



Lifting Women Up: Gender Quotas and the Advancement of Women on Corporate Boards

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Abstract

The introduction of gender quotas on corporate boards may be a shock to the status-quo that produces externalities to the advancement of women in the company. In this paper, we investigate whether boardroom quotas contribute to lift more women further up the corporate ladder and to a wider range of positions. We use a legislative change in Germany as a natural experiment. Quotas increase female representation on the affected board but may have a negative impact on executive careers for women. They also fail short of eliminating the glass ceiling and do not level the playfield across women insiders and outsiders. Quotas can not be tasked with achieving gender equality in corporations on their own.

JEL Classification: J16, G32, G34, M14.

Keywords: Gender quota, Boards of directors, Corporate governance, Female leadership.

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1 Introduction

Gender diversity at the top of corporations has become a more and more ubiquitous concern in recent years. One of the most popular measures to promote diversity is the introduction of gender quotas on the board of directors. In 2003, Norway passed the first law requiring at least 40% of board seats in all public companies to be filled by women. This case naturally attracted a lot of attention, as it successfully managed to move the fraction of women directors from 5% in 2001 to 40% in 2008. Since then, other countries have introduced board quotas for the underrepresented gender. Austria, Belgium, France, Germany, Iceland, Italy, the Netherlands, and Portugal have regulated national gender quotas by law. Very recently, the European Union reached a political agreement to set a 40% female quota in non-executive director (NED) positions of all European listed companies.¹ Quotas are gaining momentum in the US as well, with California emerging as the first US state to mandate a corporate board gender quota in 2018 (California Corporations Code Section 301.3).²

Justification for the use of quotas has been found in the business case for gender quotas. The rationale is that gender diversity on the board improves corporate governance and it may result in a better financial performance. If that is the case, imposing boardroom quotas is beneficial for the firm. Studies examining the validity of the business case hypothesis of gender quotas find mixed results.³ It is not clear that, by hiring too few women, firms are leaving money on the table.

Even if firms do not profit individually, the introduction of gender quotas in the upper echelons of the firm may be justified if they produce a positive externality to the advancement of women in other areas. The hope is that the quota translates into a reduction of wage gaps, enhanced female labor participation, equal promotion opportunities or more egalitarian representation in leadership. We focus on the last point and study whether instituting positive gender discrimination by law can improve female representation at the top of cor-

¹EU Set to Approve 40% Quota for Women on Company Boards by 2026. Bravo, R. and Pronina, L. Bloomberg Europe Edition. June 8, 2022. <https://www.bloomberg.com/news/articles/2022-06-08/eu-set-to-adopt-gender-quota-requirement-on-corporate-boards>.

²The Californian quota has been challenged as recently as May 2022. A Los Angeles Superior Court judge has enjoined the measure in *Crest v. Padilla* (Crest - AB 979) because she deemed the need of remedial discrimination, a requirement for a constitutionally admissible quota, insufficiently justified.

³See Kirsch (2018) for a literature review.

porations. Specifically, we investigate the effect of board gender quotas for the advancement of women on boards. Do the quotas contribute to lift more women further up the corporate ladder and to other male-dominated positions? We investigate this question treating a legislative change in Germany as a natural experiment: the introduction of a gender quota on supervisory boards of the largest listed companies. Our main finding is that the quota does not foster the presence of women in other managerial bodies not targeted by the quota law. On the contrary, we find that the share and number of female board members on the management board is lower in treated firms after the quota. In other words, the incentives to hire women candidates for the mandated board, provided by the quota, may hurt women's prospects for advancement to executive roles. Companies exhibit a tendency to counteract the quota on the board where it is not mandatory and keep a minority percentage in each side of the board where it is. Additionally, when the type of women accessing the board is closer to an executive profile, we find the negative effect on the management board to be larger. This hints to a substitution effect whereby women enter non-executive positions over pursuing executive careers. The potential pitfall is that, by doing that, women are kept away from a managerial career that leads to more important and lucrative C-suite jobs. To our knowledge, this is the first empirical evidence that lends credence to what some commentators have named female careers as "serial NEDs".⁴

Secondly, we find that women's chances to hold the board presidency do not change, indicating that women are not necessarily closing the gap with men at the highest ranked position of the board despite the gender quota. This finding supports the existence of a second glass ceiling, which manifests as a decreasing female representation the higher the professional rank.

Lastly, the mandatory quota boosts the opportunities of some women holding multiple supervisory board appointments simultaneously, rather than improving access equality among women. This is in line with the phenomenon of the golden skirts that has been documented in other cases.

Beyond the intended effects that follow from compliance with the law, boardroom quotas

⁴'Most of the women who make up Norway's 'golden skirts' are non-execs,' Lewis, K. The Guardian, 1st July 2011. URL: <https://www.theguardian.com/business/2011/jul/01/norway-golden-skirt-quota-boardroom?intcmp=239&guni=Article:in%20body%20link>.

produce additional unintended effects. They can reduce representation in other managerial bodies, fail short of eliminating the glass ceiling, and increase access inequality between women insiders and outsiders. Quotas can not be tasked with achieving gender equality in corporations on their own. Policy design needs to take into account the desired outcomes as well as unintended effects and carefully weigh the trade-offs among them. This is specially relevant as the most recent legislative initiatives push for quotas to be introduced almost exclusively to non-executive directorships like in the German case.

Literature review. The literature on the effects of boardroom quotas is large and, for the most part, it deals with the financial consequences for a firm of an increase in the percentage of women on board seats (Ahern and Dittmar, 2012; Matsa and Miller, 2013; Nygaard, 2011; Eckbo et al., 2016; Tyrefors and Jansson, 2017; Ferrari et al., 2018; Greene et al., 2020). Ahern and Dittmar (2012) and Matsa and Miller (2013) were the first ones to look at the Norwegian pioneer experiment with gender board quotas. In 2003, Norway introduced a 40% gender quota, which became mandatory in 2006, that affected the board of all public limited companies (including all companies listed in the stock exchange). In this context, Ahern and Dittmar (2012) study the effect of the percentage of female directors on the firm Tobin's Q. Their sample comprises only companies affected by the quota between 2003 and 2009. To address this issue, they instrument the percentage change in female directors using the firm's pre-quota variation in female participation (i.e. the firm's percentage of female directors in 2002 interacted with year dummies). Their argument is that "because all firms had to meet the same 40% quota, firms that had more women when the quota was passed were required to make a smaller change to their boards to comply with the law compared to firms that had fewer women" (Ahern and Dittmar, 2012, p. 25). Ferreira (2015) formulated a criticism on this approach, arguing that the pre-quota share of females may correlate with certain firm unobserved characteristics that are relevant for the response to the quota. However, this empirical strategy is still broadly used in the study of the effects of boardroom quotas (Bertrand et al., 2019; Tyrefors and Jansson, 2017; Greene et al., 2020).

Matsa and Miller (2013), almost at the same time, follow a different approach. They take the year 2006, the year when the quota became mandatory, as a treatment year and

use a triple-difference estimation by constructing three “ad-hoc” control groups: private firms in Norway, and public firms and private firms in other Nordic countries (Denmark, Finland, and Sweden). Then, they compare Norwegian listed firms to the five closest firms in the control groups based on industry, assets, employees, and operating profits in 2006, using Abadie et al. (2004) matching algorithm. The triple-differences approach requires a weaker form of the parallel trends assumption than differences-in-differences. It attributes to the quota the difference in the company’s ROA⁵ variation between listed and unlisted Norwegian firms, assuming that, without the quota, it would have been comparable to the corresponding differential change in the other Nordic countries.

Following Norway, several other regions adopted gender quotas on the boards of directors. This provided new identification opportunities thanks to the specificities of each quota law. Ferrari et al. (2018) and Maida and Weber (2022), for instance, are able to exploit the staggered nature of the quotas roll-out in Italy. In this paper, we exploit the fact that the German quota applies to listed firms with more than 2.000 employees in order to create three comparison control groups within the country: a) listed firms that have fewer than 2.000 employees, b) large (equal or more than 2.000 employees) unlisted firms, and c) firms which are neither one nor the other. Doing so, we are able to determine the consequences of the quota for the affected firms netting out the effects that can be attributed to different trends of large firms or listed firms. On top of that, following Matsa and Miller (2013), we match each affected firm with its closest neighbour from the control group using propensity score matching on the annual difference in the share of women on the respective board, the pre-reform share of women and firm size.⁶

Both Ahern and Dittmar (2012) and Matsa and Miller (2013) find a negative impact on firm value, measured by the decline in Tobin’s Q and firm profitability respectively, whereas later works are not able to identify such clear cut results (Eckbo et al., 2016; Ferrari et al., 2018; Maida and Weber, 2022).⁷ Other papers investigate the consequences of quotas for non-financial outcomes of the firm, like environmental policy (Glass et al., 2016; Liu, 2018)

⁵The ratio of operating profits to assets.

⁶We do not have other financial characteristics of the firm in our sample to match on.

⁷More generally, the effects of gender diversity on corporate boards for the financial performance of the firm are mixed (Eagly, 2016).

and corporate social responsibility (for a review, see Rao and Tilt (2016)) whereas research on the effect of a gender quota for the advancement of women is not as extensive (Kirsch, 2018). Bertrand et al. (2019) look at the trickle-down effect of the Norwegian quota for women employed in the companies subject to it and find no effect. Similarly, in Italy, Maida and Weber (2022) find no evidence of changes on the percentage of women in top earnings positions, whereas Bozhinov et al. (2018) document a remuneration gap on German boards affected by the quota. We contribute to this literature by showing negative spillovers from the quota to the other unaffected board of the firm. We find considerable side effects for women’s advancement that might benefit some women at the expense of others in the short-term and promote certain career paths.

We also speak to a broader literature that is interested in how women on boards impact organizations. Descriptive studies find that female directors tend to participate more (Adams and Ferreira, 2009), women are more likely to join monitoring committees (Adams and Ferreira, 2009; Bozhinov et al., 2018), and they do not affect gender inequality in employee earnings in an organization (van Hek and van der Lippe, 2019) except at the executive level (Carter et al., 2017). Bozhinov et al. (2021) report that firms with women on the nominating committee are associated with a higher probability of employing at least one women on the management board. None of these papers exploit the introduction of gender quotas.

The rest of the paper is organized as follows: details of the German corporate system and the Gender Quota Law are presented in section 2. Section 3 presents the hypotheses and section 4 describes the data and the empirical strategy. The empirical results are illustrated in section 5. In section 6 we discuss some channels behind our results and in section 7, we highlight additional consequences for women’s careers on boards. Section 8 presents several robustness checks. Finally, section 9 concludes.

2 The German boardroom quota

The German corporate governance code advocates for diversity in the election of the management board, the executive staff, and the supervisory board since 2002 (Burow et al.,

2018). In spite of that, women’s participation on corporate boards in Germany has been typically very low. Women constituted less than 20% of the non-executive boards and less than 5% of the management boards of the top 200 German corporations in 2015. (Holst and Kirsch, 2015).

In March of that year, Germany introduced a compulsory gender quota for the supervisory boards of the largest listed companies. This measure was saluted as a historic achievement to promote equality among men and women in corporations. Justice Minister Heiko Maas, proponent of the measure, presented the quota as “the greatest contribution to gender equality since women got the vote” in 1918.⁸ However, the path to its approval was rife with controversy and an unexpected change in the equilibrium of forces in the Parliament was instrumental in making the quota a reality.

Not long before the quota, a majority conservative CDU cabinet with the support of its liberal coalition partner, the FDP, was adamant in its opposition to a fixed ‘hard’ quota. The Ministry for Family Affairs advocated, instead, in favour of a ‘flexi-quota’⁹ and, in 2011, it became a reality. It was an obligation of self-commitment: companies set goals for themselves and self-determine the period of time to fulfill them. This flexi-quota was only supposed to come into force if the economy did not triple the average proportion of women on boards by 2013.¹⁰

Furthermore, the government coalition rejected two proposals for a compulsory boardroom quota introduced by the opposition parties¹¹ and Germany voted against a European Commission pro-quota initiative in 2012. Chancellor Merkel publicly supported the Minister for Family Affairs in her push for a more flexible legislative framework and the liberal coalition party strongly rejected the idea of business quotas. In September 2013, however, a Federal parliamentary election took place. The incumbent CDU won with an ample margin,

⁸Germany Sets Gender Quota in Boardrooms. Smale, A. and Miller, C. The New York Times, March 6 2015. <https://www.nytimes.com/2015/03/07/world/europe/german-law-requires-more-women-on-corporate-boards.html>.

