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The Impact of the German Corporate Gender Quota: An Early View

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Abstract

In 2015, the German government introduced a mandatory quota requiring at minimum 30% equal gender representation on the supervisory boards of publicly listed and parity co-determined companies. We use two panel databases of 78 German firms to explore the effect of gender quotas on firms' financial performance and board structure. Our findings indicate that companies that comply with the quota and have more than 30% women in their supervisory board structure underperformed their counterparts. The gender quota led to older, more experienced supervisory boards but with less Ph.D. or MBA graduates.

Keywords: Gender quota, gender diversity, board composition, financial performance JEL codes: J48, G34, G38

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List of Abbreviations

- EIGE European Institute for Gender Equality
- EU European Union
- OLS Ordinary Least Squares
- ROA Return On Assets
- ROE Return on Equity
- GICS Global Industry Classification Standard

1 Introduction

The United Nation's 2030 Agenda considers gender disparities as one of the most prominent obstacles to sustainable development. Therefore, gender equality and the empowerment of women has been selected as one of the United Nation's 17 Sustainable Development Goals which underscores the imperative need for action on this issue. Amongst others, the goal highlights the imperative need to *"ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life."* (United Nations, 2015). As a result, numerous worldwide events, initiatives, and policies have implemented from governments, NGOs and corporations to tackle gender disparities in the top management positions and break the glass ceiling, the term used to highlight gender disparities in the workplace.

For instance, the European Commission's actions to foster gender equality are highlighted by key publications such as the "European Pact for Gender Equality" and, more recently, the "EU Action Plan 2017-2019: Tackling the gender pay gap" (European Commission, 2011, 2017). On the same line was the European Commission's 2012/0299 proposal for a "Directive of the European Parliament and of the Council on improving the gender balance among non-executive directors of companies listed on stock exchange and related measures" (European Commission, 2012) which constituted the first attempt to address the shy progress on gender imbalances in economic-decision making and to promote female participation in corporate boardrooms. The Council of the EU rejected the proposed directive by a qualifying majority, but multiple European countries have enacted national gender quotas since then.

Even though the gender composition of corporate boardrooms has come in the spotlight with significant academic contributions and growing prominence in the public debate, the empirical literature with regards to the effect of gender quotas is still at infancy with a small yet growing amount of contributions. Therefore, the goal of this paper is to offer factbased insights on this branch of the literature by analyzing the introduction of a mandatory quota requirement for a minimum 30% representation of both genders on the supervisory boards of publicly listed and parity co-determined companies in Germany.

The German statutory quota was ratified in 2015 affecting in total 107 companies. We collect market data and historical supervisory board composition data over the period 2010 to 2017 on a yearly basis for 78 of these firm which is equivalent to c.72% of the population and construct two distinct databases. The first database consists of 624 firm-year observations and it is used as input for the OLS and the firm fixed effects regressions in order to shed light on the effect of gender diversity and gender quotas on firms' financial performance. The second database contains 9,585 observations regarding the members on the supervisory board for each company and every year, and it will be employed in order to analyze the transformation of the board structure due to the quota requirement.

Our findings indicate that gender diversity has little to no impact on the financial performance of German firms as the effect was positive and statistically significant but of an almost zero magnitude. Concerning the impact of the German statutory gender quota on the financial performance, we find that companies that comply with the quota and have more than 30% women in their supervisory board structure underperformed their counterparts. This result is in line with the findings of other papers in the literature such as Ahern and Dittmar (2012) and Dale-Olsen, Schøne, and Verner (2013) analyzing the effect of a mandatory quota in the case of Norway and Comi, Grasseni, Origo, and Pagani (2017) investigating the impact of gender quota rules in Spain, Belgium and France. Ultimately, our data suggest that the transformation of German supervisory boards due to the gender quota requirement led to older, more experienced supervisory boards but with less Ph.D. or MBA graduates.

The rest of the paper is organized as follows. Section 2 provides an elaborate review of the various mandatory gender quota laws across Europe. Section 3 presents the literature review on the effect gender composition of corporate boardrooms and puts a strong focus in the context of gender quotas. Also, it sets our empirical research questions. Section 4 describes the data collection methods and the methodology of our empirical analysis. Section 5 introduces the results of our analysis and, ultimately, Section 6 concludes.

2 Gender quota laws across Europe

In this section, we analyze the various mandatory gender quota laws across Europe. This is a necessary step before we conduct our analysis since the type of the companies affected by a gender quota and the implemented sanctions in case of non-compliance may have important implications with respect to the outcome of the law on firms' performance and corporate boardroom structure. For example, a binding gender quota with substantial fines would be expected to have a greater impact than a comply-or-explain legislation. Initially, we describe the mandatory gender quota directive proposed by the European Commission in 2012. Next, we briefly present voted gender quotas on a national level starting from the case of Norway as the oldest case-study and we analyze in more detail the German quota for which we will conduct our empirical research. Concluding, we present data from European Institute for Gender Equality (EIGE) regarding the percentage of women on corporate boardrooms in the countries we have analyzed.

2.1 European Commission

Gender disparities have always been at the core of the European Commission's agenda as highlighted by key publications such as the "European Pact for Gender Equality" and, more recently, the "EU Action Plan 2017-2019: Tackling the gender pay gap" (European Commission, 2011, 2017). On the same line was the European Commission's 2012/0299 proposal for a "Directive of the European Parliament and of the Council on improving the gender balance among non-executive directors of companies listed on stock exchange and related measures" (European Commission, 2012) which constituted the first attempt to address the shy progress on gender imbalances in economic-decision making and to promote female participation in corporate boardrooms.

In particular, the proposal suggested the introduction of a binding 40% quota of the underrepresented gender for all non-executive boards of publicly listed companies. In case of contravention, the directive stated that the Member States should be responsible for introducing coercive sanctions to the non-complied firms starting from January 2020 and onwards. In addition, the European Commission's encompassed measures to enhance the transparency of candidates selection process and further provisions with regards to the monitoring and implementation of the directive. Nonetheless, the Council of the EU rejected the proposed directive by a qualifying majority vote and the directive is now on hold. The main arguments of the Netherlands, Denmark, the UK and Sweden which voted down the binding gender quota were two. First, these countries highlighted that policies related to gender quotas should be opted locally and, second, they claimed the superiority of alternative measures in promoting gender diversity over binding quotas.

Consequently, despite the early initiative from the European Commission for a mandatory gender quota on a European level, the recommended directive was never implemented. Indeed, many European countries have currently gender quotas in place which apply to companies with different legal structure and size, but most importantly with different sanctions in case of non-compliance. Therefore, it is imperative to highlight the differences in the designs in order to be able to draw valid conclusions during our empirical analysis.

2.2 Norway

Norway is the oldest and best-documented case-study of a mandatory gender quota. In December 2003, the Norwegian parliament ratified a law requiring all public limited liability firms to possess at least 40% women directors on their board structure by July 2015 in order to tackle gender disparities in the composition of the corporate boardrooms. The 40% quota level applied to both executive and non-executive members and, initially, the compliance was opted to be voluntary. However, on the grounds of shy progress under the voluntary compliance scheme, the national parliament made the legislation compulsory in 2006 offering a two-year grace period with failure to adhere leading to substantial financial fines or even dissolution of the non-complied firm (Ahern & Dittmar, 2012).

2.3 Spain

Spain was an early adopter of Norway's example being the first country in the European Union legislating a non-mandatory gender quota on the corporate boardrooms. The enacted 2007 Equality Act required at least 40% of the board of the executive directors in all listed and private firms to be women by 2015, but there were no legal punishments or fines for non-compliers. Nevertheless, under this law, complied firms would receive preferential treatment concerning the government's projects and contracts.

Gabaldon and Giménez ("2017") highlight that among the listed companies in the IBEX 35 index in 2007, there were just 10 women among 478 board members or about 2% of the total. Currently, this percentage stands at about 23% based on data from the EIGE. In addition to the Equality Act which is still in place, the 2015 Spanish Corporate Governance Code set a goal of 30% women representation on corporate boards by 2020.

2.4 Iceland

As early as 2010, Iceland followed the examples of Norway and Spain, passing a gender quota of 40% on firms supervisory boards with a compliance date at the beginning of September 2013. The Icelandic quota had an extensive nature requiring from all government-held enterprises, stock listed companies and private limited companies to comply but it had no punitive sanctions for non-compliers (Deloitte, 2017). Nevertheless, data from EIGE show that women participation in the largest firms increased from 15.8% in 2010 to 48% in 2013.

