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Article

Board Gender Diversity and Voluntary Carbon Emission Disclosure

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Abstract: In this study, we investigate the effect of board gender diversity on the decision to disclose carbon emissions voluntarily. Using an international sample consisting of 22,841 firm-year observations from 38 countries for the period 2010–2019, we determine the existence of a positive relationship between the percentage of female directors on the board and carbon disclosure. This evidence supports agency and resource dependency theories, as a gender diverse board indicates strong governance and better communication among stakeholders. Additionally, we examine the moderating effect of gender quotas across sample countries, where either soft or hard quotas have been implemented. We show that the number of firms disclosing their carbon emissions is, on average, higher in countries with either hard or soft quotas than in countries with no quota. Moreover, the positive effect of board gender diversity on voluntary carbon emission disclosure is similar across firms in countries with quotas and without quotas. The reported results demonstrate that there seems to be no need for country-level strict regulations regarding the firm-level percentage of female representation on the board to be effective, as gender board diversity in countries with no quotas has a similar effect in explaining voluntary carbon disclosure as in countries with quotas and those changing to quota regulation.

Keywords: board gender diversity; gender quota; carbon emissions; voluntary disclosure



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1. Introduction

Over the past couple of decades, environmental concerns with global warming have tremendously increased. The efforts of corporations that operate in especially heavily polluting industries to reduce their greenhouse gas (GHG) emissions have also increased in order to mitigate these concerns. In response to the global warming issue, it is important to know the level of carbon emissions at the corporation level. As the disclosure of carbon emissions is not mandatory—except in a few countries such as the U.K.—stakeholders may only be informed regarding the contributions of corporations to climate risks and opportunities through voluntarily disclosed carbon reduction initiatives and achievements [1]. A growing number of firms worldwide have determined their global warming strategies as part of their core policies, recognizing that going green can save money through improved energy efficiency and waste management [2]. Several initiatives have also started gathering information regarding carbon emissions; for example, the carbon disclosure project (CDP), which collects information regarding carbon emissions annually through questionnaires (<https://www.cdp.net/>, accessed on 12 January 2022). Data related to green finance have recently emerged as a standard aspect of investment decisions [3].

Corporate leadership composition affects corporate strategies with regard to socially responsible practices [4,5]. Various studies, as well as image [6,7], have shown that gender diversity on the board of directors can improve financial and environmental performance. Closely related to the aim of this study, Liao et al. [6] examined the effect of gender diversity and board independency on GHG emission disclosure, measured in terms of whether a firm

participated in the CDP project in U.K. firms only, and observed a significant and positive effect. We extend this argument to a broad set of firms worldwide, using the direct proxy of reporting specifically the amount of CO₂ emitted. Valls Martínez et al. [8] examined the relationship between gender diversity and CO₂ emissions for firms in both emerging and developed markets and showed that firms with a higher ratio of female board members had lower emissions. We are particularly interested in understanding whether board gender diversity, measured by the percentage of female directors in the board of directors, is linked with voluntary carbon emission disclosures. Nationwide quotas have been imposed by some governments with the intent to stimulate gender diversity. Therefore, the use of a large international sample allowed us to test whether imposing gender quotas has an effect on the relationship between board gender diversity and voluntary carbon emission disclosures, which is important in extracting the stand-alone effect of female representation without being forced by any regulations.

We gathered data and formed a sample of 22,841 firm-year observations of unique firms from 38 countries over the period from 2010 to 2019. We found that increasing the representation of female board members increases voluntary carbon disclosure. We show that nationwide quota regulations do not have a significant effect on the positive relationship between female representation and carbon disclosure. More specifically, the increase in the number of firms disclosing carbon emissions with gender board diversity is similar across countries that already have a gender quota in place, after imposing a gender quota, or without a gender quota. This evidence implies that the effectiveness of female representation on the board is not dependent on country-level strict regulations.

This study contributes to the existing literature in multiple ways. First, there are very few studies available regarding the effect of board gender diversity on carbon emission disclosure. Prior research has mainly focused on the relationship between board gender diversity and financial performance, social responsibility, or sustainability-related outcomes. It is important to study the effect of female representation in boards on voluntary carbon disclosure as we live in a world characterized by economic growth stimulated by high-energy demand, which, in turn, causes global warming and natural resource exhaustion due to high-level CO₂ emissions. Second, we contribute to the limited research considering the effect of board gender diversity on energy-related outcomes using a large international sample. The panel data consisting of various firms in different countries with various legal systems and institutional environmental stringency factors enhances the external validity of our main findings.

The remainder of this paper is structured as follows: Section 2 provides a literature review, which supports theoretical discussions on the relationships between board composition, gender quotas, and carbon emission disclosure, in addition to developing corresponding hypotheses. Section 3 describes the data and methodology employed in the empirical analysis. Section 4 presents the main results and discussions. Finally, Section 5 concludes the study with recommendations for future research.

2. Literature Review and Hypothesis Development

2.1. Theoretical Framework

The board of directors and its influence on the success of an organization are important for establishing a strong corporate governance structure. Gender composition on boards is an important dimension of corporate governance, as women and men are traditionally, culturally, and socially different. Gender diverse boards benefit the organization in terms of both market- and accounting-based financial performance [9–13], tend to be more innovative [14–16], and are less likely to conform to traditional practices [14,15]. Gender board diversity has been associated with greater understanding and sensitivity to competing perspectives [16] and greater consideration for fairness and the needs of others when weighing alternative perspectives. Female directors overall attend board meetings more when compared to their male colleagues and having women on boards can also improve the overall attendance of other directors [10].

Female directors lead social- and governance-related outcomes, next to financial ones [10,17,18]. A gender diverse board can strengthen corporate governance, in order to ensure that environmental concerns will be addressed sufficiently [19]. There are formal laws and regulations, such as the Paris Agreement and various gender quotas imposed by governments, that many corporations try to achieve to be environmentally responsible. The presence of female directors can strengthen relationships with stakeholders, enhancing interest in environmental and social objectives [7]. On the other hand, businesses should engage in socially responsible behaviors as it is “the right thing to do”, and businesses are or ought to be motivated by intrinsic factors such as ethical values and moral leadership [20]. Having women on the board could also lead the board in such a direction.

The literature has also explained the role of gender diversity using the stakeholder theory point of view and has provided growing evidence that stakeholders are concerned with how firms manage their actions towards environmental issues [21], leading to the engagement of firms in environmental governance initiatives to address these concerns. The board of directors must, therefore, deal with pressure not only from shareholders but also from stakeholders and must consider the interests of different groups [22]. Women adopt more responsibility for stakeholders and try to engage better with consumers, employees, suppliers, activists, regulators, society, and any other group that can be affected by the corporation and its objectives [6]. Moreover, the presence of women on the board can strengthen relationships with stakeholders, thus enhancing interest in environmental and social objectives [9].

