Does Board Gender Diversity Matter for the ESG Performance? The Moderating Effect of Board Characteristics

by

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Abstract

The following paper investigates the relationship between gender board diversity and ESG performance and especially how the impact of board independence, CEO duality, and CEO gender moderates the baseline relationship through various panel data and fixed-effects estimators. To conduct these analyses, a sample of S&P 1500 US firms is used for a period ranging from 2015 to 2021. Based on prior literature, a higher proportion of women directors on boards enhances financial and sustainability performance, leading to higher firm value and reputation. The results of this paper align with the existing findings since it was found that board gender diversity improves ESG performance. Moreover, this relationship is positively moderated by board independence, whereas CEO duality negatively affects it. The moderating effect of CEO gender is statistically insignificant. Thus, this paper contributes by underlining the importance of board composition and incentivizing policymakers toward the establishment of equal rights and opportunities for both genders.

Keywords: Board gender diversity, ESG performance, board independence, CEO duality, CEO gender, financial performance, female board representation, gender equality, enforcement of policy frameworks

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1. Introduction

The topics of board gender equality and sustainability performance within a firm have gained prominence and crucial importance over the last few years. According to the 2030 Agenda for sustainable development, gender equality is essential in achieving social development, enhancing corporate performance, and accelerating economic growth. Therefore, it is becoming more and more significant for governing bodies to handle long-term environmental, social and governance challenges and incorporate them into their corporate strategies and business operational models (Gungor N., & Şeker Y., 2022). Indeed, numerous initiatives and regulations f.e. quotas have been implemented to combat gender inequality and encourage businesses to adopt more sustainable practices (Arndt & Wrohlich, 2019). Most recent academic literature points out the significant effect of the composition of the board of directors, which is one of the most powerful elements within a company, on various firm characteristics, such as financial performance, transparency, disclosures, reputation, and sustainability (Cucari et al., 2017).

Economic results are not the only criteria by which corporations are valued nowadays. Environmental, Social, and Governance scores are equally of great importance in the modern business world. Besides, as Galbreath (2013) argues, ESG has emerged as a critical indicator of managerial proficiency, risk management, and non-financial performance. Hence, since recently businesses are starting to recognize the variety of benefits that sustainability offers to their operations, organisations are demonstrating significant engagement in the creation of ESG initiatives. According to Ernst & Young (2012), the primary elements influencing directors' sustainability agendas right now include cost savings, meeting stakeholder expectations, improved risk management, stronger income creation, and governmental regulations. ESG-oriented practices can furthermore influence investment decision-making since in most Western countries people pay attention to social, ethical, and environmental issues (Peattie, 1995). More and more individual investors tend to allocate a larger share of their portfolio to ESG securities. Hence, ESG is considered by investors to be consistent with maximising shareholder wealth while achieving socially responsible goals.

In charge of making strategic decisions on behalf of a company, including its commitment to adherence to more sustainable practices, is the board of directors. The board of directors consists of one of the most influential components within a company since it provides

both valuable advice to management and monitors the company's operations at the same time, to ensure that the interests of the firm's shareholders are accomplished (Fracassi & Tate, 2012). As a result, the effectiveness of a board is strongly associated with its composition. Given that, a firm can be both financially and sustainably benefited by board diversity because it encourages board discussion, promotes creativity and innovation, and generates more insights by bringing more multi-perspectives for efficient board decision-making (Watson, Kumar, & Michaelsen, 1993; Hillman, Shropshire, & Cannella, 2007; Gul, Srinidhi, & Ng, 2011), and lastly properly adjusts its decisions to fulfil company's objectives and shareholders' needs. In other words, directors are expected to develop operational and financial strategies and audit the efficiency of the company's activities while acting as the shareholders' agents at the same time.

