BALANCED GENDER BOARDS AND ENVIRONMENTAL, SOCIAL, AND GOVERNANCE PERFORMANCE

Maria João Guedes *, Anne Sophie Grübler **

* *Corresponding author*, ISEG (Lisbon, School of Economics and Management), University of Lisbon, Lisbon, Portugal
Contact details: ISEG (Lisbon, School of Economics and Management), University of Lisbon, Rua do Quelhas 6, 1200-781, Lisbon, Portugal
** ISEG (Lisbon, School of Economics and Management), University of Lisbon, Lisbon, Portugal

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Abstract

This study examines the relationship between gender balance on boards and environmental, social, and governance (ESG) performance. The results show that gender diversity has a positive impact on a company's ESG performance, suggesting that a balanced representation of women and men on boards is beneficial for a company's sustainable efforts. Furthermore, we provide evidence of the optimal level of diversity that maximizes ESG performance. ESG performance of companies reaches its maximum when the proportion of female directors on the board is approximately 60 percent. The results show that gender diversity on boards should be recognized not just as a milestone towards achieving gender equality but as a strategic asset that impacts companies' outcomes. The study argues that fostering gender diversity in corporate boards is not merely an obligation to promote equality and fairness but is also a crucial tool in corporate governance to improve a company's ESG performance. Furthermore, it provides valuable insights for academics, business leaders, and policymakers committed to fostering a sustainable and inclusive business world.

Keywords: ESG, Gender Diversity, Critical Mass, Women on Boards

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1. INTRODUCTION

Environmental, social, and governance (ESG) is a sustainability framework that is garnering increasing importance and has become a pivotal topic in the agenda of stakeholders. Not surprisingly, over recent years, we have experienced an exponential increase in interest in the topic. This has resulted in numerous research studies on its impact and relevance, new metrics to assess its value, and even new job titles, such as chief sustainability officer, which signal the importance that companies attach to the issue.

Research has rendered some important findings. For example, disclosing ESG information has advantages for both companies and stakeholders, such as improved risk management (Chen & Feng, 2023), reduced information asymmetries between stakeholders and the company (Wu et al., 2024) with a potential positive impact on corporate transparency (Chen & Xie, 2022), improved reputation (Galletta et al., 2023; Song, 2024), investment efficiency (Allman & Won, 2022), and financial performance (Duque-Grisales & Aguilera-Caracuel, 2021).

Given the positive impact of ESG on various aspects of business and the growing emphasis on doing good rather than focusing solely on financial profit (Huang, 2021), it is imperative to understand the factors that drive strong ESG performance. An important element is the integration of gender equality. In the "social" dimension, this integration helps to foster an inclusive work environment and to tackle social inequalities. In the "governance" pillar, it enhances corporate leadership diversity, enriches decision-making processes, and reinforces strategic management.

A greater share of women on boards is viewed as a core societal goal to promote greater social justice and gender equality. However, despite the significant progress that has been made in recent years, women comprised only 33% of board members in the largest listed companies in the European Union (EU) in 2023 (European Institute for Gender Equality [EIGE], n.d.). This percentage is still below the parity of 40%, which represents the equal distribution of power, responsibilities, and access to economic and strategic decision-making between women and men. Gender equality is far more than a question of social justice; it plays an important role in improving a company's economic performance and can strengthen its competitiveness (EIGE, 2017). The inclusion of women in companies especially on the board of directors (BOD) is crucial for promoting diverse perspectives (Baker et al., 2020; Kolev & McNamara, 2020), for fostering innovation and flexibility (Miller & Del Carmen Triana 2009), and for improving financial performance (Post & Byron, 2015; del Carmen Valls Martínez & Rambaud, 2019).

Although gender diversity and its impact on financial performance has been the subject of extensive scrutiny, its relationship with the ESG performance of companies remains unclear. According to Yahya (2023), there are two channels through which women can influence the ESG performance of companies: either through the high-risk avoidance preference or through the altruistic characteristics associated with women. Increasing evidence suggests that diversity matters, primarily because men and women bring different experiences, skills, and knowledge to the board.

This diversity of perspectives is particularly relevant when addressing complex challenges, such as those encountered in ESG issues. The varying perspectives and opinions that diverse boards offer can enhance both the environmental and social performance of companies (Kyaw et al., 2017). Women tend to exhibit a greater concern for climate change (Ciocirlan & Pettersson, 2012) and are more committed to effectively addressing environmental and social issues (Arayssi et al., 2020). They are inclined to prioritize sustainability in their decision-making and interactions with stakeholders (Huang et al., 2023), which can contribute to enhancing the ESG performance of companies (Heubeck, 2024; Wasiuzzaman & Wan Mohammad, 2020).

However, the empirical evidence has not always confirmed the positive link between gender diversity and ESG performance, with some studies either failing to find such a relationship (Boulouta, 2013) or finding a negative one (Dong et al., 2023). For example, Abdelkader et al. (2024) argue that female directors are confronted with prejudices and stereotypes, which can have a negative impact on ESG performance. Other studies point out that the use of different measures of ESG may not permit comparison (Edmans, 2021). But, to date, scholars have yet to adequately explore other possible explanations for the mixed findings, which may reside in the measure of gender diversity itself. Most studies use either the percentage of female board members or a single dummy variable to signal the existence of women on boards. Guedes and Casaca (2021) point out that these studies do not actually measure gender balance on boards but look instead at the percentage of women represented. Logically, this approach would seem to imply that a 100% female boardroom epitomizes the best configuration. Furthermore, these research papers tend to disregard the inherent social dynamics in the boardroom. In other words, most studies do not consider the existence of a critical mass of one gender influencing the outcomes (Kanter, 1977). A notable exception is the study by Yadav and Prashar (2023), which employs critical mass theory to show that, whereas a relatively low percentage of female directors has little effect on ESG performance, the relationship becomes more favorable when there are at least three female directors. Relatedly, Heubeck (2024) suggests that there might be a threshold level for board gender diversity, after which point the beneficial influence on ESG performance starts to decline.