⁹Federal Ministry for Family Affairs, Senior Citizens, Women and Youth of the Federal Republic of Germany, *Stufenplan “Frauen und Männer in Führungspositionen”* v. 6.6.2011, <http://www.bmfsfj.de/BMFSFJ/gleichstellung,did=172756.html>.

¹⁰The percentage of women on boards in 2013 missed that mark but the obligation never ensued.

¹¹One, introduced by the social democrats (SPD), targeted supervisory boards of listed firms with parity co-determination; the second, introduced by the SPD and the Greens, targeted both the supervisory and the management boards of these same firms.

as it was expected, only five seats away from an absolute majority. But their former minority partner fell short of meeting the 5% vote threshold, denying them seats in the Bundestag for the first time in their history. Suddenly, the former government coalition could not be reenacted. The CDU and the SPD, the only two parties with the ability to form a government, started negotiations. In November 2013, they agreed on a coalition government for the 18th legislative term. As part of the agreement, the social democrats imposed the gender quota as a priority on the new government’s agenda (Lang, 2015). In 2014, a decision on the regulation of the quota was announced.¹² The Ministry for Family Affairs drew up the ‘Bill for the equal participation of women and men in executive positions in the private sector and in public service,’¹³ which was subsequently approved on March 6, 2015. The law came into force on May 1, 2015, becoming effective January 1, 2016.

The Bill, which we will refer to as the Gender Quota Law (GQL), affects supervisory boards of listed firms subject to parity co-determination. Co-determination is a system of labor participation that gives employees representation at the board level (Carley, 1998; Schulten and Zagelmeyer, 1998). In practical terms, under the Codetermination Act,¹⁴ if a company has more than 2,000 employees, half the members of the supervisory board must be affiliated with the employee side (*Arbeitnehmerseite*) and half with the capital side (*Kapitalseite*).¹⁵ The quota applies to the joint board and not to each side individually.

Germany has a dual board corporate system. This means that companies subject to the Stock Corporation Act¹⁶ have two boards with distinct tasks. The management board (or executive board) is responsible for the daily operation of the company. The supervisory board (also known as the non-executive board) controls and monitors the management board. Companies that fall under the purview of the GQL shall adopt: i) a mandatory 30% quota

¹²‘Germany backs law demanding at least 30% women in top boardrooms,’ Connolly, K. The Guardian, 26th November 2014. URL: <https://www.theguardian.com/world/2014/nov/26/germany-women-quotas-frauenquote-boardrooms>.

¹³*Gesetz für die gleichberechtigte Teilhabe von Frauen und Männern an Führungspositionen in der Privatwirtschaft und im öffentlichen Dienst* (Bundesgesetzblatt Jahrgang 2015 Teil I Nr. 17 S. 642).

¹⁴*Gesetz über die Mitbestimmung der Arbeitnehmer* of May 4, 1976 (Bundesgesetzblatt I S. 1153).

¹⁵For more details on the regulation of the co-determination regime in Germany, see Addison and Schnabel (2009).

¹⁶The Stock Corporation Act applies to stock corporations, partnerships limited by shares, and, partially, to companies with limited liability. A *Societas Europaea* can choose between a one-tier and a two-tier board structure; however, most German SEs opt for the two-tier board system.

on supervisory boards; and ii) voluntary quotas individually determined by each company for the members of its management board.

To sum up, the GQL imposes a minimum 30% of the underrepresented gender on the supervisory board from January 1, 2016 onward.¹⁷ A firm subject to the Law that does not comply with the threshold will not be able to elect a new male to the supervisory board, otherwise the election will be declared void and the seat left vacant. The seats will remain vacant until new elections are held or a member is appointed by court.¹⁸ Additionally, failure to meet a quota constitutes an administrative offence that can be punished with up to a 50,000 euro fine.

In recent years, the share of women on boards has been increasing in the largest German firms, as seen in figure 1. The board affected by the law - the supervisory board - has a higher percentage of women than the management board during the whole period analyzed. In 2016, the first year the obligation of the quota comes into force, the percentage of women on the supervisory board is approximately 14%, still far from the mandated GQL goal of 30%.

3 Hypotheses development

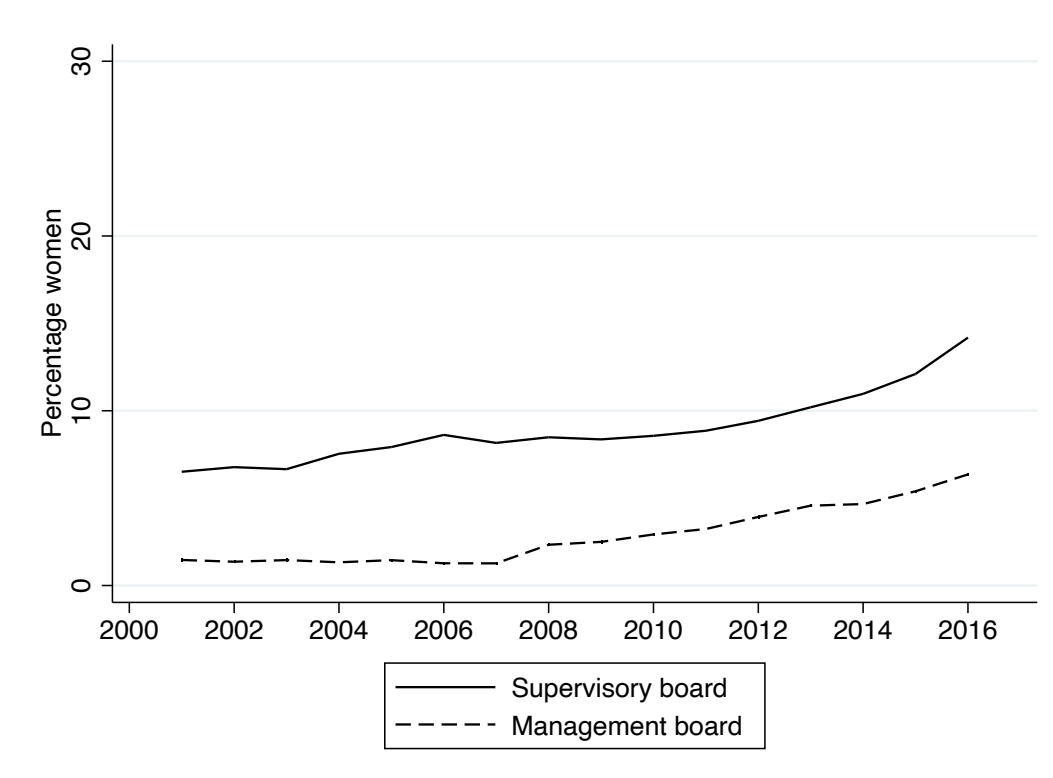
As we have stated in the introduction, our research question is the following: does the quota contribute to lift more women further up the corporate ladder and to a wider range of positions?

Spillover to executive boards. The first manifestation of the question is whether quotas expand opportunities for women to veer into other leadership positions in corporations. The theoretical underpinning behind this effect may be homophily. Women may hire and promote fellow female colleagues to other positions of power within the firm because they prefer to be in a working environment made by individuals more similar to them. Homophily in male managers is shown to be pervasive in empirical settings (Hek and Lippe, 2019). As women

¹⁷The Law does not affect elections taking place before January 1, 2016, nor the ongoing term of current board members.

¹⁸These sanctions have been enforced: for example, Villeroy & Boch, a manufacturer of ceramics, was forced to leave a position on its supervisory board vacant for several months in 2018.

Figure 1: Evolution of the share of women on supervisory boards and management boards for the largest German firms.



Note: This figure shows the average percentage of women on the supervisory board (solid line) and the management board (dotted line) between years 2000 and 2016 in the largest German companies. Percentage women is the number of women over the total number of board members in percentage points. Source: 'Die Großen 500' [CD-ROM] Neuhäsel: Müssig Verlag, 2000-2017.

become more prevalent at the top, the inclination to favor your own kind should display its effects through all the rungs of the corporate ladder.¹⁹ Since the supervisory board appoints the members of the management board, we would expect that an homosocial environment leads to an increase in the share of women on the management board.

On the contrary, a compulsory quota could prompt a reduction of other managerial career chances for women if the quota is seen as an imposition and shareholders do not welcome the interference to their right to choose their board representatives. In this case, we would see firms trying to circumvent the mandated increase in female presence, whenever possible. The German case is specially interesting given the dual board system, where only one of the boards has a mandatory quota. The other board, where no quota applies, would be the ideal target to compensate for a forced increase in female representation. If we observe a reduction in female representation on the management board that is linked to that same firm necessity to hire women to non-executive directorships, it should be attributed to a strategic choice on the part of the firm rather than a general market tightness for women directors.

Portfolio career non-executive directors. Unlike most other countries, Germany has a dual board system.²⁰ It dates back to the 19th century, but it was definitely adopted in its modern form following the Second World War. With respect to one-tier board structures, it is intended to separate management and control within a firm. Members of the supervisory board are elected by the shareholders during the general meeting and they cannot sit on the management board of the same firm.²¹ German directors tend to have one primary executive position (mostly CEO) and serve simultaneously in one or more supervisory boards (Aluchna, 2013).

Anecdotal evidence in other places that have introduced gender quotas has pointed out a novel phenomenon: women leave or do not pursue an executive career to become portfolio career NEDs.²² As portfolio career NEDs, their primary job is to sit on different boards,

¹⁹ Cohen and Huffman (2007) show that female managers report they are more favorable to intensifying efforts to hire and promote qualified women than male managers.

²⁰In Europe, only a few other countries have a dual board system. These are Austria, Denmark, Finland, and the Netherlands.

²¹However, it is not uncommon in Germany that members of the management board switch to the supervisory board after retirement and often become chairman of this body (Jungmann, 2006).

²²Most of the women who make up Norway's 'golden skirts' are non-execs,' Lewis, K. The Guardian, 1st July 2011. URL: <https://www.theguardian.com/business/2011/jul/01/norway-golden-skirt->

possibly simultaneously. Remuneration is typically lower than top management but so are responsibilities and the rigidities associated with high-end corporate jobs. As a consequence, this might steer female talent away from type of job where it may be better suited. There is a lack of empirical evidence of this phenomenon and its relation to the quota.

Golden skirts. Gender board quotas could open up opportunities to access board membership for a larger group of women candidates. This would narrow the opportunity gap between women insiders, who are already occupying directorships within the firm, and women outsiders and foster equality among women. Studies show that, compared to the general female population, women directors display characteristics that are more similar to their male peers and more dissimilar to the average women; e.g. risk aversion (Adams and Funk, 2012). Henceforth, forcing firms to look for female director talent in a broader pool of women could have effects on the leadership style that prevails in the boardroom. Additionally, it may level the playfield across women who compete for very scarce opportunities, thus removing the incentives for ‘queen bee’ type of situations to arise (Bagues et al., 2017; Faniko et al., 2020).²³ On the contrary, gender quotas also have the potential to make women insiders accumulate more board nominations themselves. This is commonly referred to as the ‘golden skirts’ phenomenon (Smith, 2014). Part of the increase in female representation benefits women who are already serving on boards, instead of increasing the participation of new women. This creates a small elite group of women directors, similar to the traditional ‘old boys’ network’ (Huse, 2011), which is at odds with a greater distribution of power among women in general (Seierstad and Opsahl, 2011). The increase in corporate ‘golden skirts’ worsens existing inequalities among women and it may also risk to overburden women insiders with excessive duties.

The ‘golden skirts’ phenomenon has been examined by researchers and the media and has been found to be on the rise after a gender quota is applied to the board (e.g., see the evidence for Norway by Bertrand et al., 2019). In the German case, in theory, there is a limit to the extent that this may happen. Under the Stock Corporation Act, an individual cannot hold more than ten supervisory board positions and the seat of the chairperson counts double.

quota-boardroom?intcmp=239&guni=Article:in%20body%20link.