A large piece of academic evidence suggests that board gender diversity can significantly impact firm performance. Board diversity refers to the variety of backgrounds, ethnicities, abilities, competencies, and experiences that the board of directors possesses collectively and it is seen as a sign of the company's sensitivity to stakeholder expectations. Diversity on boards generates a couple of benefits for corporations by resulting in better decision-making, better market and employee awareness, and more effective boardroom behaviour. From a corporate performance perspective, it also improves the reputation of the company by boosting its legitimacy and integrity, securing financing from moral investors, and motivating women even at the lower management layers of the firm to take more initiative.

Corporate finance literature suggests that female representation on boards enhances financial and sustainability performance and improves market value by indicating a firm dedication to stakeholders' needs. Therefore, the issue of women on boards has internationally gained considerable interest and a worldwide trend has emerged aiming to increase the number of females in top management positions to enhance CSR practices. Many countries have also recently introduced gender quotas with the purpose of raising the percentage of women's presence on boards. The implementation of the board quota law within those countries has led to the structure of a more ESG-oriented board which improves the overall ESG scores of a company (Ginglinger & Raskopf, 2019) since female directors are more receptive to ESG initiatives. More specifically, they are more concerned about stakeholders, the environment, and social welfare while actions that may have detrimental consequences to societies are averted (Chu, H. L., Liu, N. Y., & Chiu, S. C., 2023).

Due to the advancements in the issues of board gender diversity and sustainability, the impact of board composition on ESG practices has been a subject of interest for many researchers. However, the current academic discourse on female representation on boards is mainly focused on the effect on corporate financial performance and how the board and firm characteristics can be factored in. It is noticeably less the existing literature to rely on in terms of ESG performance, even though over the last decade, it has become an increasingly crucial proxy for the firm's value and profitability. This limited knowledge is even more profound when it comes to the moderating effect of these characteristics and how they impact the baseline relationship between diverse boards and ESG performance. Hence, the following paper aims to contribute to the literature by analysing the relationship between board gender diversity and ESG performance and fill the gap in theoretical knowledge by factoring in the moderating variables of board independence, CEO duality, and CEO gender and investigating to what extent the aforementioned relation will be strengthened or weakened. All in all, the conducted research intends to underline the importance of women's contribution to the value-creation process and stronger ESG performance and to outline the most important significance of a firm adopting the ESG approach. Therefore, the main research questions of this paper are:

1) Does board gender diversity matter for ESG performance?

2) To what extent is this relationship moderated by the board characteristics of a firm?

To test the research questions, several panel regressions were conducted on a sample of S&P 1500 US firms for a 7-year period, from 2015 to 2021. The panel data used for the analysis was retrieved from WRDS and Thomson Reuter's Refinitiv Eikon. Measures on sustainability, i.e. ESG indicators are obtained from Refinitiv Eikon DataStream. Regarding board characteristics data, such as board size, board independence, director age, and tenure BoardEx database was used. Finally, data on firm characteristics are collected from CompuStat whereas for CEO gender was extracted from Execucomp. To examine the relationship between female board representation and ESG performance, as well as the interaction terms of board independence, CEO duality, and CEO gender, POOLED OLS and Fixed-Effects regressions have been performed. To reduce potential endogeneity between gender diversity and ESG score, independent and control variables have been one-year lagged. The empirical results are aligned with prior literature and, in particular, imply that greater board gender diversity improves ESG performance. Moreover, this relationship is positively moderated by board

independence, whereas CEO duality has a negative impact. The moderating effect of CEO gender is statistically insignificant.

The findings of this paper contribute to academic literature in two ways. First, it expands the existing research on the effect of board gender diversity on improving ESG performance by delving into the potential influence of factors that have not been investigated before; The impact of board independence, CEO duality and CEO gender on the baseline relationship. Secondly, it offers useful insights that can be incorporated into real-life settings to enhance the governance policy of firm entities. More specifically, policy-makers interested in defining legislative measures mandating the presence of women directors on corporate boards may be motivated to take better initiatives to ensure gender equality and board independence, despite the recent improvements. Especially, in case female representation matters to ESG performance, internal policies which will guarantee equal rights and opportunities for women, should be adopted by corporations. In addition to it, shareholders will be incentivized to appoint more females in executive positions and independent directors with no connections to the CEO or holding the position themselves to fight for their interests.