Taken together, these research findings suggest that the relationship between gender diversity and ESG performance may be complex, extending beyond a linear relationship. One difficulty is to determine the share of women that reflects the peak of performance. For financial performance, past studies suggest a critical mass between 20% to 40% (Joecks et al., 2013; Konrad et al., 2008). The other difficulty is in accepting that women should always be the under-represented sex and that boards with more men deliver stronger outputs. We simply do not have sufficient studies that examine truly gender-balanced boards.

In the current study, we propose that gender-balanced boards deliver better ESG performance. We test this hypothesis using a sample of 1,878 companies in Europe, corresponding to 9,778 company observations in the period 2012–2022. Our results show that it is a balanced board that maximizes ESG scores. Specifically, the results show that ESG performance reaches its maximum when the proportion of female directors on boards is about 60%.

The remainder of the paper is structured as follows. Section 2 presents a review of the literature on gender balance on boards and ESG. Section 3 presents the sample and methodology used. Section 4 provides the results. Section 5 discusses the research results. Section 6 concludes the paper.

2. LITERATURE REVIEW

2.1. ESG and its relevance

ESG is designed to evaluate the sustainability efforts of companies (Linnenluecke, 2022), and it serves as an essential tool both for the reporting company itself and for its stakeholders, acting as a key indicator of the significance of ESG themes within the organization (Weber, 2014). Furthermore, it guides investment decisions, enabling the identification of companies whose practices are considered sustainable and, thus, aimed at long-term viability (Meng et al., 2023). This reflects the underlying idea

that companies with high ESG ratings potentially carry lower risk and are likely to achieve better financial performance in the long run. However, the motivation for ESG investments transcends financial objectives. ESG investments can also be driven by the desire to promote social or environmental change (impact investing), to align investment portfolios with personal beliefs (value-based investing) (Giese et al., 2019), or to comply with both increased regulatory requirements and pressure from various stakeholders, including governments, customers, and investors (Aldowaish et al., 2022).

Disclosing ESG information can yield advantages for both companies and stakeholders. These include, for example, improved risk management (Cheng & Feng, 2023) and improved investment efficiency (Allman & Won, 2022). Additionally, ESG disclosures reduce information asymmetries between stakeholders and the company, and it may have a positive impact on corporate transparency (Chen & Xie, 2022).

In recent years, there has been a significant and ongoing increase in international academic research focusing on the impact of ESG considerations on a company's financial performance and its subsequent market value (Duque-Grisales & Aguilera-Caracuel, 2021). Several studies show that ESG performance and its sub-dimensions (Fu & Li, 2023) have a positive impact on financial performance (Fu & Li, 2023; Zhao et al., 2018) and the profitability of companies (Kim & Li, 2021). Furthermore, a significant positive association exists between ESG performance and a company's reputation, potentially attracting investors' attention and offering a crucial competitive benefit (Meng et al., 2023). Companies are facing growing expectations of doing good, rather than solely focusing on financial profit (Huang, 2021).

Given these positive impacts of ESG performance on various aspects of business, it is imperative to understand the factors that drive a strong ESG performance. There is already a large body of literature analyzing the various factors influencing ESG performance. Among these, a study by Birindelli et al. (2018) reveals that the governance structure of a company, including factors such as board size and composition and the existence of a corporate social responsibility (CSR) committee, is decisive for its ESG performance. In addition, the findings from Almaqtari et al. (2023) indicate that board characteristics, such as company size, diversity, and independence of the directors, significantly impact the ESG performance of organizations. Furthermore, numerous studies show that country-specific factors, such as economic and social development and the political and regulatory environment, influence the ESG performance of companies (Daugaard & Ding, 2022).

2.2. Gender diversity on boards and ESG performance

The lack of female representation on corporate boards has received considerable attention from the public and academics (Kirsch, 2018). Three fundamental viewpoints highlight and justify the importance of gender equality on boards. First, the utilitarian argument suggests that the presence of women on boards positively impacts the profitability of companies. Second, the ethical argument addresses issues such as discrimination and fairness (Kirsch, 2018). From this viewpoint, gender equality is seen as a goal in itself, irrespective of the impact on the company's profitability (del Carmen Valls Martínez & Rambaud, 2019). Third, from a political or social justice perspective, it has been argued that gender equality on boards is a matter of democracy (Kirsch, 2018).

In this context, extensive research has explored the relationship between gender diversity on corporate boards and the company's performance. Despite the existence of a vast literature, the results are inconsistent. On the one hand, a positive impact is the justification found in resource dependence theory, which posits that the behavior of organizations is influenced by external resources (Pfeffer & Salancik, 1978). In the context of gender diversity, resource dependency theory argues that diverse boards have superior resources because female board members provide resources that male board members cannot. Similarly, Kyaw et al. (2017) highlight the crucial role of varied resources that diverse board members bring to the board's performance. Given that women and men offer distinct perspectives and skills, the inclusion of women introduces diverse resources to the board, potentially enriching the decision-making process (Hedija & Němec, 2021; del Carmen Valls Martínez & Rambaud, 2019). Linked to this line of argument, some studies claim that the positive relationship is only present when a critical mass of women is reached. This is aligned with the theory of critical mass, introduced by Kanter (1977).

On the other hand, some studies indicate no significant relationship (Pletzer et al., 2015) or even a negative one (Ajaz et al., 2020; Shehata et al., 2017) between gender diversity and the financial performance of companies. Nevertheless, the advantages of gender diversity reach beyond mere financial indicators, with extensive research analyzing its impact on a variety of other corporate dimensions. It has been found that companies with a gender balance on their boards tend to be more effective in upholding ethical standards and conducting business ethically (Garcia-Sanchez et al., 2014). Furthermore, female directors engage more in philanthropy and community (Groysberg & Bell, 2013) and positively impact the CSR performance of companies (Bear et al., 2010). Looking at the governance of companies, numerous studies have demonstrated that gender-diverse boards enhance control mechanisms, improve monitoring (Gul et al., 2011; Lakhal et al., 2015), and contribute to better decision-making quality, underscoring their role in effective corporate governance (Lakhal et al., 2015). Furthermore, Abad et al. (2017) and Kirsch (2018) state that having female directors on the BOD leads to more stringent management oversight, given that women tend to be more independent and diligent than their male counterparts. The findings are in line with agency theory, which emphasizes the crucial role of the BOD as an instrument to reconcile the interests of both shareholders and managers by serving as a monitoring and control mechanism (Jensen & Meckling, 1976). In the context of gender diversity, agency theory can be applied to explore whether female directors assist boards in overseeing the company's management (Kirsch, 2018), with authors arguing that gender diversity can improve monitoring (Kirsch, 2018), enhance decision-making processes, and reduce agency costs (Post & Byron, 2015).