²³‘Queen bee’ refers to a female who sabotages other women’s progress in male-dominated environments because it could hurt her own possibilities to access the very few existing jobs for females.

Additionally, members of the management board cannot hold more than three positions on the supervisory board of external companies in the same or a similar industry (Deloitte, 2016). This might reinforce the incentives for women to abandon the managerial career path and become a professional NED, as we have stated before.

Second glass ceiling. Another question of interest is whether the quota may help to lift women up to the very top positions, shattering the so-called ‘glass ceiling’. It seems reasonable to expect that, once women achieve certain positions of power, they would be able to progress all the way to the highest echelons of the firm. However, if women are not seen as equals at the board, this may not be the case. A practical implication may be that, even though women make it to the top of the firm, they may lack real power to enact changes. Eagly (2016) suggests that this may happen because women are ‘disadvantaged in groups composed mainly of the other gender..., and this disadvantage can hamper their contributions.’

Highest ranked positions, like that of the chairperson or the head of some board subcommittees, bear more power to influence decisions. The chairperson of the board ‘is often seen as the most influential director on a board by being responsible for managing the board, setting its agenda, and having a close relationship with the chief executive officer’ (Seierstad and Opsahl, 2011). If women on the board do not have an improved chance to become chairperson, it may be an indication that they do not hold as much influence in decisions as men do. So far, works looking at the effect of board quotas on the feminization of the chair find mixed results (Wang and Kelan, 2013; Bozhinov et al., 2018).

4 Data and empirical specification

4.1 Data description

The dataset contains information on 1,128 firms from 2000 to 2016. The data has been obtained from the database ‘Die Großen 500,’ which provides managerial and financial information based on public records for the largest German firms, in volume of sales.²⁴

²⁴Since 1970 ‘Die Großen 500’ or ‘Die Großen 500 auf einen Blick’ (subtitle ‘Deutschlands Top-Unternehmen mit Anschriften, Umsätzen und Management’) by Luchterhand Verlag has released yearly

The main advantage of this dataset is that it contains the full names of the members of the executive board and the supervisory board, identifying whether they belong to the capital side or the employee side of the supervisory board. Even though other sources of data (for instance, Orbis) provide more extensive coverage of business information, data on the historical composition of boardrooms, which is the core of our analysis, is not available.

We focus our analysis in the years 2008 to 2016. This leaves us with 7,953 firm-year observations. The overall number of treated and untreated firms in that period is shown in table 1. Approximately 100 German companies are obliged to implement the gender quota, we have 94 treated firms in our database. Firms are spread across various industries and regions, such that the effect is not confined to a specific region or economic sector.

Board members are classified by gender based on their first name. We listed all names of the board members and assigned them manually to the categories ‘*male*’ or ‘*female*’ whenever there was no ambiguity regarding their gender. If this classification was not possible on the basis of the first name alone (for instance, if the first name was foreign or can be used by both genders), we performed a search of the name and surname on the internet looking for public records, journal articles, or other business data sources where the person was referenced. Then, we assigned the gender according to the visual inspection of a picture or the personal pronouns used to refer to the person or their job title.²⁵ In table 2, we present selected summary statistics about gender in boards. Women hold a minority of the board seats: on average, management boards have 0.2 female members and supervisory boards have 1.8 female members. Approximately 50% of the firms do not have any women on their supervisory boards and more than 85% do not have any women on their management board.

In figure 2, we plot the evolution of the share of women on the supervisory board and on the management board over time. The solid lines represent firms that are affected by the GQL and the dotted lines represent unaffected firms. The share of women on both boards of treated firms took off vis-à-vis untreated firms from 2011 onwards, after the introduction of

updates of its database in print, with accompanying disks since 1994 and CD ROMs since 2000. From 2000 to 2017, the publisher changed to Müssig Verlag: ‘Die Großen 500’ [CD-ROM] Neuhäsel: Müssig Verlag, 2000-2017. The resource is accessible via the DIW Berlin library as well as other German institutions with OCLC reference 634902939 and ID number 2015473-2 from the catalogue of the Zeitschriften Datenbank.

²⁵The German language foresees a distinction between male and female in the declination of the job titles. For instance, a male CEO would be referred to as ‘Vorsitzender,’ but a female CEO would be ‘Vorsitzende.’

Table 1: Number of firms per year by treatment.

	Untreated	Treated	Total
2008	582 (86.2)	93 (13.8)	675 (100.0)
2009	599 (86.6)	93 (13.4)	692 (100.0)
2010	613 (86.8)	93 (13.2)	706 (100.0)
2011	623 (87.0)	93 (13.0)	716 (100.0)
2012	632 (87.2)	93 (12.8)	725 (100.0)
2013	665 (87.6)	94 (12.4)	759 (100.0)
2014	671 (87.6)	95 (12.4)	766 (100.0)
2015	672 (87.6)	95 (12.4)	767 (100.0)
2016	573 (85.8)	95 (14.2)	668 (100.0)
Total	5630 (87.0)	844 (13.0)	6474 (100.0)

This table shows the total number of firms in the database and its percentages (in parenthesis), between 2008 and 2016, split by their treatment status. A ‘treated’ company is defined as a company that satisfies the two criteria required by the law to fall under the obligation of implementing a gender quota: being listed on the stock exchange and being subject to the Co-determination Act. The rest are considered ‘untreated’. Source: ‘Die Großen 500’ [CD-ROM] Neuhäsel: Müssig Verlag, 2000-2017.

Table 2: Board descriptive statistics

	mean	sd	min	max
Members management board	4.3	2.0	1.0	16.0
Members supervisory board	10.8	6.2	1.0	40.0
Female members management board	0.2	0.5	0.0	4.0
Female members supervisory board	1.1	1.5	0.0	8.0

This table presents descriptive statistics of the total number of members of the management board (first row) and supervisory board (second row) and the number of female members of the management and the supervisory board (third and fourth row). The first column presents the mean value, the second presents the standard deviation, while the third and fourth columns present the minimum and maximum values, respectively. Units are number of individuals. Source: ‘Die Großen 500’ [CD-ROM] Neuhäsel: Müssig Verlag, 2000-2017.

the ‘flexi-quota.’ As we explained in the previous section, the ‘flexi-quota’ was an obligation to set individual voluntary quotas and comply with them over a self-determined period of time. Quotas could be set to zero and, in many instances, they were. In 2014, it became clear that the GQL would impose a rigid quota and, unlike the ‘flexi-quota,’ it would apply only to the supervisory board. After that, figure 2 shows that the share of women on the supervisory board of treated firms continues to rise, reaching past 20% in 2016. The share on management boards, on the other hand, decreases after 2014 for treated firms and then advances more slowly than in untreated firms, where the tendency is to continue growing.

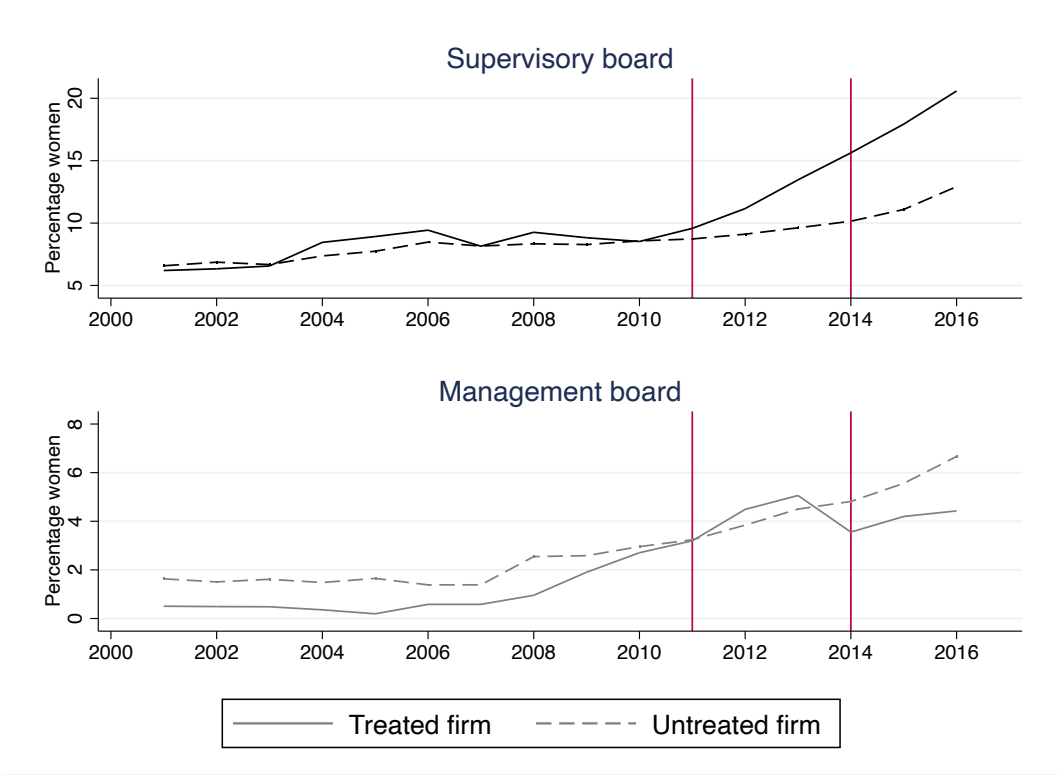
4.2 Empirical specification

In considering the causal effects of the quota, we estimate the following difference-in-differences model:

$$Y_{i,t} = \beta \text{Treated}_i \times \text{Post2014}_t + \gamma X_{i,t} + \kappa_i + \tau_t + u_{i,t}, \quad (4.1)$$

where $Y_{i,t}$ is the dependent variable, the share of women on the board, Treated is a dummy variable that takes value 1 if the firm is affected by the GQL and 0 if it is not, $X_{i,t}$ is the size of the firm proxied by the number of employees, and Post2014 is a dummy variable that takes value 1 in the post-treatment years and 0 in the pre-treatment years. The specification

Figure 2: Evolution of the share of women on supervisory boards and management boards.



This figure shows the average percentage of women on the supervisory board (panel above) and the management board (panel below), between years 2008 and 2016, split by treated (solid line) and untreated (dotted line) firms. Percentage women is the number of women over the total number of board members in percentage points. A ‘treated’ company is defined as a company that satisfies the two criteria required by law to fall under the obligation of implementing a gender quota: being listed on the stock exchange and being subject to the Co-determination Act. The rest are considered ‘untreated’. The 2011 year line marks the introduction of the ‘flexi’ quota and the 2014 year line marks the introduction of the Gender Quota Law. Source: ‘Die Großen 500’ [CD-ROM] Neuhäsel: Müssig Verlag, 2000-2017.

includes year and firm fixed effects.²⁶ Standard errors are clustered at the firm level.

