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The valuation impact of gender quotas in the boardroom: Evidence from the European markets

Carlos Fernández-Méndez [a,*], Shams Pathan [b]

[a] Department of Business Administration, University of Oviedo, Avda. del Cristo s/n. 33071, Oviedo, Spain
[b] Curtin Business School, Curtin University, Australia

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ABSTRACT

We investigate stock market reactions to the announcement of the new, June 2022 European Union (EU) regulation on board gender diversity, which requires firms to appoint a minimum of 33% female directors (or 40% female non-executive directors). We find that the abnormal market returns surrounding the EU announcement are positive. We also note that the observed positive valuation effects are particularly strong for: (1) firms in countries with softer existing regulations on board gender diversity; and (2) firms with a larger gap between current levels of board gender diversity and the 33% gender quota. Our analysis of the EU legislation on gender quotas offers solid evidence that board gender quotas are perceived by investors as beneficial, particularly for firms exposed to a large gender imbalance.

1. Introduction

Women have traditionally suffered from discrimination in the labour market (Tatli et al., 2013) and are generally under-represented in upper management positions (Thams et al., 2018). Women's underrepresentation on corporate boards is pervasive in many major economies including the US (Kogut et al., 2014), China (Qiu et al., 2022), Japan (Binder et al., 2019), the UK (Goyal et al., 2021), France (Nekhili and Gatfaoui, 2013), Italy (Bianco et al., 2015) and Spain (de Cabo et al., 2011). To address this widespread gender imbalance, many countries have implemented various gender diversity policies ranging from enforceable quotas with hard or soft sanctions to voluntary recommendations included in corporate governance codes. While multiple European Union (EU) Member States have developed their own legislation on board gender diversity, a proposal for imposing gender quotas submitted by the European Commission in November 2012, later supported by the European Parliament in November 2013, faced a moratorium by the European Council for nearly ten years. Finally, on the evening of 7 June 2022, the European Parliament announced an agreement with the Member States' negotiators to introduce a gender quota, so that by 2026, "at least 40% of non-executive director posts or 33% of all director posts are occupied by the under-represented sex".

The effectiveness of gender quotas is fiercely debated. On the positive side, quotas are seen as an effective way to reduce board gender imbalances and liberate boards from the selection bias linked to the old-boy network. The imposition of gender quotas supports the development of gender diverse boards which provide access to a broader knowledge base and more varied work experiences and social networks than all-male boards (Rixom et al., 2022). The wider human capital in gender diverse boards contributes to improvements in firm governance (Adams and Ferreira, 2009), financial performance (Terjesen et al., 2016) and social performance

* Corresponding author.
E-mail address: cfenan@uniovi.es (C. Fernández-Méndez).

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(Bruna et al., 2021, 2022). Moreover, board gender diversity benefits firms' legitimacy (Gao et al., 2016), alleviates problems arising from group thinking (Adams and Funk, 2012) and improves boards' ethical standards (Eagly et al., 2004).

On the negative side, many commentators consider that compulsory quotas break the economic rationale behind the board nomination process. Assuming that firms aim for optimal board composition, the imposition of restrictions via gender quota regulations could result in suboptimal director selection from a limited pool of female candidates. The resulting boards might also be suboptimal due to excessive board size if new female directors are added, or might suffer from the loss of valuable human capital if long-tenured male directors are replaced by new female directors. In addition, female directors selected under positive discrimination rules might be seen as unfairly appointed, which could be a source of tension that might damage the board's functioning.

Previous evidence on the negative market reaction to the announcement of board gender quota laws passed in Norway (Ahern and Dittmar, 2012) and California (Greene et al., 2020) suggests that investors consider the negative aspects of board gender quotas to outweigh the potential positives. However, these results cannot be extrapolated to the EU's imposition of a gender quota in 2022. For instance, the Norwegian law was passed at an early stage of the implementation of gender diversity positive policies, when empirical evidence supporting the business case for gender diversity was scarce. In addition, there are noticeable differences between the United States and Europe regarding how the public views government interventions, potentially affecting support for quota laws (Möhring and Teney, 2020).

In light of these fundamental differences, it is important to understand the stock market reactions to the 7 June 2022 announcement of the passing of the EU legislation on a gender quota for corporate boards, and this study is the first attempt to evaluate these reactions. Empirical analysis of the valuation effects and the determinants of the market reaction to this external shock may provide robust evidence on the relationship between board gender diversity and firm value in a quasi-natural experimental framework. In addition, comparison of market reactions between firms under different regimens of board gender diversity enforcement (ranging from voluntary to punitive) provides a better understanding of investors' perceptions of the effectiveness of the different gender diversity policies implemented across Europe over the past 20 years.