In addition, the presence of women helps to optimize board dynamics, especially when it comes

to mitigating default risk. However, this effect only becomes significant when there is a critical mass of at least three women on the board and when these women hold key leadership roles on the board (Abinzano et al., 2023). Moreover, research suggests that boards with greater gender diversity experience fewer conflicts, which is attributed to women's interpersonal conflict resolution skills and participatory leadership style (Nielsen & Huse, 2010).

From the perspective of signaling theory, which posits that decision-makers rely on observable signals from other parties (Spence, 1973), gender diversity on the BOD positively impacts a company's reputation by signaling non-discrimination and promoting a positive image (Kaur & Singh, 2018).

Despite significant empirical evidence supporting the financial and non-financial advantages of gender diversity on company boards, achieving gender equality between women and men in leadership positions remains a considerable challenge. As of 2023, women constituted just 28.2% of management positions in the workplace worldwide. If progress continues at this current rate, it is anticipated that women's share of management positions will only reach 30% by the year 2050 (Hanna et al., 2023).

Taken together, these findings suggest a potential avenue for investigating the influence of gender diversity on ESG performance. Inevitably, the composition of the BOD is a key element in encouraging sustainable management practices (Ferrero-Ferrero et al., 2015), with gender diversity gaining significant attention in recent years in this context.

According to Yahya (2023), there are two channels through which female leadership can influence the ESG performance of organizations. First, through the high-risk avoidance preference or the altruistic characteristics associated with women. In this context, increasing evidence suggests that a diverse makeup can positively impact corporate performance, primarily because men and women bring different experiences, skills, and knowledge to the board. Diverse perspectives enhance company performance (Hedija & Němec, 2021; Post & Byron, 2015). This diversity is particularly relevant when addressing complex challenges, such as those encountered in ESG issues. The varying perspectives and opinions that diverse boards offer can, for example, enhance both the environmental and the social performance of companies (Kyaw et al., 2017; Yahya, 2023) leading to an improvement in overall performance (Kyaw et al., 2017).

Studies show that there is a positive association between gender (female) and environmental attitudes and behaviors, with women tending to exhibit a greater concern for climate change (Ciocirlan & Pettersson, 2012). In addition to the unique skills that female members bring to the board, this fact results in female board members being more committed to effectively addressing environmental and social issues (Arayssi et al., 2020) and prioritizing sustainability in their decision making, leading to higher ESG performance (Heubeck, 2024).

Male and female directors carry distinct ethical responsibilities (Adams & Ferreira, 2009), and women are likely to build more trusting relationships and prioritize extensive interaction with stakeholders compared to men (Alkayed et al., 2024). This tendency contributes significantly to enhancing the ESG performance of companies because it introduces a compassionate perspective to corporate governance and sustainability initiatives (Yahya, 2023). Boulouta (2013) reinforces this view by emphasizing that female board members are characterized by personality traits, such as a commitment to transparency, risk aversion, and a strong attachment to social and environmental goals, all of which contribute significantly to improving sustainable performance.

In concordance with the studies mentioned, there are numerous studies that explored the impact of gender diversity, as part of a company's corporate governance, on ESG performance. A majority of these studies showed a significant positive relationship (Almaqtari et al., 2023; Paolone et al., 2024; Wasiuzzaman & Wan Mohammad, 2020), suggesting that a greater presence of women on boards can improve companies' sustainability practices (Romano et al., 2020). Specifically, Nguyen and Faff (2007) show that more female directors on the board improve not only the ESG ratings but also the financial performance of a company, thus highlighting the mediating role of ESG performance. Nevertheless, the literature in this area has not yet produced fully conclusive results. Some studies show that women on boards do not have a significant effect (Zaid et al., 2020), or may even have a negative effect (Dong et al., 2023), on the sustainability performance of a company.

For example, Abdelkader et al. (2024) argue that female directors are confronted with prejudices and stereotypes, which can have a negative impact on ESG performance. Likewise, drawing on critical mass theory, Yadav and Prashar (2023) demonstrate a positive relationship between gender diversity on boards and ESG performance, although it depends on the number of women. While a relatively low percentage of female directors has little effect on ESG performance, the relationship becomes more favorable when there are at least three female directors. This observation is consistent with other studies, which show that the contribution of women to the strategic functions of the BOD increases significantly when a minimum number of three women is reached (Schwartz-Ziv, 2017; Torchia et al., 2010).

On the other hand, the findings by Heubeck (2024) indicate that there might be a threshold level for diversity, after which the beneficial influence on ESG performance starts to decline. These research findings suggest that the relationship between gender diversity and ESG performance may be complex and go beyond a linear relationship. This is supported by the findings of Menicucci and Paolucci (2022), who analyzed the link between gender diversity and ESG performance in the Italian banking sector. Their results suggest that the presence of women on boards has a positive impact on the ESG performance of companies, but that the nature of this impact changes once a certain number of women on the board is attained. Once this critical mass is exceeded, a further increase in the number of female board members does not necessarily lead to a proportional improvement in ESG performance, but the relationship takes on a non-linear tendency (Menicucci & Paolucci, 2022).

All in all, previous studies present a broad spectrum of findings on the impact of gender diversity on various aspects of the ESG performance of companies, and we posit that the inconclusive findings are explained by the fact that the studies do not account for the gender balance itself. Thus, some studies use the percentage of women on

boards, which supports the idea that a board composed of 100% women is the maximum point for performance. Other studies, employing critical mass theory, use the number three as the "magical" number to achieve the maximum performance level. However, the magic number of three has its limitations; Guedes et al. (2018) argue that: "… three women on a board of six has a different dynamic than three women on a board of twelve" (p. 183).