Treatment year. The treatment year is 2014, the year the gender quota was agreed upon, after a surprise election outcome did away with the former government’s opposition to a rigid quota. Before that event, we assume that the possibility of a gender quota was highly uncertain. In figure 3, we can see the trends in google searches within Germany for the topic “Frauenquote” (transl. “gender quotas”). The interest in the term can be seen as representative of the awareness amidst the population and hints at possible anticipation effects. It is easy to spot spikes taking place in February-March 2011, April 2013, November 2014, and March 2015. The first one, in 2011, corresponds to the announcement of the ‘flexi-quota’.²⁷ The following one, in April 2013, coincided with the German Parliament expectedly rejecting a boardroom quota proposed by the opposition parties.²⁸ This was yet another reassurance against the imposition of a hard quota. After the formation of the CDU-SPD government coalition resulting from the 2013 Federal election, the interest in the topic of the gender quota raised again with the announcement of the GQL in November 2014. The last spike of March 2015 corresponds with the official approval of the GQL in the Parliament. After the announcement of the GQL in 2014, firms were aware of the upcoming quota and, therefore, could react to it. Before 2014, however, we assume that the position of the government was undoubtedly against the quota. Elections took place on the 22nd November 2013. Since the beginning of August, election polls were estimating the former junior government party FDP to be above the 5% threshold that grants representation in the Parliament. The incumbent CDU, was leading in the polls with an estimated 40% of the electorate and, together with the FDP, they were close to or above the absolute majority. More importantly, the coalition made up by the other two big parties, the SPD and the Greens, was not forecasted to be able to form an alternative government.²⁹ The parties that

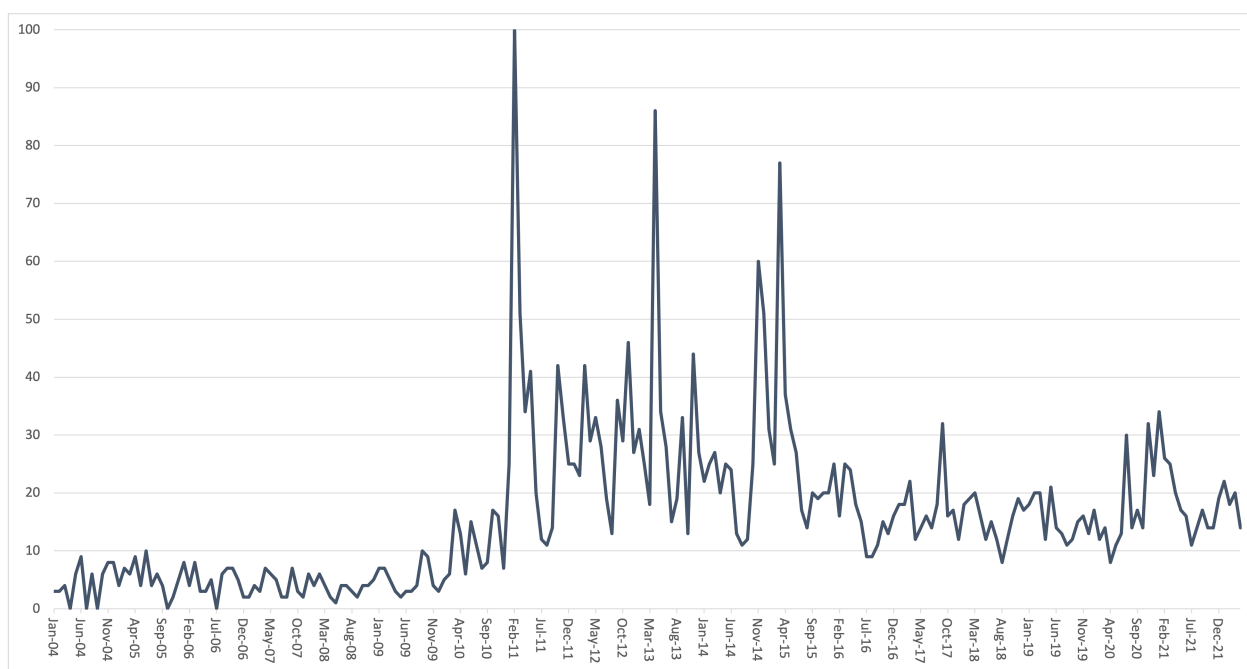
²⁶The constant and the variable *Treated* are absorbed by the inclusion of firm dummies and the variable *Post2014* is absorbed by the inclusion of year dummies.

²⁷‘Germany’s biggest companies promise to promote more women,’ The Guardian, 30th March 2011. URL:<https://www.theguardian.com/society/2011/mar/30/german-companies-promise-to-promote-women>. [Retrieved: 13th April 2022].

²⁸‘Boardroom quota for women rejected by German Bundestag,’ Deutsche Welle News, 18th April 2013. URL: <https://www.dw.com/en/boardroom-quota-for-women-rejected-by-german-bundestag/a-16755599>. [Retrieved: 13th April 2022].

²⁹Based on the pollytix german election trend. The forecast is calculated daily from the weighted average of all federal voting intention polls of the previous twenty days in Germany. Polling agencies taken

Figure 3: Google Trends search for the topic "Frauenquote" in Germany.



This figure shows the volume of google searches in the German territory for the topic "Frauenquote" (German term for "Gender quotas") between 2004 and 2022. Units are an index with maximum value equal to 100.

Table 3: Summary of the Gender Quota Law requirements.

		Supervisory board		Management board	
		2011	2013	2011	2013
Listed	Co-determination	$\geq \text{share}_{t-1}$	30%	$\geq \text{share}_{t-1}$	0%
	Without co-determination	0%	0%	0%	0%
Unlisted	Co-determination	0%	0%	0%	0%
	Without co-determination	0%	0%	0%	0%

This table summarizes the requirements firms have to meet to fall under the purview of the GQL and the legal obligations it establishes.

were supposed to reenact the former ruling coalition were known to have opposed explicitly a hard quota in the past and did not consider it a legislative priority.

Treated and control group. We first classify treated firms according to public records of eligible firms. Eligibility is recorded based on the list of 108 firms produced by DIW Berlin for the ‘Managerinnen-Barometer’ in 2015.³⁰ We then cross-check this classification with the list of 107 firms elaborated by the Hans-Böckler-Stiftung, a foundation that undertakes research in the areas of business and administration in Germany, and with Bozhinov et al. (2018)’s 103 affected firms based on the ‘Women-on-Board’ list by the FidAR organization. We select the firms in our sample that are eligible according to those lists and call them treated. These are 94 distinct firms. The rest are considered untreated.

Recall the requirements of the gender quota law summarized for convenience in table 3. Firms subject to parity co-determination, as can be seen in table 3, are affected by the GQL if they are listed. Unlisted firms are not. Notice, though, that this does not make our analysis a comparison of listed versus unlisted.³¹ What we compare is a specific category of firms (listed and co-determined) to firms that are lacking either one or the two requirements. We acknowledge that the group of treated firms is like no other: firms that are both listed and particularly large (which makes them co-determined) may have particular characteristics and could have followed a different path over time even in the absence of the GQL. This

into account comprise Allensbach, Emnid, Forsa, Forschungsgruppe Wahlen, GMS, Infratest dimap, and INSA/YouGov.

³⁰We thank Elke Holst, the former Research director of Gender Studies at DIW Berlin, for sharing this information with us.

³¹There is also a group of listed firms that are unaffected by the GQL: firms without parity co-determination.

would violate the assumption of parallel trends required in our specification (equation (4.1)). In what follows, we propose modifications of the baseline empirical specification to make our analysis more robust to trend differentials.

The first one is to allow for a linear trend difference as in equation (4.2).

$$Y_{i,t} = \beta \text{Treated}_i \times \text{Post2014}_t + \delta_t \text{Treated}_i + \gamma X_{i,t} + \kappa_i + \tau_t + u_{i,t}. \quad (4.2)$$

In a recent paper, Bilinski and Hatfield (2019) recommend this approach to assess the robustness of parallel trends. The advantage of the model in equation (4.2) is that it allows for the treated and the control groups to have linear trends with different slopes. If the difference in the treatment effect does not differ much from the baseline model (which assumes parallel trends), the hypothesis of parallel trends cannot be rejected.

Furthermore, we considered another specification focusing only on the subset of firms that are either listed or co-determined. In this case, treated firms are those that are listed and subject to parity co-determination, whereas listed (but not co-determined) and co-determined (but unlisted) firms are two separate control groups. Small unlisted firms are dropped out of the sample. Since our dataset does not contain information on the listed status of the firm neither on parity co-determination, we need to construct proxy variables. For the listed status, we first merge our dataset with Compustat international. We collect information on stock prices from Compustat and combine it with information on the societal form. We consider a firm to be ‘listed’ if its societal form is a stock corporation (*Aktiengesellschaft*) and we have information on stock prices for that year. We also consider ‘listed’ all European companies (*Societas Europaea*). We set the firms without information on the societal form to missing and consider the rest to be ‘unlisted’.³² Regarding the status of ‘co-determined’, we follow the Co-determination Act, and consider any firm with 2.000 employees or more in our sample to be subject to parity co-determination.

Then, we estimate the following equation on the subsample of firms meeting at least one

³²Other societal forms are *Einzelunternehmen*, *Genossenschaft*, *offene Handelsgesellschaft*, *Kapitalgesellschaft*, *Kommanditgesellschaft auf Aktien*, *rechtsfähiger Verein*, *Stiftung des Privatrechts*, *Anstalt des öffentlichen Rechts*.

requirement of the GQL:

$$Y_{i,t} = \beta_1 \text{Listed}_i \times \text{Codet}_i \times \text{Post2014}_t + \beta_2 \text{Listed}_i \times \text{Post2014}_t + \beta_3 \text{Codet}_i \times \text{Post2014}_t + \gamma X_{i,t} + \kappa_i + \tau_t + u_{i,t} \quad (4.3)$$

where $Y_{i,t}$ is the share of women on the board, Listed_i and Codet_i are dummy variables that take value 1 if the firm is listed or subject to full parity co-determination, respectively, and 0 if it is not, $X_{i,t}$ is the size of the firm proxied by the number of employees, and Post2014 is a dummy variable that takes value 1 in the post-treatment years and 0 in the pre-treatment years. The specification includes year and firm fixed effects.³³ Standard errors are clustered at the firm level. The inclusion of the interaction term $\text{Listed}_i \times \text{Post2014}_t$ allows listed and unlisted firms to behave differently after the GQL. The interaction $\text{Codet}_i \times \text{Post2014}_t$ let the firms evolve differently after 2014 because of their size. Having accounted for the differences coming from being a listed company and from being large, independently, the residual effect that we find on both listed and large firms, which are the treated firms, is plausibly due to the quota.

Finally, we create a synthetic control group of untreated companies that are the closest to certain pre-treatment characteristics of the affected firms using propensity score matching (Abadie and Imbens, 2016). We do this by estimating propensity scores using probit with common support and without replacement. Then we select each firm’s closest neighbor based on the difference in the share of women in 2008-09, in 2009-10, in 2010-2011, in 2011-12, and in 2012-13 in the respective board, and the share of women and the number of employees in 2013. Next, we estimate equation (4.1) on the subsample of treated firms and its ‘matched’ controls, selected as explained above. We assume that if the two groups (treated and ‘matched’ control) were in a similar pre-reform trend, they would have continued to evolve in a similar way absent the introduction of the gender quota. The fact that there were no other major events that affected exclusively listed and co-determined firms in Germany during that time helps sustain this assumption.

³³The inclusion of firm dummies absorbs the constant and the variable $\text{Listed} \times \text{Codet}$ and the inclusion of year dummies absorbs the variable Post2014 .

5 Gender quotas and women on boards

In this section, we investigate whether gender quotas enhance women’s representation on boards. We refer to the supervisory board as the board ‘targeted’ by the Law because a rigid 30% quota apply to this board. As for the management board, the GQL requires each company to specify its desired quota goal.³⁴ Sanctions for non-compliance are not foreseen, other than requiring a public explanation of the failure to meet the goal. Following this, the management board will be referred to as the ‘non-targeted’ board because of the voluntary nature of the quota and the lack of enforcement.

5.1 Effects of the quota on the targeted board

First, we want to evaluate compliance with the GQL. Firms may be unwilling or unable to hire women to fill in supervisory board positions, even in the face of sanctions, if the costs of doing so outweigh the sanction penalty. In order to evaluate the effects of the GQL on the targeted board, we use the share of women on the supervisory board as a dependent variable and estimate equations (4.1), (4.2), and (4.3).

Results are reported in table 4. Column 1 presents the estimation of equation (4.1) with the unrestricted sample of firms covered in the database and column 2 with a balanced panel of firms present in the sample during the whole period of estimation. Column 3 corresponds to the estimation of equation (4.2), which includes differential time trends for treated and control firms. The difference in trends is significantly higher for treated firms. The last column estimates equation (4.3) in the subsample of firms that meet at least one requirement of the GQL.

We find evidence of compliance with the GQL. After the GQL was announced, firms that learned they were affected by the law increased the presence of females on the targeted board at a higher rate than its unaffected counterparts. The estimated effect is an increase in the share of women on the supervisory board between 1.5 and 3.5 percentage points in the years from 2014 to 2016.

³⁴The quota can be the same as the current percentage of women on the management board but cannot be lower.

Table 4: Effect of the gender quota on the targeted board.