2.5 France

In 2011, the French parliament passed the Copé-Zimmermann law setting a mandatory gender quota of 40% in both supervisory boards and boards of directors in order to tackle gender disparities in the corporate decision making. The enacted law applied to about

2,000 firms which belong to at least one of the following two categories: (1) companies listed in the CAC 40 index or (2) firms with either more than 500 employees or with revenues over $50 \in$ million over the previous three financial years (Soulier-Avocats, 2016).

Regarding the implementation of the law, it was decided to be progressive over a period of six years to provide targeted companies with sufficient time to adjust to the changes. In particular, all targeted firms could not have women representation of less than 20% by 2014 while they should meet the 40% gender quota at the beginning of 2017. Furthermore, non-adhering companies do not face such strict sanctions as in the case of Norway but the members of the boards are not entitled to remuneration when the composition of the board is not in line with the quota (Zenou, Allemand, & Brullebaut, 2017). In addition, appointing a board member without satisfying the quota lead to automatic cancellation of the appointment.

2.6 Belgium

The Belgian House of Representatives ratified in 2011 a mandatory gender quota stating that at least 33% of the board members must be of the opposite gender, but the compliance date of the law varies for companies with a different structure. More specifically, state-owned companies were obliged to comply with the law in 2012, large listed companies by 2017 and listed SME's must adhere two years later than large ones. Moreover, publicly listed firms have to report annually on the undertaken measures in order to ensure that they are compliant with the regulation. All companies that fail to comply with the quota are obliged to appoint as next board member that of the underrepresented gender. On top of that, the board members of publicly listed companies are not entailed to monetary and non-monetary remuneration if the composition of the board fails to adhere to the gender quota (Levrau, 2017).

2.7 Italy

The mandatory Italian quota enacted under the Legge Golfo-Mosca Act and requires all executive and supervisory boards of government-held and publicly listed firms to have no less than 33% of the underrepresented gender. The regulation demanded targeted companies to achieve a 20% target by 2012 and the final target of 33% one year later. However, the law is set to be binding only until 2022 and then companies would be able to choose their board members freely (Rigolini & Huse, 2017; De Vita & Magliocco, 2018).

The enforcement of the quota is appointed to the Italian Companies and Exchange Commission which is the primary regulatory body for the Italian Stock Exchange. If a company fails to comply with the established gender quota level, it faces fines and nullification of the appointment (CONSOB, 2011).

2.8 Dutch quota

In 2011, the Dutch government legislated a 30% non-mandatory gender quota under the Management and Supervision Act. The effective date of the regulation was set in January 2013 with an expiration date by 2016. However, the shy progress with regards to gender imbalances in the corporate boards led the Dutch government to extend it highlighting also that it will proceed to more active measures shortly if firms fail to promote gender diversity by themselves (Deloitte, 2017).

The enacted regulation concerned only large public (NV) and private limited companies (BV) which fulfill at minimum one of the following requirements: (1) the firm employs more than 250 people (2) the company realizes a net annual turnover of more than $35 \in$ million or (3) it has total assets that exceed the $17.5 \in$ million threshold (Henderikse & Pouwels, 2016). As compliance to the gender quota was not mandatory, firms did not encounter sanctions for not meeting the 30% threshold, but they only had to explain the reasons why they do not comply and the taken steps to achieve the target in the future on their annual report (Kruisinga & Senden, 2017).

2.9 Germany

The discussion for a gender quota in Germany started in parallel with the other core European countries around 2010 and in May of the same year, the German Corporate Governance Code was modified to underscore the need for an appropriate representation of both genders on the supervisory boards. However, any political efforts to impose legal restrictions on corporations was blocked by the conservative-liberal coalition between the Christian Democratic Party and the Free Democratic Party (Kirsch, 2017). The following years, Bührmann (2014) argues that multiple women's associations were formed and had a significant impact on public debate due to the persistent imbalances in the economicdecision making positions on the side of the firms. Indeed, the 2013 federal elections led to a coalition among the Christian Democratic Party and the Social Democratic Party which announced the intention to introduce a statutory gender quota (CDU, CSU, & SPD, 2013). This intention realized in May 2015 when the government enacted the "Act on Equal Participation of Men and Women in Leadership Positions in the Private and the Public Sector" introducing a statutory 30%-quota and self-determined women targets. Therefore, the quota was exogenously introduced to the firms.

The mandatory quota required at minimum 30% representation of both genders on the supervisory boards of publicly listed and parity co-determined companies. In essence, these are public limited companies ("AG"), partnerships limited by shares ("KGaA") and European companies (Societas Europaea - "SE") which are parity co-determined and have more than 2,000 employees on a regular basis (Linklaters, 2015). According to Weckes (2015) only 107 companies were subject to the statutory 30%-quota requirement. Furthermore, the effective date of the law was set to be on 1 January 2016 with non-compliance resulting in empty board seats and nullity of appointments in the supervisory board. It should be noted that German companies follow a two-tier corporate governance system where there is a clear distinction between the management and the supervisory board. Hence, the composition of the management board was not subject to the statutory gender requirement.

The self-determined women targets are related to individual gender goals set independently by each firm for both supervisory and management boards. The law firms Slaughter May, Bredin Prat and Hengeler Mueller (2016) estimate that this legal requirement affects approximately 3,500 companies. In particular, this legal requirement applies to all publicly listed companies and all co-determined companies with more than 500 employees whereas non-adherence could lead to an administrative fine up to $50,000 \in$.

Figure 1 summarizes the differences in applicability between the statutory gender quota and the self-determined targets. Concluding, we note that in the empirical part we will analyze the effect of the statutory gender quota.



Figure 1: An overview of the German gender quota

Source: The Law for the Equal Participation of Women and Men in Leadership Positions in the Private Sector and the Public Sector (Accessed via: https://bit.ly/293weGy)

2.10 Austria

Austria constitutes the most recent European country legislating a mandatory gender quota on the corporate boardrooms as during the last year the Austrian parliament voted in favor of a 30% gender quota on the supervisory boards. The passed legislation affects publicly listed companies, firms which employ more than 1,000 people and those whose supervisory board consists of more than six employer's representatives. Moreover, the targeted companies have to comply with the gender quota by the end of 2018 while failure to adhere must leave the seat empty until the fill it with the underrepresented gender (Mensi-Klarbach, 2017).

Country	Year quota voted	Legislated quota level	Compliance year	Sanctions	Governance code
Austria	2017	35%	2018	Yes	2009
Belgium	2011	33%	2017	Yes	2009
Bulgaria	_	_	_	_	_
Croatia	—	_	—	—	_
Cyprus	—	_	—	—	_
Czech Republic	—	_	—	—	_
Denmark	—	_	—	—	2008
Estonia	—	_	—	—	_
Finland	—	_	—	—	2008
France	2011	40%	2017	Yes	2010
Germany	2015	30%	2016	Yes	2010
Greece	—	_	—	—	2013
Hungary	—	_	—	—	_
Iceland	2010	40%	2013	No	2011
Ireland	—	_	—	—	_
Italy	2011	33%	2015	Yes	2011
Latvia	—	_	—	—	_
Lithuania	_	_	—	—	_
Luxembourg	_	_	_	—	2009
Malta	_	_	—	_	_
Netherlands	2011	30%	2013	No	2009
Norway	2003	40%	2008	Yes	2009
Poland	_	_	—	_	2010
Portugal	_	_	—	_	2015
Romania	_	_	—	_	2016
Slovakia	_	_	—	_	_
Slovenia	_	_	—	_	_
Spain	2007	40%	2015	No	2006
Sweden	_	_	_	_	2008
United Kingdom	_	_	_	_	2010

Table 1: Corporate gender quota laws for the EU-28 countries, Iceland and Norway

Notes: 1. In Greece a 33% mandatory quota applies only to state-owned companies 2. Governance code refers to year that self-regulation or soft policy measures were included in the Corporate Governance Code of the country regarding the gender balance within boardrooms. 3. (-) indicates that there is no implemented corporate gender quota or Corporate Governance Code recommendations/requirements. Source: Authors' creation based on data from Ahern and Dittmar (2012), Magda, Angela, and

Rossella (2015), European Commission (2016), and Deloitte (2017)



Figure 2: Percentage of women supervisory board members for the largest listed companies