To that end, this study claims that the truly gender-diverse board is one that has better outcomes. Therefore, we propose the following hypothesis:

H1: The gender balance on boards is positively related to ESG performance.

3. SAMPLE AND METHODOLOGY

3.1. Sample

After excluding countries with less than 10 observations or incomplete information, the data set of this study comprised a sample of 1,878 European companies from 25 countries, resulting in 9,778 observational data points for the period 2012–2022. The data was retrieved from the Refinitiv Eikon database, supplemented with information from the World Bank. The software used was Stata 18. Table A.1 (see Appendix) shows the detailed composition of the sample by country.

3.2. Variables

The dependent variable is *ESG performance*, which is provided by the Refinitiv Eikon database. Companies are assessed using this ESG score. A company's aggregate ESG score is determined from over 630 self-disclosed data points and spans a scale from 0 to 100. The score encompasses three distinct pillars: environment, social, and governance. Each of these pillars is composed of specific categories, which receive an individual category score. In the environmental pillar, resource use, emissions, and innovation are considered. The social pillar includes the factors of workforce, human rights, community, and product responsibility. The governance pillar is delineated into management, shareholders, and CSR strategy. The overall ESG rating for a company is determined by summarizing the results of these individual categories, with the weighting being sector-specific. Furthermore, an additional factor is taken into account, which includes corporate scandals and controversies that may influence the final ESG rating.

The main independent variable of interest is a measure of gender diversity. Gender diversity can be measured in various ways, whether by absolute numbers, ratios, or dummies. However, absolute numbers and dummies neglect the size of boards, impacting the comparability of boards of different sizes. While ratios consider board size, they can be sensitive to variations in board size, potentially distorting results. For instance, a small board with only one female member may exhibit a high percentage ratio, giving a misleading impression of diversity. The same ratio might appear less representative in a larger board. Therefore, in this study, the *gender balance on boards* (GBB) index, developed by Guedes and Casaca (2021), is used to measure the balance between women and men on corporate boards. The index ranges from zero, indicating a homogenous board consisting of only men or only women, to one, signifying a fully balanced board with 50% women and 50% men. The proposed GBB formula is presented in eq. (1):

$$GBB\ index = 4^k * (Percentage\ of\ women)^k * (Percentage\ of\ men)^k \quad (1)$$

where, k represents the exponent variable that can be chosen based on theory, industry, or the phenomenon under investigation, leading to various types of results and curves. Following Guedes and Casaca (2021), the adopted value is $k = 2$ to measure gender balance on boards. Thus, as presented in eq. (2), the formula for the GBB index used in this work is:

$$GBB\ index = 4^2 * (Percentage\ of\ women)^2 * (Percentage\ of\ men)^2 \quad (2)$$

This quadratic calculation results in a non-linear relationship, which is reflected in an inverted U-shaped curve, reaching its maximum value of one at complete gender parity. If the proportion of women or men on the board is initially low, a small change in this proportion has a relatively small effect on the GBB index. However, the closer the distribution approaches a balanced 50-50 ratio, the index becomes progressively more reactive, reflecting a greater sensitivity to shifts towards a balanced gender representation. Moreover, adding a new board member of the under-represented gender consistently improves the index more than removing a member of the over-represented gender. Consequently, the index favors larger boards. The most effective way to increase the index value is to replace members of the over-represented gender with members of the under-represented gender, moving towards parity (Guedes & Casaca, 2021).

Our study includes a set of control variables. Larger companies often have more resources and greater public visibility, which may lead to greater pressure to meet ESG standards and mitigate reputational risks (Barros et al., 2022). This idea is supported by numerous research findings that have identified a positive association between a company's size and its ESG performance (Drempetic et al., 2020; Nekhili et al., 2021) as well as its sustainability disclosure practices (Brammer & Pavelin, 2004; Branco & Rodrigues, 2008). Therefore, the company size (*Size*) is measured by the natural logarithm of the number of employees (*lnsize*).

The financial performance of companies is measured by the return on assets (*ROA*). It is calculated as a ratio of the net income after tax divided by the total assets in the same period. Companies exhibiting higher levels of profitability are likely to possess greater capital resources, which could be allocated to ESG initiatives. The *debt-to-equity ratio* reflects company debt levels and is calculated by dividing the total debt by the common equity. Companies with greater indebtedness may face more financial constraints, limiting their capacity to invest in ESG initiatives.

The size of the corporate board (*Board size*), measured by the number of directors, is taken as a control variable. According to previous research, a high number of directors may decelerate the decision-making process and reduce the efficiency of boards (Cheng, 2008; Jensen, 1993). On the other hand, a larger BOD could provide a broader range of opinions and resources (Post et al., 2011), which

could potentially improve the company's ESG performance. Research findings by Menicucci and Paolucci (2022) and Gurol and Lagasio (2023) further suggest that a larger board can help resolve representation conflicts in a company while providing a wealth of diverse expertise and encouraging innovation. The number of independent board members (*Independence*) is the percentage of independent directors. Independence is often seen as a key factor in effective corporate governance because it enables the board to monitor business practices more effectively (Liao et al., 2015). Several studies report that corporate sustainability performance is positively and significantly associated with a higher proportion of independent directors on the board (Bigelli et al., 2023; Husted & Milton de Sousa-Filho, 2019; Shahbaz et al., 2020).

Furthermore, the model includes the binary variable, chief executive officer (CEO) chairman duality (*CEO duality*), as a control variable, which indicates whether the positions of CEO and chairman of the board are held by the same person or not. If they are the same person, this is referred to as a CEO–chairman dual function. Regarding the effects of a CEO's dual function in companies, two different theoretical approaches can be recognized. According to agency theory, the dual role of a CEO negatively impacts company performance because it complicates decision-making processes and increases both conflicts of interest and agency costs (Yu, 2023). However, stewardship theory posits that the dual function of an individual as both CEO and chairman of the board can promote more efficient and effective corporate management, aligned with shareholder interests. Regarding the impact on ESG performance, these two distinct perspectives are also evident. A substantial number of papers conclude that CEO duality enhances agency conflict, impeding the corporate transition to ESG practices (Bhat et al., 2023; Naciti, 2019; Romano et al., 2020). However, proponents of the stewardship theory argue that CEO duality is found to enhance overall ESG performance and CSR disclosure (Fahad & Rahman, 2020; Nekhili et al., 2021; Tamimi & Sebastianelli, 2017).