There are at least two potential theoretical views explaining the mechanism of a possible relationship between board gender diversity and the voluntary disclosure of carbon emissions. According to agency theory, one of the main functions of the board of directors is to monitor CEOs and other managers, in order to align managerial goals with those of shareholders by reducing agency costs [23,24]. In this respect, the literature has shown that a more diverse group of people will have a wider perspective, hence improving the decision-making quality [25,26]; thus, differences in the gender of board members, as one type of diversity, can be expected to improve decision-making [25,26]. Greater gender diversity can lead to the incorporation of different points of view in styles of communication and experience [6]. Moreover, the integration of different skills and knowledge between male and female directors can improve the board’s effectiveness [9].

Boards with female directors may also make decisions to be more socially responsible, relative to boards with male directors [27]. With existing agency problems, managers may be hesitant to propose environmentally friendly strategies, which will not offer immediate rewards, and may instead prefer to focus on activities that increase their prestige and short-term benefit. A gender diverse board is more likely to resolve these types of conflicts of interest among managers, shareholders, and stakeholders by finding a balance between financial and non-financial objectives.

While agency theory focuses on gender diversity as a mechanism to increase the board effectiveness in decision making, resource dependency theory (RDT) suggests that women in boards help the board to access resources by creating strong societal links. When it comes to environmental performance, gender diverse boards could have the better and clear communication with shareholders and other stakeholders that sustainable development requires for strong economic efforts and yield better long-term results. The performance of management depends on the mixture of human and social capital provided by individual board members [28,29]. From the RDT point of view, the board directors play an important role in gaining access to human and social capital from outside of the firm [29]. Gender diverse boards are better at problem solving and decision making, due to the variety of resources at their disposal [9,30]. With gender diversity, the board’s resource capability, in terms of knowledge, skills, values, experiences, and network, is increased.

2.2. Hypotheses

Female directors are positively associated with greater transparency in firm governance, the prioritization of long-term strategies, and the acknowledgement of non-financial performance outcomes. The literature has shown that gender diverse boards are more likely to pursue environmentally responsible practices and achieve higher environmental ratings than other firms. As addressing environmental concerns is a new challenge, new insights and fresh perspectives at the board level are likely to be important [6]. Female directors tend to express a stronger commitment to environmental sustainability and are more likely to support environmentally responsible practices, even when they require increased personal costs [4]. In line with these arguments, our first hypothesis is as follows:

Hypothesis 1. (H1). *There is a significant positive relationship between board gender diversity and voluntary carbon emission disclosure.*

2.3. Moderating Effect of National Gender Quotas

Even though various studies have recognized the benefits of hiring women onto the board of directors, the representation of women on boards remains low. Since female representation on the board is to be considered one of the significant governance mechanisms in corporations [26] and gender equality is very important in modern societies, a different route seems to be needed to achieve gender equality. It has been recognized, by various regulatory institutions such as the EU Commission, that women are typically under-represented on boards or corporations; therefore, such organizations have put pressure on corporations to enhance the presence of women on boards. Over the last two decades, many nations have enacted guidelines and mandatory laws to increase the ratio of female to male directors. The goal of such legislation is to increase and accelerate the process of female representation in positions regarded as the top leadership.

The first country that fully implemented a gender quota was Norway in 2008. The legislation provided by Norway is a so-called hard gender quota, meaning that companies failing to maintain the required number or percentage of women on the board of directors will face legal sanctions, such as delisting from the stock exchange or forced dissolution [31]. Other regulatory institutions, such as in the Netherlands, have considered enacting a so-called soft gender quota, which is a non-binding legislation [16]. This means that companies failing to reach the required level of board gender composition do not face any legal sanctions; however, they will not be considered for subsidies and government contracts and, in the event of non-compliance, will be given recommendations, warnings, and reports, close to the principle of comply-or-explain legislation [31].

The empirical results on the relationship between imposed gender quotas and firm performance in the literature remain inconclusive. As stated in the prior section, having female directors alongside male directors should lead to many benefits, such as the improvement of the decision-making process and increased firm performance. However, there has been evidence that gender quotas may result in negative outcomes. This might be as gender quotas subtly discriminate against the function of women directors. It could be that some women are hired because of their expertise, while the remaining ones are hired just to comply with the binding quota. Stakeholders and shareholders should not be in the impression that female directors are hired solely because of their gender, as this could lead to the described negative reaction to firm performance or stock prices. Quotas negatively influence the nature of candidate selection, as the group of people to be selected from is reduced [32]. When setting strict requirements for gender, to candidates with the right skills and experience may not be able to apply in the first place.

Quota legislations intend to eventually increase the number of female directors on boards. This increase is accompanied by many benefits, according to various studies, including higher transparency, mitigating poor governance, and positively influencing the returns of a firm. However, as firms are pressured to comply with the legislation, it may be the case that less-experienced directors will be hired to comply with the legislation.

This could negatively affect the quality of decision-making and could ultimately lead to decreased firm performance [10]. Hence, the strategic contribution of a diverse board may be impacted adversely by complying with gender quotas. Based on these arguments in the literature, we have following hypothesis:

Hypothesis 2. (H2). *Hard or soft gender quota regulations moderate the positive relationship between board gender diversity and voluntary carbon emission disclosure.*

3. Data and Methodology

3.1. Sample Description

To examine the effect of board gender diversity on the voluntary disclosure of carbon emissions, we used a worldwide sample over a time span of ten years (from 2010 to 2019). The voluntary disclosure of GHG emissions, indicators for board gender diversity, and firm-level financial variables were collected from the Thomson Reuters Eikon/Datastream and ESG databases. Country-level economic indicators were obtained from the World Bank databases. Additionally, data regarding quota compliance per country were gathered from various sources in the literature [16,32]. Finally, we followed common practice in the finance literature and excluded financial firms and utility firms with standard industrial classification (SIC) codes 6000–6999 and 4900–4999, as these firms usually have different capital structures, goals, and growth rates. The final sample contained unbalanced panel data with 22,841 firm-year observations from 38 countries.

We made a distinction across sample countries, in terms of the presence of binding legislation on gender diversity (i.e., as hard and soft quotas). We used several descriptive variables to test the role of such quotas in explaining the effect of gender diversity on carbon disclosure across nations. The first variable, Quota, was used for countries that adopted either hard quotas or soft quotas. The second, Hard Quota, was used for countries after the year of compliance of a hard quota. Third, Soft Quota was used for countries either having soft quota regulations or recommending it in corporate governance, both of which are voluntary. An overview of the sample countries, along with the mean of the dependent variable and the gender board diversity, is presented in the Appendix A.

