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The impact of board gender quotas on analyst recommendations: A difference-in-differences analysis

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ABSTRACT

Norway provides the case study for examining the impact of board gender quotas on firm performance. The debate that ultimately led to the introduction of the quota was heated and polarised, with opponents of the quota arguing that the inability of the firm's owners to select the best candidates for the board (regardless of gender) would result in poorly managed firms. Although several articles have empirically examined the impact of the Norwegian gender quota on performance, the available evidence is inconclusive. These articles use return on assets and/or Tobin's Q as indicators of performance. The present study contributes to the literature by providing a new and complementary approach to this research topic. To this end, we examine the impact of board gender quotas on analysts' perceptions of performance, as measured by investment recommendations. The research design adopts a difference-in-differences methodology coupled with fixed effects panel data estimation. The results document that recommendations on Norwegian stocks did not change significantly after the introduction of the quota. This result is robust to a variety of sensitivity analyses and controls.

El impacto de las cuotas de género en los consejos de administración sobre las recomendaciones de los analistas: Un análisis de diferencias en diferencias

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RESUMEN

Noruega se ha convertido en un caso de estudio para investigar los efectos de las cuotas de género en los consejos de administración sobre los resultados corporativos. El intenso y polarizado debate que finalmente condujo a la promulgación de la cuota dio lugar a que los opositores a esta argumentaran que la incapacidad de los propietarios de la empresa para elegir a los mejores candidatos para el consejo (independientemente de su género) daría como resultado empresas mal gestionadas. Aunque varios artículos han examinado empíricamente el impacto de la cuota de género noruega en el rendimiento empresarial, la evidencia disponible no es concluyente. Estos artículos utilizan el rendimiento de los activos y/o la Q de Tobin como indicadores de rendimiento. El presente estudio contribuye a la literatura al proporcionar un enfoque nuevo y complementario a este tema de investigación. Para ello, investigamos el impacto de las cuotas de género en el consejo de administración en las percepciones de los analistas financieros, medido por las recomendaciones de inversión. El diseño de la investigación combina el análisis de diferencias en diferencias y estimaciones de datos de panel de efectos fijos. Los resultados documentan que las recomendaciones sobre las empresas noruegas no cambiaron significativamente tras la promulgación de la cuota. Este resultado es sólido, puesto que se mantiene en una variedad de análisis de sensibilidad.

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1. Introduction

Supranational organizations such as the United Nations (UN) or the European Union (EU) explicitly acknowledge lack of gender diversity in leadership positions as one of the principal challenges faced by governments and corporations alike.[1] Focusing on senior management positions, the usual approach for solving the problem draws on the inclusion of board gender equality recommendations in the national codes of good governance. These codes are a voluntary tool on the basis of "comply or explain", designed to improve corporate governance (Aguilera & Cuervo-Cazurra, 2004). Firms that do not comply with the recommendations must explain the reasons for the non-compliance. In addition to this so-called "soft" approximation to the problem of lack of gender diversity in senior management, some countries have implemented mandatory board gender quotas through hard legislation.

The main criticism of regulating board gender diversity through a set of (soft) recommendations that firms are free to comply is that it may not be effective in achieving more gender diverse boards. In fact, since mandatory quotas are controversial (Teigen, 2015), whereas voluntary quotas are not, the growing number of countries with mandatory board gender quotas indicates lack of effectiveness of the voluntary quotas. The Norwegian case illustrates this issue, as there was an agreement between the government and the private sector that the mandatory quota would be abandoned if, by July 2005, companies voluntarily increased the percentage of women on the boards (Seierstad, 2016). On the other hand, the implementation of mandatory quotas is mainly criticized from the perspective that it limits the ability of the owners of the firm to appoint the most suitable candidates to the boardroom (Teigen, 2015).

This study investigates the impact of board gender quotas on the financial performance of firms. As prior related studies (e.g., Matsa & Miller, 2013; Yang et al., 2019), it takes advantage of the Norwegian case to investigate the impact of board gender quotas on financial performance, and implements a difference-in-differences approach (hereinafter, diff-in-diff). Whereas several countries have established board gender quotas, Norway is the study case for the investigation of the effects of quotas on corporate outcomes. This is explained by the fact that Norway was a pioneer country in the adoption of quotas, and likely more importantly, by the particularly serious implications for the non-compliant firms (liquidation). The research period includes the years from 2000 to 2010, whereas the treated and control groups consists on public firms from Norway and other Scandinavian countries, respectively. Several prior studies have empirically examined the effects of the Norwegian gender quota on financial performance, although the evidence is largely inconclusive. Hence, Ahern & Dittmar (2012), Matsa & Miller (2013) and Yang et al. (2019) find that the quota had a negative impact on performance, yet Dale-Olsen et al. (2013) and Eckbo et al. (2021) report insignificant results. Unlike these studies, we propose an alternative and complementary approach to this research topic, based on the perceptions of financial analysts captured by investment recommendations. Therefore, if as quota opponents argue, the new regulation leads to more competent men being replaced by less competent women, this should favor less competent boards and worse managed firms. Under this scenario we would expect a worsening in the investment recommendations on Norwegian stocks relative to their peers from neighboring countries not affected by quota requirements.

The motivation for this study is threefold. First, the research topic is relevant, with important practical implications at various levels. As the Norwegian experience illustrates, with an extraordinary increase in the presence of women on boards, mandatory board gender quotas may be an extremely efficient way of increasing gender diversity in senior management. However, the heated and polarized debate surrounding the enactment of the quota in Norway (Teigen, 2015) ilustrates the difficulties of implementing this "hard" regulatory approach. Second, the lack of consensus in the research literature on the implications of this type of regulation, in particular, for the financial performance of corporations, provides additional motivation for this study. Finally, because firm performance is a complex concept, the standard proxies used for measuring it present one form of limitation or other. This is particularly the case for the accounting-based indicators of performance. In that regard, this study complements the extant evidence by providing a new research approach.

We contribute to the literature on the impact of mandatory board gender quotas on performance by examining the perception of financial analysts, a key stakeholder and social actor in the capital markets that monitor and channel the flow of information towards these markets (Ioannou & Serafeim, 2015). By providing a new and fresh perspective, this approach complements the evidence reported by previous studies that measure financial performance through accounting-based and/or market-based indicators. Additionally, focusing on investment recommendations provides some interesting advantages regarding prior studies. On the one hand, due to their short-term focus, accounting-based indicators of performance such as the return on assets (hereinafter, ROA) may not be able to capture the strategic role of the board of directors, whose decisions have mainly long-term effects. Accordingly, previous related studies based on ROA make the unrealistic assumption that the appointment of a certain number of female directors will have immediate effects on the income statements of firms. Furthermore, these accounting-based indicators are incomplete because they ignore the risk dimension of financial performance, and are also vulnerable to accounting manipulation (Dale-Olsen et al., 2013). On the other hand, although market-based indicators do not present the above shortcomings and, on that regard, provide sounder measures of performance, the participation of a significant number of irrational investors in the stock market, whose investment decisions are not based upon considerations inherently related to the fundamentals of the stock, affects stock market prices (Hirshleifer et al., 2006) and, from this perspective, limit the ability of market-based indicators to adequately capture firm performance.

In anticipation of the results of the empirical analysis, financial analysts did not worsen investment recommendations on Norwegian stocks after the enactment of the mandatory board gender quota, compared to the stocks of the firms from the neighboring countries that were unaffected by the quota. This result seems sound and robust as it holds across a battery of sensitivity checks. Therefore, this study adds evidence against a negative impact of mandatory board gender quotas on financial performance.

The study continues as follows. The next Section summarizes the Norwegian board gender quota regulation. Then, Section 3 discusses the related literature and develops the hypothesis. Section 4 introduces the design of the research and describes the sample. Sections 5 and 6 presents and discusses the results of the empirical analysis, respectively, while

[1] See, for example, the 2030 Sustainable Development Agenda by the UN or the Gender Equality Strategy 2020-2025 by the EU.

the paper ends with the conclusions, implications and limitations of the study.