Furthermore, the study includes country-specific control variables — namely, the inflation rate (*Inflation*) and the gross domestic product (GDP) per capita, for interpretation purposes measured by the natural logarithm of GDP per capita (*lnGDP*). Both of them reflect macroeconomic conditions, which are expected to influence the ESG performance of companies (Daugaard & Ding, 2022; Garcia et al., 2017). Finally, variables relating to the sector in which the company operates (*Industry*) and to the reporting year (*Year*) are taken into account. It is expected that a company's ESG performance will vary according to its location (Daugaard & Ding, 2022; Garcia et al., 2017) and sector (Cheng & Feng, 2023), and also over the course of the study period (Daugaard & Ding, 2022). All the variables' definitions are provided in Table 1.

Table 1. Variables descriptions

Variable	*Description*
Dependent variable	
ESG performance	The aggregate ESG score (scale from 0 to 100) from the Refinitiv Eikon database. It is composed of the environmental, social, and governance pillars.
Independent variables	
Gender-balanced diversity	Gender balance on boards (GBB) index, from Guedes and Casaca (2021).
Women on boards	Percentage of women in the total number of board members.
Board size	Number of the board of directors.
Independence	Percentage of independent board members on the BOD.
CEO duality	The dummy variable that takes the value "1" if the CEO and chairperson roles are held by the same person, and "0" otherwise.
Size	Natural logarithm of the total number of employees.
ROA	Return on assets, measured by net income after tax divided by total assets.
Debt-to-equity	Ratio of total debt to total common equity.
GDP per capita	Natural logarithm of the gross domestic product divided by the number of inhabitants of the country.
Inflation	Rate of change in the consumer price index.
Industry	Two-digit industry dummies based on the Global Industry Classification Standard.
Year	Year dummies, from 2012 to 2022.

4. RESULTS

4.1. Descriptive statistics

Table 2 shows the descriptive statistics and the correlation. During the period of analysis, the ESG mean score was 55.68, with a range of 0.63 to 95.91, which illustrates that companies' commitment to ESG issues varies greatly. Companies have the highest average score in the social pillar (58.81), followed by the governance pillar (54.4), and, finally, the environmental pillar (51.41).

The GBB index has an average of 0.59, suggesting a considerable gender imbalance in company boards. With a minimum value of 0 and a maximum value of 1, it can be concluded that the proportion of women on the boards of directors varies greatly. Some companies achieve full parity, while others have entirely male or female boards. This is supported by the mean value of 27.4% for women on boards. The company boards sampled are dominated by men, indicating a gender imbalance.

The mean value of board members is 10, and approximately 56% of them are independent. The companies have a mean of 27,765 employees and a profitability of around 7%. With regard to the country-related control variables, the average annual inflation of the sample is 2.25 %, and the GDP per capita is 41001.81 EUR.

Table 2a. Descriptive statistics: Mean, SD, Min., Max.

No.	Variable	Mean	SD	Min.	Max.
1	*ESG performance*	55.678	19.502	0.627	95.912
2	*Environmental pillar*	51.413	25.814	0	99.138
3	*Social pillar*	58.814	22.601	0.263	98.349
4	*Governance pillar*	54.442	21.927	0.462	98.562
5	*GBB index*	0.591	0.318	0	1
6	*Women on boards*	27.405	14.328	0	100
7	*Board size*	9.602	3.704	1	30
8	*Independence*	55.779	26.076	0	100
9	*CEO duality*	0.23	0.421	0	1
10	*Size*	8.708	1.946	0	13.505
11	*ROA*	0.066	0.074	0	2.518
12	*Debt-to-equity*	1.103	10.203	-53.42	820.259
13	*GDP per capita*	10.527	0.458	7.165	11.508
14	*Inflation*	2.247	2.554	-2.097	48.7

Note: N = 9,778.

Table 2b. Descriptive statistics: Correlation

	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1												
2	0.858***	1											
3	0.900***	0.728***	1										
4	0.695***	0.394***	0.435***	1									
5	0.335***	0.275***	0.280***	0.287***	1								
6	0.309***	0.252***	0.257***	0.267***	0.960***	1							
7	0.416***	0.440***	0.402***	0.156***	0.125***	0.102***	1						
8	0.309***	0.180***	0.212***	0.407***	0.206***	0.184***	-0.086***	1					
9	0.049***	0.106***	0.109***	-0.125***	0.046***	0.055***	0.148***	-0.097***	1				
10	0.489***	0.450***	0.474***	0.278***	0.094***	0.075***	0.476***	0.099***	0.115***	1			
11	-0.068***	-0.079***	-0.072***	-0.024**	-0.010	-0.002	-0.116***	0.023**	-0.013	-0.113***	1		
12	0.003	0.009	0.004	-0.004	0.004	0.002	0.012	-0.008	-0.003	0.018	-0.009	1	
13	0.019*	-0.009	0.035***	0.025**	0.073***	0.070***	-0.182***	0.128***	0.023**	-0.084***	0.027***	-0.041***	1
14	0.017*	-0.015	-0.026**	0.099***	0.114***	0.115***	-0.094***	0.018*	-0.089***	-0.079***	0.029***	0.020**	-0.182***

*Note: N = 9,778. *** p < 0.01, ** p < 0.05, * p < 0.1.*

4.2. Regression results

Table 3 presents the ordinary least squares (OLS) regression results, with robust standard errors.