Note: The database covers only firms of each country's primary blue-chip index (max 50). For more details regarding EIGE's methodology: https://bit.ly/2NLfdl0 Source: The Gender Statistics Database of the EIGE

3 Literature review

In recent years, the gender composition of corporate boardrooms has come in the spotlight with significant academic contributions and growing prominence in the public debate. To the best of our knowledge, the most comprehensive analysis of the academic literature on the topic comes from Kirsch (2018) who systematically reviews 316 articles on gender equality and the composition of the corporate boards from the 1980s and onwards. Author's study identifies the following four main streams of research (Kirsch, 2018):

- Stream 1: Researchers have investigated to what extent individual women directors differ from their male counterparts. Their results indicate that there are some gender differences in the social, demographic and human capital characteristics between male and female directors shaping the behavior of the board.
- Stream 2: Scholars have also sought to grasp the determinants of the corporate board gender composition. The findings highlight that a range of macro-, meso- and micro-level factors form the institutional, organizational and social environment, respectively, which facilitates or hinders a more equal gender representation in the corporate boardrooms.
- Stream 3: Another stream of the literature tries to understand the impact of the composition of the boardrooms on firms' outcomes. Overall, the existing literature uncovers a negligible impact of boardroom composition on the financial performance of the firm and a positive outcome on firms' behavior regardings ethical aspects and social practices. Nevertheless, Adams, Hermalin, and Weisbach (2010) and Adams (2016) underscore that many of the studies suffer from reverse causality and omitted variables bias when using a gender proxy to establish a causal inference between firms' outcomes and the composition of the board.
- Stream 4: The most recent stream of research has evolved over the last decade and evaluates the effect of national regulations on the composition of the board, firm financial outcomes, firms behavior and the outcome for females. As the Norwegian quota is the oldest and most-documented case-study of mandatory gender legislation in Europe, most of the empirical evidence is drawn from papers investigating the impact of the quota on Norwegian companies. Indeed, there are some preliminary evidence for the impact on other European countries as well drawn from the papers of Singh, Point, and Moulin (2015) and Comi et al. (2017), but none of them analyzes the case of Germany.

Consequently, the results of this paper have significant empirical implications contributing, altogether, to the fourth stream of research regarding the gender composition of the boards. In particular, we analyze the effect of the German mandatory gender quota (See Section 2.9) on firms' financial performance and board gender composition. To the best of our knowledge, this is the first quantitative analysis for the largest European economy.

3.1 Empirical literature on gender quotas

Since Norway was the first country to implement a gender quota law, it has long served as a case study on the effects of mandatory gender quotas on corporate boardrooms and the performance of the firm. Therefore, we start this section with empirical papers for the Norwegian case and, then, we present some evidence for other European countries.

Ahern and Dittmar (2012) examine whether the introduction of the 40% gender quota in Norway impacted firms' outcomes by employing an instrumental variable approach. As an exogenous instrument, the authors use the pre-quota cross-sectional variations in women representation in the corporate boards and employ a sample of 248 Norwegian companies over the period 2001-2009. Accordingly, their findings indicate that the introduction of the mandatory gender quota law negatively affected firms' financial performance which recorded a substantial drop in Tobin's Q ratio, worsened leverage positions and a decline in their operating performance. Moreover, the authors provide evidence that companies with a lower number of women representation on their boards before the mandatory quota are more likely to be delisted or move abroad after the ratified regulation in order to avoid compliance with the law. Finally, regarding the effect on the characteristics of the boardroom, Ahern and Dittmar (2012) highlight that the enacted quota led to more educated and younger boardrooms with a higher probability to be employed as non-executive members but with less experience.

Another essential contribution examining the effect of the mandatory gender quota in Norway comes from Dale-Olsen et al. (2013). The researchers investigate the short-run impact of more diverse corporate boardrooms due to the exogenously imposed constraint on firms' financial performance as measured by Return On Assets (ROA). In more detail, they use a population-wide panel for the period 2003-2007 which consists of accounting data for all Norwegian Publicly Limited Companies and Ordinary Limited Companies and apply a difference-in-difference model in order to examine if the performance of the affected firms differs from the performance of the unaffected companies for the period before and after the quota intervention. Dale-Olsen et al. (2013) methodology yields a negligible effect of the gender quota which led the authors to conclude either that the impact of the regulation is small or that the newly appointed female board members failed to bring remarkably different skills and ideas compared to the replaced male peers.

Next, concerning the impact of the quotas on the gender gap, Wang and Kelan (2013) employ a probit regression model during the period 2001-2010 and analyze whether the Norwegian quota alters the probability of having women appointed as either a corporate board member or a CEO. For the former, their empirical estimates show that the enhanced female presence in the boardrooms due to the quota is indeed positively associated with women's qualifications, age, and independence. Thus, the probability to appoint a female director is larger for companies with older and more educated female board members. For the latter, they find that the likelihood of a female being appointed as a CEO rises with the independence and the qualifications of the directors but the result depends on the existence of a critical mass of at minimum three female directors.

Matsa and Miller (2013) analyze the impact of the Norwegian quota on the corporate decisions and corporate leadership style. The authors employ a triple-difference identification method considering not only differences between the treated and untreated firms within Norway but also cross-country variations across the other Nordic firms. Their findings indicate that targeted firms realized a decrease in short-term profits compared to the unaffected firms because they recorded larger labor costs, had fewer layoffs and higher employment levels. Hence, they conclude that the mandatory gender quota brings a change in the managerial style and corporate strategy of the firms.

Bertrand, Black, Jensen, and Lleras-Muney (2014; 2018) study the direct and indirect labor market outcomes of the enacted gender quota in Norway using data for all Norwegian population aged between 16 and 64 years old over the period 1984-2014. For their identification strategy the authors use the pre- and post-reform variation in order to capture the exogenously mandated changes on the composition of the boardrooms. Although their results yield a smaller gender and pay gap in the aftermath of the reform, the representation of women in other leadership positions apart from the board members remained unchanged. Hence, the authors find no spillover effects from the top to the bottom of the hierarchy. Additionally, the business environment remained unchanged with regards to family-friendly policies.

Regarding the effect of the gender quota laws in the European Union, the empirical evidence is still at infancy. Singh et al. (2015) approach the quota as an environmental threat and investigate how the threat of imposing a gender quota on corporate boardrooms affects female representation and the characteristics of the board members. The authors use data for French companies in the SBF 120 Index for the period 2008-2010 and observe the composition of firms board members. Their findings indicate that female representation in the corporate boardrooms increased under the threat of the gender quota with the newly appointed female board members being younger and with more international experiences compared to the male peers. The result also holds for boardrooms having already multiple women directors. Therefore, they conclude that the candidate pool for women directors was expanded under the threat of the gender quota in order to include women with higher human capital skills.

Besides, Comi et al. (2017) follow a similar methodology with Dale-Olsen et al. (2013) and investigate the effect of the gender quotas in Spain, Belgium, France and Italy using accounting data. In line with the empirical evidence in the case of Norway, the authors find either negligible or negative impact of gender quota laws on firms' financial outcomes. The only exception is Italy where the authors identify a positive impact. To explain this country-specific result, they analyze the characteristics of the boardrooms in Italian firms and conclude that the gender quota regulation led to a general restructuring of the boardrooms. Appointed women directors were more highly educated and less experienced compared to male peers, but also newly appointed male board members were more experienced compared to the male peers before the quota.

3.2 Hypotheses

Based on the findings of the empirical literature, we formulate and examine three distinct hypotheses in this thesis in order to broaden our understanding of a mandatory gender quota on firms' supervisory boards without monetary fines. The formulated hypotheses are the following:

- Hypothesis 1. More diverse supervisory boards are associated with better financial performance.
- Hypothesis 2. German firms satisfying the mandatory gender quota requirement achieved better financial performance compared to those who failed to do so.
- Hypothesis 3. The mandated gender quota has led to younger and more educated board members.

4 Data and Methodology

This section of the paper describes the data sample employed on the empirical part and the data collection methods. Furthermore, we explain the methodology used in order to investigate the formulated research questions. Lastly, we present the descriptive statistics of the data.

4.1 Data description

The German statutory quota applies to the supervisory boards of all publicly listed and parity co-determined companies affecting in total 107 companies when the law was ratified in 2015 (Weckes, 2015). For these firms, we collect market data and historical supervisory board composition data over the period 2010 to 2017 on a yearly basis. This allows us to have a window of three years before the announcement of the corporate gender quota, three years in the timespan between the announcement and the implementation, and two years since the implementation of the legislation.