2. The Norwegian board gender quota regulation

In Norway, limited liabilities stock companies are classified into private limited liability companies (abbreviated AS) and public limited companies (abbreviated ASA). The main differences between the two categories are that ASA companies are larger[2] and may be listed in the stock market, as it requires no consent to trade shares. It should be noted that only ASAs were subject to the board gender quota. Ownership concentration in Norway is lower than in any other European country, except the UK (Bøhren and Strøm, 2010). Regarding corporate governance indicators, in La Porta et al. (1998) classification scheme, Norway forms, together with Denmark, Finland and Sweden, the Scandinavian civil law category, and it has a strong corporate governance system, which in many ways is similar to that of the US and the UK. In terms of investor protection, the Scandinavian civil law region is characterized by higher investor protection than other civil law countries, with Norway scoring higher than Sweden and Denmark in the LLSV index of investor protection (Sinani et al., 2008). Besides, board structure in Norway and in the other Scandinavian countries has been described as both one-tier and two-tier and even semi two-tier ones (Sinani et al., 2008). Finally, Norway approved its first corporate governance code in 2004. Since then, nine different editions have been enacted, the latest in 2021.

Norway provides the reference case study of implementation of a mandatory board gender quota. In December 2003 it was approved the reform of the Companies Act establishing a minimum representation of 40% for each gender on the boards of directors of public limited companies.[3] Although the 2003 regulation was initially not mandatory, it established that if firms did not voluntary comply with the regulation by July 2005, the gender quota will become mandatory. When this time arrived, women held only 13% of the board seats (Dale-Olsen et al., 2013), thus, far from the 40% objective. Consequently, the 40% benchmark became mandatory from January 2006 onwards for newly created firms, while previously existing firms were given two years of margin (until January 2008) for adapting to the new gender regulation.

As Teigen (2015) points out, in Norway until the late 1990s it was taken for granted that the owners of the firm were solely responsible for appointing the members of the board they considered most suitable to protect the interests of the company. Therefore, it was not surprising that the debate prior to the adoption of the gender quota was heated and polarized. According to the author, the main argument of those who opposed the quota (i.e., corporate managers and owners and representatives of employers' organizations) was that it would lead to more competent men being replaced by less competent women. On the other hand, supporters of the quota (i.e., politicians, civil servants and those connected to the gender equality machinery) pointed out that appointing more women to boards would be beneficial for firms, as it would add new resources, competences and impulses to Norwegian trade and industry (Teigen, 2015).

Even though several countries have enacted board gender quotas, Norway is the reference case for scholars interested in studying the effects of these quotas. This is explained because Norway was the first country to enact a mandatory board gender quota on a general basis[4] (Terjesen et al., 2015) and, therefore, a point of reference for the other countries that have also imposed gender quotas more or less inspired by the Norwegian experience. Furthermore, and probably more importantly, the interest in the Norwegian case comes from the particularly serious implications for the non-compliant firms. Hence, the inability to comply with the quota involved the liquidation of the company (Teigen, 2015). In that regard, none of the countries which later approved mandatory board gender quotas imposed such dramatic consequences for the non-compliant firms.[5]

3. Background and hypothesis

The linkage between board gender diversity and financial performance can be examined from different theoretical lenses. However, similar to previous related studies (Ahern & Dittmar, 2012; Garcia-Blandon et al., 2022; Yang et al., 2019), we use the agency theory and the resource dependence theory as the theoretical framework for our analysis. The agency theory stresses the role of the board of directors in the firm's governance structure, as a mechanism that contributes to aligning the interest of managers and shareholders. The main function of the board is to control the CEO and the top management team. In that regard, a more diverse and heterogeneous board should be better able to perform this function, because a wider variety of views will enhance its independence (Martínez-Córdoba et al., 2023; Reguera-Alvarado et al., 2017). Therefore, board gender diversity should be associated with sounder governance structures and practices and, according to Core et al. (2006), this reduces agency costs and improves firm performance. On the other hand, the resource dependence theory (Pfeffer & Salancik, 1978) also provides a suitable framework for the study of the impact of board gender diversity on performance. Hence, Hillman et al. (2007) specifically refer to three types of benefits of the appointment of female directors. First, it results in more diverse boards, with broader range of perspectives and likely more efficient, for example, regarding information searching. Secondly, since directors provide legitimacy to the firm (Certo, 2003; Davis & Mizruchi, 1999), gender diverse boards contribute to enhance the reputation of the firm.[6] Finally, in the specific area of communication, commitment and resources, "by virtue of their different experience sets, beliefs, and perspectives, women have the potential to link organizations to different constituencies than men" (Hillman et al., 2007; p. 944). Hence, according to Reguera-Alvarado et al. (2017), board gender diversity facilitates the relationship of the firm with customers and competitors, as well as improves industry knowledge and access to external finance. Consequently, like the agency theory, the resource dependence theory also advocates a positive impact of board gender diversity on firm performance.

It should be noted that the usefulness of the above theoretical framework for understanding the impact of mandatory board gender quotas on firm performance is limited, be-

[2] The minimum capital is 10 times larger for ASA firms than for AS firms.

[3] See Teigen (2015) for a detailed discussion of the Norwegian gender quota legislation.

[4] Even though Finland approved a board gender quota in 2005, one year before than Norway, it only affected State-owned enterprises.

[5] For example, in the case of the 2011 French board quota, the implications are that directors do not receive any fees, the 2011 Italian quota establishes that directors lose office and the 2007 Spanish quota offered incentives for state contracts for compliant firms (Terjesen et al., 2015).

[6] Navarro-García et al. (2022) find evidence that female directors actually improve corporate reputation.

cause it implicitly assumes that the appointment of women (or men) to the board is a free decision of the firm's owners. Nevertheless, under the regulatory framework created by the Norwegian board gender quota, some women may have been appointed directors, not because they were considered the best candidates but to meet the minimum 40% gender diversity benchmark. Therefore, in the context created by the quota, the appointment of female directors could have opposite effects on firm performance. Hence, the positive effects of increasing board gender diversity discussed above must be balanced against the possibility that the supply of competent female directors may not be sufficient to satisfy the enormous demand for these directors by firms in order to meet the quota obligations. Under a limited supply of female directors (Ahern & Dittmar, 2012), firms would be compelled to appoint less qualified (female) directors in substitution of better qualified (male) directors. Accordingly, if, due to the limitations in the firm's ability to appoint the best directors regardless of their gender, the level of competence of the boards of Norwegian firms diminished, the quota regulation may have a negative impact on firm performance.

Taking advantage of the Norwegian case, several studies have empirically examined the impact of mandatory board gender quotas on performance. However, the evidence reported by these studies is largely inconclusive. Ahern & Dittmar (2012) and Matsa & Miller (2013) find that the quota had a negative impact on financial performance. Ahern & Dittmar (2012) implement a fixed-effects within an instrumental variable approach, in which pre- and post-treatment periods are defined depending on when each company implemented the changes in the board required by the new regulation, and they use the Tobin's Q as a market-based indicator of financial performance. On the other hand, Matsa & Miller (2013) use diff-in-diff methodology, where a sample of Norwegian firms formed the treatment group and firms from other Scandinavian countries, not affected by the quota, composed the control group. The pre- and post-treatment periods include the years 2003-2006 and 2007-2009, respectively, and they use ROA as an accounting-based indicator of financial performance. On the other hand, neither Dale-Olsen et al. (2013) nor Eckbo et al. (2021) find any significant impact of the quota on performance. Both studies define the treated and control groups as Norwegian public limited firms (affected by the quota) and Norwegian private limited firms (not affected by the quota), respectively. Dale-Olsen et al. (2013) measure performance by ROA and use the year 2003 as the pre-treatment period and the year 2007 as the post-treatment period. On the other hand, Eckbo et al. (2021) measure performance by abnormal stock returns, ROA and Tobin's Q and use several pre-and post-treatment periods. Finally, Yang et al. (2019) observe a negative impact of the Norwegian quota on ROA, whereas the impact on Tobin's Q is insignificant. They also follow the diff-in-diff methodology and the pre- and post-treatment periods are defined by the years 2002 and 2003, and the years between 2004 and 2008, respectively.