Our empirical results demonstrate that the stock market reactions to the announcement of the new EU legislation on board gender diversity are positive; these findings show that investors are persuaded by the positive aspects of gender quota rules. In addition, we find that this positive valuation effect is stronger for firms in countries with softer board gender diversity regulations or no regulations at all (i.e., quota laws with weak penalties or no sanctions, voluntary code recommendations or no gender regulation) compared to firms in countries with stricter board gender diversity regulations (i.e., quota laws with hard sanctions). Also, the market reactions are positively associated with the size of the gap firms need to fill to meet the 33% board gender quota. In summary, our evidence suggests that the new EU regulation on gender quotas for boards has been applauded by investors, especially for firms with boards showing larger gender imbalances, which are thus expected to benefit more from this gender diversity legislation. Our paper contributes to the current debate on gender diversity quotas by showing the positive assessment that the markets have made of the EU agreement on board gender quotas and the perceived corrective capacity of this rule in countries and companies that have fallen short in their efforts to achieve board gender equality.

2. Data and empirical framework

2.1. Data

In this paper, we analyse the relationship of the stock market reaction surrounding the announcement of the EU regulation on board gender diversity with the type of national regulation on board gender diversity currently in place and with the gap between the existing proportion of women board directors and the 33% female directors quota. We collected equity market prices and financial data from the Compustat Global database, and data on board size and composition are from BoardEx. Our initial sample consisted of 3137 EU listed companies for which we have complete daily prices over the period 3 August 2021 to 5 July 2022. We merged this dataset with the BoardEx data, leaving us with a final sample of 2211 cross-sectional observations from 25 European countries. A complete description of the sample is provided in online appendix Table A-III.

2.2. Measures of variables

We measured the market reaction by calculating the firm's daily abnormal returns around the date of the announcement of the EU regulation on gender diversity. We estimated the market model parameters using a window of 200 days starting on 3 August 2021 and ending on 9 May 2022 (days −220 to −21 in relation to the announcement date). We used the Eurostoxx600 index as our proxy for the market portfolio.[1] To estimate the valuation effects surrounding the EU announcement, we computed abnormal returns (AR) on the

[1] We also used the market return factor for the European markets obtained from Kenneth French's data library as an alternative proxy for the market portfolio return. The results are all in line with those presented in Tables 1 and 2. Regression estimates are shown in Table A-V of the online appendix.

announcement day (day 0)[2] and cumulative abnormal returns (CAR) in two separate event windows: [0, +1] and [−1, +1] .[3]

To analyse the effect of differences in the nature of any pre-existing national regulation related to board gender diversity (*REGULATION*) on the observed market reactions, we created four binary variables to indicate countries with a hard quota regulation (*Hard quota*: Belgium, France and Italy), a soft quota rule (*Soft quota*: Austria, Germany, Greece, Netherlands, Portugal and Spain), voluntary recommendations (*Recommendations*: Denmark, Finland, Ireland, Luxembourg, Poland, Romania, Slovenia and Sweden) and no rule of any sort on board gender diversity (*Unregulated*: Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Lithuania and Malta) .[4]

We also analysed the effect of any pre-existing gender gap (*FEMALE GAP*) on the observed market reactions using a set of proxies that capture the presence of female directors on firm boards and the observed gap between this current female representation and the 33% goal prescribed by the EU regulation. We used the proportion of female board directors *(%Female bd*), a binary variable indicating whether the firm has to add at least one female director to reach the 33% goal (*Dummy add female*), a variable indicating the additional proportion of female directors necessary to reach the 33% goal (*%Gap female*) and a variable indicating the number of additional female directors necessary to reach the 33% goal (*#Add female*). In addition, we categorised the last two variables into multiple groups. The percentage gap (*%Gap female*) was divided into three categories: firms that had reached the 33% goal (*%Gap 0*), firms that had a small gap of under 15% for female directors (*%Gap 0 to 15%*) and firms that had a large gap of over 15% (*%Gap>15 to 33%*). The *#Add female* variable was divided into four categories: firms with a zero gap (*#Add 0*), firms with a small gap of one female director (*#Add 1*), firms with a gap of two female directors (*#Add 2*) and firms with a gap of three or more female directors (*#Add 3+*). Finally, we controlled for the effects of board size (*Board size*) and board independence (*Board independence*), firm size (*Size*), leverage (*Leverage*), return on assets (*Return on assets*) and market to book ratio (*Market to book*). All variables are defined in Table A-I and the descriptive statistics are in Table A-II in the online appendix.