3.2. Variables

The dependent variable (Disclosure) was used as a proxy for the voluntary disclosure of carbon emissions. The Thomson Reuters ESG Data contain GHG emissions (in carbon dioxide equivalents), which is in line with the operational boundaries proposed in the Corporate Accounting and Reporting Standard of the Greenhouse Gas Protocol Initiative (GHG Protocol) and collected from various sources; that is, sustainability reports, annual reports, and information on corporate websites [33]. Focusing on a company's organizational boundaries, in terms of the operations that it owns or controls, the GHG Protocol introduces the concept of scopes to delineate between direct and indirect emission sources (i.e., scopes 1, 2, and 3 were introduced by the GHG protocol). To capture the disclosure preference effectively, we consider only scope 1 in our analysis. Scope 1 refers to the direct emissions from fuel combustion and the processing of chemicals from sources owned or controlled by the company [33]. In the ESG data, scope 1 was contained in the category score of emissions reduction, which, in turn, is an item determining the environmental performance of an ESG pillar. Our dependent variable was a dummy variable, which takes the value of one if both scope 1 and the emission score are available and takes a value of zero if scope 1 is not reported even though the emission score is still available.

The variable for board gender diversity is denoted as Female, which is defined as the ratio of the number of female directors to the total number of directors on a board. This measure has been extensively used in the prior literature [4–9,18].

We added several control variables, due to their potential effects on carbon disclosure, based on prior studies [4–8,18,34]. We included several characteristics of the board, such as Board Size and Independence. Large boards and no or low participation of independent

directors may lead to agency problems [35]. Firm characteristics that influence carbon emission disclosure are as follows: R & D Intensity, which is a widely used proxy for innovation, controlling for the potential effect of the possibility of missing R & D expenditures (R & D missing dummy); Tobin's Q and ROA, which are indicators for market- and accounting-based performance measures as they present different pictures and complement one another; Firm Size, which is based on the book value of assets; Leverage, which measures financial distress; Cash Holding, which indicates liquidity; and Capital Expenditures, which implies the potential for on the growth. The values of all financial variables were winsorized at both 1% and 99% levels in order to control for possible outliers and/or mistakes in the data sets.

We also included some country-level variables into our analysis. GDP was used to control for the economic development of countries. The country's Legal Origin provides an indicator of country level governance, as common law and enforcements provide stronger governance, relative to civil law. Finally, the explanatory variable Environmental Stringency was added, which is a proxy for the stringency of a country in complying with environment regulations. Detailed definitions of all variables are given in Table 1.

Table 1. Definition of variables.

Variables	Definitions	Source
Disclosure	A dummy variable that takes the value 1 if scope 1 as well as the emission score are available and 0 if the emission score is available but no scope 1.	ESG Data
Female	Ratio of the number of female directors to the total number of directors on the board [10].	Datastream
Quota	A dummy variable that takes the value 1 if the country adopted a quota regulation to regulate for board gender, either hard or soft, and 0 if no quota regulation was adopted to regulate for board gender.	Literature [16]
Hard Quota	A dummy variable that takes the value 1 if the country adopted a hard quota regulation and 0 if no hard quota regulation.	Literature [16]
Soft Quota	A dummy variable that takes the value 1 if the country adopted a soft quota regulation and 0 if no soft quota regulation.	Literature [16]
Board Size	Natural logarithm of the total number of directors in a given firm-year.	Datastream
Board Independency	Ratio of number of independent directors divided by the total number of directors in a given firm-year.	Datastream
R & D Intensity	Research and development (R & D) expenses divided by total assets.	Datastream
R & D Missing	A dummy variable that takes the value 1 if R & D is missing and 0 for non-missing R & D.	Datastream
Tobin's Q	Ratio of (book value of total assets + market value of common equity—book value of common equity) to the book value of total assets.	Datastream
ROA	Ratio of net income to total assets	Datastream
Firm Size	Natural logarithm of total assets in USD.	Datastream
Cash Holding	Ratio of cash and short-term investments to total assets.	Datastream
Leverage	Ratio of total debt to total assets.	Datastream
Capital Expenditures	Ratio of capital expenditures to total assets.	Datastream
GDP	Natural logarithm of Gross Domestic Product (GDP) per country-year	World Bank
Legal Origin	A dummy variable that takes the value 1 if a country legal origin is civil law and 0 if a country legal origin is common law.	[29]
Environmental Stringency	Country specific time invariant variable, which is a proxy for the stringency of a country to letting firms comply to regulations related to the environment.	World Bank

3.3. Methodology

We performed multi-variate regressions with ordinary least squares (OLS) estimations, in which heteroskedasticity-robust standard errors were clustered at the firm-level to test our hypotheses. We prefer to use the OLS estimation method to a logit estimation, in order to provide easy economic interpretations of the estimated coefficients, rather than probabilistic interpretations. In order to take endogeneity concerns into account, all of the explanatory variables were lagged by one year. To test for the proposed hypotheses in an international environment, regarding how gender diversity in the board of directors

influences voluntarily carbon disclosure (Hypothesis 1) and the moderating effect of quota regulations (Hypothesis 2), the following equation was used:

$$\begin{aligned} Disclosure_{i,t} = & \beta_0 + \beta_1 Female_{i,t-1} + \beta_2 Quota_{c,t} + \beta_3 Female_{i,t-1} * Quota_{c,t} + \beta_4 Board\ Size_{i,t-1} \\ & + \beta_5 Board\ Independency_{i,t-1} + \beta_6 R\&D\ Intensity_{i,t-1} + \beta_7 R\&D\ Missing_{i,t-1} \\ & + \beta_8 Tobin's\ Q_{i,t-1} + \beta_9 ROA_{i,t-1} + \beta_{10} Firm\ Size_{i,t-1} + \beta_{11} Cash\ Holding_{i,t-1} \\ & + \beta_{12} Leverage_{i,t-1} + \beta_{13} Capital\ Expenditures_{i,t-1} + \beta_{14} GDP_{c,t-1} \\ & + \beta_{15} Environmental\ Stringency_c + \beta_{16} Legal\ Origin_c + Year\ FE + Industry\ FE + \varepsilon_{i,t} \end{aligned}$$

where i , c , and t index firm, country, and year, respectively. To capture differences across industries and years, we include industry- and year-fixed effects. These fixed effects control for differences across countries, industries, and years, in order to determine different carbon emissions that may be explained by unobservable variables. To test for the moderating effect of quotas (Hypothesis 2), an interaction variable between the Female and Quota variables was added. Furthermore, to test for the different effects of hard and soft quota regulations, the Quota variable was interchanged with the Hard Quota and Soft Quotas, for which interaction variables are presented accordingly.