All the financial and accounting data were gathered from Bureau van Dijk's database Orbis. Even though the Orbis database provides an extensive array of coverage on business information, data on the historical composition of boardrooms are not available. Therefore, we collect historical supervisory board composition data from firms' annual reports. For each supervisory board member, we record information about person's name, gender, age, nationality, current outside occupation, education, prior experience as CEO, the number of years as board member and whether the person is an employee or a shareholders' representative. To identify this information we use the following steps. First, we search whether there is a photograph in the annual report revealing the gender of the respective person. Second, we search if there is a curriculum vitae of the person on the company's website. Lastly, we use the business intelligence service BoardEx which contains in-depth personal and professional information on public company board members to fill in any gaps. All variable definitions are provided in Appendix Table A.1.

Overall, we managed to gather data for 78 of the companies which are equivalent to c.72% of the population. The rest of the companies either have merged, acquired or they have no information on the composition of the supervisory board throughout our analysis and, therefore, have been exlcuded from the analysis. We provide a full list with the names of the companies on the Appendix Table A.3 also indicating which ones have been included in our analysis.

Furthermore, we use the Orbis database to obtain the sector of each company based on the 11 sectors defined by the Global Industry Classification Standard (GICS). However, given the fact that some sectors include only one or two companies, we reclassify the 78 firms in eight major sectors defined as follows: 1. Energy, 2. Materials, 3. Industrials, 4. Consumer Products, 5. Health Care, 6. Financials, 7. IT - Telecom and 8. Utilities. All the reclassifications can be found on the Appendix Table A.2.

Therefore, after following the aforementioned procedure, we end up with two distinct

databases. The first database consists of 624 firm-year observations and it will be used to investigate Hypothesis 1 and Hypothesis 2. The second database contains 9,585 observations regarding the members on the supervisory board for each company and every year, and it will be employed in order to investigate Hypothesis 3. However, it should be noted that firms in the Financials sector have been excluded from the empirical part of our analysis since their ratios tend to be substantially different compared to the other sectors.

4.2 Empirical Methodology

For our empirical model, the first step is to define the independent variable of our analysis which reflects a firm's financial performance. In the literature, there are two distinct types of measures used to capture financial performance: stock-based measures and accounting variables. We follow prior research on the literature of corporate governance (Yermack, 1996; Coles, Daniel, & Naveen, 2008; Ahern & Dittmar, 2012) and we employ the stock-based variable Tobin's Q ratio in order to capture companies' financial performance because accounting measures are substantially affected by changes in the accounting standards. The interpretation of the Tobin's Q ratio is quite straightforward. When the ratio exceeds the value of 1 the firm is overvalued and, vice versa, if the ratio is between 0 and 1 the company is undervalued. The Tobin's Q ratio is calculated as follows:

$$Tobin's \ Q = \frac{Total \ Market \ Value}{Total \ Assets \ Value} = \frac{Share \ Price \ * \ Number \ of \ Shares \ Outstanding}{Total \ Assets \ Value}$$

Next, we generate a binary *Quota* dummy which takes the value of 1 if the company satisfies the quota in any given year, i.e. 2016 or 2017, and 0 otherwise. Furthermore, using the data obtained from firms' annual reports, we calculate the diversity on the supervisory board for every firm-year observation measured in percentages by the following equation:

$$Gender \ Diversity = \frac{Number \ of \ Women \ in \ the \ Supervisory \ Board}{Total \ Members \ in \ the \ Supervisory \ Board} * 100$$

Additionally, we include a set of control variables into our models in order to control for differences in firms' financial performance due to external factors other than diversity in the supervisory board. More specifically, we include three control variables related to the size of the firm which are the board size, the natural logarithm of the number of employees and the natural logarithm of firms' total assets. In addition, we use Return on Assets (ROA), Return on Equity (ROE) and debt ratio (leverage) to control for difference in the earnings capacity and management efficiency of the firms. More information about the definitions of the employed financial ratios are presented in the Appendix Table A.1. Indeed, we believe that the inclusion of those control variables are crucial as they may affect the probability of a woman being elected as a member of the supervisory board.

The formulated hypotheses in the Section 3.2 will be investigated by using an Ordinary Least Squares (OLS) as a simple baseline model and a firm fixed effects model allowing to control for unobserved time-invariant heterogeneity of the firm characteristics. Hausman test and Mundlak's approach will be jointly used to choose between firm fixed and random effects. Also, it is possible the performance of the firms within each sector to be correlated due to sector-specific characteristics. In that case, the standard errors generated by OLS regression are incorrect since the residuals are not independently and identically distributed (i.i.d). Therefore, in order to account for similar traits of the firms within the same sector, we opt to cluster standard errors on an industry level.

Particularly, we examine hypotheses 1 and 2 using the following two models, respectively:

Tobin's
$$Q_{i,t} = \beta_0 + \beta_1$$
 Gender Diversity_{i,t} + $\sum_{j=1}^{N} K_{j,i,t} + \gamma_i + \epsilon_{i,t}$ (1)

$$Tobin's \ Q_{i,t} = \beta_0 + \beta_1 \ Gender \ Diversity_{i,t} + \beta_2 Quota_{i,t} + \sum_{j=1}^N K_{j,i,t} + \gamma_i + \epsilon_{i,t} \ (2)$$

Both models consist of the Gender Diversity variable, a set of control variables with the individual characteristics of each firm noted as $\sum_{j=1}^{N} K_{j,i,t}$ where N is the number of control variables and γ_i the firm fixed effects term. Model 2 also includes the Quota dummy concerning firms' compliance with the gender quota requirement. Besides, since the German political parties introduced the statutory gender quota and it was not an initiative of the companies, we believe that reverse causality should not be the case. Concluding, hypothesis 3 will be investigated using descriptive statistics with regards to the characteristics of the supervisory board members.

4.3 Descriptive Statistics

Table 2 presents cross-sectional mean values of firms' financial/accounting variables from 2010 to 2017. Our data show that Tobin's Q ratio ranges from a low of 0.62 in 2011 during the European debt crisis to a high of 0.86 in 2017 with an average value of 0.74. Firms' book of assets and number of employees are growing over the period of our analysis with exception a small decline in the number of employees in 2017. Hence, we can infer that the size of the firms is increasing. Profitability (ROA) and financial performance (ROE) remain relatively constant averaging 12% and 32%, respectively. Ultimately, debt ratio follows a hump-shaped pattern with a peak in 2013.

Table 2: Descriptive statistics of financial variables (excl. Financials)

	2010	2011	2012	2013	2014	2015	2016	2017	Average
Tobin's Q	0.71	0.62	0.67	0.78	0.74	0.78	0.75	0.86	0.74
Log(Assets)	3.75	3.79	3.80	3.81	3.84	3.86	3.88	3.88	3.83
Log(Employees)	9.98	10.01	10.03	10.04	10.04	10.04	10.06	10.05	10.03
ROA	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.12
ROE	0.32	0.31	0.34	0.31	0.31	0.31	0.36	0.32	0.32
Debt Ratio	1.65	1.70	1.72	1.73	1.68	1.70	1.68	1.71	1.70

Source: Bureau van Dijk's database Orbis



Figure 3: Average Tobin's Q ratio over year and sector

Furthermore, Figure 3 illustrates Tobin's Q ratio for every sector from 2010 to 2017 showing that different sectors record not only different financial performances but they do also have different trends. In particular, our data indicate that Telecom was the best performing sector and together with Health Care and Industrials, recorded a strong increase in Tobin's Q ratio over time. In contrast, Utilities performed the worst and was the only sector with declining Tobin's Q ratio. Lastly, Consumer Products and Materials had both relatively constant Tobin's Q ratios on an above average level. Hence, the different trends enhance our choice to cluster standard errors on an industry level.

We also explore the performance of the firms based on the percentage of women on their supervisory boards. Figure 4 depicts the average Tobin's Q ratio per year grouped by the % of women on firms' boards. Firms that have more than 30% female representation consistently outperform the others. At the same time, this result does not hold if we compare those with less than 20% females and those in the range of 20% to 30%. Moreover, Table 3 records the number of firms satisfying the gender quota per year. Notably, less than 50% of the firms satisfied the quota in 2017 as they are obliged to act only during their next board elections and no sanctions exist. Nonetheless, the number of firms with less than 20% representation has markedly declined from 47 in 2013 to 14 in 2017.