2.3. Empirical framework

First, we conducted univariate tests to gauge the magnitude and statistical significance of the market reactions for the whole sample as well as for the subsamples based on the categorical variables capturing the nature of national regulation related to board gender diversity and the existing gender gap with respect to the required 33% ratio of female directors. We used parametric *t*-tests for all subsamples and for the differences in means between them.[5]

Second, we estimated the following regression equation examining the effect of existing national regulations and the board gender gap on market reactions:

$$(\mathrm{AR})_i = \alpha_j + \beta_1(REGULATION|FEMALE\ GAP)_i + \sum_{j=1}^{6}\mu_j(CONTROLS)_i + \sum_{k=1}^{57}\delta_k(SIC)_k + \varepsilon_i \quad (1)$$

where subscript *i* denotes individual firms. The dependant variable $(\mathrm{AR})_i$ represents the abnormal returns of firm i for three windows: on the announcement day (AR(0)), a two-day event window (CAR[0,+1]) and a three-day event window (CAR[−1,+1]). The coefficients α, *β*, *μ* and *δ* are the parameters to be estimated, while ε is a disturbance term. Our proxies of *REGULATION* and *FEMALE GAP* are described in Section 2.2. *CONTROL* comprises six variables, as noted in Section 2.2. In addition, two-digit SIC industry dummies (*SIC)* are used to control for industry fixed effects. We estimated the above Eq. (1) using the ordinary least squares technique.

3. Main results

3.1. Univariate analysis

Table 1 shows the abnormal returns on the day of the announcement of the EU regulation on board gender diversity (AR(0)) and the cumulative abnormal returns in two separate windows: [0, +1] and [−1, +1]. Panel A reports the AR for the whole sample. We found positive market reactions and statistically significant *t*-test statistics for AR(0) and CAR for both windows. Particularly, the significant market reactions observed on day zero and those corresponding to the two event windows [0 + 1] and [−1 + 1] were 0.45%, 0.65% and 0.60%, respectively. These results indicate that investors assessed the regulation on board gender quotas positively for all firms, independently of pre-existing national regulations on board gender diversity and the size of the gender gap in reference to the proposed 33% quota.

Panel B compares ARs and CARs for the subsamples of firms subjected to different types of national regulations related to board

[2] Since the press release about the agreement was released at 20:20 on 7 June 2022, we considered the next trading day in the European markets (i.e., 8 June) as day zero for the construction of the event windows.

[3] We also calculated CAR for five additional windows:[0,+2], [−2,+2], [0,+3], [−3,+3] and [+2,+30]. The results are reported in online Appendix Table A-IV.

[4] We classified the "hard quota" category as those countries imposing monetary penalties and restrictions to the formation of the board in the form of open seats or even dissolution of the board (i.e., Italy, France, and Belgium). The "soft quota" group included those countries imposing only "open seat" sanctions (Austria, Germany, Netherlands), countries in which a noncompliant appointment is considered provisional (Portugal) and countries which do not impose any type of sanction (Spain).

[5] Similar results using non-parametric Wilcoxon *z*-tests are available on request from the authors.

Table 1
Abnormal returns on the EU directive on board gender diversity.