3.4. Descriptive Statistics

Table 2 provides sample descriptive statistics—number of observations, mean, median, standard deviation, minimum, and maximum—for all the variables included in the empirical analysis. The sample consisted of 22,841 firm-year observations. Over the sample period, the mean Disclosure was 0.480, indicating that 48% of the sample firms voluntarily disclosed their carbon emissions. The mean of Female was 0.150, indicating that, on average, 15% of the directors on boards were female directors, with a maximum percentage reaching up to 50%. The Quota variable had a mean of 0.611, indicating that 61.1% of the firm-year observations had a quota regulation in place; either was a recommendation, hard, or soft quota. The mean values of the Hard and Soft Quotas indicated that, on average, 3.2% and 60.5% of the firm-year observations had mandatory regulation and national corporate governance recommendations, respectively. The main reason for the high mean of the Soft Quota was due to the high percentage of USA firm-year observations, where a recommendation of good corporate governance is in place. The mean of Hard Quota and Soft quota was the mean value of Quota, as this variable is the actual sum of the former variables.

The mean log board size corresponded to an average number of directors of 9.2, with a minimum of 4 directors and a maximum of 20 directors. Board Independence demonstrated that, during the sample period, 60.4% of the directors were independent board members. The Legal Origin value indicated that 32.3% of the observations in the sample originated from civil law countries.

Table 3 provides the Pearson correlation coefficients, which were used to check for the possibility of multi-collinearity. As expected, Board Size had a high correlation (0.5694) with Firm Size, as the board of a larger firm is likely to be bigger [30]. In addition, a slightly higher correlation coefficient (0.5514) was obtained between Cash Holding and R & D Intensity. Holding more cash increases the possibility of a firm taking on value-adding projects, which usually ought to have more R & D expenses. We also report variance inflation factors (VIF) as another measurement, in order to check potential correlations between variables. Based on the correlation coefficients (other than two usual suspects being exceptions) and VIF values, there were no indications of a possible multicollinearity problem.

Table 2. Descriptive statistics.

	N	Mean	Median	Std. Dev.	Minimum	Maximum
Disclosure	22,841	0.480	0.000	0.500	0.000	1.000
Female	22,841	0.150	0.143	0.124	0.000	0.500
Quota	22,841	0.611	1.000	0.488	0.000	1.000
Hard Quota	22,841	0.032	0.000	0.176	0.000	1.000
Soft Quota	22,841	0.605	1.000	0.489	0.000	1.000
Board Size (log)	22,841	2.220	2.197	0.329	1.386	2.996
Board Independency	22,841	0.604	0.667	0.257	0.000	1.000
R & D intensity	22,841	0.025	0.000	0.064	0.000	0.553
R & D Missing	22,841	0.526	1.000	0.499	0.000	1.000
Firm Size (log)	22,841	14.935	14.950	1.647	10.643	18.769
Cash Holding	22,841	0.160	0.103	0.172	0.002	0.910
Leverage	22,841	0.248	0.232	0.191	0.000	0.919
Tobin's Q	22,841	2.051	1.519	1.626	0.537	10.969
ROA	22,841	0.064	0.073	0.139	−0.677	0.403
Capital Exp.	22,841	0.913	0.050	3.353	0.000	28.219
GDP (log)	22,841	8.267	8.152	1.414	5.441	9.973
Legal Origin	22,841	0.323	0.000	0.468	0.000	1.000
Stringency	22,841	5.295	5.260	0.591	3.740	6.320

This table displays the following metrics: Number of Observations (N), Mean, Median, Standard Deviation (Std. Dev.), Minimum, and Maximum. All variables were winsorized at both the 1% and 99% levels and lagged by one year. The sample period is 2010–2019. Detailed definitions of the variables are presented in Table 1.

Table 3. Pearson correlation matrix.

	VIF	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Disclosure		1								
(2) Female	1.44	0.2424	1							
(3) Quota	2.11	−0.0839	0.2441	1						
(4) Hard Quota	1.26	0.112	0.2489	0.1206	1					
(5) Soft Quota	1.11	0.0457	0.0055	0.1426	−0.0358	1				
(6) Board Size	1.69	0.3319	0.1037	−0.2153	0.072	0.042	1			
(7) Board Indp.	1.84	−0.02	0.2737	0.4848	−0.0736	−0.0336	−0.1589	1		
(8) R & D Intensity	2.27	−0.1247	−0.0194	0.1536	−0.016	−0.0315	−0.1035	0.1223	1	
(9) R & D Missing	2.05	−0.0792	0.0159	−0.0266	−0.0346	−0.0401	−0.1277	0.0213	−0.4125	1
(10) Firm Size	1.25	0.4663	0.1073	−0.1552	0.0634	0.0592	0.5694	−0.0443	−0.2392	−0.1239
(11) Cash Holding	1.66	−0.2079	−0.1017	0.0668	−0.0349	−0.015	−0.1692	0.0136	0.5514	−0.2377
(12) Leverage	1.66	0.0508	0.0479	0.049	0.005	0.0144	0.1453	0.0626	−0.1338	0.1183
(13) Tobin's Q	1.31	−0.1415	0.0367	0.1456	−0.0394	0.0547	−0.1451	0.1044	0.3196	−0.1225
(14) ROA	1.89	0.1247	0.0921	−0.0349	0.0029	0.0541	0.1259	−0.0268	−0.4204	0.0577
(15) Capital Exp	2.23	0.0148	−0.1606	−0.2785	−0.0482	0.0541	0.0257	−0.285	−0.0568	−0.0033
(16) GDP	1.76	−0.2625	−0.0732	0.4478	−0.1389	−0.1365	0.0426	0.3026	0.223	−0.203
(17) Legal Origin	1.28	0.1696	−0.0429	−0.5131	0.2904	0.0249	0.2328	−0.5517	−0.0761	−0.1804
(18) Stringency	2.17	0.1303	0.11	0.1963	0.1582	−0.1765	−0.0825	−0.0001	0.0605	−0.1119
		(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
(10) Firm Size		1								
(11) Cash Holding		−0.3244	1							
(12) Leverage		0.2461	−0.3011	1						
(13) Tobin's Q		−0.3361	0.404	−0.143	1					
(14) ROA		0.1932	−0.2356	−0.0455	0.1593	1				
(15) Capital Exp		0.0787	−0.0407	−0.0134	−0.0009	0.0627	1			
(16) GDP		0.0742	0.164	0.0803	0.0983	−0.0487	−0.1456	1		
(17) Legal Origin		0.2756	−0.0274	−0.0181	−0.1313	0.0551	0.2962	−0.3094	1	
(18) Stringency		−0.0353	−0.0072	−0.0788	−0.0508	−0.0617	−0.1876	−0.0494	0.0824	1

This table provides the correlation coefficients for all the variables involved during the analysis. Detailed definitions of the variables are presented in Table 1.