Accordingly, in Model 1, the GBB index has a positive and significant relationship with ESG performance ($\beta = 10.89$; $p < 0.01$). Thus, balance boards are associated with positive ESG performance. This is also confirmed by the results of the individual ESG pillars. When disaggregated into each of the three pillars, Models 2 to 4 confirm that the positive relationship continues to hold. The environmental pillar score, the social pillar score, and the governance pillar score are all statistically significant at a significance level of 1% ($p < 0.01$). They exert a positive influence on the GBB index and, therefore, on gender diversity on corporate boards. Taken together, *H1* is supported.

In the absence of previous studies that have examined gender balance in the boardroom, we are unable to compare our results. However, they align with those results that suggest increasing the representation of women on boards may render positive outcomes in terms of ESG (García Martín & Herrero, 2020; Romano et al., 2020). Thus, we augment the evidence from previous studies showing that increased representation of women will bring distinct perspectives and life experiences to boardrooms. For example, the existing literature suggests that female board members are not only inclined to prioritize and effectively tackle social and environmental matters (Arayssi et al., 2020; Ciocirlan & Pettersson, 2012) but they also play a pivotal role in enhancing corporate governance (Lakhal et al., 2015).

Building on the work of Guedes and Casaca (2021), which proposes that the GBB index is non-linear, our study also supports the non-linear nature of the relationship between gender diversity and ESG performance. This non-linearity can be attributed to the inherent characteristics of our chosen metric, the GBB index, which follows an inverted U-shaped pattern. The low representation of one gender and the high representation of the other, or vice versa, can produce equally favorable or unfavorable outcomes in terms of ESG performance. Therefore, the findings not only underscore the potential for a positive association between gender diversity and ESG performance but also accentuate the presence of non-linear effects that should be further explored. This result of nonlinearity extends the discussion on critical mass theory. While the theory states that gender diversity will only exert influence in a company once the minority gender reaches a certain number (Kanter, 1977), our findings suggest that a point may be reached where a further increase in the minority gender no longer leads to linear improvements. It could imply that achieving a minimum number of female board members is crucial for unlocking positive effects, but it may also indicate the importance of avoiding an overly dominant presence of any one gender if the optimal impact on ESG performance is to be achieved. Thus, it might not just be about achieving a "critical mass" but also about maintaining a "critical balance" that addresses both the under-representation of women and avoids over-representation to ensure the most positive effects on ESG performance.

Table 3. OLS regression results

Variable	*(1) ESG*	*(2) Environmental*	*(3) Social*	*(4) Governance*
GBB index	10.886***	14.635***	9.723***	9.816***
	(21.036)	(20.983)	(15.017)	(15.230)
Board size	1.069***	1.368***	1.256***	0.382***
	(19.551)	(19.138)	(18.995)	(5.573)
Independence	0.172***	0.115***	0.126***	0.281***
	(28.948)	(14.270)	(16.751)	(38.316)
CEO duality	-1.291***	1.861***	0.950**	-7.007***
	(-3.602)	(3.781)	(2.111)	(-14.994)
Size	5.244***	6.205***	5.877***	3.573***
	(45.906)	(41.126)	(41.397)	(25.437)
ROA	0.241	2.043	-0.739	0.299
	(0.141)	(0.782)	(-0.304)	(0.116)
Debt-to-equity	-0.004	0.008	0.002	-0.020
	(-0.834)	(0.543)	(0.312)	(-1.361)
Inflation	-0.709***	-0.759***	-0.870***	-0.520***
	(-5.364)	(-4.610)	(-5.077)	(-3.002)
GDP per capita	1.790***	2.814***	2.320***	-0.002
	(4.188)	(4.953)	(4.107)	(-0.003)
Constant	-45.389***	-67.971***	-56.515***	-7.656
	(-9.321)	(-10.442)	(-8.889)	(-1.346)
Year and industry dummies				
Observations	9,778	9,778	9,778	9,778
Adjusted R^2	0.533	0.486	0.445	0.359

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

4.3. Robustness tests

In further support of the argument that boards should be balanced, we investigated the non-linear nature of the relationship between gender diversity and ESG performance, which extends the discussion on critical mass theory. While the theory states that gender diversity will only exert an influence in a company once the minority gender reaches a certain percentage (Kanter, 1977), the findings above suggest that a point may be reached where any further increase in the under-represented gender no longer leads to linear improvements. It may imply that achieving a minimum number of female board members is crucial in unlocking positive effects, but it may also indicate the importance of avoiding an overly dominant presence of any one gender to realize the optimal impact on ESG performance. Thus, it may not just be about achieving a "critical mass" but also about maintaining a "critical balance" that addresses both the under-representation of women and avoids over-representation to ensure the most positive effects on ESG performance.

Accordingly, the results presented in Table 4, Model 1 show that the proportion of women on boards has a positive and significant relationship with ESG performance ($\beta = 0.229$; $p < 0.01$). Then, in Model 2, the non-linear coefficient is negative and significant ($\beta = -0.004$; $p < 0.01$), showing an inverse-U relationship between the presence of women on boards and ESG performance. This provides support for the case of gender-balanced boards as defended by Guedes and Casaca (2021).

Thus, the impact of increasing gender diversity may decrease or even become negative, and there may be an optimum level of gender diversity where the ESG performance of companies is maximized. This result is particularly relevant in light of the discussion on a "critical mass" for women in leadership positions as discussed by Schwartz-Ziv (2017) who contends that the positive impact of gender diversity on ESG performance only becomes significant above a certain threshold.