Panel A: Whole sample							
		Obs	Mean		*t stats*		
AR (0)		3137	0.0045		*10.55****		
CAR [0 + 1]		3137	0.0065		*11.37****		
CAR [−1 + 1]		3137	0.0060		*8.41****		
Panel B: Comparison of different types of board diversity regulations							
		AR (0)					
Group	Obs	AR(0)	*t stats*	Groups compared	diff		*t stats*
1 Hard quota	876	0.0015	*2.06***				
2 Soft quota	824	0.0065	*8.66****	(1) vs (2)	−0.0050		*−5.00****
3 Recommendations	1316	0.0050	*6.84****	(1) vs (3)	−0.0035		*−3.40****
4 Unregulated	121	0.0055	*3.27****	(1) vs (4)	−0.0040		*−2.00***
		CAR [0 + 1]					
Group	Obs	CAR [0 + 1]	*t stats*	Groups compared	diff		*t stats*
1 Hard quota	876	0.0032	*3.24****				
2 Soft quota	824	0.0089	*9.11****	(1) vs (2)	−0.0057		*−4.05****
3 Recommendations	1316	0.0066	*6.64****	(1) vs (3)	−0.0034		*−2.30***
4 Unregulated	121	0.0126	*5.40****	(1) vs (4)	−0.0094		*−3.35****
		CAR [−1 + 1]					
Group	Obs	CAR [−1 + 1]	*t stats*	Groups compared	diff		*t stats*
1 Hard quota	876	0.0020	*1.69**				
2 Soft quota	824	0.0090	*7.82****	(1) vs (2)	−0.0070		*−4.15****
3 Recommendations	1316	0.0055	*4.61****	(1) vs (3)	−0.0035		*−1.95**
4 Unregulated	121	0.0135	*4.88****	(1) vs (4)	−0.0115		*−3.30****
Panel C: Comparison of different female director percentage gaps							
			AR (0)				
Group		Obs	AR(0)	*t stats*	Groups compared	diff	*t stats*
(1)%Gap 0		1139	0.0026	*4.44****			
(2)%Gap 0 to 15%		669	0.0057	*7.09****	(1) vs (2)	−0.0031	*−2.55***
(3)%Gap>15 to 33%		403	0.0068	*5.69****	(1) vs (3)	−0.0042	*−3.80****
			CAR [0 + 1]				
Group		Obs	CAR [0 + 1]	*t stats*	Groups compared	diff	*t stats*
(1)%Gap 0		1139	0.0036	*4.30****			
(2)%Gap 0 to 15%		669	0.0072	*5.96****	(1) vs (2)	−0.0036	*−2.52***
(3)%Gap>15 to 33%		403	0.0084	*5.53****	(1) vs (3)	−0.0048	*−2.84****
			CAR [−1 + 1]				
Group		Obs	CAR [−1 + 1]	*t stats*	Groups compared	diff	*t stats*
(1)%Gap 0		1139	0.0033	*3.23****			
(2)%Gap 0 to 15%		669	0.0090	*6.24****	(1) vs (2)	−0.0057	*−3.33***
(3)%Gap>15 to 33%		403	0.0081	*4.30****	(1) vs (3)	−0.0048	*−2.38***
Panel D: Comparison of different female director numerical gaps							
	AR (0)						
Group	Obs	AR(0)	*t stats*	Groups compared	diff	*t stats*	
(1) #Add 0	1139	0.0026	*4.44****				
(2) #Add 1	584	0.0053	*5.78****	(1) vs (2)	−0.0027	*−2.50* **	
(3) #Add 2	363	0.0067	*5.67****	(1) vs (3)	−0.0041	*−3.22****	
(4) #Add 3+	125	0.0104	*4.84****	(1) vs (4)	−0.0078	*−3.13****	
	CAR [0 + 1]						
Group	Obs	CAR [0 + 1]	*t stats*	Groups compared	diff	*t stats*	
(1) #Add 0	1139	0.0036	*4.30****				
(2) #Add 1	584	0.0066	*4.76****	(1) vs (2)	−0.0030	*−1.96***	
(3) #Add 2	363	0.0092	*6.38****	(1) vs (3)	−0.0056	*−3.32****	
(4) #Add 3+	125	0.0089	*3.3335****	(1) vs (4)	−0.0053	*−1.61*	
	CAR [−1 + 1]						
Group	Obs	CAR [−1 + 1]	*t stats*	Groups compared	diff	*t stats*	
(1) #Add 0	1139	0.0033	*3.23****				
(2) #Add 1	584	0.0084	5.11***	(1) vs (2)	−0.0051	−2.80***	
(3) #Add 2	363	0.0083	4.53***	(1) vs (3)	−0.0050	−2.42**	
(4) #Add 3+	125	0.0105	3.15***	(1) vs (4)	−0.0072	−2.40**	

This table shows the abnormal returns on the day of the announcement of the EU regulation on board gender diversity AR(0) and the cumulative abnormal returns in two windows: CAR [0, +1] and CAR [−1, +1]. Panel A shows results for the whole sample. Panel B compares ARs and CARs for the subsamples of firms subjected to different types of national regulations related to board gender diversity. Panels C and D displays the comparison of ARs and CARs for different groups based on the existing gap with respect to the required 33% (percentage gap in panel C and numerical gap in panel D). All group variables are defined in Table A-I of the online appendix We display parametric t-tests for all subsamples and for the means differences between them. *, **, *** represent statistical significance at the 10%, 5% and 1% level, respectively.

Table 2
Effect of board gender quota and gender gaps on AR and CAR.