4. Results

4.1. The Role of Board Gender Diversity

Table 4 reports the results of the OLS estimations with six models that differ in terms of the composition of explanatory variables and fixed effects. Model 1 examines the stand-alone effect of female directors in the board on the dependent variable by including country-, industry-, and year-fixed effects (we performed separate F-tests to determine whether there existed significant year, country, and industry effects, in order to justify their inclusion into our models. The F-statistics were 2462, 407, and 26.8 when we included dummies for year, country, and industry, respectively. These statistics indicated that there were unobserved heterogeneities that we need to control across those factors). The statistically significant estimated coefficient of Female indicated that, when the percentage of female directors increased, the number of firms with firm-level voluntary carbon emission disclosure also increased. Model 2 includes the firm-level control variables and Model 3 adds the country-level variable GDP into the model. Both models showed consistent results, with the variable Female having positive and significant coefficients at the 1% level. This outcome supports the first hypothesis, indicating that higher female representation on boards increases the voluntary disclosure of carbon emissions. The coefficient of Female can be interpreted, in terms of its economic significance, through Model 2 as follows: with a one standard deviation increase in the percentage of female directors, the number of firms that voluntarily disclose their carbon emissions increases by 0.1% of its mean $((0.383 \times 0.124)/0.480)$, ceteris paribus. This corresponds to an increase in number of firms by 24.

Table 4. Carbon disclosure and female board members.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Female	0.916 *** [0.054]	0.383 *** [0.049]	0.379 *** [0.049]	0.566 *** [0.051]	0.630 *** [0.052]	0.574 *** [0.051]
Board Size (log)		0.113 *** [0.023]	0.112 *** [0.023]	0.155 *** [0.024]	0.133 *** [0.024]	0.157 *** [0.024]
Board Indp.		0.168 *** [0.033]	0.165 *** [0.033]	0.109 *** [0.029]	0.045 [0.032]	0.05 [0.032]
R & D Intensity		0.281 *** [0.095]	0.286 *** [0.095]	0.362 *** [0.104]	0.371 *** [0.104]	0.343 *** [0.104]
R & D Missing		−0.038 ** [0.016]	−0.039 ** [0.016]	−0.028 * [0.017]	−0.051 *** [0.017]	−0.037 ** [0.017]
Capital Exp.		0.009 ** [0.004]	0.008 * [0.004]	−0.001 [0.002]	−0.003 [0.002]	0 [0.002]
Tobin's Q		0.012 *** [0.004]	0.012 *** [0.004]	0.013 *** [0.004]	0.010 *** [0.004]	0.012 *** [0.004]
ROA		0.059 * [0.033]	0.056 * [0.033]	0.080 ** [0.035]	0.05 [0.036]	0.076 ** [0.035]
Leverage		−0.092 *** [0.031]	−0.090 *** [0.031]	−0.093 *** [0.035]	−0.113 *** [0.035]	−0.091 *** [0.035]
Cash Holding		−0.033 [0.035]	−0.034 [0.035]	−0.129 *** [0.039]	−0.140 *** [0.040]	−0.111 *** [0.040]
Firm Size		0.141 *** [0.005]	0.141 *** [0.005]	0.133 *** [0.005]	0.139 *** [0.005]	0.139 *** [0.005]
GDP			−0.134 *** [0.029]	−0.105 *** [0.006]	−0.113 *** [0.006]	−0.111 *** [0.006]
Stringency				0.095 *** [0.012]		0.100 *** [0.012]
Legal Origin					−0.058 *** [0.021]	−0.076 *** [0.020]
Constant	0.203	−1.961 ***	−1.135 ***	−1.679 ***	−1.096 ***	−1.689 ***

Table 4. Cont.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Year FE	[0.152]	[0.173]	[0.246]	[0.167]	[0.153]	[0.171]
Industry FE	yes	yes	yes	yes	yes	yes
Country FE	yes	yes	yes	no	no	no
Adjusted R squared	0.325	0.49	0.491	0.394	0.385	0.397
Observations	22,841	22,841	22,841	22,841	22,841	22,841

This table presents estimates of the effects of board gender diversity on the voluntary disclosure of carbon emissions. The dependent variable, Disclosure, is a dummy variable, which equals one if a firm voluntarily discloses its carbon emissions directly. All variables were winsorized at both the 1% and 99% levels. All independent variables are lagged by one year. Detailed definitions of the variables are presented in Table 1. The robust heteroscedasticity standard errors clustered at the firm level are shown in brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Regarding the control variables, board size had a significantly positive effect (at the 1% level) on the voluntary disclosure of carbon emissions, which is in line with the prior literature [6,33]. This positive and significant coefficient implies that larger boards can more effectively mitigate the disadvantages of carbon emission opacity [36]. Moreover, the regression results of the first three models indicated that board independence, R & D intensity, capital expenditures, Tobin's Q, ROA, and firm size all have significantly positive effects on carbon disclosure. These findings are all in line with prior studies [9,33,34]. Leverage had a significantly negative effect in all models at the 1% level, meaning that the more a firm is leveraged, the less likely it is that they will disclose their carbon emissions voluntarily. Models 4–6 exclude country-fixed effects, as the time-invariant country-level variables Environmental Stringency and Legal Origin are added into the models. The negative and significant estimated coefficients of Legal Origin in Models 5 and 6 indicate that the number of firms with voluntary carbon disclosure in civil law countries is, on average, less than that in common law countries, as we would expect to observe. Furthermore, environmental regulations increase the number of firms disclosing carbon emissions. The coefficient of the main independent variable, Female, remained significantly positive at the 1% level. The coefficient for Female obtained in Model 6 indicated that a one standard deviation increase in the percentage of female directors would increase the voluntarily disclosure of carbon emissions by 0.15% of its mean $((0.574 \times 0.124)/0.480)$, ceteris paribus. This corresponds to an increase in the number of firms by 35.