	All firms	Balanced panel	Linear trend	Near eligible firms
	(1)	(2)	(3)	(4)
	Share women	Share women	Share women	Share women
Treated X Post2014	3.570*** (0.749)	3.382*** (0.839)	1.474* (0.765)	
Listed X Co-det X Post2014				3.262*** (0.791)
Size controls	Yes	Yes	Yes	Yes
Linear trend	No	No	Yes	No
Time FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	4184	3095	4184	2961
R-squared	0.17	0.16	0.17	0.22
F-statistic	26.48	20.33	24.57	24.09

This table shows the average effect of the gender quota on the supervisory board of the largest German firms between 2008 and 2016. The dependent variable is the share of female members over the total members of the supervisory board. The treatment year is 2014. ‘Treated’ firms are those satisfying the requirements of the quota law: being listed and subject to parity co-determination under the Co-determination Act. ‘Listed’ firms are stock corporations with publicly traded stocks and ‘Co-det(etermined)’ firms are those with 2.000 employees or more. ‘All firms’ refers to the whole sample, ‘Balanced panel’ to a balanced sample of firms present in the database from 2008 to 2016, ‘Linear trends’ includes differential time trends for treated and control firms and ‘Near eligible firms’ refers to firms that satisfy only one of the two requirements of the quota law. Standard errors clustered at the firm level in parentheses. Significance * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Effect of the gender quota on the non-targeted board.

	All firms	Balanced panel	Linear trend	Near eligible firms
	(1)	(2)	(3)	(4)
	Share women	Share women	Share women	Share women
Treated X Post2014	-2.288*** (0.812)	-3.241*** (0.865)	-3.125*** (0.972)	
Listed X Co-det X Post2014				-2.717*** (0.864)
Size controls	Yes	Yes	Yes	Yes
Linear trend	No	No	Yes	No
Time FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	4184	3095	4184	2961
R-squared	0.05	0.05	0.05	0.06
F-statistic	5.24	4.44	5.03	4.45

This table shows the average effect of the gender quota on the management board of the largest German firms between 2008 and 2016. The dependent variable is the share of female members over the total members of the management board. The treatment year is 2014. ‘Treated’ firms are those satisfying the requirements of the quota law: being listed and subject to parity co-determination under the Co-determination Act. ‘Listed’ firms are stock corporations with publicly traded stocks and ‘Co-det(ermined)’ firms are those with 2.000 employees or more. ‘All firms’ refers to the whole sample, ‘Balanced panel’ to a balanced sample of firms present in the database from 2008 to 2016, ‘Linear trends’ includes differential time trends for treated and control firms and ‘Near eligible firms’ refers to firms that satisfy only one of the two requirements of the quota law. Standard errors clustered at the firm level in parentheses. Significance * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

5.2 Effects of the quota on the non-targeted board

In this section, we analyze the effect of the gender quota on the share of women on the non-targeted board. We do this by estimating equations (4.1), (4.2) and (4.3) with the share of women on the management board as dependent variable. Results of the estimation of equation (4.1) with the whole sample are in column 1 and with a balanced sample in column 2. Column 3 controls for different linear trends across groups as in equation (4.2) and column 4 cleans form the effect of being either listed or co-determined as in equation (4.3).

We do not find any evidence of a positive externality of the quota onto female representa-

tion in the executive board of the firm. On the contrary, table 5 reports a decline in the share of women after 2014 in firms affected by the quota. The average effect is approximately a 3 percentage points lower share of women in treated firms with respect to control firms from 2014 to 2016. Firms affected by the law had fewer women on the non-targeted board than control firms after the quota. The negative effect is present through all specifications. This documents a negative spillover effect of the quota onto the non-targeted board of treated firms.

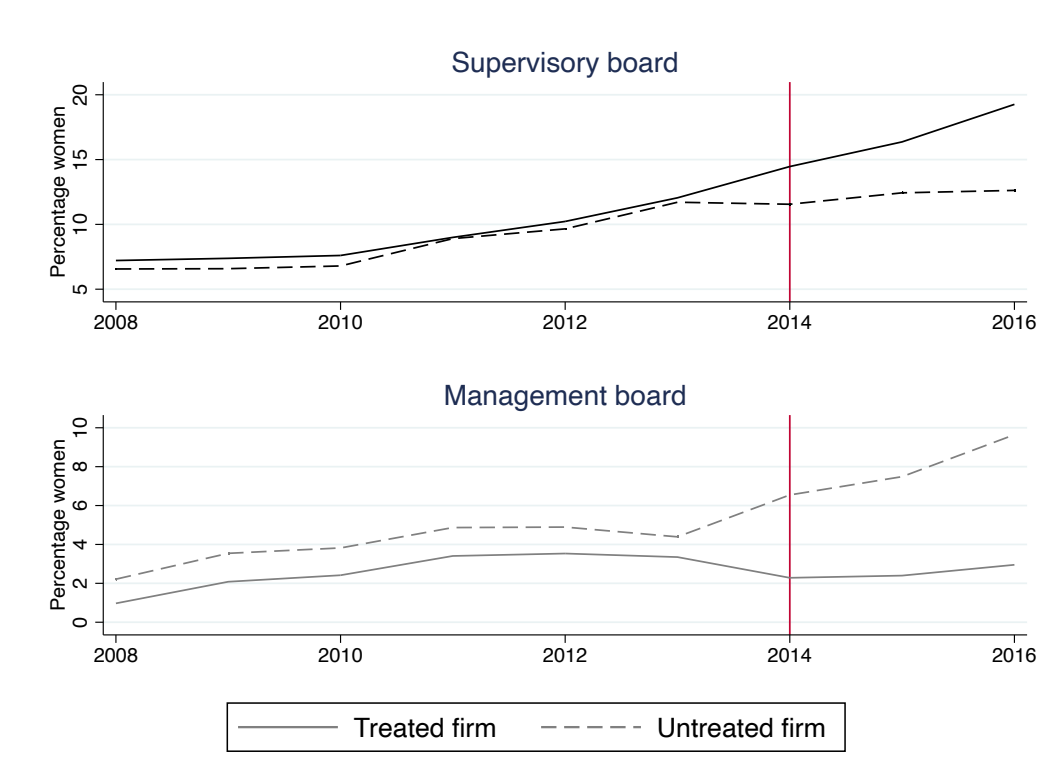
5.3 Propensity score matching

In this section, we estimate equation (4.1) using a sample of treated firms and matched controls. For each board, we match on the annual differences in the share of women in the years leading up to the GQL and the pre-reform share of women and number of employees, as explained in section 4.2. A graph showing common support and the table with the percentage of bias reduction for each matching procedure is presented in appendices A and B .

Figure 4 allows us to visually inspect the trends of the share of women on board, separately for the supervisory board (above) and the management board (below). As can be seen, we have achieved parallel trends prior to the GQL. Similarly to what we find in figure 2, the share of women on the supervisory board raises after the intervention whereas, on the management board, it decreases and subsequently flattens out with respect to untreated firms.

Results in table 6 confirm what we find above. Matching treated companies with the closest untreated firm, we find an increase in the share of women in the supervisory board in columns 3 and 4 and a decrease in the share in the management board in columns 5 and 6. In numbers, these amount to an increase of about half woman on the supervisory board and a 0.14 women loss in the management board. Overall, given that the number of members in both boards is unequal, we find a negligible effect in the share of women when the two boards are considered jointly, as can be seen in column 1 of table 6.

Figure 4: Evolution of the share of women on supervisory boards and management boards (matched sample).



This figure shows the average percentage of women on the supervisory board (panel above) and the management board (panel below), between years 2008 and 2016, split by treated (solid line) and untreated (dotted line) firms. Percentage women is the number of women over the total number of board members in percentage points. A ‘treated’ company is defined as a company that satisfies the two criteria required by law to fall under the obligation of implementing a gender quota: being listed on the stock exchange and being subject to the Co-determination Act. A synthetic control group of ‘untreated’ firms has been created using propensity score matching on the closest neighbour based on the share of women in 2008-09, 2009-10, 2010-11, 2011-12 and 2012-13 in the respective board and the share of women and the number of employees in 2013. The 2014 year line marks the introduction of the Gender Quota Law. Source: ‘Die Großen 500’ [CD-ROM] Neuhäsel: Müssig Verlag, 2000-2017.

Table 6: Effect of the gender quota on the targeted and non-targeted board using propensity score matching.

	All boards		Supervisory board		Management board	
	(1)	(2)	(3)	(4)	(5)	(6)
	Share women	Num. women	Share women	Num. women	Share women	Num. women
Treated X Post2014	0.0150 (0.0107)	-0.162 (0.461)	2.757** (1.207)	0.477** (0.183)	-3.482** (1.353)	-0.135** (0.0660)
Size controls	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1020	1020	1020	1020	1023	1023
R-squared	0.35	0.02	0.31	0.32	0.05	0.04
F-statistic	19.50	1.05	16.89	13.58	1.82	1.69

This table shows the average effect of the gender quota on the percentage of women and the number of women on each board of the largest German firms between 2008 and 2016. The dependent variable is the share of female members over the total members of the joint board in column (1), the supervisory board in column (3), and the management board in column (5) and the number of women of the respective boards in columns (2), (4), and (6). The treatment year is 2014. ‘Treated’ firms are those satisfying the requirements of the quota law: being listed and subject to parity co-determination under the Co-determination Act. The rest are considered ‘untreated’. Estimation using propensity score matching on the closest neighbour based on the share of women in 2008-09, 2009-10, 2010-11, 2011-12 and 2012-13 in the respective board and the share of women and the number of employees in 2013. Standard errors clustered at the firm level in parentheses. Significance * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

6 Do firms avoid having ‘too many’ women?

In the previous section, we have documented a casual relationship between the quota and a reduction of the share of women on the non-targeted board. Our results do not support homophily driven spillovers from women in the supervisory board nominating other women to the executive board. One explanation might be that women directors display less homophily than men directors do.³⁵ Another explanation might be that women directors are not so influential within boards. Firms may want to keep the overall board as homogeneous as possible, which under the restrictions imposed by the GQ, could be achieved by two channels: firstly, compensating an increase in one board with a decrease in the other board and, secondly, spreading the percentage of women across sides of the targeted board so that women are not a majority in either one of them.

In this section we explore these two channels. First, if firms want to maintain a low number of women on the board overall, they will try to circumvent the law by compensating the mandated increase in one board with a reduction in the other board. If this is the case, firms that were forced to hire more women in order to comply with the GQL would have more incentives to undo this change. To check whether this hypothesis holds, we need to find a source of variation across affected firms in the necessity to hire women. We distinguish between firms which are “effectively constrained” by the quota law and those which are not, looking at whether the mandated number of women is different than their preferred board composition. Then, we compute the women gap as the difference between the number of women in the supervisory board of the firm in 2013 and the target number that they are required to reach.³⁶ A gap equal to zero or negative means that the firm currently has enough women on the supervisory board to comply with the law. On the contrary, a positive gap means that the firm is required to hire women in order to meet the GQL target.

We estimate equation (4.1) in the two subsamples and find significant effects only on firms that are constrained by the quota (positive female gap). That is, affected firms employing a sufficient number of women in the supervisory board when the law passed, do

³⁵There is evidence that women form social networks differently than men (Lindenlaub and Prummer, 2021), engage less in collaboration (Kwiek and Roszka, 2021) and evaluate the same gender less favourably than men do (Bagues et al., 2017).

³⁶The methodology for the calculation can be found in Appendix C.

not register a negative spillover to the management board relative to untreated firms. Neither do they hire more women to the targeted board compared to unaffected firms. This indicates that the management board changes composition as a reaction to what is happening on the supervisory board. The reduction of female managers can be due to layoffs or to shifts from the no-quota board to the quota board. It is less likely to be related to a general market tightness for woman directors because it would affect the ability to hire of unconstrained firms as well as constrained ones.

The second channel hypothesizes that firms may want to keep the percentage of women as low as possible at each single body they participate in. Let us analyse the gender composition at each side of the supervisory board. As we explain above, the supervisory board comprises representatives of the employees (employee side) and representatives of the shareholders (capital side). Fulfilment of the quota is considered jointly at the supervisory board level and not separately by each side of the supervisory board.³⁷ It follows that a 30% quota in a 12 member board can be achieved by having 30% of females in each side or 60% in one side and 0% in the other side. Even though representatives for both sides of the supervisory board respond to shareholders interests and have the same duties and responsibilities, they are, in practice, elected by different stakeholders and often sit on opposite sides of the table.³⁸ Conservative directors may fear that a majority of women on either side might imbalance power dynamics, thus, fostering more disruption and contention.