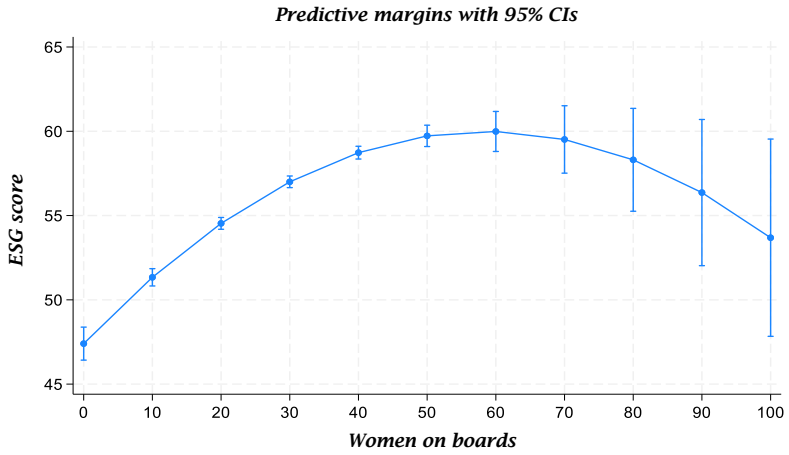
Table 4. Robustness regression results

Variable	*(1) Linear effect*	*(2) Non-linear effect*
Women on boards	0.229***	0.430***
	(19.621)	(12.285)
Women on boards squared		-0.004***
		(-6.309)
Board size	1.099***	1.039***
	(19.942)	(18.831)
Independence	0.176***	0.169***
	(29.487)	(28.131)
CEO duality	-1.367***	-1.211***
	(-3.802)	(-3.368)
Size	5.259***	5.276***
	(45.955)	(46.192)
ROA	0.158	0.292
	(0.092)	(0.169)
Debt-to-equity	-0.004	-0.005
	(-0.713)	(-1.043)
Inflation	-0.698***	-0.703***
	(-5.273)	(-5.387)
GDP per capita	1.839***	1.681***
	(4.301)	(3.928)
Constant	-46.622***	-46.308***
	(-9.572)	(-9.510)
Year and industry dummies	Yes	Yes
Observations	9,778	9,778
Adjusted R^2	0.531	0.533

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

Figure 1 presents the expected change in the ESG score with a gradual increase in the proportion of women on boards, thereby providing an understanding of how changes in gender diversity affect the ESG performance of companies. The horizontal axis represents the percentage of women on boards, while the vertical axis shows the predicted ESG score. According to Figure 1, as the proportion of women increases, the ESG score initially rises until an optimum is reached at 60%, seen at the highest point of the curve, with a predicted marginal ESG score of 60.11. Beyond this point, the estimated ESG score begins to decline, until it reaches a value of approximately 53.80 with a 100% female board representation. These findings suggest that there is an optimal level of board gender diversity at which the ESG score is maximized, which is higher than the 50% suggested by Guedes and Casaca (2021). The presence of non-linearity indicates that the relationship between board gender composition and corporate ESG performance is complex, and it emphasizes the importance of a differentiated view of board gender diversity.

Figure 1. Marginal effects of board gender diversity on ESG scores



5. DISCUSSION

Our study provides evidence that gender diversity has a positive influence on a company's ESG performance. The results offer valuable insights into the dynamics between board composition and sustainable corporate governance. This finding is in line with the previous research that emphasizes the positive effects of diversity on corporate performance and especially on sustainability aspects (García Martín & Herrero, 2020; Romano et al., 2020).

The results for the individual ESG pillars are, therefore, in line with the existing literature, suggesting that female board members are inclined to prioritize and effectively tackle social and environmental matters (Arayssi et al., 2020; Ciocirlan & Pettersson, 2012) and that they play a pivotal role in enhancing corporate governance (Lakhal et al., 2015). These factors may have contributed to enhancing both the distinct dimensions and the comprehensive ESG performance of the companies in our dataset.

Furthermore, our findings support a non-linear relationship between board gender diversity and ESG performance. This result is particularly relevant in light of the discussion on a "critical mass" for women in leadership positions as discussed by Schwartz-Ziv (2017) and Yadav and Prashar (2023). Both determined that the positive impact of gender diversity on ESG performance only becomes significant above a certain threshold. Our study provides evidence that the ideal threshold, rather than being measured by a statistical minimum of three female directors, is a percentage of the total board members that sit in the boardroom. According to our results, with an increasing share of women on the board, companies' ESG performance initially improves, reaching an optimum of 60% female representation. Beyond this critical point, the ESG score begins to decline.

Our result is further supported by considering the quadratic term for the percentage of women on boards, which accounts for potential nonlinearities and limits the threshold of female directors. Hence, an increasing number of women on boards does not necessarily exert a positive effect on enhancing ESG performance beyond the mentioned threshold.

Taken together, our study highlights the importance of a true gender board, confirmed by the existence of an optimal ratio of women to men on boards that maximizes ESG performance and emphasizes the importance of a balanced ratio. These results align with those of Menicucci and Paolucci (2022) who identified a nonlinear relationship in this context. It is clear that a balanced gender distribution on the board can improve ESG performance to a certain level but may not offer additional benefits beyond that. This insight emphasizes the importance of developing diversity strategies that go beyond quantity and aim for the high-quality inclusion of women in leadership positions. Understanding this nonlinear pattern is crucial for companies aiming to optimize their ESG performance through improved board composition. It sheds new light on the discussion on critical mass theory and enhances understanding of the impact of board diversity.

Our study carries several key implications for both managers and public institutions. The results suggest that CEOs and managers should pay greater attention to corporate governance, especially gender diversity on boards, to improve ESG performance. However, since the relationship between gender diversity and ESG performance is not linear but points to an optimum level, management should not focus on maximizing the number of female board directors but on achieving the optimal balance of gender diversity that fosters the most effective ESG performance. In this regard, managers should

consider gender diversity as an integral part of their corporate strategy, and they should create a company culture that values and actively promotes gender diversity. Such measures could include training programs, mentoring initiatives, and flexible working conditions, contributing to an environment where employees can thrive, regardless of their gender.

In light of the legal gender quotas that require companies to implement greater gender diversity, the findings of this study are very promising. They suggest that adhering to gender quotas can boost ESG performance and, thus, provide a competitive advantage. However, the identified non-linear relationship implies that, while a certain level of gender diversity should be encouraged, a policy aiming for maximum diversity without regard to an optimum level may be counterproductive. Given that this optimum level of gender diversity where ESG performance is maximized may differ across countries and industries, it would be advisable to ascertain the appropriate levels for various locations and sectors. With the EU directives mandating gender quotas by 2026, listed companies are required to ensure significant female representation on their boards. This policy mandates that at least 40% of non-executive board positions or 33% of all board positions are filled by women (European Commission, 2025). Arguably, for ESG performance optimization, it may be preferable to adapt these percentages to industry or country-specific optima instead of utilizing uniform quotas. However, the pursuit of gender diversity extends beyond just ESG performance and is fundamentally rooted in issues of fairness and equal rights.