Panel A: dependant variable AR(0)						
	(1)	(2)	(3)	(4)	(6)	(6)
Hard quota	−0.0050***					
	(−5.09)					
Soft quota		0.0059***				
		(5.31)				
Recommendations		0.0031**				
		(2.34)				
Unregulated		0.0138***				
		(3.79)				
%Female bd			−0.0103***			
			(−3.03)			
%Gap female				0.0164***		
				(3.13)		
#Add female					0.0020***	
					(3.99)	
Dummy add female						0.0033***
						(3.56)
Board independence	0.0023	0.0056*	0.0052*	0.0052*	0.0056*	0.0048*
	(0.85)	(1.85)	(1.80)	(1.78)	(1.96)	(1.69)
Board size	0.0012	0.0003	0.0007	0.0009	0.0000	0.0004
	(0.88)	(0.23)	(0.53)	(0.66)	(0.01)	(0.33)
Size	−0.0006**	−0.0005*	−0.0002	−0.0002	−0.0002	−0.0002
	(−2.16)	(−1.84)	(−0.86)	(−0.79)	(−0.71)	(−0.85)
Leverage	−0.0035	−0.0041*	−0.0046**	−0.0046**	−0.0044**	−0.0045**
	(−1.61)	(−1.86)	(−2.10)	(−2.10)	(−2.00)	(−2.04)
Return on assets	−0.0006	−0.0006	0.0002	0.0004	0.0002	0.0001
	(−0.17)	(−0.16)	(0.07)	(0.12)	(0.07)	(0.04)
Market to book	0.0001**	0.0001**	0.0001***	0.0001***	0.0001***	0.0001***
	(2.34)	(2.46)	(2.77)	(2.81)	(2.80)	(2.65)
Controls?	yes	yes	yes	yes	yes	yes
Industry FEs?	yes	yes	yes	yes	yes	yes
Obs	2185	2185	2185	2185	2185	2185
Adj. R^2	0.0842	0.0881	0.0770	0.0772	0.0799	0.0785
F-statistics	4.136***	4.196***	3.845***	3.856***	3.962***	3.906***
Panel B: dependant variable CAR [0,+1]						
	(1)	(2)	(3)	(4)	(6)	(6)
Hard quota	−0.0060***					
	(−4.31)					
Soft quota		0.0077***				
		(4.85)				
Recommendations		0.00308*				
		(1.67)				
Unregulated		0.0179***				
		(3.47)				
%Female bd			−0.0113**			
			(−2.37)			
%Gap female				0.0125*		
				(1.68)		
#Add female					0.0017**	
					(2.46)	
Dummy add female						0.0035***
						(2.66)
Controls?	yes	yes	yes	yes	yes	yes
Industry FEs?	yes	yes	yes	yes	yes	yes
Obs	2185	2185	2185	2185	2185	2185
Adj. R^2	0.0728	0.0759	0.0672	0.0659	0.0674	0.0678
F-statistics	3.681***	3.717***	3.457***	3.409***	3.465***	3.482***
Panel C: dependant variable CAR [−1,+1]						
	(1)	(2)	(3)	(4)	(6)	(6)
Hard quota	−0.0088***					
	(−5.20)					
Soft quota		0.0104***				
		(5.38)				
Recommendations		0.00579**				
		(2.56)				
Unregulated		0.0194***				

(*continued on next page*)

Table 2 (*continued*)

Panel C: dependant variable CAR [−1,+1]						
	(1)	(2)	(3)	(4)	(6)	(6)
		(3.11)				
%Female bd			−0.0174***			
			(−3.00)			
%Gap female				0.0207**		
				(2.31)		
#Add female					0.0029***	
					(3.45)	
Dummy add female						0.0060***
						(3.73)
Controls?	yes	yes	yes	yes	yes	yes
Industry FEs?	yes	yes	yes	yes	yes	yes
Obs	2185	2185	2185	2185	2185	2185
Adj. R^2	0.0737	0.0759	0.0658	0.0642	0.0671	0.0680
F-statistics	3.715***	3.720***	3.405***	3.342***	3.455***	3.489***

This table presents the OLS results predicting market reaction to the 7 June 2022 announcement of the EU's regulation on board gender diversity. All variables are defined in Table A-I of the online appendix. All continuous variables are winsorized at the 1st and 99th percentiles. T statistics are presented in parentheses. *, **, *** represent statistical significance at the 10%, 5% and 1% level, respectively.

gender diversity (hard quota, soft quota, voluntary recommendations and no regulation at all). The results for both ARs and CARs confirm that the valuation effect was positive for firms irrespective of their exposure to different regulations on gender quotas. For instance, AR(0) was 0.15%, 0.65%, 0.50% and 0.55%, respectively for firms in countries with hard quota rules, soft quotas, voluntary recommendations and no regulations on board gender diversity. Our univariate tests of the differences in AR and CAR between firms from countries with hard quota regulations and other types of regulation show that firms subjected to hard quota regulations consistently experienced smaller market reactions than firms in countries with soft quota rules, voluntary recommendations or no rules at all. These results indicate that the valuation effects of the new law were stronger in countries where there is more room for improvement in board gender diversity (i.e., where there was regulation in place that is weaker than a hard quota).

Panel C displays the comparison of valuation effects separately for three groups that had different gaps between current board diversity and the 33% gender quota:*%Gap 0,%Gap 0 to 15%* and*%Gap>15 to 33%*. The market reactions on the announcement day AR (0) for these three groups were 0.26%, 0.57% and 0.68%, respectively for firms with no gap, firms with a small gap and firms with a large gap of female directors. The differences of means tests all show positive and statistically significant differences between firms that did not need to undertake any correction of their board composition *(%Gap 0)* and firms that had to increase female representation modestly (*%Gap 0 to 15%*) or undertake substantial corrections (*%Gap>15 to 33%*). The differences were greater for the last comparison group (*%Gap 0* compared to*%Gap>15 to 33%*), suggesting that the market perceived stronger beneficial effects of the new EU regulation for firms that had lower existing levels of board gender diversity.