In order to see how the gender composition of each side of the supervisory board reacted to the introduction of the quota, we estimate equation (4.1) separately for each side. Table 8 shows an increase of women both in the employee side (column 1) and in the capital side (column 2). Then, we compare the speed of feminization across sides by employing the dependent variables *Sides ratio* and *Convergence* in equation (4.1). The first variable measures the share of women on the capital side over the share of women on the employee side per firm at each point in time. This captures how fast the capital side incorporated women as compared to the employee side of the same firm. We can see in column 3 that,

³⁷Each side of the supervisory board can reject joint compliance and ask that the quota be satisfied individually by each side. At each new election, the default is always joint compliance unless one side asks for a withdrawal.

³⁸Giving workers equal representation on the board. Beatrice Weder di Mauro. INSEAD 2022. <https://knowledge.insead.edu/blog/insead-blog/giving-workers-equal-representation-on-the-board-9036>.

Table 7: Effect of the gender quota on the share of women of constrained versus unconstrained firms.

	Unconstrained		Constrained	
	Management board (1) Share women	Supervisory board (2) Share women	Management board (3) Share women	Supervisory board (4) Share women
Treated X Post2014	-4.154 (3.696)	-1.827 (3.157)	-3.860*** (0.957)	3.411*** (0.922)
Size controls	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	206	206	2178	2178
R-squared	0.12	0.36	0.06	0.21
F-statistic	6.50	6.43	4.01	19.36

This table shows the average effect of the gender quota on the percentage of women on both boards of the largest German firms between 2008 and 2016, split in two groups according to their pre-reform distance to the mandated number of women. ‘Unconstrained’ refers to firms with a share of women on the supervisory board in 2013 above or equal to the one mandated by the quota; ‘constrained’ refers to firms where the opposite is true. The dependent variable is the share of female members over the total members of the management board in columns (1) and (3) and of the supervisory board in columns (2) and (4). The treatment year is 2014. ‘Treated’ firms are those satisfying the requirements of the quota law: being listed and subject to parity co-determination under the Co-determination Act. The rest are considered ‘untreated’. Estimation on a balanced sample of firms present in the database from 2008 to 2016. Standard errors clustered at the firm level in parentheses. Significance * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

for treated firms after 2014, the capital side tends to increase faster. The positive coefficient indicates that the numerator of the ratio is growing faster. The other variable, *Convergence*, measures the absolute value of $(1 - Sides\ ratio)$, hence a decrease in this variable as the one observed in column 4, means that the ratio of women on each side of the board is getting closer to 1 (parity). In conclusion, female representation is getting more similar across the sides of the board. This is evidence that firms pursue a gender composition of the sides of the supervisory board that is closer to 30-30% than to 60-0%, thus, favoring some female representation in all bodies and avoiding having either side of the board with a majority of women.³⁹

7 Women's careers on the board

The introduction of a gender quota interferes with the incentives to hire and promote women, which may have a distortionary effect on female managerial careers. We explore some of these effects in what follows.

7.1 Career non-executive directors

Non-executive directors or NEDs serve on the supervisory board. Recall that the supervisory board is made of employee representatives and capital representatives. The representatives of the employees are selected by the workers among the workforce of the firm. A NED on the capital side can be anyone, with or without links to the firm; commonly, they are former members of the management board, people serving as CEO of a different company, or prominent members of society (e.g., professors, politicians). All members of the supervisory board control and monitor the management board but they usually work in committees specializing in one or several tasks. For their experience and specialization, the profile of the members of the capital side is considered to be closer to that of the management board

³⁹This is reminiscent of tokenism. Tokenism refers to the practice of making a symbolic effort, such as complying with the minimum diversity requirement, in order to give the appearance of equality. Some authors (Smith, 2014) argue that the introduction of a specific target could lead firms to comply with the minimum quota in order to avoid sanctions without introducing any further changes in the corporate culture that favors more balanced representation.

Table 8: Effect of the gender quota on female representation at the employee side and the capital side of the supervisory board.

	(1)	(2)	(3)	(4)
	Share employee side	Share capital side	Sides ratio	Convergence
Treated X Post2014	3.054* (1.841)	4.462*** (1.176)	0.222*** (0.0847)	-0.131* (0.0681)
Size controls	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	2193	2858	1437	1437
R-squared	0.03	0.20	0.11	0.07
F-statistic	3.33	20.87	4.58	4.39

This table shows the average effect of the gender quota on the percentage of women on the shareholder's side and the employee side of the supervisory board of the largest German firms between 2008 and 2016. The dependent variable is the share of female members over the total members of the employee side of the supervisory board in column (1) and the capital side of the supervisory board in column (2). In column (3), the dependent variable is share of women on the capital side over the share of women on the employee side and, in column (4), the absolute value of 1 minus the ratio of the share of women on the capital side over the employee side. The treatment year is 2014. 'Treated' firms are those satisfying the requirements of the quota law: being listed and subject to parity co-determination under the Co-determination Act. The rest are considered 'untreated.' Estimation on a balanced sample of firms present in the database from 2008 to 2016. Standard errors clustered at the firm level in parentheses. Significance * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

than that of the members of the employee side. Furthermore, the process of searching for independent board members is increasingly professionalized, with the intervention of Nomination Committees and headhunters, as is the case for top managers.

In this section, we explore whether the rise in females at the capital side of the firm's board is linked to a reduction in female managers, compared to the employee side of the board. Since substitutability is higher between these two bodies, we can read this as an indication that women taking on capital side NED positions are the (missing) women that are not stepping up as CEOs. Employee representatives, on the contrary, are less likely to be on the track to CEO.

We run regression (4.1) with the share of women on the management board as a dependent variable in two different samples: one group of firms which increases the share of women on the capital side of the supervisory board more than in the employee side, between 2013 and 2016, and for the other group, the opposite is true. In table 8, we find that spillovers to the management board are significant and particularly large when changes in the capital side of the board are more important. Thus, the negative spillovers on female representation in the executive board are associated with firms that made a bigger effort to hire women to the capital side than to the employee side of the board. Due to the quota requirement, a women candidate might be more likely allocated to the supervisory board, effectively interfering in the best match between the candidate abilities and the boards tasks. This highlights the possibility that more women start taking on a career as NEDs instead of managers.

7.2 Concentration of multiple board appointments

A board member may sit on the board of more than one firm simultaneously. We call that a multiple mandate. After the GQL, a large increase in the demand for women qualified to serve on a board may promote a raise in multiple mandates for women. The variable *Female mandates ratio* is defined as the number of multiple mandates that the average woman has on the board of a firm one year divided by the number of multiple mandates a man has on

Table 9: Spillover to the management board of an increase in the share of women on the employee side with respect to the capital side of the supervisory board.

	Increase capital side	Increase employee side
	(1)	(2)
	Share women	Share women
Treated X Post2014	-3.460*** (1.038)	-2.803 (2.559)
Size controls	Yes	Yes
Time FE	Yes	Yes
Firm FE	Yes	Yes
Observations	2363	297
R-squared	0.06	0.05
F-statistic	4.30	1.07

This table shows the average effect of the gender quota on the percentage of women on the management board of the largest German firms between 2008 and 2016, split according to the side of the supervisory board that experiences the largest increase in the share of women after the reform. ‘Increase capital side’ refers to the sample of firms which increase the share of women on the capital side of the supervisory board more than in the employee side between 2013 and 2016. ‘Increase employee side’ refers to the sample of firms which increase the share of women on the employee side of the supervisory board more than in the capital side between 2013 and 2016. The dependent variable is the share of female members over the total members of the management board. The treatment year is 2014. ‘Treated’ firms are those satisfying the requirements of the quota law: being listed and subject to parity co-determination under the Co-determination Act. The rest are considered ‘untreated’. Estimation on a balanced sample of firms present in the database from 2008 to 2016. Standard errors clustered at the firm level in parentheses. Significance * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 10: Effect of the gender quota on multiple mandates.

	(1)	(2)	(3)
	Female mandates ratio	Mandates per women	Mandates per men
Treated X Post2014	0.0298** (0.0138)	0.846*** (0.308)	-2.943*** (1.014)
Time FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Observations	3094	3095	3095
R-squared	0.09	0.12	0.18
F-statistic	16.16	11.03	11.72

This table shows the average effect of the gender quota on multiple mandates held by each gender on the supervisory board of the largest German firms between 2008 and 2016. The dependent variable is the ratio of female multiple mandates to male multiple mandates in the supervisory board in column (1), the number of women in the supervisory board holding more than one board position simultaneously in column (2), and the number of men in the supervisory board holding more than one board position simultaneously in column (3). The treatment year is 2014. ‘Treated’ firms are those satisfying the requirements of the quota law: being listed and subject to parity co-determination under the Co-determination Act. The rest are considered ‘untreated’. Estimation on a balanced sample of firms present in the database from 2008 to 2016. Standard errors clustered at the firm level in parentheses. Significance * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

the same firm and year:

$$\text{Female mandates ratio}_{j,t} = \frac{\text{Number of multiple mandates females}_{j,t}}{\text{Number of multiple mandates males}_{j,t}}; \quad (7.1)$$

where j represents the firm and t represents time. A ratio higher than 1 means that a woman typically sits on more boards simultaneously than a man. The *Female mandates ratio* in treated firms increases by almost 50% from 2013 to 2016 (from 0.12 to 0.18).

We estimate equation (4.1), where $Y_{i,t}$ is the *Female mandates ratio* in the supervisory board, *Treated* takes value 1 if the firm is affected by the GQL and 0 otherwise, and 2014 is the treatment year. We find a positive effect on the ratio of female to male multiple mandates in the supervisory board of treated firms, as seen in column 1 of table 10. A more detailed analysis indicates that movements in the ratio are driven by the decrease in the number of multiple mandates held by men; column (3) of table 10 shows that men hold, on average,

about two to three mandates fewer than before the reform took place. This indicates that there are fewer available positions for men to fill multiple mandates because membership is spread across different people. In column (2) of table 10, we see that, contrary to men, women experience an increase in the number of positions that they accumulate. There is an average increase of almost one mandate for women who occupy positions in treated firms after the quota. We interpret this as an indication of power concentration due to the quota among women who are insiders.

We observe this phenomenon of the golden skirts only for the supervisory board and not for the management board.⁴⁰ This, together with the evidence on the high substitutability of women with executive profiles, gives credence to the hypothesis that some women are becoming serial non-executive directors.

7.3 Second glass ceiling

Lastly, women may achieve representation, as firms display formal compliance with the GQL, without acquiring the effective power to make a substantial difference within the firm. This would represent a second glass ceiling for women at the upper echelons of the firm. For women to be able to enact changes at the firm level, they need to hold enough sway and a ‘glass ceiling’ could effectively prevent them from doing so.

If women were to participate on an equal footing on the board roles, for the same level of ability, an increasing female representation on the board would imply a correspondingly increasing representation among board presidencies. On the contrary, if women face a second glass ceiling, the increase in the share of women on the board of affected firms will not translate into an increase in the chances that the board is presided by a female chairperson.

We estimate a linear probability model:

$$Y_{i,t} = \beta \text{Treated}_i \times \text{Post2014}_t + \gamma X_{i,t} + \kappa_i + \tau_t + u_{i,t}, \quad (7.2)$$

where $Y_{i,t}$ is a dummy variable that takes value 1 if the chairperson is female and 0 if it is not. The rest of the variables have the usual meaning. In table 11, we find no evidence that

⁴⁰See Appendix D.

the GQL increases the likelihood of a female chairperson of the board.

8 Robustness

In what follows we present several robustness checks to the main result in section 5.2.

Effects of the flexi-quota. As we have explained in section 2, the flexi-quota was a voluntary commitment that listed and co-determined firms set for themselves regarding the share of women on their boards. It was applicable to the two boards. The flexi-quota could have motivated firms to increase the share of females on the management board above their desired share. Once the GQL passed and the flexi-quota was removed, they would return to previous situation.