This paper is structured as follows. Chapter 2 will include a literature review that covers previous research done on board gender diversity and ESG performance. While reviewing the related literature, hypotheses with their underlying arguments will be introduced. In Chapter 3 research methodology, data collection and regression analysis will be presented. Ultimately, Chapters 4 and 5, will discuss the results of this paper, any limitations to the study, and possible considerations for future research.

2. Literature Review

In this chapter, key findings from relevant literature on the effect of board composition on ESG performance are presented and incorporated into the development of hypotheses and theoretical framework. The main framework concepts are discussed and the relationships between them are explained using pertinent organisational theories. Based on these theoretical explanations, four hypotheses are formulated aimed at generating answers to the main research questions of this study.

2.1. Board Gender Diversity and ESG Performance

Over the recent decades, the relevance of gender diversity on boards has escalated, motivating some research in this field. As a result, several papers have examined the effect of board characteristics, including the presence of females on the board, on a firm's performance. Some of the early contributions can be traced back to Roman et al(1999); Hillman et al (2001) & Doh et al(2010); Post & Byron (2015); Velte (2016) all confirming that gender diversity positively influences various aspects, such as firm performance, accounting returns, etc. In accordance with Adams & Ferreira (2009) diversity can enhance a board's independence to better perform its monitoring function. Also, Campbell & Mínguez-Vera (2008) confirm that the gender composition of the board can influence the quality of the monitoring role and thus affect the financial performance. Calabrò, Huse & Brogi (2010) argue that a firm can benefit in terms of board strategic tasks by hiring "at least three women" in executive positions as more gender-diverse boards tend to be better able to align the business with the customers' needs, stimulate creativity and innovation as well as problem-solving ability due to more diverse perspectives. Other studies have demonstrated either that there is no correlation between gender diversity in boards (Renneboog, 2008; Garcia-Castro et al, 2010) or according to Lahouel et al(2021); Campopiano et al (2019) a negative one exists due to stricter monitoring or delays in the decision-making process.

Research has also begun to investigate whether gender board diversity influences potential performance outcomes such as ESG sectors. The findings in the literature provide evidence that female directors enhance boards of directors' effectiveness (e.g., Zhang, Zhu & Ding, 2013). According to Ginglinger & Raskopf (2019), female directors have certain skills, life experiences, and social preferences that enable them to guide businesses toward more ESG-oriented policies. Boards composed of a high number of female presence, are associated with better sustainability outcomes and superior corporate reputation according to Bear, S., Rahman, N., & Post, C. (2010). Moreover, as Alexandre Di Miceli & Angela Donaggio (2018) suggested, women who own leadership positions within corporations, improve corporate governance and demonstrate higher levels of compliance with environmental, social, and governance standards. On top of that, Muhammad Nadeem et als' (2020) studied the impact of gender-diverse boards regarding the environmental behaviour of the company and found that women on boards profoundly promote environmental innovation and conscience. Brinette,

Sonmez & Tournus (2023) also showed that the shareholders of a firm value the female representation on boards as well as the presence of independent directors especially in an event of controversies. Moreover, as pointed out by Joecks, Pull & Vetter (2013) the representation of women adds value after a given percentage, i.e. 30 percent. Overall, the relationship between female board directors and sustainability performance seems to be positive and supports the argument that female directors are more likely to invest in CSR (Harjoto et al., 2014). However, despite the fact that there is a general consensus in favour of women's presence on boards, in practice, boards still remain extraordinarily homogenous (Singh & Vinnicombe, 2004; European Commission, 2010; Torchia et al., 2010; Catalyst, 2015).