Summing up, the above theoretical frameworks support, for the most part, a positive impact of board gender diversity on firm performance. However, its usefulness is limited when this diversity is mandated by the Law. The board gender quota may have opposite effects on performance, since, on the one hand, it improves board gender diversity, and this may be positively related to performance, but, on the other hand, it limits the freedom of the owners of the firm to appoint the most suitable directors, which could have a negative impact on performance. Furthermore, the extant empirical evidence has provided mixed and inconclusive results. Therefore, the predicted effect of the board gender quota on investment recommendations is ambiguous, and the final effect would ultimately be an empirical issue. In that regard, the following non-directional hypothesis is posed:

> ***Hypothesis**: The Norwegian board gender quota has a significant impact on investment recommendations.*

4. Research design, sample and validation conditions

Most of the empirical studies reviewed in the previous section implement a diff-in-diff methodology. This has become standard practice in modern empirical work in economics and finance (Barth & Israeli, 2013). According to Abadie (2005), this is explained by the need of using natural experiments to evaluate treatment effects, given the lack of truly experimental data in these fields of knowledge, and considering that a mere comparison between the treated individuals before and after the treatment will likely be contaminated by temporal trends in the dependent variable or by the effects of other unconsidered events. Hence, when only part of the individuals is exposed to the treatment (treated group), an untreated comparison group (control group) allows to identify temporal variation in the dependent variable not explained by the treatment. Therefore, diff-in-diff models overcome the standard regression approach in terms of robustness to endogeneity concerns (Abadie, 2005; Kausar et al., 2016).

As in prior studies that have used diff-in-diff models to examine the impact of gender board composition on firm performance (Eckbo et al., 2021; Matsa & Miller, 2013; Yang et al., 2019), this paper views the enactment of the quota in Norway in early 2006 as the "treatment". Like in these studies, the treated group is formed by Norwegian firms, which were not affected by the quota until 2006, but bound to it since then, whereas the control group consists of firms from neighboring countries, not affected by the quota during the whole research period. The use of firms from Denmark, Finland and Sweden as the control group is justified because Scandinavia forms a homogeneous region from the perspective of corporate legislation, this being the consequence of a long history of cooperation (Gregorič & Hansen, 2017). However, while previous studies investigate the impact of the quota on accounting-based and/or market-based indicators of performance, the present study focuses on the perceptions of financial analysts captured by the investment recommendations.

The definition of the pre- and post-treatment periods is not an easy issue in our research setting. The reason is that the quota was initially approved by December 2003 on the basis of voluntary compliance. Due to the lack of success of this regulation in increasing board gender diversity, in January 2006 the quota finally became mandatory. While the law had immediate effects for newly created companies, existing companies at that time were given a two-year transition period (until January, 2008) to comply with the quota. This regulatory situation likely explains the lack of consensus in the literature regarding the definition of the pre-[7] and post-[8] treatment periods. In keeping with our main interest in examining the impact of the mandatory board gender quota finally

[7] For example, the year 2003 in Dale-Olsen et al. (2013); the years 2002 and 2003 in Yang et al. (2019); and the years between 2003 and 2006 in Matsa & Miller (2013).

[8] For example, the year 2007 in Dale-Olsen et al. (2013); the years between 2004 and 2008 in Yang et al. (2019); and the years 2007, 2008 and 2009 in Matsa & Miller (2013).

approved in early 2006, the pre-treatment period includes the years between 2000 and 2005, and the post-treatment period the years from 2006 to 2010. However, according to the above discussion, we conduct several sensitivity analyses using different pre- and post-treatment periods.

The design of the empirical analysis is based on the diff-in-diff model represented by Eq. *(1)* below:

$$RECOMM_{it} = \alpha + \beta * TREAT_i + h * POST_t + \lambda * POST\,x\,TREAT_{it} + \sigma * CONTROLS_{it-1} + \varepsilon_{it} \quad (1)$$

The dependent variable (*RECOMM*) is the average consensus recommendation during the year *t* on the stocks of the firm *i*. Analysts recommendations range between a minimum of 1 (the best possible recommendation on a stock, indicating "strong buy") and a maximum of 5 (the worst possible recommendation, indicating "strong sell"). Following Ioannou & Serafeim (2015), with the aim of facilitating the interpretation of the results, we invert this scale and, thus, more positive recommendations have a higher value. *TREAT* and *POST* are indicator variables. *TREAT* shows whether the observation belongs to the treated (with value of 1) or control (with value of 0) group. The treated group is formed by Norwegian public firms, mandated to meet the gender quota from 2006 onwards, but not obliged to do it before this year; whereas the control group includes public firms from Denmark, Sweden and Finland, not affected by any mandatory quota. Similarly, *POST* indicates if an observation belongs to the pre- (with value of 0) or post- (with value of 1) treatment period. The variable of interest in diff-in-diff models is the interaction variable between *TREAT* and *POST*. This variable distinguishes whether a specific observation simultaneously belongs to the treated group and the post-treatment period (with value of 1) or not (with a value of 0) and, therefore, it captures the differences in the dependent variable in the treated group before and after the gender quota. According to the definition of *RECOMM,* a positive (negative) coefficient of *POSTxTREAT* would indicate that the consensus recommendation for Norwegian firms improved (worsened) after the approval of the gender quota, compared with the recommendations for their peers from neighboring countries.

The control variables in Eq. *(1)* are based on Bradshaw (2002), Ioannou & Serafeim (2015), Jegadeesh et al. (2004) and Zuckerman (1999), and are explained next. Similar to Ioannou & Serafeim (2015), the return on assets (*ROA*) is included as an indicator of profitability, as more profitable firms would be expected to receive better stock recommendations. The percentage of intangible assets (*INTANG*) and capital expenditures as percentage of total assets (*CAPEX*) intend to capture the growth potential of the firm, as growth firms tend to received more favorable recommendations from the analysts (Ioannou & Serafeim, 2015; Jegadeesh et al., 2004). Ioannou & Serafeim (2015) argue that large firms (*SIZE*) are also expected to receive better recommendations because they generate more trading commissions and investment banking business, and these are the main sources of analysts' compensation. Similarly, as financial analysts are expected to issue more favorable recommendations to firms with better valuation ratios, we include the earnings-to-price (*EP*) and the book-to-market (*BM*) ratios as controls (Ioannou & Serafeim, 2015). Jegadeesh et al. (2004) argue that analysts tend to chase stock returns, and hence, they issue more favorable recommendations to those stocks that have performed better in the past. The variable market-adjusted return (*RETURN*) intends to control for this behavior. Bradshaw (2002) points out the level of financial leverage as one of the determinants used by analysts to justify a specific recommendation, and thus, the debt ratio (*DEBT*) is included as a control variable. Finally, Eq. *(1)* also controls for the number of analysists that follow the stock (*NUMANL*), as analysts' attention has been found to affect the value of the firm (Zuckerman, 1999). Table 1 provides the exact definitions for the above variables. Following Ioannou & Serafeim (2015), *ROA*, *INTANG, SIZE, EP, BM, DEBT* and *RETURN* are included in the model with one-year lag.[9]

Table 1. Variable definitions

Variable	Definition
RECOMM	The average consensus recommendation for the corresponding year.
TREAT	1 if the observation corresponds to a Norwegian firm (treated group) and 0 otherwise.
POST	1 if the observation corresponds to a year after 2005 (post-treatment period) and 0 otherwise.
POSTxTREAT	The interaction variable resulting of multiplying POST and TREAT.
ROA	Net income over total assets.
INTANG	Intangible assets over total assets.
CAPEX	Capital expenditures over total assets.
SIZE	The natural logarithm of total assets.
EP	Net income over market value of equity.
BM	Book value of equity over market value of equity.
RETURN	Stock return for the company over a fiscal year less the stock return on the stock market of the country of origin of the firm.
DEBT	Total debt over total assets.
NUMANL	The number of analysts following the company in the corresponding year.

