression is 27.8%, showing a reasonable explanatory power.

(2) Return on Assets (ROA): When regressing ROA on FFD and after2006, after2006 was dropped. This could be due to correlation with other year variables, or other factors in the regression. When running the regression without the year variables, the after2006 variable is not dropped and is highly statistically significant at t-value -5.21 and has a negative coefficient of -8.974.

The FFD variable is found to be statistically insignificant when using the regressing ROA. FFD is also insignificant when not controlling for year effects. This result is not consistent with the findings in Erhardt, Werbel and Sharder 2003 and Adams & Ferreira, 2009 who show weak significance when using similar methods. However, both these studies use larger samples.

The firm size variable is statistically significant, having a t-value of 3.72 and a coefficient of 6.798. This can be compared to the variable's negative coefficient when regressing Tobin's Q.

Board size is statistically insignificant; this result is inconsistent with the findings of Carter et al. (20003) showing that board diversity has a positive impact on ROA.

As after2006 was dropped and FFD was insignificant, these results do not support the first hypothesis.

The explanatory power of this regression was $R^2 = 14.30\%$.

(3) Return on Equity (ROE): when regressing ROE on the independent variables, the after2006 is dropped as in the regressions using ROA. This is probably a consequence of multicollinearity with the two other significant time variables (2007 and 2008). The after2006 variable is statistically significant when not controlling for year effects, supporting the idea that it is dropped due to high multicollinearity with the other statistically significant year variables.

The FFD variable is statistically insignificant and has a large negative coefficient. We cannot support hypothesis 1. a), that firm's performance, here as measured by ROE, has been affected by the gender quota law.

The firm size variable is statistically significant, although at a t-value of 3.30 suggesting an increase in performance as a consequence of growth in total assets.

The regression gives an R^2 of 11.2%, indicating small explanatory power to the variables used concerning how much FFD and after2006 and the control variables affect ROE.

Most effects in the regressions using performance proxies are captured by the year variables. One can conclude that the biggest effect on performance is the passage of time, and mainly the years 2007-2008. This can be pertaining to the law taking effect, but it can also be explained by the financial crisis that took full effect in 2008. FFD is insignificant for all of the regressions containing control variables. We thus cannot support the hypothesis 1 a), that the performance proxies used have been affected by the introduction of the law.

4.2.4 Results on risk regressions

Presented below are the risk regression results, where risk has been estimated using the proxies: D/E((4) in the table), D/ME (5), Fixed-To-Total Asset (6), Cash-To-Total Assets (7) and Cost of Equity (8); the results for each regression are presented in that order.

Table 9 – regressions for risk variables

(10) $R = \beta_0 + \beta_1$*after2006 + β_2*FFD + β_3*board size + β_4*age + β_5*firm size + δ_3*IndustryID+ δ_4*IndustryID + … + δ_n*IndustryID + δ_{n+1}*year1 + δ_{n+2}*year2 + … + δ_{n+5}*year5 + a + u

	(4)	(5)	(6)	(7)	(8)
	DebtEquityRatio	**DebtMarketEquityRatio**	**FixedToTotalAssets**	**CashToTotalAssets**	**Cost Of Equity**
after2006	(dropped)	2.540***	(dropped)	(dropped)	-0.0531***
	.	(3.45)	.	.	(-8.48)
FFD	0.545	-1.240	0.0819	-0.0320	-0.00750
	(0.51)	(-0.54)	(1.51)	(-0.60)	(-0.43)
boardsize	-0.0757	0.486	-0.00721	0.0114	0.00115
	(-0.44)	(1.30)	(-0.83)	(1.32)	(0.37)
age	-0.0251	-0.277	0.00418*	-0.00520*	-0.000101
	(-0.43)	(-1.97)	(1.97)	(-2.34)	(-0.16)
firmsize	0.569	1.743*	0.0325*	-0.0385	0.00348
	(1.55)	(2.12)	(2.01)	(-1.86)	(1.03)
year1	(dropped)	0.656	(dropped)	(dropped)	(dropped)
	.	(1.43)	.	.	.
year2	-0.128	(dropped)	-0.0371*	0.0257	-0.00248
	(-0.39)	.	(-2.28)	(1.51)	(-0.74)
year3	-0.595	-2.316***	-0.0200	0.0254	0.0497***
	(-1.32)	(-4.26)	(-1.07)	(1.32)	(9.36)
year4	0.485	(dropped)	0.0304	-0.0331	(dropped)
	(0.96)	.	(1.61)	(-1.67)	.
year5	(dropped)	(dropped)	(dropped)	(dropped)	(dropped)
	.	.	.	.	.
constant	-4.377	-12.43	-0.128	0.963***	-0.00631
	(-0.80)	(-1.06)	(-0.52)	(3.33)	(-0.11)
N	657	293	658	657	536
R-sq	2,40%	28,40%	11,10%	10,70%	37,60%