In general, it can be claimed that having a more diverse board of directors, including gender as a diversity aspect, intensifies the range of viewpoints and ideas presented to the decision-making process, which in turn improves the quality of those decisions (Nguyen & Faff, 2007). However, some researchers document insignificant or contradicting results that suggest no relationship between female representation on boards and corporate sustainability performance or even a negative one between them (Dobbin and Jung, 2011). More precisely, as Randøy, Thomsen & Oxelheim (2006) suggest, board diversity and ESG efforts aggravate conflicts between majority and minority groups and as a result impede decision-making. In other words, according to their results, board diversity and ESG initiatives are not necessary for a company's success. On the contrary, engaging in high ESG activities may harm a firm's growth and profitability. In the same narrative, Sammut (2021) shows in his study that the interaction effect of ESG and board gender diversity weakens the positive effect of board diversity on firm performance. Similar findings are reported by Glass, C., & Cook, A. (2016) which demonstrates a slightly significant relationship when combining the presence of female CEOs and female directors on the board with the association between female directorship and the environmental performance of the company. In addition to that, using a sample of Spanish-listed companies and a wide range of market and accounting performance criteria, Isabel Gallego-Alvarez et al. (2009) found that companies with higher levels of gender diversity, including diversity on their boards, did not perform better than those with less diversity. There are also cases in which the conclusions addressing the association between board gender diversity and sustainability performance are contradictory. For instance, according to Jeremy Galbreath's (2011) research, the higher the number of women on boards within a firm the better

the social and economic results. Nevertheless, he was unable to establish a direct link between the gender diversity of the board and environmental effects.

Additionally, the relationship between gender-balanced boards and ESG performance can be positive but not be linear when a critical mass of women is attained (Menicucci, E., & Paolucci, G., 2022). The inconsistent results found in the literature on the relationship between diversity and sustainability performance can be attributed to variations in performance measures, methodologies, time horizons, omitted variable biases or other contextual factors. Overall, it remains unclear exactly how a company's sustainability policies and board gender diversity are related, or what factors strengthen or hinder this relationship. Further research is required to enlighten this debate.

The current literature on the effect of increased female board representation and firm sustainability performance mainly relies on agency theory, resource dependence theory, and stakeholder theory. More specifically, agency theory predicts that the presence of women directors on boards can mitigate the conflicts of interest that might arise between the shareholders and the manager of a company and therefore can improve corporate performance. More diversification among board members, especially regarding female representation, is associated with increased board independence, more ethical behaviour, more efficient monitoring, and fewer agency costs (Hillman and Dalziel, 2003). Regarding resource dependency theory, valuable resources are required for the development of the firm such as advice and counsel, legitimacy, and accessibility to channels of communication. Consequently, diversity on boards is a valuable asset as it enhances the variety of skills, experience, and knowledge that are needed for the organisation's success (Konrad, A. M., Kramer, V., & Erkut, S., 2008). Lastly, stakeholder theory, which adopts a completely different, more moral approach in comparison to other corporate governance theories, explains the relationship between board gender diversity and firm performance, including corporate sustainability performance and ESG (Birindelli et al., 2019; Fakir & Jusoh, 2020; Romano et al., 2020). Stakeholder-focused outcomes are more likely to be achieved by female directors compared to men since women tend to pursue more participative and relationship-building approaches which are essential elements for a good ESG performance.

Besides, according to previous literature, women compared to men have a deeper understanding of risks and care more about their peers (Birindelli et al., 2019). As a result, a

larger number of female directors can enhance board functioning and efficiency (Hillman, 2015) due to the inherent disparities between men and women. In particular, female directors have greater experience in human resources jobs and are characterised to show strong empathy, better communication skills, involvement, and cooperation, which lead to a positive impact on ESG performance (Veltri, Mazzotta & Rubino, 2021). Also, certain papers argue that there are differences in ethical behaviour between women and men (Dawson, 1997; Briano & Turrent 2020) while others document that women are more risk-averse (Jianakoplos & Bernasek, 1998; Sapienza, Zingales, & Maestripieri, 2009) or more independent compared to their male counterparts, leading more effectively to monitor management decisions and corporate strategies (Dang, R., et al., 2014). Lastly, as Carter et al. (2003) suggest, female directors can be considered the "ultimate directors". Therefore, we can argue that women are considered to be ESG-friendly directors and, consequently, their presence on boards will increase the ESG ratings in a corporation.