Panel D presents the comparison of valuation effects separately for four categories of firms based on the number of additional female directors needed to reach the 33% goal (firms with no gap against firms that have to add one, two or at least three more female directors). The AR(0) for *#Add 0, #Add 1, #Add 2* and *#Add 3+* were 0.26%, 0.53%, 0.67% and 1.04%, respectively. The differences in AR(0) between firms that had already reached the 33% goal and the other groups were all positive and statistically significant. In addition, these differences increased with the size of the gender gap. These results provide further evidence that the market expected more benefits from the new EU regulation for those firms that had to appoint more female directors to meet the 33% gender quota.

3.2. Multivariate analysis

Table 2 presents the regression results for Eq. (1) examining the effect of *REGULATION* and *FEMALE GAP* on the abnormal market return surrounding the announcement of the new EU regulation related to board gender quotas. Panel A shows the results using AR(0) as the dependant variable, while Panels B and C present the results for CAR[0, +1] and CAR[−1, +1], respectively. In columns (1) and (2) we report the effect of national regulation of board gender diversity and in columns (3) to (6) we present the effect of firms' current board gender diversity gap with respect to the EU's 33% goal. We found significantly negative coefficients for the binary variable *Hard quota* in all three panels. When we compared the three remaining categories of regulation, *Soft quota, Recommendations* and *Unregulated,* in the second column with the group of firms subjected to hard quota regulations, we found positive coefficients for all our proxies of board gender regulation. These results reinforce our univariate findings in Table 1 that firms in countries with pre-existing hard quota regulations experienced the lowest valuation effects of the new EU regulation compared to firms in countries with any other type of gender diversity regulation, such as soft quotas, voluntary recommendations and no regulation at all.

Regarding the proportion of female directors and proxies for the gender diversity gap in reference to the 33% gender quota, we note stronger market reactions for firms that fell substantially short of this goal. We found significantly negative coefficients for the percentage of board female directors (*%Female bd)* in column (3) across all three panels. Firms with a low percentage of female directors enjoyed greater benefits from the implementation of the 33% gender quota. We corroborate this evidence when we measure the gender gap with the additional proportion (*%Gap female*) or additional number (*#Add female*) of female directors needed to reach the 33% gender quota. We found positive, statistically significant coefficients for both variables. The results in column (4) of Panels A, B and C

indicate that a firm needing to add 10% more female directors to reach the 33% target would experience an average 0.16%, 0.12% and 0.21% of AR(0), CAR[0,+1] and CAR[−1,+1], respectively. These positive effects are in line with the positive CAR associated with elections of new directors resulting from the introduction of the gender quota in the Italian market (Ferrari et al., 2022). Although those authors did not find a positive market reaction to the passing of the gender quota regulation, they found a positive relationship between the female directors' gap and the market reactions to directors' elections resulting from the introduction of the gender quota. Similarly, the results in column (5) indicate that firms experienced an extra 0.2%, 0.17% and 0.3% of AR(0), CAR[0,+1] and CAR[−1, +1], respectively for each additional female director needed to reach the 33% target. The final column in Panels A, B and C indicates that firms needing to add female directors (*Dummy add female*) to comply with the new EU rule experienced an additional 0.33%, 0.35% and 0.6% of AR(0), CAR[0,+1] and CAR[−1,+1], respectively compared to firms that had already met the 33% gender quota. These results are opposite to the 1% and 0.5% negative market reactions reported by Greene et al. (2020) for Californian firms holding female director proportions bellow the SB 826 quota threshold and for each additional female director necessary to meet the 2021 quota target, respectively. These differences can be understood as the product of a higher supply of qualified female director candidates in the European markets as suggested by Eckbo et al. (2022).[6] As a whole, our multivariate analysis confirms our univariate results in Table 1 indicating that firms with a greater board gender gap experienced higher positive valuation effects from the new EU rules.

3.3. Robustness tests

In this section we present results from Propensity Score Matching (PSM) followed by OLS robust regressions on matched samples to alleviate endogeneity issues concerning confounding factors that might systematically affect board composition and gender balance. First, we compare the CAR mean values for samples of firms separated by the variable *Dummy add female*. Firms that have to add at least one female director to reach the 33% goal will be affected by the EU quota and form the treatment group, while the firms that have already reached the 33% threshold level form the comparison group. Panel A of Table 3 displays the covariate balance across groups before and after matching and panel B shows the difference in CAR means between comparison groups defined by the variable *Dummy add female* for the whole sample and the matched samples.