We study the treatment of the flexi-quota, jointly with the GQL, and estimate the following difference-in-differences equation by OLS:

$$Y_{i,t} = \beta_1 \text{Treated}_i \times \text{Post2014}_t + \beta_2 \text{Treated}_i \times \text{Flexi-quota}_t + \gamma X_{i,t} + \kappa_i + \tau_t + u_{i,t},$$

for the baseline specification and, similarly, for the specifications with linear trends and with two ‘near eligible’ control groups as in equations (4.2) and (4.3).⁴¹ The variable *Flexi-quota* is a dummy variable that takes value 1 in the years 2011 to 2013, during which the flexi-quota was in place.

As can be seen in table 12, we find that the inclusion of the treatment of the flexi-quota does not change the expected sign or magnitude of the effect of the GQL. The coefficient of the flexi-quota is insignificant. During the time that the flexi-quota was established, the affected firms did not display a significantly different behaviour than the rest.

Dynamics of the gender quota. The empirical specification that we estimate is the following:

$$Y_{i,t} = \beta \text{Treated}_i \times \text{Years}_t + \gamma X_{i,t} + \kappa_i + \tau_t + u_{i,t}, \tag{8.1}$$

⁴¹The two groups consisting of the firms that satisfy one of the requirements to be eligible under the law but not the other one.

Table 11: Effects of the gender quota on the gender of the chairperson of the supervisory board.

	Balanced panel	Linear trend	Near eligible firms	PSM
	(1)	(2)	(3)	(4)
	Female chairperson	Female chairperson	Female chairperson	Female chairperson
Treated X Post2014	-0.0125 (0.0212)	-0.00251 (0.0119)		-0.0577 (0.0401)
Listed X Co-det X Post2014			-0.0104 (0.0157)	
Size controls	Yes	Yes	Yes	Yes
Linear trend	No	Yes	No	No
Time FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	3076	3076	2936	1006
R-squared	0.00	0.00	0.01	0.03
F-statistic	1.15	1.06	1.57	0.61

This table shows the average effect of the gender quota on the likelihood that the chairperson of the supervisory board is a woman. The dependent variable is a dummy variable that takes value 1 if the chairperson is female and 0 otherwise. The treatment year is 2014. ‘Treated’ firms are those satisfying the requirements of the quota law: being listed and subject to parity co-determination under the Co-determination Act. ‘Listed’ firms are stock corporations with publicly traded stocks and ‘Co-det(ermimed)’ firms are those with 2,000 employees or more. ‘Balanced panel’ refers to a balanced sample of firms present in the database from 2008 to 2016, ‘Linear trends’ includes differential time trends for treated and control firms, ‘Near eligible firms’ refers to firms that satisfy only one of the two requirements of the quota law and ‘PSM’ to a sample of treated firms and matched controls using propensity score matching. Standard errors clustered at the firm level in parentheses. Significance * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 12: Effect of the gender quota on the non-targeted board with controls for the flexi-quota period.

	Balanced panel	Linear trend	Near eligible firms	PSM
	(1)	(2)	(3)	(4)
	Share women	Share women	Share women	Share women
Treated X Flexi-quota	-0.0945 (1.009)	-0.0604 (1.031)		0.111 (1.336)
Treated X Post2014	-3.288*** (1.137)	-3.217** (1.629)		-3.425** (1.682)
Listed X Co-det X Post2014			-2.430** (1.139)	
Listed X Co-det X Flexi-quota			0.581 (0.917)	
Size controls	Yes	Yes	Yes	Yes
Linear trend	No	Yes	No	No
Time FE	Yes	Yes	No	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	3095	4184	2955	1023
R-squared	0.05	0.05	0.61	0.05
F-statistic	4.15	4.62	5.78	1.75

This table shows the average effect of the gender quota on the percentage of women on the management board of the largest German firms between 2008 and 2016. The dependent variable is the share of female members over the total members of the management board. The treatment year is 2014. ‘Treated’ firms are those satisfying the requirements of the quota law: being listed and subject to parity co-determination under the Co-determination Act. ‘Listed’ firms are stock corporations with publicly traded stocks and ‘Co-det(etermined)’ firms are those with 2,000 employees or more. ‘Flexi-quota’ is a dummy variable that takes value 1 for the years 2011 - 2013 and 0 otherwise. ‘Balanced panel’ refers to a balanced sample of firms present in the database from 2008 to 2016, ‘Linear trends’ includes differential time trends for treated and control firms, ‘Near eligible firms’ refers to firms that satisfy only one of the two requirements of the quota law and ‘PSM’ to a sample of treated firms and matched controls using propensity score matching. Standard errors clustered at the firm level in parentheses. Significance * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

where Years_t are year dummies for the years 2008 to 2016 and the rest of the variables have the usual meaning. Equation (8.1) is estimated using propensity score matching as in section 5.3. Errors are clustered at the firm level. Results are graphically represented in figure 5. In the left-hand side graph, the coefficients of the estimation of β in equation (8.1) are plotted year by year. We observe no trend prior to 2014 and a positive but insignificant trend after. The right-hand side graph refers to the management board. The effect here is negative and significant from 2015 onwards.

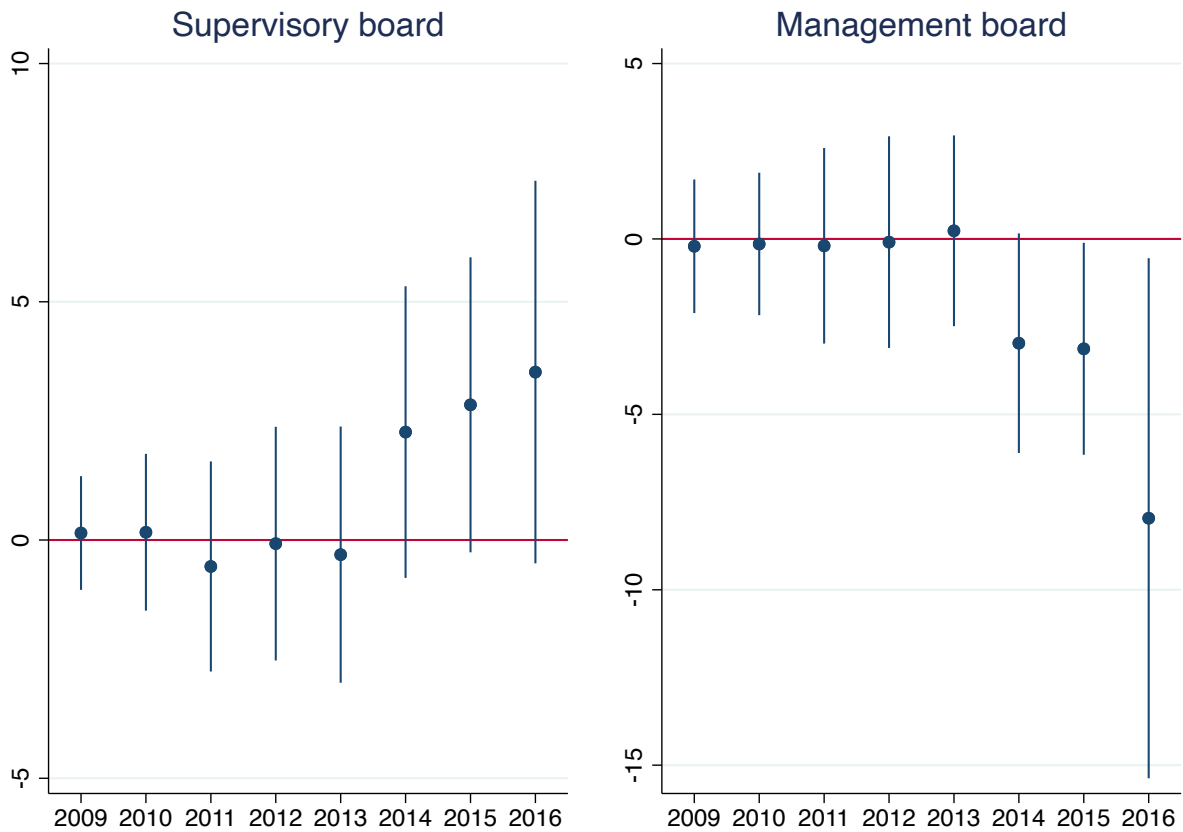
Two-step estimation of standard errors in propensity score matching. Given the nature of our panel data and our specification, which includes year and firm fixed effects, throughout the paper we use a matched sample of control firms that results from propensity scores calculated estimating the following equation by probit:

$$Y_i = \alpha + \beta X_i + u_i, \tag{8.2}$$

where the dependent variable is *Treated*, a dummy variable that takes value 1 if the firm is affected by the Gender Quota Law and 0 if it is not, and the vector X_i are the control variables: the difference in the share of women on the respective board in 2008-09, in 2009-10, in 2010-2011, in 2011-12, and in 2012-13, the percentage of women on the board in 2013, and the number of employees in 2013.

Throughout the paper, the standard errors of the difference-in-differences estimation did not take into account this previous step. To address this issue, we have to transform the yearly data into two observations per individual: an average for the period before the reform (2011-2013) and an average for the period after the reform (2014-2016). If we use an algorithm that computes the standard errors correctly, results are consistent and the effect is robust, as seen in table 13. In the main specification, we prefer to keep the panel structure of the data, which allows to control for time fixed effects with the inclusion of year dummies.

Figure 5: Effect of the gender quota on the share of women in the supervisory board and the management board over time.



This figure plots the coefficient β of equation (8.1) in the scale on the right, measuring the average effect of the GQL at each year indicated in the horizontal axis. ‘Treated’ firms are those satisfying the requirements of the quota law: being listed and subject to parity co-determination under the Co-determination Act. The rest are considered ‘untreated’. Estimation using propensity score matching with errors clustered at the firm level. The dots represent the point estimates and the lines are the 90% confidence intervals.

Table 13: Alternative specification propensity score matching.

	Supervisory board		Management board	
	(1) Share women	(2) Number women	(3) Share women	(4) Number women
Treated X Post2014	5.108*** (1.139)	0.746*** (0.186)	-3.842** (1.806)	-0.122* (0.0626)
Observations	378	378	378	378

This table shows the average effect of the gender quota on the percentage of women and the number of women on each board of the largest German firms between 2008 and 2016. The dependent variable is the average share of females in the period before (2011-2013) and after (2014-2016) the reform. The treatment year is 2014. ‘Treated’ firms are those satisfying the requirements of the quota law: being listed and subject to parity co-determination under the Co-determination Act. The rest are considered ‘untreated’. Estimation using propensity score matching on the closest neighbour based on the share of women in 2008-09, 2009-10, 2010-11, 2011-12 and 2012-13 in the respective board and the share of women and the number of employees in 2013. Standard errors clustered at the firm level in parentheses. Significance * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

9 Conclusion

Gender quotas are gaining increasing traction in the European corporate framework, as shown by its gradual expansion to a growing number of countries. Only five years after its introduction on non-executive boards, Germany is already working towards extending the quota to the management board as well. At the same time, the European Commission has reached an agreement to institute a gender quota on supervisory boards of all European countries, which is pending its final approval, and the first state in the US that introduced a boardroom quota is a facing heavy push-back.

We need to understand how quotas impact, not only the gender composition of the board in question, but also female advancement on boards more broadly. Does a boardroom quota contribute to lift women up? In this paper, we exploit a change in the legislation in Germany and document several findings. First, we find evidence of compliance with the quota for the targeted board of affected firms. More female representation at the board level has the potential to foster female advancement in other dimensions as well. If women prefer

to work with similar individuals in terms of gender, their increased presence would extend to other organization bodies. We find no evidence of this. Rather, we uncover negative spillover effects for the access of females to executive roles within the firm (represented by positions in the management board). This is partially explained by a tendency to avoid large concentrations of women wherever possible in firms that are forced to hire due to the quota.

In addition, we bring the empirical evidence that some women may privilege accumulating executive board positions instead of entering a managerial position. Finally, we cannot reject the existence of a second glass ceiling, as others have pointed out, that prevents women from accessing the presidency of the board, even though they formally have more seats at the table.

Increasing women's representation on the board is a tool that can improve diversity but it is not the ultimate solution to achieve greater gender equality that some believe it to be. More needs to be done, pairing quotas to other initiatives that promote female talent within the firm in all capacities and lift women up to drive the changes that enable themselves and others to thrive in corporations.