Estimations with panel data models with fixed effects eliminate time-invariant confounding factors, computing the effect of the independent variable using only within-unit variation (Mummolo & Peterson, 2018), as the fixed-effects term already captures any time-invariant firm characteristic that may impact the dependent variable. Therefore, similar to Ioannou & Serafeim (2015), Eq. *(1)* is estimated with firm and year fixed effects, and with robust standard errors clustered at the firm level. The use of clustered robust standard errors is standard procedure in panel data estimations and, in particular, in diff-in-diff estimations (Abadie et al., 2017), as they account for heteroskedasticity across "clusters" of observations (in our case, across firms). Considering the research topic of this study, diff-in-diff panel data estimations coupled with firm fixed effects seems a particularly suitable methodology, as it allows to focus on changes within the company over time, rather than on variations between companies. All the necessary information for constructing the variables in Eq. *(1)*, in particular, the investment recommendations, is obtained from Capital IQ, a Standard and Poor's database.

The sample for conducting the empirical analysis consists of firms from Norway, Sweden, Denmark and Finland listed in the stock market for the whole research period (from 2000 to 2010). This initially led to 239 firms and, given the 11-year research period, 2629 firm-year observations. However, 19 firms (209 observations) were not followed by financial analysts and, consequently, did not have any consensus recommendation during the research period. Additionally, in keeping with the diff-in-diff methodology, we impose the condition that each firm in the sample should at least have one

[9] Whereas Ioannou & Serafeim (2015) do not explain the use of control variables with one-year lag, we understand that the more likely explanation is that the observed recommendations are the average of the recommendations issued by analysts in different times.

Table 2. Summary statistics for RECOMM by year

Year	Mean	St. Dev.	Min.	Max.
2000	4.03	0.748	1	5
2001	3.947	0.752	1.9	5
2002	3.859	0.781	1.8	5
2003	3.743	0.768	1.8	5
2004	3.643	0.826	1.8	5
2005	3.629	0.719	1.5	5
2006	3.593	0.668	1.8	5
2007	3.626	0.63	2	5
2008	3.546	0.575	1.8	5
2009	3.466	0.609	1.5	5
2010	3.548	0.607	2	5

Variable: *RECOMM*: the average consensus recommendation for the specific year.

consensus recommendation over the pre- and post-treatment periods. This condition led to the removal of 16 firms, representing 176 observations. Finally, we lose 340 observations due to lack of data for at least one of the control variables. After the said adjustments, the final sample consists of 1904 firm-year observations (313 from Norway, 376 from Denmark, 417 from Finland and 798 from Sweden). The composition of the sample by industry reflects that "Industrials" (27% of the sample), "Financials (17% of the sample) and "Materials" (9% of the sample) are the industries best represented, whereas "Real State" (5% of the sample), "Energy" (2% of the sample) and "Utilities" (1% of the sample) the industries with the lowest representation.

Table 2 provides a summary of the descriptive statistics for the dependent variable in Eq. *(1)*. The Table shows a steady decrease in the mean of *RECOMM* over the research period, indicating a worsening of the consensus recommendations. It also shows that the worst consensus recommendations correspond to the years 2008 and 2009, reflecting the impact of the global financial crisis. Interestingly, whereas for all the years in the research period there is always at least one firm with the best "strong buy" recommendation (with value of "5"), only in year 2000 are we able to find at least one firm with the worst "strong sell" consensus recommendation (with value of "1").

Table 3. Summary statistics for the sample

	Mean	St.Dev.	p25	p50	p75
RECOMM	3.694	0.722	3.207	3.64	4.143
TREAT	0.176	0.381	0	0	0
POST	0.455	0.498	0	0	1
*POST*TREAT*	0.08	0.272	0	0	0
ROA	0.149	0.278	0.053	0.14	0.236
INTANG	0.113	0.141	0.005	0.052	0.167
CAPEX	0.045	0.049	0.008	0.033	0.064
SIZE	8.04	2.037	6.569	7.874	9.477
EP	0.077	0.176	0.027	0.071	0.118
BM	0.802	0.857	0.324	0.583	0.964
RETURN	-0.021	0.318	0-.219	-0.048	0.212
DEBT	0.242	0.176	0.094	0.229	0.36
NUMANL	9.739	8.487	3	7	014

Variables: *RECOMM*: the average consensus recommendation for the specific year; *TREAT*: 1 if the observation belongs to the treatment group (Norwegian firms) and 0 otherwise; *POST*: 1 if the observation corresponds to the post-treatment period and 0 otherwise; *post*treat*: the interaction variable between *POST* and *TREAT*; *ROA*: return on assets; *INTANG*: intangible assets; *CAPEX*: capital expenditures; *SIZE*: the size of the firm; *EP*: earnings-price multiple; *BM*: book-to-market multiple; *RETURN:* market-adjusted return; *DEBT*: the debt ratio; and *NUMANL:* number of analysts that follow the firm.

Table 3 shows the descriptive statistics for the sample. The average recommendation is 3.7, which means a "hold" recommendation. This value is very similar as in Ioannou & Serafeim (2015) (3.65). Regarding the specific variables for the diff-in-diff estimations, the average value of *TREAT* (0.176) indicates that the firms in the treated group represent less than 20% of the sample, whereas, the average value of *POST* (0.455) confirms a rather balanced distribution of the sample between the pre- and post-treatment periods. As for the control variables, the average number of analysts (*NUMANL*) in our sample (9.7) is similar as in Ioannou & Serafeim (2015) (10.7), this despite the average size of the firms in our sample being considerable smaller than in Ioannou & Serafeim (2015). On the other hand, the firms in our sample present an average *ROA* of nearly 15%, which almost double the value in Ioannou & Serafeim (2015). Finally, the higher book-to-market (*BM*) and earnings-price (*EP*) multiples in our sample compared to the US sample in Ioannou & Serafeim (2015) is in accordance with the results in Fernández (2008).

Table 4 summarizes the pairwise correlation coefficients. The most interesting result is the correlation pattern of *RECOMM* with both *TREAT* and *POST*TREAT*. Taken together, this indicates that Norwegian firms are associated with more favorable recommendations than other firms, however the nature of the association did not change after the enactment of the mandatory board gender quota in 2006. Apart from that, and focusing on the correlations between each pair of control variables, the highest correlation is between *SIZE* and *NUMANL* (0.71) and it simply indicates that larger firms are followed by more financial analysts. Apart from that, the relatively low coefficients do not anticipate serious multicollinearity problems in the estimation of Eq. *(1)*.

Table 4. Pairwise correlation coefficients with significance level

Variables	*RECOMM*	*TREAT*	*POST*	*POST*TREAT*	*ROA*	*INTANG*
RECOMM	1.000					
TREAT	0.138***	1.000				
POST	-0.174***	-0.000	1.000			
*POST*TREAT*	0.032	0.638***	0.323***	1.000		
ROA	0.056***	-0.004	0.053**	0.045**	1.000	
INTANG	0.028	-0.088***	0.196***	-0.006	-0.023	1.000
CAPEX	-0.048**	0.042*	-0.068***	0.032	0.026	-0.040*
SIZE	-0.184***	0.022	0.139***	0.066***	0.169***	-0.018
EP	0.077***	0.103***	-0.014	0.111***	0.537***	-0.070***
BM	-0.021	0.118***	-0.052**	0.067***	-0.203***	-0.133***
RETURN	0.059***	-0.094***	-0.054**	-0.055**	0.047**	0.030
DEBT	-0.190***	0.070***	0.002	0.052**	0.020	-0.065***
NUMANL	-0.131***	-0.028	0.122***	0.023	0.081***	0.096***

Variables	*CAPEX*	*SIZE*	*EP*	*BM*	*RETURN*	*DEBT*
CAPEX	1.000					
SIZE	-0.039*	1.000				
EP	-0.099***	0.015	1.000			
BM	-0.113***	-0.275***	0.235***	1.000		
RETURN	-0.003	-0.111***	0.128***	0.190***	1.000	
DEBT	0.034	0.068***	0.084***	0.188***	-0.001	1.000
NUMANL	0.011	0.714***	-0.048**	-0.172***	0.015	0.008

*** p<0.01, ** p<0.05, * p<0.1
Variables: *RECOMM:* the average consensus recommendation for the specific year; *TREAT*: 1 if the observation belongs to the treatment group (Norwegian firms) and 0 otherwise; *POST*: 1 if the observation corresponds to the post-treatment period and 0 otherwise; *post*treat*: the interaction variable between *POST* and *TREAT*; *ROA*: return on assets; *INTANG*: intangible assets; *CAPEX*: capital expenditures; *SIZE*: the size of the firm; *EP*: earnings-price multiple; *BM*: book-to-market multiple; *RETURN:* market-adjusted return; *DEBT*: the debt ratio; and *NUMANL:* number of analysts that follow the firm.