Based on the argumentation above, the first hypothesis concerning board gender diversity and ESG performance is formed as follows:

H1: Board gender diversity is associated with higher ESG performance.

2.2. Board Independence

One of the highest bodies responsible for supervision, monitoring, and decision-making within a firm is considered to be its board room since it is an established mechanism supposed to ensure negotiating and structuring of social relations (Fine, 1984) and to provide oversight of management's actions and enhance overall corporate and economic performance. In addition, the board of directors is a tool that investors perceive with increasing attention. From an agency theory perspective, boards of directors play a crucial role in monitoring corporate behaviour and can prevent senior management from engaging in an opportunistic attitude by providing them incentives to pursue appropriate stockholder goals (Stevenson, W. B., & Radin, R. F. 2009). A well-functioning board of directors serves as a managerial check and an essential source of guidance. Effective directors should not just give automatic approval or authorization to executive decisions'; instead, they should voice their disagreement when management's suggestions are not aligned with the best interests of the company's shareholders. Therefore, considering the importance of their responsibilities, it's critical to further analyse their

operational role and identify director characteristics, such as independence, gender, age, board size etc., that can influence their aptitude for sharing information with the firm and impede them from performing their monitoring services accordingly (Fracassi, C., & Tate, G., 2012).

Nowadays, a company's financial performance and sustainability performance are determined by the composition and diversity of its board of directors (Coffey and Wang, 1998; Dunn and Sainty, 2009; Hafsi and Turgut, 2013; Nekhili et al., 2019). Diversity, in terms of board diversity, impacts a corporation's long-term and short-term financial value in several ways. First, it helps executives who take crucial decisions for the firm's future to better understand the marketplace. Furthermore, as increases creativity and innovation, the problem-solving procedure is becoming more and more effective and while heterogeneity may at first cause more conflict, it ultimately results in a variety of perspectives that force decision-makers to weigh more alternatives and more thoroughly consider their consequences. Thus, diversity enhances the efficacy of corporate leadership because, in contrast to homogenous boards on the top of a company which tend to have a narrow perspective, diverse top managers take a broader view, make selections make wiser and more carefully and develop a better understanding of the complexities of the environment and more adroit decisions (Horváth, R., & Spirollari, P. 2012). As Carter, D. A., Simkins, B. J., & Simpson, W. G. (2003) advocate, board diversity, due to different gender, ethnicity, or cultural backgrounds or experiences directors may have, promotes board independence and accelerates financial performance. In other words, unconventional outside directors might be identified as the ultimate directors.

A good way to diversify the board of directors of a corporation is to include more independent or outside directors. Following Ferris and Yan's (2007) definition, an independent board member has neither financial - material links to the company nor any association with connected insiders such as f.e. family members. Calderón, R., Piñero, R., & Redín, D. M. (2020) define independence as a sincere desire to serve their roles. Board independence is a vital element for boards since it promotes the compliance of a firm with the best interests of shareholders. Besides, an independent director must balance the interests of shareholders and management with a view to generating financial profit. Similarly to what the stakeholder theory proposes, independence and diversity within the board of directors, ensure that the relationship established with the stakeholders advances favourably by encouraging transparency (Ahmed et al., 2006; Cheng and Courtenay, 2006; Shaukat et al., 2016). Furthermore, aside from

facilitating the optimization of the relationship between principals and agents, at the same time plays a significant role in building and strengthening stakeholder trust (Michelon and Parbonetti, 2012; Stuebs and Sun, 2015; Shahbaz et al., 2020).