4.2. Moderating Role National Quotas

We introduced the country-level quota variable to test the moderating impact in explaining the relationship between board gender diversity and carbon emission disclosure. However, country-level quotas may be dominant over gender diversity at the firm level, as the foundation for the data refer to the same idea: a country with a hard quota will refer to firms with a higher female director ratio. Country-level quotas are introduced to obtain a certain level of gender diversity in boards; in particular, when hard quotas are not complied with, hard sanctions will be applied. Therefore, it is highly likely that country-level quotas will have the same effect as board gender diversity on carbon disclosure. However, in countries where soft quotas or recommendations of good corporate governance are introduced, the effect of gender diversity on disclosure could be different, as no sanctions are applied when not complied. To measure the stand-alone effects of the country-level quota, hard quota, and soft quota variables, we first run our regressions without firm-level gender diversity.

The results of these regressions are presented in Table 5. All models include firm- and country-level explanatory variables, as well as year- and industry-fixed effects. Model 1 examines the effect of quota regulations on the voluntary disclosure of carbon emissions. The results indicate that there is a clear significant effect of the variable Quota on the

voluntary disclosure of carbon emissions when combining the effects of soft and hard quotas. It may be the case that hard and soft quotas do have separately significant effects on voluntary disclosure of carbon emissions. To identify which of these effects drives the effect of the combined variable, Models 2 and 3 test for the effects of hard and soft quotas separately. The results indicated that both present positive effects, but the hard quota had a significant effect at the 5% level. This shows that hard quota—but not soft quota—regulation or recommendation for gender diversity in a country increases the number of firms that voluntarily disclose their carbon emissions. Furthermore, the regression results show that board size, R & D intensity, Tobin's Q, ROA, firm size, and environmental stringency have continuous significantly positive effects on the voluntarily disclosure of carbon emissions, consistent with the results shown in Table 4.

Table 5. Carbon disclosure and national gender quotas.

	Model 1	Model 2	Model 3	Model 4
Quota	0.123 *** [0.017]			
Hard Quota		0.074 ** [0.029]		0.073 ** [0.029]
Soft Quota			−0.03 [0.038]	−0.027 [0.038]
Board Size (log)	0.201 *** [0.023]	0.178 *** [0.024]	0.180 *** [0.024]	0.178 *** [0.024]
Board Independence	0.098 *** [0.032]	0.135 *** [0.032]	0.140 *** [0.032]	0.134 *** [0.032]
R & D Intensity	0.357 *** [0.106]	0.367 *** [0.107]	0.367 *** [0.107]	0.364 *** [0.107]
R & D Missing	−0.035 ** [0.017]	−0.035 ** [0.017]	−0.035 ** [0.017]	−0.036 ** [0.017]
Capital Expenditures	−0.001 [0.002]	−0.001 [0.002]	−0.002 [0.002]	−0.001 [0.002]
Tobin's Q	0.013 *** [0.004]	0.015 *** [0.004]	0.015 *** [0.004]	0.015 *** [0.004]
ROA	0.084 ** [0.036]	0.096 *** [0.036]	0.097 *** [0.036]	0.096 *** [0.036]
Leverage	−0.107 *** [0.035]	−0.098 *** [0.035]	−0.098 *** [0.035]	−0.098 *** [0.035]
Cash Holding	−0.131 *** [0.040]	−0.139 *** [0.040]	−0.141 *** [0.041]	−0.139 *** [0.040]
Firm Size	0.144 *** [0.005]	0.144 *** [0.005]	0.145 *** [0.005]	0.145 *** [0.005]
GDP	−0.135 *** [0.006]	−0.122 *** [0.006]	−0.124 *** [0.006]	−0.123 *** [0.006]
Stringency	0.089 *** [0.013]	0.110 *** [0.012]	0.111 *** [0.012]	0.108 *** [0.012]
Legal Origin	−0.031 [0.022]	−0.081 *** [0.021]	−0.071 *** [0.021]	−0.082 *** [0.021]
Constant	−1.658 *** [0.181]	−1.789 *** [0.184]	−1.800 *** [0.184]	−1.781 *** [0.184]
Year FE	yes	yes	yes	yes
Industry FE	yes	yes	yes	yes
Country FE	no	no	no	no
Adjusted R squared	0.389	0.382	0.382	0.382
Observations	22,841	22,841	22,841	22,841

This table presents the estimates of the effect of different quotas on the voluntarily disclosure of carbon emissions. A distinction is made between quota (Model 1), a dummy variable that combines soft and hard quotas; hard quotas (Model 2); soft quotas (Model 3); and the latter two together (Model 4). The dependent variable, Disclosure, is a dummy variable that equals one when a firm voluntarily discloses its carbon emissions directly. All variables were winsorized at both 1% and 99% levels. All independent variables are lagged by one year. Detailed definitions of the variables are presented in Table 1. The robust standard errors are shown in parentheses. ***, and ** indicate significance at the 1% and 5% levels, respectively.

In Table 6, the regression results for the complete baseline regressions are presented, including the three moderating variables and corresponding interaction terms. Model 1 regresses Female and Quota against Disclosure, whereas Model 3 includes Female, Quota,

and the respective interaction term. Model 1 is in line with Model 6 from Table 4, which both confirm the first hypothesis; namely, female board directors increase the number of firms that voluntarily disclose their carbon emissions. The coefficient of Female was significantly positive at the 1% level. Model 3 includes the interaction term between quota and female, but it was not significant. This finding implies that quotas do not have a moderating effect on the positive relationship between female board directors and voluntary carbon emission disclosure, rejecting Hypothesis 2. Thus, the relationship between gender board diversity and the number of firms that voluntarily disclose their carbon emissions are similar in countries with quota regulations in place and countries without any quota regulations. Models 2 and 4 use the Soft and Hard Quota variables separately and the moderators of the main relationship as explanatory variables. We did not observe any effects under these regulations.

Table 6. Carbon disclosure, female board members, and gender quotas.