t statistics in parentheses
* p<0.05
* p<0.05, ** p<0.01, *** p<0.001

Table 10 – regressions excluding year variables

	(4)	(5)	(6)	(7)	(8)
	DebtEquityRatio	**DebtMarketEquityRatio**	**FixedToTotalAssets**	**CashToTotalAssets**	**Cost Of Equity**
after2006	0.00964	1.095*	0.0318*	-0.0216	-0.0247***
	(0.03)	(2.07)	(2.30)	(-1.57)	(-5.75)
FFD	0.411	-1.422	0.0445	-0.00404	-0.0124
	(0.36)	(-0.61)	(0.80)	(-0.07)	(-0.71)
boardsize	-0.00792	0.545	-0.00573	0.00869	-0.00266
	(-0.05)	(1.33)	(-0.63)	(0.96)	(-0.82)
age	-0.0337	-0.264	0.00365	-0.00466*	0.000343
	(-0.56)	(-1.81)	(1.70)	(-2.09)	(0.43)
firmsize	0.575	1.678*	0.0269	-0.0353	0.00125
	(1.58)	(2.06)	(1.68)	(-1.79)	(0.35)
constant	-4.387	-12.14	-0.0397	0.910***	0.0208
	(-0.83)	(-1.09)	(-0.17)	(3.33)	(0.32)
N	657	293	658	657	536
R-sq	1,00%	18,30%	7,00%	6,50%	12,40%

t statistics in parentheses
* p<0.05
* p<0.05, ** p<0.01, *** p<0.001

(4) Debt/Equity: The FFD is highly statistically insignificant when regressing D/E using firm fixed effects. This also holds when regressing without using firm fixed and year effects.

The after 2006 is dropped when controlling for year effects and statistically insignificant when not controlling for these. Neither independent variables, nor any control variables are significant when controlling for year effects indicating no certain reason for multicollinearity. We can thus not support our second hypothesis regressing D/E on FFD and after2006.

The variables used in this regression only explain D/E to 2.4% (R^2 = 0.0240), a very low explanatory power.

(5) Debt/Market Equity: D/ME is different from D/E as the former is a market based measure for risk, and the later is accounting based. D/ME uses the market value of equity, while D/E uses the book value of equity. When regressing D/ME, we observe big differences in the result when comparing to D/E.

After2006 is highly statistically significant at a t-value of 3.45 and has a very large coefficient at a value of 2.540. An increase in firm risk taking is thus observed after 2006, as measured by D/ME.

The independent variable FFD is insignificant. As FFD is insignificant but after2006 is highly significant, We can only partly support the second hypothesis regressing D/ME on FFD and after2006.

The firm size variable is statistically significant at a t-value of 2.12 and has a coefficient of 1.743. This indicates a big increase in risk taking for each change in firm size.

The control variable year 2007 is highly statistically significant at a t-value of 4.26. The coefficient is negative with a value of -2.316. This suggests that the need for financial leverage was lower before the financial crisis in 2008 and financial risk taking thus was low. As the after2006 variable showed an increase in leveraging after the year 2006, this could indicate that the after2006 variable mostly captures effects for the year 2008.

The variables used in regressing D/ME have a much higher explanatory power than when used in D/E regression; in the case of D/ME, R^2 is 28.40%.

(6) Fixed-To-Total Assets: The FFD independent variable is statistically insignificant and the variable after206 dropped when regressing Fixed-To-Total Assets.

The only significant control variables are age, firm sized and the year variable 2006. The significance levels are low however, being t=1.97 for age, t=2.01 for firm size and t=-2.28 for the year variable 2006.

Taking the results of regressing Fixed-To-Total Assets, I cannot support hypothesis 1.b), that firm risk taking has decreased due to the Norwegian gender quota law.

The explanatory power of the variables used when regressing Fixed-To-Total Assets is 11.10%.

(7) Cash-To-Total Assets: When regressing Cash-To-Total Assets, the after2006 variable is dropped and the FFD variable is insignificant.

The only significant control variable is the age variable with a coefficient of -0.00520 and a t-value of -2.34.This can indicate that the drop in the average age of the board members has had a positive effect on firm risk taking (as the operating risk has decreased).

As in the case of the Fixed-To-Total Assets variable, this measure of operating risk has not been affected by the introduction of the law, and I can thus not support hypothesis 1.b).

The explanatory power of the variables used is almost the same as in the case of the Fixed-To-Total Assets regression, at an R^2 of 10.70%.