Diff-in-diff estimations require the fulfillment of the assumption that, in the absence of the treatment, the average outcomes for the treated and control groups would have fol-

lowed a parallel trend over time (Abadie, 2005). Accordingly, under this so-called "parallel trend assumption", any behavior of the treated group after the treatment departing from the parallel trend is considered a consequence of the treatment. This study implements a twofold approach for the validation of the parallel trend assumption. First, we compute the annual mean and median changes in *RECOMM* for both the treated and control groups and, afterwards, conduct the *t*-test for mean differences and the Mann-Whitney test for median differences. The results of this analysis, summarized in Table 5, do not show any significant mean or median differences in the annual changes of *RECOMM* between the treated and control groups (p-value < 0.05). An alternative approach for evaluating the parallel trend assumption in diff-in-diff models draws on "placebo" tests (Gertler et al., 2016), where a fake post-treatment period is defined. To conduct this test, we assume a fake date for the enactment of the mandatory board gender quota (the year 2002 instead of the real date of 2006) and, afterwards, re-estimate the diff-in-diff model. Since in 2002 there were no differences between the treated and control groups regarding board gender diversity regulations, under the parallel trend assumption the interaction variable (*POST*TREAT*) should present an insignificant coefficient. This is exactly what we observe in the re-estimation of Eq. *(1)* with the fake post-treatment period (results untabulated) and, therefore, we conclude that the parallel trend assumption holds in our sample.

Table 5. Annual mean and median changes of *RECOMM* for the treated and control groups during the pre-treatment period, with significance values

	Mean			Median		
Year	Treated group	Control group	P-value	Treated group	Control group	P-value
2001	-0.077	-0.035	0.364	-0.000	-0.000	0.489
2002	-0.070	-0.034	0.560	-0.000	-0.000	0.109
2003	-0.060	-0.059	0.869	-0.000	-0.000	0.117
2004	0.054	-0.036	0.065	-0.000	-0.007	0.842
2005	-0.059	-0.018	0.433	-0.943	0.001	0.949

The *t*-test and the Man-Whitney test are used for the assessment of mean and median differences, respectively.
Variable: *RECOMM*: the average consensus recommendation for the specific year.

5. Results of the empirical analysis

Table 6 (Column (1)) summarizes the panel data estimates of Eq. *(1)* with fixed effects and robust standard errors clustered by firm. The use of fixed effects automatically removes from the model the time-invariant variable *TREAT* as well as country and industry fixed effects, but it maintains year fixed effects. The pairwise correlation coefficients in Table 4 do not suggest multicollinearity problems in the dataset, the exception being the high correlation between *SIZE* and *NUMANL*. To further assess this issue, after the estimation of Eq. *(1)* we calculate the variance inflation factors (VIFs). The relatively small VIFs observed for the control variables, all of them below 3, do not indicate that multicollinearity has affected the results.[10]

The main result in Table 6 (Column (1)) refers to the interaction variable *POST*TREAT*, which presents a positive but statistically insignificant coefficient. In keeping with diff-in-diff methodology, this result is interpreted in terms that the board gender quota did not have a significant impact on the investment recommendations of Norwegian companies. The results for the control variables are in the predicted direction for *SIZE*, *ROA*, *DEBT* and *RETURN*. This shows that large, profitable and less risky firms receive better investment recommendations and, in the case of *RETURN*, that analysts tend to issue more favorable recommendations to those stock that performed better in the former period. On the other hand, even though the evidence for *EP* and *NUMANL* contradicts our initial expectations, both results are consistent with Ioannou & Serafeim findings (2015).

Table 6. Results of the diff-in-diff estimations. Dependent variable: *RECOMM*

	Pre-treat.: 00-05; Post-treat.: 06-10		Pre-treat.: 00-05; Post-treat.: 06, 07 and 10	
	(1)	(2)	(3)	(4)
VARIABLES	Fixed Effects	Random Effects	Fixed Effects	Random Effects
TREAT		0.182*		0.187**
		(0.0943)		(0.0915)
POST	-0.0378	-0.0175	-0.0195	0.00101
	(0.0639)	(0.0606)	(0.0640)	(0.0609)
POST*TREAT	**0.0296**	**0.0530**	**0.0236**	**0.0474**
	(0.101)	**(0.101)**	**(0.0962)**	**(0.0958)**
ROA	0.138**	0.106	0.101	0.0753
	(0.0669)	(0.0698)	(0.0775)	(0.0868)
INTANG	-0.202	0.0630	-0.138	0.133
	(0.256)	(0.205)	(0.249)	(0.192)
CAPEX	-0.658	-0.637	-0.457	-0.521
	(0.615)	(0.548)	(0.638)	(0.565)
SIZE	0.140***	0.0455*	0.139***	0.0344
	(0.0406)	(0.0266)	(0.0459)	(0.0280)
EP	0.255**	0.265**	0.344**	0.364**
	(0.121)	(0.126)	(0.159)	(0.170)
BM	0.0158	-0.0513	-0.00700	-0.0896*
	(0.0430)	(0.0371)	(0.0651)	(0.0514)
RETURN	0.294***	0.274***	0.321***	0.302***
	(0.0674)	(0.0684)	(0.0905)	(0.0898)
DEBT	-0.759***	-0.663***	-0.656***	-0.563***
	(0.220)	(0.163)	(0.234)	(0.169)
NUMANL	-0.0189***	-0.0188***	-0.0233***	-0.0206***
	(0.00552)	(0.00422)	(0.00553)	(0.00439)
Constant	2.767***	3.683***	2.778***	3.790***
	(0.352)	(0.280)	(0.398)	(0.290)
Country FE	NO	YES	NO	YES
Year FE	YES	YES	YES	YES
Industry FE	NO	YES	NO	YES
Firm FE	YES	NO	YES	NO
R-squared	0.115	0.146	0.106	0.15
Observations	1,904	1,904	1,522	1,522

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1
Variables: *RECOMM:* the average consensus recommendation for the specific year; *TREAT*: 1 if the observation belongs to the treatment group (Norwegian firms) and 0 otherwise; *POST*: 1 if the observation corresponds to the post-treatment period and 0 otherwise; *post*treat*: the interaction variable between *POST* and *TREAT*; *ROA*: return on assets; *INTANG*: intangible assets; *CAPEX*: capital expenditures; *SIZE*: the size of the firm; *EP*: earnings-price multiple; *BM*: book-to-market multiple; *RETURN:* market-adjusted return; *DEBT*: the debt ratio; and *NUMANL:* number of analysts that follow the firm.