	Model 1	Model 2	Model 3	Model 4
Female	0.511 *** [0.052]	0.572 *** [0.053]	0.558 *** [0.085]	0.562 *** [0.054]
Quota	0.088 *** [0.018]		0.100 *** [0.023]	
Hard Quota		0.005 [0.029]		−0.05 [0.078]
Soft Quota		−0.019 [0.038]		−0.013 [0.061]
Female*Quota			−0.075 [0.093]	
Female*Hard Quota				0.183 [0.208]
Female*Soft Quota				−0.038 [0.255]
Board Size (log)	0.174 *** [0.024]	0.157 *** [0.024]	0.174 *** [0.024]	0.156 *** [0.024]
Board Independence	0.029 [0.032]	0.049 [0.032]	0.028 [0.032]	0.05 [0.032]
R & D Intensity	0.337 *** [0.103]	0.341 *** [0.104]	0.335 *** [0.103]	0.344 *** [0.103]
R & D Missing	−0.037 ** [0.017]	−0.037 ** [0.017]	−0.037 ** [0.017]	−0.037 ** [0.017]
Capital Expenditures	0.001 [0.002]	0.000 [0.002]	0.001 [0.002]	0.000 [0.002]
Tobin's Q	0.011 *** [0.004]	0.013 *** [0.004]	0.011 *** [0.004]	0.013 *** [0.004]
ROA	0.070 ** [0.035]	0.077 ** [0.035]	0.070 ** [0.035]	0.078 ** [0.035]
Leverage	−0.098 *** [0.035]	−0.091 *** [0.035]	−0.098 *** [0.035]	−0.091 *** [0.035]
Cash Holding	−0.107 *** [0.039]	−0.111 *** [0.040]	−0.106 *** [0.039]	−0.111 *** [0.040]
Firm Size	0.140 *** [0.005]	0.139 *** [0.005]	0.140 *** [0.005]	0.139 *** [0.005]
GDP	−0.121 *** [0.006]	−0.112 *** [0.006]	−0.121 *** [0.006]	−0.112 *** [0.006]
Stringency	0.085 *** [0.013]	0.099 *** [0.012]	0.085 *** [0.013]	0.100 *** [0.012]
Legal Origin	−0.047 ** [0.021]	−0.077 ** [0.021]	−0.045 ** [0.021]	−0.077 ** [0.021]
Constant	−1.594 ***	−1.683 ***	−1.605 ***	−1.686 ***

Table 6. Cont.

	Model 1	Model 2	Model 3	Model 4
	[0.171]	[0.171]	[0.170]	[0.171]
Year FE	yes	yes	yes	yes
Industry FE	yes	yes	yes	yes
Country FE	no	no	no	no
Adjusted R squared	0.4	0.397	0.4	0.397
Observations	22,841	22,841	22,841	22,841

This table presents the estimates regarding the moderating effect of quotas on the main relationship between female representation on boards and the voluntarily disclosure of carbon emissions. A distinction is made between quota (a dummy variable that combines soft and hard quotas), hard quotas, soft quotas, and the latter two together. The dependent variable, Disclosure, is a dummy variable that equals one when a firm voluntarily discloses its carbon emissions directly. All variables were winsorized at both the 1% and 99% levels. All the independent variables were lagged by one year. Detailed definitions of the variables are presented in Table 1. The robust standard errors are shown in parentheses. ***, and ** indicate significance at the 1% and 5% 10% levels, respectively.

As shown in Table 6, the main relationship between female representation and voluntary carbon emission disclosure remained significantly positive at the 1% level. Moreover, neither hard quota nor soft quotas significantly altered the main relationship. It is highly likely that the variable Female captures the effect of hard quotas, as proven by the regression results in Table 4. However, when including the interaction terms of female with hard and soft quotas, respectively, as in Model 4, no significant interactions were observed. Therefore, hard and soft quota regulations separately do not significantly moderate the relationship between the percentage of female directors and the voluntary disclosure of carbon emissions. Thus, the variable Female captures the effect of the quota regulations separately. Furthermore, the combined effect of both did not appear to have a significantly positive effect in Model 3, either. These results do not provide any support for Hypothesis 2.

4.3. Robustness Checks

In order to test for the validity of the results provided in the prior section, we performed robustness checks. For this purpose, we ran our baseline regressions on different subsets of the data. Table 7 reports these results. The first column shows the results for the firm-year observations that never had to comply with any quota regulation. The main relationship between female representation on boards and voluntary disclosure of carbon emission remained significantly positive at the 1% level, which is consistent with results in the prior literature [6,9,34].

The second column represents the results for the firms that always had to comply with quota regulations during the sample period (i.e., 2010–2019). The main relationship between female representation on boards and voluntary disclosure of carbon emissions was again significantly positive at the 1% level. When we tested the difference in the estimated coefficients for Female between countries with never and always quota, the chi square statistic was insignificant, indicating that the effect was similar.

The third column presents the results for firms in countries that initially did not have any regulation but, between 2010 and 2019, the country changed to using quota regulations (either hard or soft). The results indicated that firms in countries that apply gender quotas presented a significant and positive effect of the female representation on boards on the voluntary disclosure of carbon emissions; however, this effect was not as strong as in countries either always or never implementing a quota. The chi square statistic indicated that the difference in the coefficient for Female in the sample with changed quota was not statistically significant, relative to that for the sample with no quota, but was statistically significant (at the 5% level), relative to always-quota countries. These findings indicate that the effects of gender diversity are important across countries, but to a lesser extent for countries in the process of changing their quota regulations.

Table 7. Robustness test based on quota regulation.

	Never Quota	Always Quota	Change Quota
Female	0.438 *** [0.111]	0.446 *** [0.076]	0.229 *** [0.085]
Board Size (log)	0.202 *** [0.038]	0.150 *** [0.038]	0.211 *** [0.044]
Board Independence	0.101 * [0.060]	0.179 *** [0.050]	0.143 *** [0.049]
R & D Intensity	0.619 * [0.365]	0.266 ** [0.117]	0.185 [0.297]
R & D Missing	−0.038 [0.031]	−0.068 *** [0.023]	0.007 [0.030]
Capital Expenditures	0.002 [0.002]	0.065 [0.043]	−0.049 *** [0.011]
Tobin's Q	0.012 [0.008]	0.014 *** [0.005]	0.005 [0.008]
ROA	0.146 * [0.080]	0.029 [0.052]	0.098 * [0.055]
Leverage	0.034 [0.079]	−0.116 *** [0.037]	−0.022 [0.072]
Cash Holding	−0.092 [0.089]	0.039 [0.046]	−0.209 *** [0.067]
Firm Size	0.135 *** [0.010]	0.160 *** [0.007]	0.105 *** [0.009]
GDP	−0.136 *** [0.014]	−0.06 [0.061]	0.158 *** [0.027]
Stringency	0.092 *** [0.015]	0.267 [0.362]	−0.009 [0.029]
Legal Origin	0.049 [0.044]	−0.034 [0.567]	−0.033 [0.030]
Constant	−1.708 *** [0.266]	−3.487 ** [1.407]	−2.574 *** [0.289]
Year FE	yes	yes	yes
Industry FE	yes	yes	yes
Country FE	no	no	no
Adjusted R squared	0.333	0.529	0.463
Observations	7372	9203	6266
Chi_Sq (Never Quota vs. Others)		0.00 (0.95)	2.26 (0.13)
Chi_Sq (Always Quota vs. Change)			3.67 (0.06) **