Figure 4: Average Tobin's Q ratio per year grouped by the % of women on firms' boards

Additionally, the correlation matrix of the model variables presented in Fig 5 and Appendix Table A.5 suggest that Tobin's Q ratio is negatively related with the size of the firm and the size of the supervisory board. In contrast, we find that more diverse supervisory boards and firms achieving the quota have a positive and statistically significant correlation with firms' financial performance.

Table 4 details the characteristics of all supervisory board members in Panel A.1 and the characteristics of only shareholders' representatives in Panel A.2. Our data indicate that the average board size of German firms remained roughly constant at 15 members high-lighting the fact that existing male supervisory board members were replaced by women in order companies to increase the representation of the women. Therefore, the % of female supervisory board members recorded a 17% increase from 2010 and a 10% increase from 2013 when the government announced its intentions for a gender quota. This change is

 Table 3: Number of firms satisfying the gender quota per year

	2010	2011	2012	2013	2014	2015	2016	2017
$\overline{ m W < 20\%}$	62	59	53	47	41	24	15	14
$20\% < { m W} < 30\%$	7	7	10	17	22	29	27	24
$\mathrm{W}>30\%$	2	5	8	7	8	18	29	33

Note: Appendix Table A.4 also presents the allocation of the firms per sector

Figure 5: Correlation matrix

_		2 4 6	i	0.2.4		1 2 3 4		0.51
	Tobinq							
6- 4- 2-		Lassets						
			Lemployees					
.4 - .2 - 0 -				ROA	All and			
					ROE			
4- 3- 2- 1-						DebtRatio		
							% of Women	
1- .5-								Quota
0-L	1 2		5 10 1	5	0.5 1		0 5)

even more pronounced on the shareholder-elected members with females representing 28% of all members in 2017 compared to a mere 6% in 2010 and a 15% in 2013. Interestingly, only 10 out of 334 females in 2017 participate in more than on supervisory boards underscoring that there is no shortage of suitable female candidates. Regarding the nationality of the supervisory board members, we observe that German supervisory boards have become slightly more international over the years, but they remain German dominated as 85% of all members and 76% of shareholders' representatives are Germans. This trend to international people appears to be driven from the shareholder-elected members who have recorded a c.5.5% decrease in Germans.

Besides, we note that the number of members with higher education qualifications sharply increased due to the appointment of more educated females. From a 12% deficit in 2010, the percentage of women with higher education qualification landed in a 3% surplus over male members in 2017. In contrast, the percentage of females with an MBA or a Ph.D. has a hump-shaped pattern with a peak in 2012 and a declining trend after that. Similarly, the percentage of shareholders' representatives with CEO experience also follows a hump-shaped pattern driven by the path of the percentage of women with CEO experience which records a sharp increase up to 2013 and then declines. Nevertheless, it should be highlighted that the hump-shaped behavior of the percentages results from higher increase in the total number of women compared to those with an MBA and/or CEO experience. Ultimately, the average age is steady at 57 with females being on average 5-6 years younger than males and the average tenure increases by 1 year with males sitting 3 more years on the boards compared to females.

Next, Table 5 presents the outside occupations of the supervisory board members compiled from firms' annual reports in conjunction with data available at BoardEx database. This information is also separated into Panel B.1 an B.2 for all and shareholders elected board members, respectively. The most common outside occupation of firms' supervisory board members is the participation on the executive or supervisory boards of other companies. Nevertheless, this category presents a substantial downward trend recording a c.8%decline from 2010 to 2017 primarily because fewer shareholders' elected representatives have as main outside occupation this profession. However, when looking at the two genders separately, this aggregate trend holds only for males and for females as the latter more than doubled over the sample period. The next most common profession is Chairperson on a firm's working council and it is mostly populated from employee-elected representatives. Regarding the other profession, the number of CEOs slightly increases accounting for c.7% of the total population and c.13% of shareholders' representatives as there are more male and female CEOs. Another important observation is the substantial increasing trend in those with main outside profession as partner, director or head of a department which holds for either Panel C.1 or Panel C.2. Penultimately, when looking only on the shareholders' representatives, we find that the portion of consultants, entrepreneurs and professors becomes slightly larger while that of lawyers declines. Lastly, the percentage of CFOs, CTOs and COOs doubled over the covered period mainly due to the substantial increase in the number of women with this profession and especially over the last two years.

Overall, our data suggest that the transformation of German supervisory boards due to the gender quota requirement led to older, more experienced supervisory boards but with less Ph.D. or MBA graduates.

	2010	2011	2012	2013	2014	2015	2016	2017
Panel A.1: Board cha	racterist	ics of all	board r	nembers				
Board Size	14.87	14.87	14.87	14.91	14.91	15.09	15.23	15.23
German (%)	88.71	88.31	86.58	85.60	85.94	86.00	85.57	84.86
Female (%)	11.00	13.55	16.13	18.30	19.90	23.15	26.97	28.29
No. F in 1 board	125	154	178	208	227	272	320	334
No. F in >1 boards	5	7	13	12	10	7	8	10
CEO experience (%)	22.93	23.40	23.82	25.12	25.10	24.90	24.92	24.92
% Females	10	16	17	21	20	19	20	21
% Males	25	25	25	26	26	27	27	27
MBA (%)	37.14	36.62	37.84	36.69	37.45	36.18	35.36	34.70
% Females	23	26	32	31	31	30	30	30
% Males	39	38	39	38	39	38	38	36
Higher Education (%)	63.79	64.48	64.86	65.39	66.33	66.89	66.94	67.27
% Females	54	56	61	65	67	68	69	70
% Males	66	66	66	66	67	67	67	67
Average Age	56.89	57.13	57.14	56.97	57.29	57.27	57.32	57.61
Average of Females	51	52	52	53	53	53	53	54
Average of Males	58	58	58	58	58	58	59	59
Average Tenure	1.11	1.17	1.22	1.19	1.26	1.26	1.28	1.35
Average of Females	0.92	0.90	0.90	0.91	0.97	0.96	0.94	1.00
Average of Males	1.13	1.21	1.28	1.26	1.33	1.35	1.41	1.48
Panel A.2: Board cha	racterist	ics of sh	areholde	ers' electe	ed board	l membe	rs (%)	
	2010	2011	2012	2013	2014	2015	2016	2017
German (%)	81.29	80.82	78.24	76.39	77.29	77.87	77.50	76.42
Female (%)	6.35	9.40	12.71	15.36	16.97	20.87	25.62	27.84
No. F in 1 board	34	52	64	85	94	120	152	161
No. F in >1 boards	4	4	11	7	7	5	4	8
CEO experience (%)	43.31	44.30	45.76	48.08	47.56	47.08	46.63	46.29
% Females	32	39	39	45	42	38	39	38
% Males	44	45	47	49	49	49	49	49
MBA (%)	65.55	64.43	66.27	64.11	65.04	62.94	61.25	60.63
% Females	66	61	68	64	61	57	54	55
% Males	66	65	66	64	66	65	64	63
Higher Education (%)	91.81	91.78	92.71	91.99	92.77	93.82	93.27	93.74
% Females	92	89	93	92	94	95	94	95
% Males	92	92	93	92	93	93	93	93
Average Age	52.61	52.96	53.37	53.43	53.71	54.09	54.20	54.57
Average of Females	52	54	53	54	55	54	54	55
Average of Males	61	61	61	61	61	62	62	62
Average Tenure	1.08	1.12	1.19	1.18	1.22	1.26	1.28	1.36
Average of Females	0.83	0.73	0.73	0.74	0.84	0.82	0.83	0.90
Average of Males	1.16	1.26	1.34	1.29	1.38	1.38	1.44	1.50