We conduct a series of robustness checks with the aim of assessing the soundness of the above results. First, we estimate Eq. *(1)* with random effects instead of fixed effects. Even though we have justified the use of fixed effects in the same grounds as Ioannou & Serafeim (2015), we want to assess the sensitivity of the reported findings to the estimation method. Hence, Table 6 (Column (2)) summarizes the es-

[10] See, in parentheses, the VIFs for the independent variables: *SIZE* (2.09); *NUMANL* (1.85); *ROA* (1.62); *EP* (1.57); *BM* (1.33); *DEBT* (1.19); *POST* (1.15); *CAPEX* (1.13); *RETURN* (1.12); *POST*TREAT* (1.11); *INTANG* (1.09).

timates of Eq. *(1)* with random effects and robust standard errors clustered by firm. In this case, the estimation includes the variable *TREAT* as well as year, country and industry fixed effects. As in the estimation with fixed effects in Column (1), *POST*TREAT* presents a positive though insignificant coefficient.

The second analysis assesses the issue of multicollinearity. Although the results of the analysis of VIFs did not suggest multicollinearity problems, we have re-estimated Eq. *(1),* after alternatively excluding *SIZE* and *NUMANL,* the two independent variables with the largest correlation. The results of the new estimation for the interaction variable *POST*TREAT* are qualitative the same in terms of sign and significance as the results shown in Table 6 (Column (1)).

The next sensitivity analysis assesses whether the results of the study would have been different if the investment recommendations were examined on a specific day of the year instead of the average recommendation for each year. We used average annual recommendations instead of recommendations from a specific day because they may provide a better understanding of analysts' perceptions of a stock for a given year. However, Ioannou & Serafeim (2015) measure the consensus recommendation at the end of March of each year of the research period. To conduct this analysis, we re-estimate Eq. *(1)* first, with consensus recommendations referred to March, 31, and then to December, 31. The results of these estimations (untabulated) are qualitatively the same as those reported in Table 6.

The fourth analysis intends to control for the potential confounding effect of the 2008 financial crisis. Even though this was a global crisis, it did not have the same effects in every country and/or industry. Accordingly, if for whatever reasons (for example, differences in the industry composition between Norway and the other Scandinavian countries) the 2008 crisis had a differential impact on the consensus recommendation of Norwegian companies compared to companies from neighboring countries, this situation could cause the results of this study to be misleading. To conduct this analysis, we re-estimate Eq. *(1)* after removing the years 2008 and 2009 from the post-treatment period, as these were the years more directly affected by the crisis. The results of the new estimations with fixed and random effects are reported in Columns (3) and (4) of Table 6, respectively. Similar to the main analysis shown in Columns (1) and (2), the interaction variable *POST*TREAT* presents insignificant coefficients in both estimations.

In the review of the literature section of the study we argue that definition of pre- and post-treatment periods is not

Table 7. Sensitivity of the results to the definition of alternative pre- and post-treatment periods. Dependent variable: *RECOMM*

	Pre-treat.: 03; Post-treat.: 07		Pre-treat.: 03-06; Post-treat.: 07-09		Pre-treat.: 02-03; Post-treat.: 04-08	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Fixed Effects	Random Effects	Fixed Effects	Random Effects	Fixed Effects	Random Effects
TREAT		0.0901		0.178		0.162
		(0.125)		(0.114)		(0.104)
POST	-0.0854	3.855***	-0.216***	-0.186***	-0.0373	-0.00196
	(0.126)	(0.342)	(0.0660)	(0.0642)	(0.0571)	(0.0432)
POST* TREAT	**0.0440**	**0.0253**	**-0.0550**	**-0.00978**	**-0.0584**	**-0.0284**
	(0.142)	**(0.146)**	**(0.111)**	**(0.112)**	**(0.110)**	**(0.112)**
ROA	0.125	-0.150	0.223**	0.121	0.163*	0.0867
	(0.182)	(0.127)	(0.0869)	(0.103)	(0.0915)	(0.105)
INTANG	-0.838*	0.0515	-0.315	0.0645	-0.252	0.0972
	(0.496)	(0.250)	(0.301)	(0.212)	(0.310)	(0.219)
CAPEX	-1.171	-1.120	-1.019	-1.036	-0.957	-0.900
	(1.240)	(0.830)	(0.842)	(0.714)	(0.688)	(0.610)
SIZE	0.219**	0.0588*	0.194***	0.0406	0.147**	0.0279
	(0.0939)	(0.0353)	(0.0525)	(0.0308)	(0.0583)	(0.0310)
EP	1.084***	1.112***	0.197	0.243*	0.260	0.317*
	(0.373)	(0.314)	(0.120)	(0.139)	(0.161)	(0.179)
BM	0.0352	-0.192***	0.105**	-0.0150	0.0534	-0.0776
	(0.0952)	(0.0618)	(0.0443)	(0.0390)	(0.0721)	(0.0624)
RETURN	0.0946	0.411*	0.222***	0.231***	0.323***	0.323***
	(0.225)	(0.212)	(0.0740)	(0.0812)	(0.0870)	(0.0892)
DEBT	-0.470	-0.367*	-0.876***	-0.738***	-0.817***	-0.663***
	(0.470)	(0.218)	(0.238)	(0.182)	(0.252)	(0.179)
NUMANL	-0.0270	-0.0203***	-0.00923	-0.0150***	-0.0149*	-0.0167***
	(0.0175)	(0.00666)	(0.00797)	(0.00539)	(0.00784)	(0.00533)
Constant	2.213***		2.232***	3.755***	2.674***	3.977***
	(0.754)		(0.466)	(0.322)	(0.505)	(0.343)
Country FE	NO	YES	NO	YES	NO	YES
Year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	YES	NO	YES	NO	YES
Firm FE	YES	NO	YES	NO	YES	NO
R-squared	0.196	0.272	0.110	0.160	0.101	0.172
Observations	356	356	1,297	1,297	1,261	1,261

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Variables: *RECOMM:* the average consensus recommendation for the specific year; *TREAT*: 1 if the observation belongs to the treatment group (Norwegian firms) and 0 otherwise; *POST*: 1 if the observation corresponds to the post-treatment period and 0 otherwise; *post*treat*: the interaction variable between *POST* and *TREAT*; *ROA*: return on assets; *INTANG*: intangible assets; *CAPEX*: capital expenditures; *SIZE*: the size of the firm; *EP*: earnings-price multiple; *BM*: book-to-market multiple; *RETURN:* market-adjusted return; *DEBT*: the debt ratio; and *NUMANL:* number of analysts that follow the firm.

an easy issue in the investigation of the effects of the Norwegian board gender quota. This is mainly due to the specifics of the process that ultimately led to the enactment of the quota in early 2006. Hence, compliance with the 40% gender quota approved in 2003 was initially voluntary for firms, although the regulators established that if the percentage of women on boards did not increase substantially in the following years, the quota would become mandatory. This situation complicates the design of a diff-in-diff approach, as the expectation of a likely mandatory quota in 2006 might have influenced some decisions about board composition before that date. Supporting this view, prior related studies also investigating the Norwegian case do not agree on the pre- and post-treatment periods. The aim of this analysis is to assess the robustness of the results reported in Table 6 to the definition of alternative pre- and post-treatment periods. Table 7 shows the results of the estimation of Eq. *(1)* with fixed effects (Column (1)) and random effects (Column (2)) with the pre- and post-treatment periods defined by the years 2003 and 2007, respectively, exactly as in Dale-Olsen et al. (2013). Afterwards, Columns (3) and (4) summarize the estimations of Eq. *(1)* with fixed and random effects, respectively, and using the same periods as in Matsa & Miller (2013): pre-treatment: 2003-2006; post-treatment: 2007-2009. Finally, following this same pattern, Columns (5) and (6) present the estimates of Equation *(1)* with fixed with random effects, but with the pre- and post-treatment periods used in Yang et al. (2019): pre-treatment: 2002-2003; post-treatment: 2004-2008. Similar to the evidence provided in the main analysis (in Table 6, Column (1)), the new estimations show insignificant coefficients for *POST*TREAT* in all cases.