This table presents the estimates of the baseline model separated for firm-year observations that never had a quota from 2010–2019, always had a quota from 2010–2019, and that changed from no quota to quota regulation during 2010–2019. The dependent variable, Disclosure, is a dummy variable that equals one when a firm voluntarily discloses their carbon emissions. All variables were winsorized at both the 1% and 99% levels. All independent variables were lagged by one year. Detailed definitions of the variables are presented in Table 1. The robust standard errors are shown in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

4.4. Discussion

In our empirical analysis, we examined the relationship between female directors (i.e., board gender diversity) and voluntary disclosure of carbon emissions, as well as the moderating effect of quota regulations, using an international sample of 22,841 firm-year observations in the period from 2010 to 2019. We found that female directors have a significantly positive effect on the voluntary disclosure of carbon emissions, consistent with the first hypothesis. This result implies that gender board diversity is an important determinant of carbon disclosure and that increasing the number of females on the board will increase the willingness of firms to inform the public about their carbon emissions. This is important information, which can be used to identify the potential contributions of

firms to activities to reduce GHG emissions and therefore to demonstrate their productions becoming clean. On the other hand, such disclosure helps to identify heavy polluters. Overall, the presence of women on the board can aid in such identification.

This study differed from similar studies as we used an international sample, whereas the prior studies have typically only considered the relationship within a national setting. The international nature of our sample allowed us to investigate the role of nationwide gender quotas in explaining firm-level voluntary carbon disclosure. We tested both the stand-alone and combined effects of alternative quota regulations—namely, hard, soft, and recommendation—with firm-level gender board diversity on voluntary carbon disclosure. We also performed robustness checks using several subsamples, including countries that never had a quota, always a quota, or that changed their quota regulations within the study period. We found that nationwide quotas in general and hard quotas have significant and positive effects, similar to gender board diversity, but their effects are not as strong as firm-level gender representation. We did not identify a significant joint effect between the two on carbon disclosure, either. Furthermore, the effect of board gender diversity was similar between countries that always or never had a quota throughout the study period, and the effect was smaller and marginal in countries with changing regulations. Thus, we argue that the positive relationship between board gender diversity and voluntary carbon emission disclosure is neither altered nor strengthened by nationwide quotas. These findings do not support our second hypothesis.

5. Conclusions

We provided evidence that female directors have a significantly positive effect on the voluntary disclosure of carbon emissions. Our study differed from other similar studies as we considered an international sample, whereas the prior studies only considered such a relationship within national settings. Therefore, this study adds value on the basis of the existing literature.

Some limitations should be mentioned. In this study, the main moderating variable, Quota, included hard and soft quotas, as well as recommendations for good corporate governance. We performed our analysis on hard and soft quotas separately, where the recommendations were added to the Soft Quota variable. Therefore, when considering the outcomes of the Soft Quota variable, it is unclear whether the outcome provided is due to the effect of soft quotas or due to the recommendations. As this study mainly considered the effect of all quota regulations together on the main relationship, no distinction was made between the latter. Even though soft quotas have a comply-or-explain basis and recommendations do not, they were qualified as being equal for this study. In further research, it could be interesting to investigate whether there is a different effect between soft regulations and recommendations.

Furthermore, in this study, we used the Scope 1 variable, which is a proxy for the amount of carbon emissions a firm emits from its direct supply chain; however, we recommend future studies include indirect carbon disclosure, when more data are available to measure this indicator.

The outcomes of this study have important managerial implications. We reported a significant effect of gender diversity in boards on the voluntary disclosure of carbon emissions, which implies the transparency of a company regarding its sustainability efforts. Over the past two decades, sustainability has become one of the most important concerns in business as well as in society. Recent regulations, at both the national and international level, have mandated corporations to be more sustainable in their processes as well as outcomes. As these types of goals cannot be reached overnight, a long-term orientation is important when working towards sustainability-related goals. Prior studies have proven that having a diverse board, in terms of gender, can create a more long-term oriented view in terms of setting goals for the corporation. This study also indicated that including female directors in important decisions could lead to a more transparent image of the company. Furthermore, with respect to our results based on an international sample, we hope that

worldwide managers can consider these findings to improve their strategies in terms of corporate governance matters. Based on our current knowledge, there are no concrete case studies or statistics that we can present to support such a recommendation. Therefore, we leave this to potential future research, which should examine such issues in more detail in order to validate our conclusions.

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Appendix A

Table A1. Sample distribution by country.

Country	N	Disclosure	Female	Quota	Hard/Soft/Recommend	Compliance Year
Argentina	89	0.180	0.055	no	-	
Australia	2448	0.258	0.133	±	Recommend	2011
Austria	82	0.744	0.205	yes	Hard	2017
Belgium	188	0.612	0.223	yes	Hard	2011
Brazil	467	0.601	0.081	no	-	
Canada	1826	0.426	0.132	yes	Soft	2011
Chile	100	0.590	0.052	no	-	
China	1246	0.104	0.095	no	-	
Colombia	64	0.906	0.167	no	-	
Denmark	188	0.739	0.192	±	Recommend	2008
Finland	238	0.962	0.283	yes	Soft	2010
France	731	0.847	0.314	yes	Hard	2017
Germany	713	0.728	0.209	yes	Hard	2016
India	588	0.468	0.092	yes	Soft	2013
Indonesia	206	0.248	0.082	no	-	
Ireland	86	0.419	0.124	±	Recommend	2013
Israel	102	0.324	0.171	yes	Soft	2010
Italy	269	0.828	0.250	yes	Hard	2012
Japan	2503	0.522	0.039	no	-	
Malaysia	293	0.532	0.170	no	-	2012
Mexico	242	0.620	0.067	no	-	
Netherlands	272	0.846	0.206	yes	Soft	2013
New Zealand	175	0.371	0.252	no	-	
Norway	225	0.764	0.327	yes	Hard	2008
Peru	79	0.190	0.076	no	-	
Philippines	74	0.757	0.081	no	-	
Poland	131	0.366	0.132	±		2010
Portugal	65	0.846	0.110	yes	Hard	2017
Saudi Arabia	72	0.292	0.008	no	-	
Singapore	280	0.421	0.072	no	-	
South Africa	782	0.774	0.203	no	-	2009
Spain	282	0.872	0.175	yes	Soft	2015
Sweden	536	0.750	0.306	±	Recommend	2008
Switzerland	493	0.623	0.136	no	-	
Thailand	198	0.763	0.112	no	-	
Turkey	177	0.569	0.094	no	-	
United Kingdom	2230	0.927	0.184	±	Recommend	2011
United States	11,068	0.283	0.154	±	Recommend	2010
Total	23,226	0.458	0.148			

This table displays the sample countries, including whether there is a quota regulation (hard or soft) or a recommendation in place.

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