 Table 4: Descriptive statistics of supervisory board characteristics

Note: Appendix Table A.1 explains in detail each variable

	2010	2011	2012	2013	2014	2015	2016	2017
Panel B.1: Outside	occupat	ion of al	l board	member	s			
Board Member (%)	37.14	36.53	34.97	33.11	32.91	31.70	30.59	29.11
% Females	2.88	3.70	4.48	4.83	5.12	6.22	6.74	6.41
% Males	34.26	32.83	30.49	28.29	27.79	25.48	23.85	22.70
CEO (%)	6.18	6.73	7.09	7.57	7.39	6.80	6.83	7.40
% Females	0.25	0.59	0.76	1.08	1.01	1.08	1.07	1.23
% Males	5.92	6.14	6.33	6.49	6.30	5.64	5.67	6.09
CFO/COO (%)	1.44	1.26	1.44	1.50	1.68	2.16	2.63	2.96
% Females	0.08	0.17	0.17	0.33	0.59	0.50	1.07	1.56
% Males	1.35	1.09	1.27	1.16	1.09	1.66	1.56	1.40
Chairperson (%)	18.02	18.10	19.26	20.47	20.15	20.08	19.41	19.33
% Females	2.45	2.69	3.04	3.74	3.86	4.07	4.44	4.61
% Males	15.57	15.40	16.22	16.72	16.29	16.02	14.97	14.72
Consultant (%)	2.79	2.69	2.79	2.91	3.02	2.99	3.04	3.29
% Females	0.00	0.17	0.25	0.25	0.34	0.41	0.58	0.66
% Males	2.79	2.53	2.53	2.66	2.69	2.57	2.47	2.63
Entrepreneur (%)	1.10	1.26	1.10	1.25	1.26	1.41	$1.40^{-1.40}$	1.48
% Females	0.17	0.25	0.34	0.33	0.25	0.25	0.25	0.25
% Males	0.93	1.01	0.76	0.92	1.01	1.16	1.15	1.23
Lawyer (%)	1.18	1.26	1.10	1.25	1.09	1.16	1.32	1.32
% Females	0.17	0.17	0.17	0.08	0.17	0.17	0.25	0.25
% Males	1.02	1.09	0.93	1.16	0.92	1.00	1.07	1.07
Partner	11.76	11.78	12.25	13.14	13.18	14.69	15.21	15.13
% Females	1.10	1.68	2.20	2.75	3.19	4.40	5.18	5.51
% Males	10.66	10.10	10.05	10.40	9.99	10.29	10.03	9.62
Professor	2.45	2.44	2.79	2.83	3.11	3.15	3.13	2.96
% Females	0.59	0.51	0.76	0.92	0.92	1.00	1.07	1.15
% Males	1.86	1.94	2.03	1.91	2.18	2.16	2.06	1.81
Other	17.94	17.93	17.23	15.97	16.20	15.85	16.45	17.02
% Females	3.30	3.62	3.97	3.99	4.37	4.98	6.25	6.58
% Males	14.64	14.31	13.26	11.98	11.84	10.87	10.20	10.44
	2010	2011	2012	2013	2014	2015	2016	2017
Panel B.2: Outside	occupat	ion of sh	narehold	ers' elect	ted boar	d memb	ers (%)	
Board Member	60.20	59.06	57.12	54.09	53.11	51.25	49.10	46.46
CEO	11.04	12.25	12.88	13.86	13.45	12.35	12.48	13.84
CFO/COO	2.84	2.52	2.88	3.01	3.36	4.34	5.09	5.77
Chairperson	0.84	0.67	1.19	1.00	1.18	1.34	1.15	1.32
Consultant	4.52	4.03	4.58	4.67	5.21	5.18	5.42	5.93
Entrepreneur	1.67	2.01	1.69	2.00	2.18	2.34	2.30	2.47
Lawyer	1.67	1.85	1.36	1.50	1.18	1.17	0.99	0.82
Partner	8.70	8.72	9.15	10.85	10.25	12.19	13.63	13.67
Professor	3.85	4.03	4.58	4.67	5.38	5.51	5.25	5.11
Other	4.68	4.87	4.58	4.34	4.71	4.34	4.60	4.61

Table 5: Outside occupation of supervisory board members (%)

Note: Appendix Table ${\rm A.1}$ explains in detail each variable

5 Empirical results

In this section, we perform our empirical analysis and examine Hypothesis 1 and Hypothesis 2 using the methodology described in Section 4. Therefore, we present the estimations of the OLS and the firm fixed effects regressions in order to shed light on the effect of gender diversity and gender quotas on firms' financial performance. Furthermore, we conduct a sensitivity analysis of our results and, as a final step, we discuss the policy implications of our findings.

5.1 The effect of gender diversity

Table 6 reports the regression outputs of Model 1 which has as an independent variable the Tobin's Q ratio and as dependent variables the *Gender Diversity* and a set of controls being fully described in Section 4.2. The obtained results are divided in two subsection: the OLS regression output and the firm fixed effects regression output. Furthermore, each subsection contains three different columns to obtain better insight on the obtained results.

Columns (1) and (4) examine the association of the Tobin's Q ratio with the control variables. In the basic OLS model, we see that the performance of the firm is independent of the firm size, but it is positively affected by ROA and financial leverage. Contrarily, in the firm fixed effects model the control variables related with the size of the firm play an important and statistically significant role. In particular, board size and firms' assets are positively related to the Tobin's Q ratio while a higher number of employees leads to lower financial performance. Moreover, ROA, ROE and financial leverage have positive and statistically significant effect on firm performance. Besides, we observe substantial changes in the coefficients of the firms' assets, ROA and ROE when moving from the OLS to the firm fixed effects model. The main reason is that the OLS estimation cannot account for unobserved time-invariant confounding factors across the firms that we are not able to control such as, for instance, the culture of the firms and business practices. Contrarily, all the time-invariant unobserved variables drop out in the fixed effects model. Therefore, the estimated coefficients of the OLS model are probably suffering from omitted variable bias.

Next, we analyze the relation between the independent variable and gender diversity in the board. The obtained results presented in Columns (2) and (5) provide unsubstantial evidence as the estimated coefficients are statistically significant, but the magnitude is extremely small.

Finally, Columns (3) and (6) present the output of the full model. Indeed, combining all the variables into one model leads to similar results in terms of statistical significance of the coefficients, magnitude and direction. Therefore, the basic intuition remains the same as before and, thus, we can infer that gender diversity has little to no effect on firms financial performance as the gender diversity variable is found to be positive and statistically significant but of an almost zero magnitude. Consequently, we reject the proposition of Hypothesis 1 that more diverse supervisory boards are associated with better

		OLS		Fii	Firm Fixed Effects				
	(1)	(2)	(3)	(4)	(5)	(6)			
Gender Diversity		0.009^{***} (0.002)	0.006^{***} (0.002)		0.004^{***} (0.002)	$\begin{array}{c} 0.004^{***} \\ (0.001) \end{array}$			
Board Size	-0.014 (0.009)		-0.014 (0.009)	0.012^{***} (0.001)		$\begin{array}{c} 0.013^{***} \\ (0.001) \end{array}$			
Log(Assets)	-0.007 (0.089)		-0.015 (0.090)	$\begin{array}{c} 0.742^{***} \\ (0.227) \end{array}$		$\begin{array}{c} 0.581^{***} \\ (0.190) \end{array}$			
Log(Employees)	$\begin{array}{c} 0.030 \\ (0.037) \end{array}$		0.031 (0.038)	-0.148^{***} (0.046)		-0.116^{***} (0.056)			
ROA	$3.244^{***} \\ (0.475)$		3.243^{***} (0.446)	$2.133^{***} \\ (0.600)$		$2.435^{***} \\ (0.582)$			
ROE	$\begin{array}{c} 0.040 \\ (0.262) \end{array}$		-0.010 (0.263)	0.257 (0.103)		$0.172 \\ (0.097)$			
Debt Ratio	$\begin{array}{c} 0.315^{***} \\ (0.068) \end{array}$		0.301^{***} (0.068)	$\begin{array}{c} 0.364^{***} \\ (0.024) \end{array}$		$\begin{array}{c} 0.348^{***} \\ (0.021) \end{array}$			
Constant	-0.257^{***} (0.091)	0.575^{***} (0.097)	-0.301^{***} (0.124)	-1.753^{*} (0.973)	0.660^{***} (0.40)	-1.525^{*} (0.910)			
Adjusted R^2 Observations	$\begin{array}{c} 0.560 \\ 564 \end{array}$	$\begin{array}{c} 0.039 \\ 564 \end{array}$	$\begin{array}{c} 0.578 \\ 564 \end{array}$	$0.872 \\ 564$	$\begin{array}{c} 0.621 \\ 564 \end{array}$	$\begin{array}{c} 0.875\\ 564 \end{array}$			

Table 6: The effect of supervisory board diversity on Tobin's Q ratio

***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively

financial performance.