4.2.5 Results on cost of equity regressions

(8) Cost of Equity: the variable after2006 is highly statistically significant when regression the Cost of Equity, with a t-value of -8.48 and a coefficient of -0.0531. This would indicate that the expected return equity holders would receive has decreased after the introduction of the law. However, the financial crisis has caused an overall drop in risk-free interest rates, hence lowering the cost of capital for all firms. A low cost of equity can thus be due to generally low risk free interest rates.

The FFD variable is statistically insignificant when regressing the Cost of Equity. We can thus partly support our third hypothesis, as FFD is insignificant but after2006 is highly statistically significant.

The year variable 2007 is highly statistically significant at a t-value of 9.36 and has a positive coefficient of 0.0497. This indicates that firms risk as measured by the cost of equity increased in 2007. This goes against the after2006 variable being negative, but the year variable 2007 only captures the effect of one year, whilst the after2006 captures effects of the years 2006 and onwards.

When regressing the Cost of Equity without including the year variables, the explanatory power decreases dramatically; from 37.60% when including the year variables to 12.40% when excluding them.

4.3 Summary analysis

We conclude the analysis of the three hypotheses with a short summary.

The results on the after 2006 variable suggest that when looking at Tobin's Q, Debt-to-market equity and the Cost of Equity, there has been a consistent effect for the years in which the law has been in effect. The fact that this effect is shown in the proxies that combine market and accounting values suggest that the market may have adjusted their expectations of the return on their invested equity. Such an adjustment may depend on the changes in corporate governance that the law has introduced.

FFD is insignificant for all regressions, even when excluding year variables. Given that the after2006 variable might contain disturbances not caused by the introduction of the law and that the FFD variable is insignificant we do not find sufficient support for our hypotheses 1a) through 1c).

5. Discussion and Conclusions

We will present my conclusions and discussion in this section. We will include comments and remarks on further research that can be done in this field.

5.1 Conclusions

Using the unique opportunity that the Norwegian gender quota law has opened up, we have examined the effects it has had on firms' performance and firms' risk taking.

The results suggest that the law has not affected firm performance, firm risk taking or the cost of equity. We can thus draw the conclusion that the law has not affected companies in a significant way, when looking at their performance, firm risk taking or their cost of capital.

These are very interesting results, as there have been divergent views on how a quota law might affect companies. These findings go against one side of previous research which shows a significant relationship between the fraction of female board directors and firm performance and risk taking (Carter, Simpkins & Simpson 2003; Erhardt 2003; Wahlsten & Wåhlin 2009).

One important thing to take into consideration when analyzing previous research done on the subject of corporate governance and board characteristics is the problem of endogeneity. With the use of the exogenous variables FFD (Fraction of female directors) and after2006, w have to a large extent surmounted this problem.

5.2 Discussion and further research

The previous section presented regression analysis on the effects the introduction of the law has had.

The only independent variable whose change throughout the years is truly an exogenous effect after the introduction of the law is the fraction of female directors. When controlling for the necessary firm fixed effects and year, any significance that it previously have had on the dependent variables has disappeared. This makes us unable to prove that the introduction of the law has had an effect on the profitability, risk taking and cost of equity for those companies that were required to comply by the law. Also, the tendencies of the coefficients to vary within categories of proxies make me unable to estimate a trend.

We believe that Tobin's Q is a good and consistent measure of performance. However, we note that stock markets can be volatile and the comparison of equity at accounting and market value leave some type of random effect that will increase significance of dependent variables.

We estimated the cost of capital using the capital asset pricing model (CAPM). We are fully aware that the model has suffered from severe problems (Fama & French, 1992). However, we have decided to use the model due to the fact that much of the change in cost of equity from corporate governance variables can be explained by this model (Garmaise & Giu 2005). Asbaugh et al. (2004) show that if cost of equity is affected by corporate governance, only a part of the change in the cost will be reflected in the market beta. Hence, it is possible that we have under-measured the change in cost of equity from that perspective by simply relying on the CAPM estimates.

When controlling for both firm fixed effects and year effects we have a generally low level of significance for the control variables, both those related to corporate governance and those not. This is in some cases contradictive to previous studies showing these variables should matter. It is possible that the variations of these factors within the firms have not been large enough to affect our results, given our limited data sample.

Other research done on corporate governance and the effect of female board directors on firms have included more extensive board characteristics than those applied in this study. Previous research has included the activities of the boards' monitoring committees and directors' background such as CEO experience (Adams & Ferreira 2009) and directors' independence. Such variables should be controlled for in future studies, though our belief is that they will not change the results significantly, as they are simply control variables. In order to fully evaluate the Norwegian quota law and its effect, we need to wait a few more years in order to obtain a larger sample.

The natural experiment that the Norwegian quota law entails has opened up new possibilities in the research of corporate governance and board characteristics where endogeneity no longer poses a problem, and we believe that our study will open up the way for further studies in the field.

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