The next robustness check consists of estimating Eq. *(1)* with a matched sample of firms. This analysis is pertinent because a different industry composition between treated and control groups might explain differences in the consensus recommendations issued by financial analysts in the post-treatment period, thus unrelated to the gender quota regulation. This would be the case, for example, if some specific industries more (or less) present in the treated than in the control group had better (or worse) recommendations during this period. Under this scenario, the diff-in-diff analysis would incorrectly attribute any observed differences in analysts' recommendations to the gender quota. We use the propensity score method to obtain a matched sample, where each firm from the treated group is matched with another firm from the control group with homogenous characteristics in terms of industry and size. The results of the estimation of Eq. *(1)* with the resulting matched sample are summarized in Table 8. Similar to the former analyses, the main estimation is performed with fixed effects (in Column (1)), although results with random effects are also reported (in Column (2)). As in the estimations conducted so far in this study, *POST*TREAT* maintains its insignificant coefficient in both cases.

Subsequently, we have addressed the sensitivity of the results to alternative definitions of the dependent variable. Similar to Ioannou & Serafeim (2015), in all the estimations this variable has been *RECOMM* (the consensus recommendation), which is calculated applying scores between 1 and 5 to each type of recommendation (5 to "strong buy", 4 to "buy", 3 to "hold", 2 to "sell" and 1 to "strong sell"). Thus, consensus recommendations are the result of the application of these scores to the original recommendations issued by financial analysists and, on these grounds, an arbitrary construct of these recommendations. The aim of this analysis is working with the raw recommendations as originally issued by the analysts. Hence, we define the variables *%BUY* (number of "strong buy" and "buy" recommendations over total recommendations) and *%SELL* (number of "strong sell" and "sell" recommendations over total recommendations) and, afterwards, conduct sequential estimations of Eq. *(1)* with both dependent variables. The results of the estimations for *%BUY* with fixed effects and random effects are reported in Table 9 (Columns (1) and (2)). *POST*TREAT* presents insignificant coefficients in both estimations, indicating that the percentage of favorable recommendations did not significantly change in Norway in the post-treatment period compared to the situation in other Scandinavian countries. Finally, similar results are reported in the estimations conducted with *%SELL* as the dependent variable, summarized in Columns (3) and (4) of Table 9.

In our latest analysis of the study, we evaluate the sensitivity of the results concerning the exclusion of financial entities from the sample. Initially, we followed Ioannou & Serafeim's (2015) approach by including all listed firms, regardless of the industry, for the empirical analysis. However, we recog-

Table 8. Results of the diff-in-diff estimation with a matched sample. Dependent variable: *RECOMM*. Pre-treatment period: 2000-2005; post-treatment period: 2006-2010

	(1)	(2)
VARIABLES	Fixed Effects	Random Effects
TREAT		0.281***
		(0.103)
POST	0.0319	0.0299
	(0.112)	(0.102)
POST*TREAT	**0.0108**	**0.00545**
	(0.112)	**(0.111)**
ROA	0.235**	0.137
	(0.1000)	(0.0957)
INTANG	-0.769	-0.303
	(0.481)	(0.301)
CAPEX	-2.187***	-2.003***
	(0.728)	(0.704)
SIZE	0.139**	0.0746**
	(0.0564)	(0.0343)
EP	0.414**	0.258
	(0.170)	(0.177)
BM	0.120**	0.000242
	(0.0585)	(0.0490)
RETURN	0.179	0.231
	(0.152)	(0.151)
DEBT	-0.548	-0.483**
	(0.353)	(0.215)
NUMANL	-0.0212**	-0.0207***
	(0.00879)	(0.00565)
Constant	2.846***	3.314***
	(0.517)	(0.403)
Country FE	NO	YES
Year FE	YES	YES
Industry FE	NO	YES
Firm FE	YES	NO
R-squared	0.172	0.206
Observations	649	649

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Variables: *RECOMM:* the average consensus recommendation for the specific year; *TREAT*: 1 if the observation belongs to the treatment group (Norwegian firms) and 0 otherwise; *POST*: 1 if the observation corresponds to the post-treatment period and 0 otherwise; *post*treat*: the interaction variable between *POST* and *TREAT*; *ROA*: return on assets; *INTANG*: intangible assets; *CAPEX*: capital expenditures; *SIZE*: the size of the firm; *EP*: earnings-price multiple; *BM*: book-to-market multiple; *RETURN:* market-adjusted return; *DEBT*: the debt ratio; and *NUMANL:* number of analysts that follow the firm.

Table 9. Results of the diff-in-diff estimation. Dependent variable: %*BUY* in Columns (1) and (2) and %*SELL* in Columns (3) and (4). Pre-treatment period: 2000-2005; post-treatment period: 2006-2010

	% of Buy recommendations (% *BUY*)		% of Sell recommendations (% *SELL*)	
	(1)	(2)	(3)	(4)
VARIABLES	Fixed Effects	Random Effects	Fixed Effects	Random Effects
TREAT		0.0757*		-0.0758***
		(0.0408)		(0.0278)
POST	-0.0245	-0.0194	-0.0616**	-0.0560**
	(0.0299)	(0.0275)	(0.0242)	(0.0227)
POST*TREAT	**0.0317**	**0.0411**	**0.00998**	**0.00989**
	(0.0428)	**(0.0439)**	**(0.0316)**	**(0.0316)**
ROA	0.0273	0.0149	-0.000145	-0.00348
	(0.0304)	(0.0302)	(0.0260)	(0.0217)
INTANG	-0.103	0.0243	0.137*	0.0364
	(0.100)	(0.0766)	(0.0783)	(0.0598)
CAPEX	-0.554***	-0.439**	0.113	0.0910
	(0.184)	(0.184)	(0.201)	(0.179)
SIZE	0.0353*	0.0108	-0.0186	-0.0150*
	(0.0183)	(0.0120)	(0.0152)	(0.00854)
EP	0.138**	0.0904	-0.118***	-0.107**
	(0.0634)	(0.0633)	(0.0447)	(0.0436)
BM	0.0348*	-0.00809	-0.0151	-0.00446
	(0.0188)	(0.0184)	(0.0156)	(0.0132)
RETURN	0.174***	0.189***	-0.128***	-0.145***
	(0.0355)	(0.0338)	(0.0271)	(0.0252)
DEBT	-0.171*	-0.163**	0.278***	0.200***
	(0.0952)	(0.0682)	(0.0897)	(0.0592)
NUMANL	-0.00505	-0.00433**	0.00465**	0.00231
	(0.00310)	(0.00212)	(0.00208)	(0.00146)
Constant	0.339**	0.625***	0.266**	0.247***
	(0.153)	(0.122)	(0.131)	(0.0834)
Country FE	NO	YES	NO	YES
Year FE	YES	YES	YES	YES
Industry FE	NO	YES	NO	YES
Firm FE	YES	NO	YES	NO
R-squared	0.087	0.113	0.076	0.110
Observations	1,904	1,904	1,904	1,904

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Variables: *%BUY:* percentage of buy or strong buy recommendations; *%SELL*: percentage of sell or strong sell recommendations; *TREAT*: 1 if the observation belongs to the treatment group (Norwegian firms) and 0 otherwise; *POST*: 1 if the observation corresponds to the post-treatment period and 0 otherwise; *post*treat*: the interaction variable between *POST* and *TREAT*; *ROA*: return on assets; *INTANG*: intangible assets; *CAPEX*: capital expenditures; *SIZE*: the size of the firm; *EP*: earnings-price multiple; *BM*: book-to-market multiple; *RETURN:* market-adjusted return; *DEBT*: the debt ratio; and *NUMANL:* number of analysts that follow the firm.

nized that financial entities may exhibit unique characteristics, particularly in relation to some of the control variables in Eq. *(1)*, notably the debt ratio. These distinct characteristics could potentially influence our estimations. To address this concern, we conducted a separate analysis where we removed financial entities from the sample. Subsequently, we reestimated Eq. *(1)* using this modified sample. The summarized results are presented in Table 10, with Columns (1) and (2) showing the estimates for the post-treatment periods 2006-2010 and 2006, 2007, and 2010, respectively. Interestingly, we found that the interaction variable *POST*TREAT* showed insignificant coefficients in both estimations. This finding further supports the results we presented in Table 6 (Columns (1) and (3)), which were based on the entire sample of firms. Thus, we can confidently assert that the conclusions of our study remain consistent and robust regardless of whether financial entities are included or excluded from the analysis.