However, the findings from the existing research regarding the association of board independence and corporate financial and sustainability performance are mixed. More precisely, Rosenstein and Wyatt (1990) report that boards composed mostly of independent directors are positively related to the value of the firm. In the same narrative, Bhagat and Black (2001) by using a sample of 934 large U.S companies over the period 1985 to 1995, also reveal that firms increase the number of their independent directors on boards when in cases of low profitability to achieve a more efficient monitoring and undertake significant structural changes to improve the firm's future prospects. Added to financial performance, highly independent boards are anticipated to be more prone to demonstrate social responsibility, while performing their supervision and audit functions (Ibrahim et al., 2003; Ahmed et al., 2006; Cheng and Courtenay, 2006; Jizi et al., 2014). On the other hand, Kumar and Sivaramakrishnan (2008) show evidence that the existence of independent directors deteriorates firm performance due to the decrease in their monitoring intensity firm experiences as they become less dependent on chief executive officers (Horváth, R., & Spirollari, P. 2012). This effect is even more profound during the financial crisis of 2008. Stevenson, W. B., & Radin, R. F. (2009) argue that the influence of human capital may vary given the board's structure. More specifically, their analysis of dual and non-dual boards exhibits that board independence has a positive impact only on dual boards. The explanation for this phenomenon is the fact that, usually, dual boards rely more on ties or cliques outside of meetings as a way of manipulating decisions.

Considering the importance of board independence and the context of the paper, another governance mechanism that should be factored in when we examine the relationship between gender board diversity and a firm's outcomes in terms of ESG scores is the presence of independent directors. As mentioned, a board's independence is recognized as essential for increasing board transparency, properly serving its supervisory role, developing well-reasoned unbiased arguments, and aligning the interests of managers with those of shareholders (Alabdullah, Ahmed, & Muneerali, 2019). Concerning the emerging issue of sustainability we could argue that ESG performance is positively related to the presence of independent directors based on prior findings. This could be the case since independent directors tend to promote

impactful ESG strategies to enhance their reputation. Furthermore, from the agency theory viewpoint, dependent members by being unwilling to vote against managerial initiatives can undermine the positive impact of female representation on a company's ESG outcomes and destroy firm value at the cost of shareholders (Field, Lowry & Mkrtchyan, 2013).

Indeed, in a theoretical and empirical aspect, research has suggested that the increased role played by independent directors is positively correlated to CSR components (Chang et al., 2012). In this regard, prior literature on the aforementioned relationship proposes that the presence of independent directors provides initiatives to firms to disclose a broader range of information demanded by stakeholders, engage more actively in CSR practices, and increase their ESG scores (e.g., Johnson and Greening 1999; Harjoto and Jo, 2011; Jizi, M. I., Salama, A., Dixon, R., & Stratling, R., 2014; Husted & de Sousa-Filho, 2019; Endrikat et al, 2021). Another study by Gungor N., & Şeker Y. (2022) reveals a positive and significant relationship between board independence and ESG and governance performance. Htay et al. (2012) found a similar correlation, this time with environmental aspects of CSR. Moreover, in a survey of 307 board members, Ibrahim et al. (2003) discovered that independent directors exhibit greater concern about sustainability performance while Webb's (2004) findings indicate that CSR is connected with independent and women directors. Chang, Y. K., Oh, W. Y., Park, J. H., & Jang, M. G. (2017) examined the impact of independent directors on boards on ESG scores for publicly traded Korean firms and found unprecedented curvilinear relationships between CSR and board independence. Therefore, we can conclude that the percentage of independent directors on the board level has an observable impact on corporate sustainability performance and should be included in our paper.