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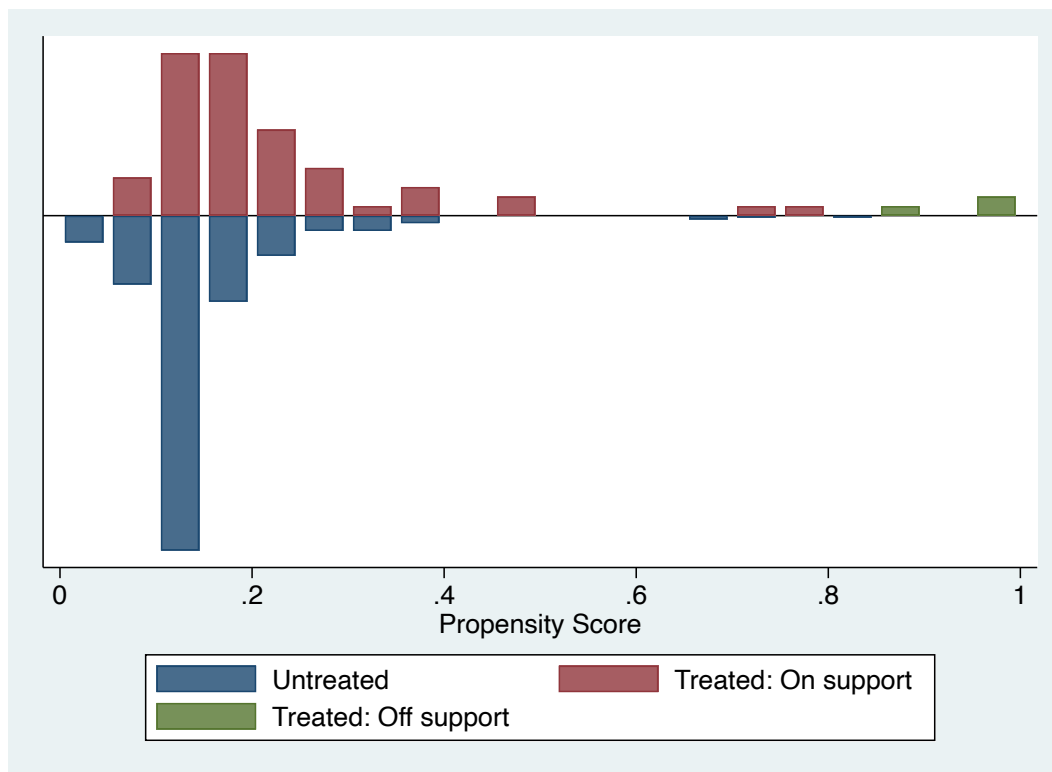
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A Propensity score matching on the supervisory board

Figure A1: Common support.



This figure shows the common support of propensity score matching done on the difference in the share of women on the supervisory board in the years before the GQL (2009-10, 2010-11, 2011-2012, 2012-2013), the share of women in 2013 and the number of employees in 2013. The bars represent the propensity scores histograms by treatment status: treated firms (above the line) and untreated firms (below the line).

Figure A2: Bias reduction table.

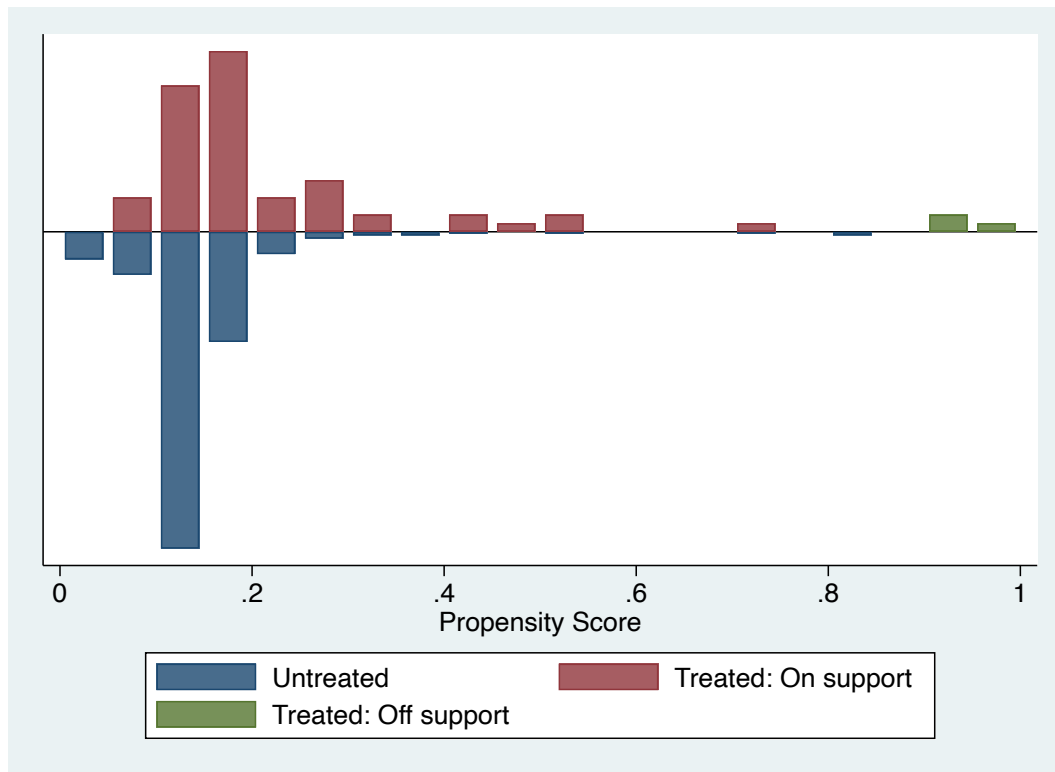
	Unmatched	Mean	Mean	Mean	%bias	%reduct	t-test	p> t	V(T)/
	Matched	Treated	Control	Control	bias	t		V(C)	
Share difference	U	0.102	0.231	-3.400	-0.270	0.786	1.590	1.420	
2009	M	0.168	0.022	3.9	-13.400	0.210	0.837		
Share difference	U	0.212	0.648	-12.600	-0.800	0.424	0.37*	0.34*	
2010	M	0.223	0.207	.4	96.500	0.020	0.982		
Share difference	U	1.490	0.125	29.700	2.140	0.033	0.950	0.51*	
2011	M	1.393	2.112	-15.600	47.400	-0.710	0.482		
Share difference	U	1.185	0.276	19.400	1.300	0.195	0.58*	0.34*	
2012	M	1.229	0.750	10.200	47.300	0.450	0.651		
Share difference	U	1.737	0.766	19.800	1.430	0.154	0.970	0.710	
2013	M	1.824	2.056	-4.700	76.100	-0.230	0.816		
Share women	U	12.408	10.667	17.200	1.190	0.236	0.730	0.620	
2013	M	12.051	11.711	3.4	80.400	0.180	0.857		
Employees	U	58100	14936	52.900	5.560	0.000	8.21*	0.58*	
2013	M	37364	34674	3.3	93.800	0.230	0.816		
* if variance ratio outside [0.61; 1.65] for U and [0.60; 1.67] for M									
Sample	Ps R2	LR chi2	p>chi2	MeanBias	MedBias	B	R	%Var	
Unmatched	0.092	31.280	0.000	22.200	19.400	67.1*	4.09*	43	
Matched	0.007	1.140	0.992	5.9	3.9	19.300	0.620	57	

* if B>25%, R outside [0.5; 2]

This table shows the percentage of bias reduction after using propensity score matching.

B Propensity score matching on the management board

Figure B1: Common support.



This figure shows the common support of propensity score matching done on the difference in the share of women on the management board in the years before the GQL (2009-10, 2010-11, 2011-2012, 2012-2013), the share of women in 2013 and the number of employees in 2013. The bars represent the propensity scores histograms by treatment status: treated firms (above the line) and untreated firms (below the line).

Figure B2: Bias reduction table.

	Unmatched Matched	Mean Treated	Mean Control	%bias	%reduct bias	t-test t	p> t	V(T)/ V(C)
Share difference 2009	U M	1.235 1.111	0.145 1.329	22.200 -4.400	1.890 80.000	0.059 -0.190	2.41* 0.849	0.770
Share difference 2010	U M	0.538 0.333	0.284 0.278	8.6 1.9	0.600 78.200	0.551 0.140	0.750 0.889	1.030
Share difference 2011	U M	0.837 0.992	0.478 1.048	6.2 -1.000	0.460 84.300	0.646 -0.040	1.160 0.967	0.52*
Share difference 2012	U M	0.384 0.125	1.110 0.023	-10.600 1.5	-0.690 86.000	0.488 0.120	0.49* 0.907	1.570
Share difference 2013	U M	-0.145 -0.183	1.145 -5	-21.100 5.2	-1.360 75.400	0.175 0.330	0.43* 0.742	0.740
Share women 2013	U M	3.774 3.351	4.962 4.393	-11.000 -9.700	-0.730 12.300	0.465 -0.610	0.55* 0.543	0.830
Employees 2013	U M	58100 37364	14936 44162	52.900 -8.300	5.560 84.300	0.000 -0.560	8.21* 0.578	0.49*

* if variance ratio outside [0.61; 1.65] for U and [0.60; 1.67] for M

Sample	Ps	R2	LR	chi2	p>chi2	MeanBias	MedBias	B	R	%Var
Unmatched				30.280	0.000	19.000	11.000		64.9*	3.65*
Matched				2.130	0.952	4.6	4.4		26.5*	0.700

* if B>25%, R outside [0.5; 2]

This table shows the percentage of bias reduction after using propensity score matching.

C Target number of women by firm size

For companies subject to parity co-determination, the size of the supervisory board is determined by law. Firms with a number of employees between 2,000 and 10,000 must have 12 seats on the supervisory board, between 10,000 and 20,000 they must have 16 seats, and, for more than 20,000 employees, 20 seats (Section 7(1)1, 2 Co-determination Act). Therefore, based on their board size, firms have to hire a different number of women in order to reach the 30% quota requirement. This number may be a decimal number and rounding needs to be applied. The Gender Quota Law foresees rounding up for decimals 0.5 and higher and down for decimals lower than 0.5. The target number of women that arise from rounding calculations is summarized in the following table.

Table C1: Minimum number of women required on the supervisory board.

Number of employees	Number of women required
between 2,000 and 10,000	4
between 10,000 and 20,000	5
more than 20,000	6

This table presents the number of women required on the supervisory board of firms affected by the Gender Quota Law according to the number of employees of a firm.

The variable ‘Women gap’ is computed taking the required number of women on the table above and subtracting the number of women that were sitting on the supervisory board of a given firm before the law was announced, in 2013. Summary statistics for this variable are summarized in table (C2).

Table C2: Summary statistics of the variable ‘Women gap’.

	mean	sd	min	max
Women gap	3.4	1.8	-3.0	6.0
Observations	4295			

This table presents descriptive statistics of the variable ‘Women gap’. The first column presents the mean value, the second presents the standard deviation, while the third and fourth columns present the minimum and maximum values, respectively.

D Effect of the gender quota on multiple mandates on the management board

	(1) Female mandates ratio	(2) Mandates per women	(3) Mandates per men
Treated X Post2014	-0.0316** (0.0149)	-0.112* (0.0639)	-0.162 (0.268)
Time FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Observations	3092	3095	3095
R-squared	0.04	0.05	0.07
F-statistic	3.66	4.66	7.39

This table shows the average effect of the gender quota on multiple mandates held by each gender on the management board of the largest German firms between 2008 and 2016. The dependent variable is the ratio of female multiple mandates to male multiple mandates in the management board in column (1), the number of women in the management board holding more than one board position simultaneously in column (2), and the number of men in the management board holding more than one board position simultaneously in column (3). The treatment year is 2014. ‘Treated’ firms are those satisfying the requirements of the quota law: being listed and subject to parity co-determination under the Co-determination Act. The rest are considered ‘untreated’. Estimation on a balanced sample of firms present in the database from 2008 to 2016. Standard errors clustered at the firm level in parentheses. Significance * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.