We used kernel and nearest neighbour matching strategies[7] to form the comparison groups. Our results in panel A show that the balancing of the matching strategies are correct, generating non-statistically significant differences for the covariates that could act as confounding factors. Our PSM results in Panel B show that the values of AR(0), CAR[0, +1] and CAR[−1, +1] are higher for the firms with less than 33% female directors on the board (treatment group) compared to firms that already complied with the 33% female directors quota (control group). For instance, on the event day, the differences in abnormal return between treatment and control firms were 0.36%, 0.35% and 0.36% for the whole sample and the matched samples, respectively. These results indicate that the higher AR and CAR experienced by firms affected by the new EU quota regulation are not driven by the confounding effects of the covariates.

We used the matched samples from the nearest-neighbour strategy to analyse the effect of the female director gap on gender-quota-related abnormal returns. Results are shown in Table 4. The sign and statistical significance of the coefficients on the variable *Dummy add female* resemble those in Table 2, providing further support and robustness to our results.

3.4. Additional analysis

Previous analyses were performed considering the 33% threshold of female directors in relation to total board size. In Table 5 we show regressions examining the relationship between the CAR surrounding the announcement of EU quota regulation and boards' gender gap with respect to the 40% quota of female non-executive directors' also prescribed by the current EU regulation.

The signs and statistical significance of the coefficients for the proxies of gender gap are similar to those reported in Table 2. These results provide further support to the notion that the market positively views the EU gender quota regulation, especially in those firms that present a more pronounced gender imbalance.

4. Summary and conclusion

The study examines the firm valuation effects of the new EU regulation related to board gender diversity. We found positive market reactions to this announcement. The positive reactions were stronger for firms in countries with softer or no gender diversity regulations, and reactions were positively associated with the size of the gap to be filled to reach the 33% goal of female directors. Our paper contributes to the current debate on gender diversity quotas by showing that the market perceives the corrective capacity of the EU regulation on board gender diversity in countries and companies that have fallen short of achieving board gender equality.

Our results are of interest for regulators and policy makers. Previous evidence on the effectiveness of corporate gender diversity

[6] In an un-tabulated analysis that uses the board nationality mix as proxy for the firms' exposure to the scarcity of female board candidates in the national market, we found a consistent positive relationship between the internationalization of the board and the AR resulting from the EU gender quota regulation. This result supports the notion that with sufficient supply of candidates, the negative effects of gender quotas reported by Green et al., (2020) are avoided.

[7] We used nearest neighbour with replacement and without replacement. Results are similar with both strategies. Here we show the results without replacement as we later use the resulting matched samples for the regressions in Table 4.

Table 3
Results for treatment effect analysis using propensity score matching: effect of board gender diversity.

Panel A: Covariate balance across treatment and comparison groups before and after matching.

	Original Sample				Kernel Matched Sample				Nearest neighbour Matched Sample			
Covariates	Treated	Controls	Difference	t stat	Treated	Controls	Difference	t stat	Treated	Controls	Difference	t stat
Board size	0.746	0.842	−0.096***	−13.37	0.746	0.745	0.001	0.18	0.802	0.803	−0.001	−0.12
Board independence	2.141	2.248	−0.107***	−5.85	2.141	2.144	−0.003	−0.16	2.205	2.200	0.005	0.22
Size	6.982	8.041	−1.059***	−10.21	6.980	6.903	0.077	0.71	7.506	7.407	0.099	0.82
Leverage	0.571	0.609	−0.038***	−4.01	0.570	0.582	−0.012	−1.3	0.593	0.584	0.009	0.73
Return on assets	0.019	0.034	−0.015***	−2.74	0.018	0.017	0.001	0.08	0.027	0.028	−0.001	−0.19
Market to book	6.064	4.669	1.395***	3.14	6.099	5.832	0.267	0.53	4.814	5.393	−0.579	−1.16

Panel B: Average treatment effect on the treated

	Original Sample				Kernel Matched Sample				Nearest neighbour Matched Sample			
Variable	Treated	Controls	Difference	t stat	Treated	Controls	Difference	t stat	Treated	Controls	Difference	t stat
AR0	0.62%	0.26%	0.36%***	3.99	0.63%	0.30%	0.33%***	3.09	0.60%	0.24%	0.36%***	3.31
CAR [0 + 1]	0.76%	0.36%	0.40%***	3.12	0.76%	0.38%	0.38%**	2.52	0.69%	0.35%	0.34%**	2.3
CAR [-1 + 1]	0.89%	0.33%	0.57%***	3.7	0.90%	0.30%	0.59%***	3.28	0.96%	0.31%	0.65%***	3.59

Average differences of Abnormal returns (AR) and cumulative abnormal returns (CAR), between firms with a proportion of female directors under /above 33% on matched samples from Propensity Score Matching analysis (PSM). Panel A presents covariate balance and Panel B presents average differences of the AR0 and CAR in the windows [0,+1] and [−1,+1] for the original sample and matched samples obtained from PSM analysis. Levels of significance are indicated by **, and *** for 5%, and 1%, respectively.