Our study offers valuable insights but carries with it certain limitations. Firstly, it relies on the assumption that ESG scores are an effective indicator of a company's sustainability performance. However, the literature has tendered significant criticism of these scores. Different ESG rating agencies may yield vastly varied scores for the same company due to their distinct criteria and weightings (Billio et al., 2021). The quality and availability of data used in ESG evaluations are often inadequate, especially for small companies or those in emerging markets. Moreover, the complexity and diversity of a company's social or environmental impacts are challenging to capture through metrics alone. While ESG scores can make critical factors such as carbon emissions transparent, sustainability encompasses many crucial aspects that are difficult to measure, such as the development of a company culture that promotes diversity (Edmans, 2021). ESG scores may not accurately reflect a company's true performance in ESG efforts but rather the extent of information disclosure (Minutolo et al., 2019). In addition, ESG scores often provide only a short-term perspective, potentially overemphasizing short-term risks or achievements at the expense of long-term sustainability impacts (Edmans, 2021). ESG metrics are useful for providing insights into a company's sustainability efforts but should be complemented with qualitative information and deeper analysis for a comprehensive understanding. Therefore, this study's reliance on ESG scores as an indicator of sustainability performance can be seen as a limitation.

Secondly, the GBB index represents an innovative measure of gender diversity, whose validity and reliability should be further investigated across various contexts. A potential limitation arises from the flexibility in choosing the exponent *k*. While this flexibility allows for adjustment of the index's sensitivity to different research scenarios, it may also raise concerns regarding standardization and comparability of results (Guedes & Casaca, 2021). Additionally, the index has a tendency to favor larger boards, which could affect the interpretation of gender diversity. These factors should be considered when evaluating the outcomes, and they should be the subject of further research to enhance our understanding of how gender diversity impacts ESG performance.

Furthermore, the identification of the non-linearity and optimal thresholds presents a methodological challenge and constitutes a limitation of this study. Although the study suggests a nonlinear relationship, pinpointing the exact inflection point is challenging and requires sensitive analytical methods. This could influence the interpretation of the results and potentially lead to inaccuracies.

Another main limitation lies in the potential influence of cultural norms and legal frameworks on the relationship between gender diversity and ESG performance. Cultural norms and legal regulations vary significantly across countries and regions, impacting the perception and implementation of gender diversity at the corporate level. In cultures with progressive gender equality policies, gender diversity may have a more substantial positive effect on ESG performance compared to regions with less advanced equality. Given the direct contributions of gender diversity to ESG performance, legal frameworks, such as mandatory gender quotas, play a crucial role. These quotas mandate specific levels of gender diversity in companies, thereby directly affecting ESG performance. Such discrepancies across countries highlight the challenge of accounting for diverse legal and cultural contexts in evaluating the relationship between gender diversity and ESG outcomes.

Another significant limitation of this study is that it does not consider the potential effects of tokenism and adjustment pressure. Tokenism, where a minimal number of women in board positions might feel isolated or marginalized (Kanter, 1977) and the pressure on minorities to conform to the prevailing majority culture to win acceptance and seize career opportunities represent complex challenges. These dynamics could lead women to suppress their unique perspectives and experiences to fit in, thereby diminishing the theoretical benefits of diversity. Simultaneously, these processes of adaptation could reduce the variety of perspectives, as individual and innovative views are set aside in favor of conformity. The study, as currently structured, may not be able to capture the extent to which these factors influence the relationship between gender diversity and ESG performance, representing a significant limitation of the results.

Lastly, there is a lack of consideration given to crucial internal factors, such as the culture of a company and how it values and promotes diversity and inclusion. This aspect could significantly influence ESG performance since a robust culture of inclusion could amplify the effectiveness of gender diversity initiatives. However, the study did not integrate metrics of corporate culture or other pertinent control variables, potentially constraining the depth of comprehension concerning the correlation between gender diversity and ESG performance.

6. CONCLUSION

In conclusion, our study provides significant insights into the relationship between gender diversity on boards and ESG performance. The empirical analysis confirms that gender diversity has a positive impact on a company's ESG performance, suggesting that a balanced representation of women and men on boards is beneficial for a company's sustainable efforts. Furthermore, we provide evidence that an optimal level of diversity maximizes ESG performance. ESG performance of the companies reaches its maximum when the proportion of female directors on the board is approximately 60%. This finding underscores the importance of an equal representation of both genders in the BOD, offering invaluable knowledge for academics, business leaders, and policymakers dedicated to promoting a sustainable and inclusive business environment. Men and women each bring unique characteristics, skills, and experience to bear, and it is the fusion of these different qualities that greatly benefits organizations (Almaqtari et al., 2023). Such equal representation of both genders could emerge as a pivotal factor in advancing a company's environmental, social, and governance achievements. We argue, therefore, that gender diversity on boards should be recognized not just as a milestone towards achieving gender equality but as a strategic asset that significantly impacts the social and environmental pillars of sustainability.

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APPENDIX

Table A.1. Composition of the sample by country

Country of headquarters	*Number of companies*	*Proportion of companies*
Austria	29	1.57%
Belgium	41	2.22%
Cyprus	7	0.38%
Czech Republic	1	0.05%
Denmark	52	2.81%
Finland	71	3.84%
France	161	8.70%
Germany	232	12.53%
Greece	23	1.24%
Hungary	5	0.27%
Iceland	7	0.38%
Ireland	42	2.27%
Italy	99	5.35%
Luxembourg	31	1.67%
Malta	5	0.27%
Netherlands	55	2.97%
Norway	64	3.46%
Poland	27	1.46%
Portugal	14	0.76%
Russia	26	1.40%
Spain	61	3.30%
Sweden	233	12.59%
Switzerland	130	7.02%
Ukraine	2	0.11%
United Kingdom	433	23.39%
Total	**1878**	**100%**