5.2 The effect of gender quota

Table 7 reports the regression outputs of Model 2 which has as an independent variable the Tobin's Q ratio and as dependent variables the *Gender Diversity*, the *Quota* dummy and a set of controls with the individual characteristics of the firms. All the variables are fully described in Section 4.2. The hypothesis here is that German firms satisfying the mandatory gender quota requirement achieved better financial performance compared to those who failed to do so. In order to investigate Hypothesis 2, we employ again the OLS and firm fixed effects models with the results being presented in Column (1) and (2), respectively.

Including the *Quota* dummy to the model leaves the magnitude, the direction and the statistical significance of the coefficients analyzed in the Section 5.1 unchanged. Besides, the coefficient of the *Quota* dummy found to be negative and statistically significant with either OLS or firm fixed effect model. Notably, the former provides an estimation of -0.133 and the latter an estimation of -0.116. Hence, those companies that comply with the quota and have more than 30% women in their supervisory board structure underperformed those that failed to comply.

Consequently, our empirical analysis failed to provide support on Hypothesis 2 stating that German firms satisfying the mandatory gender quota requirement achieved better financial performance compared to those who failed to do so. In fact, the obtained empirical

	OLS	Firm Fixed Effects
	(1)	(2)
Quota	-0.133*** (0.040)	-0.116^{***} (0.036)
Gender Diversity	0.010^{***} (0.003)	0.004^{***} (0.001)
Board Size	-0.013 (0.008)	$\begin{array}{c} 0.013^{***} \\ (0.002) \end{array}$
Log(Assets)	-0.026^{***} (0.081)	0.583^{***} (0.192)
Log(Employees)	$0.035 \\ (0.032)$	-0.116^{***} (0.057)
ROA	3.323^{***} (0.582)	2.437^{***} (0.580)
ROE	-0.011 (0.258)	$0.174 \\ (0.103)$
Debt Ratio	0.297^{***} (0.067)	0.348^{***} (0.022)
Constant	-0.359^{***} (0.122)	-1.525^{*} (0.856)
Adjusted R^2 Observations	$\begin{array}{c} 0.584\\ 564\end{array}$	$\begin{array}{c} 0.875\\ 564 \end{array}$

Table 7: The effect of the gender quota on Tobin's Q ratio

***, **, * indicate statistical significance at the 1%, 5% and 10% level, respectively

results are in line with the findings of other papers in the literature such as Ahern and Dittmar (2012) and Dale-Olsen et al. (2013) analyzing the effect of a mandatory quota in the case of Norway and Comi et al. (2017) investigating the impact of gender quota rules in Spain, Belgium and France.

5.3 Sensitivity analysis and limitations

As a final step of our empirical analysis, we conduct a robustness check by including the full sample of 74 companies or 624 firm-year observation. For this reason, we repeat the methodological steps followed in Sections 5.1 and 5.2, but we do discuss only the relevant empirical findings. By including the full sample, the main findings remain unaltered. Again, we find that gender diversity has little to no effect on firms financial performance rejecting Hypothesis 1. Regarding Hypothesis 2 with the full sample, we note that the direction and the statistical significance of the coefficients are in line with those presented in the Section 5.2. Thus, companies adhere to the quota underperform their counterparts and, as a result, we can infer that our empirical findings are robust in terms of the sample selection.

Nonetheless, our research is not free of limitations. First and foremost, firms were obliged to comply with the law during their next supervisory board election period and not on the effective date of the law. For this reason, our empirical work provides insight on the short term effect of gender quota law in Germany and more research is needed to identify the long run outcomes. Additionally, our sample covers only a number of German firms being subject to a specific gender quota law. However, the type of the companies affected by a gender quota and the implemented sanctions in case of non-compliance may have important implications with respect to the outcome of the quota on firms' performance and corporate boardroom structure. On that grounds, the external validity of our results to other European economies might not hold and more research is needed on this matter.

Finally, it should be noted that firm fixed effects may not be the optimal econometric technique to measure the causal effect of the gender quota intervention making it difficult to interpret the findings of our research as causal. Indeed, using firm fixed effects might not be enough to explain the selection of firms into compliance or not. The fixed effects estimation accounts for unobserved time-invariant confounding factors across the firms that we are not able to quantify such as, for instance, the culture of the firms and business practices. However, cross-country effects and time-variant changes of the variables are possible to affect the variables of our analysis and, therefore, the obtained results.

In fact, we were not able to use more advanced techniques to approach this research question. If all firms had adhered to the gender quota requirement by the effective date of the law on 1 January 2016, the use of an instrumental variable approach as an identification strategy similar to Ahern and Dittmar (2012) could have provided a more precise picture on the effect of the German quota. Nevertheless, our data show that this is not the case. Also, we were not able to use the difference-in-difference approach to compare affected (treatment group) and not affected (control group) firms by the gender quota law. Dale-Olsen et al. (2013) employ the difference-in-difference approach in the case of Norway. The main problem with this method is the requirement of an extensive set of difficult to collect data. Besides, even if we had access to the necessary data, we cannot know a priori whether the common trend assumption is satisfied. Thus, the validity of the difference-in-difference approach is not guaranteed. Considering all the above points, we believe that the firm fixed effects was the best available model to pursue our research.

6 Conclusions

Over the last decade, the gender composition of corporate boardrooms has come in the spotlight with significant academic contributions and growing prominence in the public debate. However, the empirical literature with regards to the effect of gender quotas on firms financial performance and the composition of the boardrooms is still at infancy with a small yet growing amount of contributions. Thus, the goal of this empirical paper was to offer fact-based insights on this branch of the literature by analyzing the introduction of a mandatory quota requirement for a minimum 30% representation of both genders on the supervisory boards of publicly listed and parity co-determined companies in Germany. To the best of our knowledge, this is the first empirical paper on the impact of the German gender quota rule.

For this reason, we gathered market data and historical supervisory board composition data over the period 2010 to 2017 on a yearly basis for 78 out of 107 affected German firms. This allowed us to have a window of three years before the announcement of the corporate gender quota, three years in the timespan between the announcement and the implementation, and two years since the implementation of the legislation. The data collection was made by combining firms' annual reports, Bureau van Dijk's database called Orbis and BoardEx. As a result, we managed to create two distinct databases. The first database consists of 624 firm-year observations and it was used as input for our regression analysis in order to shed light on the effect of gender diversity and gender quotas on firms' financial performance. The second database contains 9,585 observations regarding the members on the supervisory board for each company and every year, and it was employed in order to analyze the transformation of the board structure due to the quota requirement.

Our findings indicate that gender diversity has little to no impact on the financial performance of German firms. Concerning the impact of the German statutory gender quota on the financial performance, we find that companies that comply with the quota and have more than 30% women in their supervisory board structure underperformed their counterparts which is in line with the findings of other papers in the such as Ahern and Dittmar (2012) and Dale-Olsen et al. (2013) analyzing the effect of a mandatory quota in the case of Norway and Comi et al. (2017) investigating the impact of gender quota rules in Spain, Belgium and France. Ultimately, our data suggest that the transformation of German supervisory boards due to the gender quota requirement led to older, more experienced supervisory boards but with less Ph.D. or MBA graduates.

Indeed, our research is not free of limitations. First and foremost, our empirical work provides insight on the short term effect of gender quota law in Germany and more research is needed to identify the long run outcomes. Additionally, our sample covers only a number of German firms being subject to a specific gender quota law. However, the type of the companies affected by a gender quota and the implemented sanctions in case of noncompliance may have important implications with respect to the outcome of the quota on firms' performance and corporate boardroom structure. On that grounds, the external validity of our results to other European economies might not hold and more research is needed on this matter.

On a final note, we highlight that policy actions are required to tackle the gender imbalances and to promote female participation in corporate boardrooms. With multiple instruments and policies available, whether a corporate gender quota is the proper avenue to achieve that goal remains a question mark. Nonetheless, as the number of European countries which implement gender quota laws is increasing, we hope that our paper will encourage future research on the impact of a gender quota on firms' performance and board composition.