Quite a few researchers have also investigated how board independence as the moderating effect can alter the positive relationship between board gender diversity and the ESG performance of a firm. For instance, Jizi, M. I., Salama, A., Dixon, R., & Stratling, R. (2014) examined the potential influence of the integration of CSR corporate practices on financial performance in European ESG firms, using the moderating role of board characteristics such as independence. The reached empirical results demonstrate that the presence of independent directors amplifies the positive relationship between SCR and financial performance. Towards the same direction, Al Amosh, H., & Khatib, S. F. (2022) provide evidence that independent board members have a significant impact on ownership

structure and ESG disclosure. Furthermore, they state that board independence limits the negative effect and opportunism of the block holders in terms of sustainability reporting. More recent research shows that board independence contributes to the mitigation of the negative effects of ESG controversies on firm value due to the fact that is favourably perceived by shareholders.

Taking into account the aforementioned discussion, board independence is supposed to play a moderating role in the baseline relationship. Therefore, we assume that the positive effect of the increased presence of women on boards on ESG outcomes is even stronger with high board independence. Hence, the following second hypothesis was formulated:

H2: Board Independence positively moderates the relationship between board gender diversity and ESG performance.

2.3. CEO Duality

The success of a corporation is based, to a great extent, on the effective functioning of the board of directors, which is in charge of authorizing and overseeing the governance system and corporate culture. Their duties entail the assurance of the implementation of strategic objectives which are vital for the company's progress (Birindelli et al., 2018; García-Sánchez et al., 2018; Gungor, N., & Şeker, Y. 2022). Due to their importance, it is necessary to factor into our analysis more of the board characteristics and investigate how they could potentially impact the firm's value. Except for board independence, another key institutional factor affecting the functionality of the boards and the corporate governance choices is the leadership structure or CEO duality, which under Mallin ve Michelon's (2011) definition, emerges when the roles of chairperson and CEO are simultaneously held by the same individual. Hence, CEO-chair duality is one of the topics of corporate governance research that has received the most attention and is of continuing interest to institutional investors and shareholder activists (Dalton & Dalton, 2011; Dalton Endrikat et al. 2123 et al., 1998).

There is no doubt that the composition of the boards of directors and the choice of CEO or board chairperson leadership structure is an important decision to be made that can determine the profitability of a firm. When the roles of CEO and chairman of the birds are combined, decision-making and control power are under the authority of one person which means that the same individual holds a remarkable power to govern both the board and the management

(Rossi, et al., 2021). However, the lack of separation between the decision and the control system may undermine the overall accountability of a corporation, ignite a conflict of interest between the shareholders and the management and jeopardize the board's independence (Fama and Jensen, 1983; Haniffa and Cooke 2002). Thus, corporate governance best practices discourage CEO duality within boards as it decreases the efficiency of audit and overall governance functions of firms, rises their costs, does not account for the greater interests of stakeholders and negatively influences their financial and sustainability performance (Naciti, 2019). Besides, from a CSR viewpoint, the governance position of the board over sustainable practices is also affected by the duality as Lattemann et al. (2009) propose.

Different theoretical concepts have been established either to support or to criticise CEO duality. On the one hand, the agency theory suggests that CEO duality eliminates the monitoring role of the board of directors over the executive manager undermining the overall accountability and legitimacy of the firm. Another issue could be the possibility of CEOs engaging in "empire building" and taking advantage of the firm's cash flows by investing them in negative NPV projects which will destroy shareholder value only to boost their own reputation in the labour market (e.g. Jensen & Meckling, 1976; Levy, 1981; Hemingway & Maclagan, 2004; Almashhadani et al., 2022). On the other hand, stewardship theory argues that CEO duality establishes strong leadership ability which can lead to better firm performance by improving the communication of firm-specific information, and making better and faster decisions (Stoeberl & Sherony, 1985; Anderson & Anthony, 1986; Donaldson & Davis, 1991; Muth & Donaldson, 1998; Bich & Thai, 2019). In a similar vein, Pham, D., & Pham, Q. (2020) through their analysis provide evidence that the separation of the roles of chairperson and CEO positively affects firm performance in the growth stage of the life cycle. The opposite impact on firm value is noticed during the maturing stage of the life cycle.