Table 10. Results of the diff-in-diff estimations. Dependent variable: *RECOMM*. Financial entities excluded from the sample

	Pre-treat.: 00-05; Post-treat.: 06-10	Pre-treat.: 00-05; Post-treat.: 06, 07, and 10
	(1)	(2)
VARIABLES	Fixed Effects	Fixed Effects
POST	-0.290***	-0.310***
	(0.0785)	(0.0854)
POST*TREAT	**0.0222**	**0.00223**
	(0.101)	**(0.0885)**
ROA	0.206***	0.139*
	(0.0724)	(0.0835)
INTANG	-0.0474	0.0592
	(0.179)	(0.217)
CAPEX	0.539	0.528
	(0.428)	(0.476)
SIZE	0.0667	0.0339
	(0.0429)	(0.0501)
EP	0.315**	0.382***
	(0.124)	(0.140)
BM	0.170**	0.203***
	(0.0667)	(0.0774)
RETURN	-0.902***	-0.819***
	(0.176)	(0.209)
DEBT	-0.0146***	-0.0152**
	(0.00520)	(0.00591)
NUMANL	3.563***	3.827***
	(0.329)	(0.385)
Constant	-0.290***	-0.310***
	(0.0785)	(0.0854)
Country FE	NO	YES
Year FE	YES	YES
Industry FE	NO	YES
Firm FE	YES	NO
R-squared	0.115	0.114
Observations	1,516	1,210

Robust standard errors in parentheses. **** p<0.01, ** p<0.05, * p<0.1*
Variables: *RECOMM:* the average consensus recommendation for the specific year; *TREAT*: 1 if the observation belongs to the treatment group (Norwegian firms) and 0 otherwise; *POST*: 1 if the observation corresponds to the post-treatment period and 0 otherwise; *post*treat*: the interaction variable between *POST* and *TREAT*; *ROA*: return on assets; *INTANG*: intangible assets; *CAPEX*: capital expenditures; *SIZE*: the size of the firm; *EP*: earnings-price multiple; *BM*: book-to-market multiple; *RETURN:* market-adjusted return; *DEBT*: the debt ratio; and *NUMANL:* number of analysts that follow the firm.

6. Discussion

This study shows that the enactment of the Norwegian mandatory board gender quota in early 2006 had no significant impact on the consensus recommendations for Norwegian firms, compared to the recommendations for their peers from neighboring countries, which were not affected by any similar quota regulation. We regard this result as sound, as it holds without exception across a battery of sensitivity analyses. Therefore, we must conclude that the hypothesis of the study that the Norwegian gender quota had a significant impact on the analysts' perceptions of firm performance is rejected. In the development of the hypothesis we did not predict the sign of the effect, because the quota may have opposite effects on the expected performance of firms. On the one hand, the more gender diverse boards due to the implementation of the quota could lead to better governed firms (e.g., Hillman et al., 2007; Reguera-Alvarado et al., 2017) and, as a result of that, better performing firms. However, in a situation of limited supply of qualified female directors (Ahern & Dittmar, 2012), the enactment of the gender quota

could also lead to less competent boards, and in that sense, worse performing firms. The results of the study suggest that both effects might cancel each other out.

Previous related studies measure financial performance mainly through ROA and Tobin's Q, and have provided mixed results. The evidence based on ROA must be carefully taken, mainly because this is an indicator of short-term performance, whereas the role of the board of directors is, by nature, strategic (Forbes & Milliken, 1999; Pugliese et al., 2009). Therefore, when Dale-Olsen et al. (2013) use the year 2007 as the post-treatment period, or Matsa & Miller (2013) use the years between 2007 and 2009, they are implicitly assuming that the appointment of female directors would have an almost immediate impact on the firm's income statement. We expect the main effects of the decisions taken by these more gender-diverse boards to occur several years after the adoption of these decisions. In that regard, we consider the evidence based on Tobin's Q as sounder, because it does not present this limitation, since this indicator incorporates the expectations of the market participants reflected in the market value of the firm. Hence, if we examine our results in the light of the available evidence with Tobin's Q as the measure of financial performance, we should conclude that they are consistent with most of this evidence. Thus, while Ahern & Dittmar (2012) conclude that the Norwegian gender quota had a negative impact on financial performance measured by Tobin's Q, the more recent studies by Yang et al. (2019) and Eckbo et al. (2021) report insignificant results. In that regard, our study indicates the same lack of impact of the quota on firm performance, as measured by analysts' perceptions.

7. Conclusions, implications and limitations

The enactment of a board gender quota in Norway led to an unprecedent increase in the number of female directors over a short period of time, although it was also controversial due to its restriction of shareholders' freedom to appoint directors. This was precisely the main claim of many corporate managers who argued that it would lead to less competent boards, as more competent male directors would be replaced by less competent female directors, just to meet the quota requirements.

Although the extant evidence about the actual effects of the Norwegian quota on firm performance is largely inconclusive, possibly because earlier studies reported a negative impact (Ahern & Dittmar, 2012; Matsa & Miller, 2013), this seems to be the prevalent view in the literature. However, some of this evidence is potentially problematic as it is based on the return on assets as the indicator of performance. The main problem is that this metric evaluates short-term performance, thus failing to recognize the strategic role of the board of directors, whose decisions are typically intended to yield long-term outcomes. This study proposes a new approach to the investigation of the performance effects of the gender quota, which is based on analysts' perceptions of firm performance. Our results provide sound and consistent evidence that the investments recommendations issued by financial analysts on Norwegian stocks did not change significantly after the enactment of the gender quota, compared to the recommendation issued on their peers from neighboring countries which were not affected by any quota regulation. Therefore, analysts did not adhere to the claim that the quota would worsen firm performance.

This study has some potentially interesting implications at various levels. For academia, it may contribute to change the prevalent view in the literature about the negative effects of mandatory board gender quotas on firm performance. Furthermore, it may also encourage other scholars to look for alternative perspectives for measuring financial performance. In that regard, our study adds to the existing literature by providing a new perspective from financial analysts, which complements the focus of prior research on just two indicators, namely return on assets and Tobin's Q. At a more practical level, for regulators and policy makers the results of the study may facilitate the enactment of board gender quotas in other countries, as this research effectively counters the primary argument of quota opponents, which claims that such initiatives would have a detrimental effect on firm performance. This is a particularly interesting issue, given the current debate and some recent initiatives in some countries (e.g., Germany and France) about imposing gender quotas also in the executive committee of the board. Finally, managers, shareholders, potential investors or other stakeholders should not be worried about the negative implications of the enactment of board gender quotas on firm performance. This is issue becomes particularly relevant for managers and shareholders, who may be concerned by the negative impact of a gender quota on the ability of the firms to compete with its peers from other countries not affected by any mandatory quota regulation.

Our research design presents at least the same limitation as prior related studies on the effects of the Norwegian quota on firm performance, which have also used a control group formed by public firms from the neighboring Scandinavian countries. Ferreira (2015) argues that the choice of a control group is problematic when examining the Norwegian board gender quota experience, as differences in the legal and macroeconomic environments between the treated and control groups may affect the results. Finally, the changes in the incorporation of women into senior management that have occurred in more recent years might affect the applicability the results of the study to the current context.

Finally, whereas Norway is the study case for the investigation of the effects of board gender quotas, the fact that other countries have enacted quotas, more or less inspired by the Norwegian experience, allows to replicate the analysis conducted here in other contexts (e.g., with different legal traditions and/or levels of gender equality). This would be interesting given the importance of the institutional setting of the firm in the investigation of gender and corporate governance issues. For example, country differences in the availability of qualified female directors could explain different effects of board gender quotas on perceptions of financial performance in different countries.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

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