Table 4
Regression analysis based on matched samples.

	Dep. Variable: AR(0)	Dep. Variable: CAR [0 + 1]	Dep. Variable: CAR [−1 + 1]
Dummy add female	0.0038***	0.0043***	0.0071***
	(3.54)	(2.84)	(3.89)
Controls?	yes	yes	yes
Industry FEs?	yes	yes	yes
Obs.	1510	1510	1510
Adj. R^2	0.0882	0.0837	0.0725
F-statistics	3.316***	3.189***	2.873***

.This table presents the OLS results predicting market reaction to the 7 June 2022 announcement of the EU's regulation on board gender diversity. Regressions are estimated on matched samples from nearest neighbour PSM presented in Table 3 using OLS. All variables are defined in Table A-I of the online appendix. All continuous variables are winsorized at the 1st and 99th percentiles. T statistics in parentheses. *, **, *** represent statistical significance at the 10%, 5% and 1% level, respectively.

Table 5
Effect of gender gap with respect to the 40% threshold of non-executive female directors.

	Dep. Variable: AR(0)			Dep. Variable: CAR [0 + 1]			Dep. Variable: CAR [-1 + 1]		
%Gap female 40	0.0109***			0.0109**			0.0185***		
	(3.12)			(2.20)			(3.10)		
#Add female 40		0.0016***			0.0015**			0.0026***	
		(3.40)			(2.34)			(3.41)	
Dummy add female 40			0.0032***			0.0033**			0.0051***
			(3.38)			(2.54)			(3.19)
Controls?	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry FEs?	yes	yes	yes	yes	yes	yes	yes	yes	yes
Obs	2178	2178	2178	2178	2178	2178	2178	2178	2178
Adj. R^2	0.0772	0.0782	0.0782	0.0668	0.0683	0.0687	0.0661	0.0681	0.0675
F-statistics	3.85***	3.88***	3.88***	3.44***	3.49***	3.50***	3.41***	3.48***	3.46***

This table presents the OLS results predicting market reaction to the 7 June 2022 announcement of the EU's regulation on board gender diversity. All variables are defined in Table A-I of the online appendix. All continuous variables are winsorized at the 1st and 99th percentiles. T statistics are presented in parentheses. *, **, *** represent statistical significance at the 10%, 5% and 1% level, respectively.

policies have revealed the weak effect of voluntary measures (De Cabo et al., 2019) and shown that the most intense effect appears when quota regulations are associated with some form of binding legal instrument (Piscopo and Clark-Muntean, 2018). After more than 18 years of relatively ineffective voluntary affirmative actions in EU countries, the positive market reactions to the new EU quota regulation suggests a preference for the effectiveness of compulsory quotas to speed the process of corporate boards' feminization. Even if avoiding the negative aspects of governmental interventionism might be preferable, the market has a positive view of the imposition of board gender balance for its positive economic and/or social justice implications. This result may shed some light on the choice between external institutional intervention and internal self-regulation which can be extended to other areas where gender equality policies are being discussed, such as politics, the media, and science.

We acknowledge that using a sample made up of EU firms might limit the generalization of our results to Anglo-American economies characterised by an emphasis on individual choice and market deregulation (Tienari et al., 2009). It is also worth mentioning that our results show the strictly short term market response to the new quota announcement, which opens future lines of research concerning the long term effects of the compulsory changes in EU-firm board structures. In the first place, the 33% proportion of female directors can be achieved in different ways (i.e. by replacing male directors, by adding new female directors or a combination of the two) possibly resulting in different long term effects from achieving similar levels of female director representation. Secondly, the general shift of women's presence on boards over the 33% critical mass may produce systematic changes in the relationship between female directors' influence and firms' policies and performance. In this new situation, the re-estimation of these relationships without a fixed preconception of its form (i.e., linear or curvilinear) as in Bruna et al. (2022) could provide new insights about the effects of board gender diversity in general and the concept of critical mass in particular.

Compliance with ethical standards

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CRediT authorship contribution statement

Carlos Fernández-Méndez: Conceptualization, Methodology, Formal analysis, Data curation, Investigation, Writing – original draft, Writing – review & editing. **Shams Pathan:** Conceptualization, Writing – review & editing, Resources.

Declaration of Competing Interest

The authors have no relevant financial or non-financial interests to disclose.

Data availability

Data will be made available on request.
The authors do not have permission to share data

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Supplementary materials

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