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A Appendix

Definitions of financial ratios						
Tobin's Q	Total Market Value/ Total Assets Value					
ROA	Net Income/Total assets					
ROE	Net Income/Total Equity					
Debt Ratio	Assets/Liabilities					
Asset Turnover	Revenues/Total assets					
Definitions of supervisory b	oard variables					
Board Size	The average board size					
German (%)	Percentage of supervisory board members that are German					
Female (%)	Percentage of supervisory board members that are					
female CEO experience $(\%)$	Percentage of supervisory board members that have CEO experience					
MBA (%)	Percentage of supervisory board members with an MBA and/or a Ph.d.					
Higher Education (%)	Percentage of supervisory board members with a BA, MA and/or MSc degree					
Age	The average age of the supervisory board member					
Tenure	The average number of years since board members have been elected/appointed					
Definitions of outside occup	ation variables					
Board Member	Member, chair, deputy chair of any supervisory or executive boards					
CEO	CEO, President, Member of Parliament					
CFO	CFO, CTO, COO					
Chairperson	Chair of a firm's working council					
Consultant	Consultant, advisor					
Entrepreneur	Founder, investor					
Lawyer	Attorney, lawyer, advocate					
Partner	Partner, director, head of department					
Professor	University professor, researcher on a research institution					
Other	Any job position not classified above					

Table A.1: Variable definitions

Table A.2: Categorization of the companies in sectors

	GICS	Reclassified Sector	Number of firms	
10	Energy	_	_	
15	Materials	Materials	11	
20	Industrials	Industrials	24	
$\frac{1}{25}$	Consumer Discretionary	Congumer Products	10	
30	Consumer Staples	Consumer Products	19	
35	Health Care	Health Care	6	
40	Financials	Financials		
45	Information Technology	IT Telecom		
50	Communication Services	11 - Telecom	1	
55	Utilities	Utilities	4	
60	Real Estate		_	

No	Company Name	Index	No	Company Name	Index	
Companies with data			55	Rheinmetall AG	MDAX	
1	Amadeus FiRe AG	CDAX	56	Salzgitter AG	MDAX	
2	Audi AG	CDAX	57	Südzucker AG	MDAX	
3	Bauer AG	CDAX	58	Symrise AG	MDAX	
4	EnBW Energie AG	CDAX	59	Talanx AG	MDAX	
5	HSBC Trinkaus & Burkhardt AG	CDAX	60	Adler Modemärkte AG	SDAX	
6	MAN SE	CDAX	61	Bilfinger SE	SDAX	
7	MVV Energie AG	CDAX	62	Deutz AG	SDAX	
8	Renk AG	CDAX	63	DMG MORI SEIKI AG	SDAX	
9	Schuler AG	CDAX	64	ElringKlinger AG	SDAX	
10	TUI AG	CDAX	65	Gerry Weber AG	SDAX	
11	Villeroy & Boch AG	CDAX	66	Grammer AG	SDAX	
12	Adidas AG	DAX30	67	Hamburger Hafen und Logistik AG	SDAX	
13	Allianz SE	DAX30	68	Heidelberger Druckmaschinen AG	SDAX	
14	BASF SE	DAX30	69	Koenig & Bauer AG	SDAX	
15	Bayer AG	DAX30	70	SGL CARBON SE	SDAX	
16	Beiersdorf AG	DAX30	71	Wacker Chemie AG	SDAX	
17	BMW AG	DAX30	72	Wüstenrot & Württenbergische AG	SDAX	
18	Commerzbank AG	DAX30	73	Bechtle AG	TecDAX	
19	Continental AG	DAX30	74	Drägerwerk AG & Co KGaA	TecDAX	
20	Daimler AG	DAX30	75	Freenet AG	TecDAX	
21	Deutsche Bank AG	DAX30	76	Jenoptik AG	TecDAX	
22	Deutsche Lufthansa AG	DAX30	77	Sartorius AG	TecDAX	
23	Deutsche Post AG	DAX30	78	SMA Solar Technology AG	TecDAX	
24	Deutsche Telekom AG	DAX30	Con	Companies without data		
25	E.ON SE	DAX30	79	Bremer Lagerhaus AG	CDAX	
26	Fresenius SE & Co. KGaA	DAX30	80	Bremer Straßenbahn AG	CDAX	
27	Heidelberg Cement AG	DAX30	81	Deutsche Postbank AG	Acquired	
28	Henkel AG & Co. KGaA	DAX30	82	Kabel Deutschland Holding AG	CDAX	
29	Infineon Technologies AG	DAX30	83	Maternus-Kliniken AG	CDAX	
30	Linde AG	DAX30	84	McKesson Europe AG	Merged	
31	Merck KGaA	DAX30	85	Oldenburgische Landesbank AG	CDAX	
32	Münchener Rück AG	DAX30	86	Paul Hartmann AG	CDAX	
33	RWE AG	DAX30	87	Sanacorp Pharmaholding AG	CDAX	
34	SAP SE	DAX30	88	Solarworld AG	CDAX	
35	Siemens AG	DAX30	89	ÜSTRA Hannov. Verkehrsbetr. AG	CDAX	
36	ThyssenKrupp AG	DAX30	90	BayWa AG	CDAX	
37	Volkswagen AG	DAX30	91	BOGESTRA AG	CDAX	
38	Aurubis AG	MDAX	92	HOMAG Group AG	CDAX	
39	Duerr AG	MDAX	93	Hornbach Naumarkt AG	CDAX	
40	Evonik Industries AG	MDAX	94	KSB AG	CDAX	
41	Fielmann AG	MDAX	95	KUKA AG	CDAX	
42	Fraport AG	MDAX	96	Mainova AG	CDAX	
43	GEA Group AG	MDAX	97	Mediclin AG	CDAX	
44	Gerresheimer AG	MDAX	98	Nurnberger Beteiligungs AG	CDAX	
45	Hochtief AG	MDAX	99	Porsche SE	CDAX	
46	Hugo Boss AG	MDAX	100	Wasgau AG	CDAX	
47	Jungheinrich AG	MDAX	101	Wincor Nixdorf AG	CDAX	
48	$\mathbf{K}+\mathbf{S}$ AG	MDAX	102	Hella KGaA	MDAX	
49	Kion Group AG	MDAX	103	Osram Licht AG	MDAX	
50	Krones AG	MDAX	104	CEWE Stiftung & Co. KGaA	SDAX	
51	Lanxess AG	MDAX	105	Rhon-Klinikum AG	SDAX	
52	Leoni AG	MDAX	106	Software AG	TecDAX	
53	Metro AG	MDAX	107	Telefonica Deutschland H. AG	TecDAX	
54	MTU Aero Engines Holding AG	MDAX				

Table A.3: Companies subject to the statutory 30%-quota requirement

	2010	2011	2012	2013	2014	2015	2016	2017
$\overline{{f W}<20\%}$	62	59	53	47	41	24	15	14
Consumer Products	16	16	14	12	10	3	2	2
Health Care	5	5	4	4	2	2	1	1
Industrials	21	19	20	16	15	12	6	5
IT - Telecom	5	5	3	3	3	1	1	2
Materials	11	10	9	10	9	5	5	4
Utilities	4	4	3	2	2	1		
$20\% < \mathrm{W} < 30\%$	7	7	10	17	22	29	27	24
Consumer Products	2	1	2	4	6	8	10	10
Health Care	1	1	2	2	3	2	2	
Industrials	3	3	2	5	6	8	8	8
IT - Telecom	1	1	1	3	3	3	2	1
Materials		1	2	1	2	6	4	4
Utilities			1	2	2	2	1	1
$\mathbf{W}>\mathbf{30\%}$	2	5	8	7	8	18	29	33
Consumer Products	1	2	3	3	3	8	7	7
Health Care					1	2	3	5
Industrials		2	2	3	3	4	10	11
IT - Telecom	1	1	3	1	1	3	4	4
Materials							2	3
Utilities						1	3	3

Table A.4: Number of firms satisfying the gender quota per year and sector

Table A.5: Correlation matrix

		1	2	3	4	5	6	7	8	
1.	Tobin's Q	1								
2.	Assets	-0.302***	1							
3.	Employees	-0.223***	0.896^{***}	1						
4.	ROA	0.696^{***}	-0.353***	-0.267***	1					
5.	ROE	0.252***	-0.033	0.032	0.587***	1				
6.	Debt Ratio	0.645^{***}	-0.390***	-0.327***	0.637^{***}	-0.089**	1			
7.	% of Women	0.199***	0.054	0.053	0.101**	0.100**	0.062	1		
8.	Board Size	-0.283***	0.699***	0.647^{***}	-0.257***	0.045	-0.315***	0.064	1	
9.	Quota	0.132***	0.016	0.043	0.149^{***}	0.144^{***}	0.066	0.729***	0.079	

***Indicates statistical significance at the 1% level

**Indicates statistical significance at the 5% level

*Indicates statistical significance at the 10% level