So far, scientific findings provide no consensus as to whether firms with split titles (CEO and chairman of the board) outperform firms with combined titles. As a result, whether combining or separating leadership is beneficial to the firm remains an empirical question. Overall, the results can be categorized into three groups; the ones which show that there is a positive association between CEO duality and financial outcomes, those that indicate no relation between them and finally the ones which find a negative effect. For example, Duru, A., Iyengar, R. J., & Zampelli, E. M. (2016) repost convincing evidence that the financial

performance of a firm is negatively influenced by a joint leadership structure, i.e., CEO duality. Accordingly, more studies (e.g. Rechner and Dalton, 1991; MacAvoy & Millstein, 2003; Lam and Lee, 2008; Ehikioya, 2009; Monks, R. A., & Minow, N., 2011; Ujunwa, 2013; Dogan M et al., 2013; Lin et al., 2021; Hsu S., et al., 2021) reveal that duality leads to inferior shareholder value since the dual structure compromises the ability of the board to independently monitor the CEO. These findings are aligned with agency theory which suggests that duality leads to poor firm performance through managerial entrenchment, lack of control and conflicts of interest between the management and the shareholders of the firm.

Nevertheless, the proponents of CEO duality (e.g. Donaldson; Daviset al., 1997; Lin, 2005; Peng et al., 2007; Ramdani, D., & Witteloostuijn, A., 2010; Hajes and Anis, 2018) document that in cases when the executive manager has the full authority over his corporation by also serving as the chairman has a statistically significant positive impact on corporate performance due to less disagreement is likely to arise. A large part of the literature shows that the board leadership structure has no direct impact on corporate performance meaning that it does not exist an optimal leadership structure since both duality and separation options have associated costs and benefits (e.g. Chagantiet al.,1985; Rechner and Dalton, 1989; Brickleyet al., 1997; Abdullah, 2004; Chen et al., 2005; Bukair and Rahman, 2015). Taking that into account, duality may lead to value-creation for some businesses and harm others by destroying value (Boyd, 1995). As Elsayed, K. (2007) proposes, "the relationship between CEO duality and corporate performance should not be viewed as a monotonic one". Indeed, his research reveals evidence that CEO duality has no impact on corporate performance. However, when includes CEO duality as an interaction term in his model, the impact of CEO duality varies across different industries resulting in contradictory conclusions.

Regarding the effect of a dual leadership structure on ESG performance, several empirical studies have documented a negative correlation between those two variables (Muttakin et al. 2015; Sundarasen et al. 2016; Gungor N., & Şeker Y, 2022). On top of that, according to Lagasio, V., & Cucari, N. (2019), CEO duality does not enhance the level of ESG disclosure. Likewise, the paper by Lassoued N. & Khanchel I., (2023) examines how the CEO personality traits, like CEO narcissism, are related to CRS disclosure and to what extent it can be moderated by CEO duality. The results of their analysis demonstrate that the relationships between CEO narcissism and aggregated ESG disclosure, social and corporate governance

disclosure separately are strengthened by CEO duality. Moreover, Romano et al. (2020) examined in a sample of Italian non-financial listed companies how CEO duality impacts the positive relationship between greater board gender diversity and ESG performance. Their findings again indicate a significant result that CEO duality by itself negatively moderates this positive relationship.

In general, previous empirical studies used straightforward models that only examine direct relationships between board gender diversity and sustainability performance, ignoring potential intermediate mechanisms. However, as sustainability is growing in importance and popularity on a global scale, several studies have been performed to investigate the links between board characteristics and ESG considerations in various institutional settings factoring in different aspects and using more complicated models. Again, there is still limited knowledge on whether different board structure contexts determine the focal relationships. Therefore, we examine the CEO duality by including it as a moderating effect on our analysis and argue that it would weaken the board gender diversity-sustainability performance baseline relationship since influences the way that boards' decisions are made in terms of CRS initiatives. Accordingly, the third hypothesis is formed as follows:

H3: CEO duality negatively moderates the relationship between gender diversity and ESG performance.

2.4. CEO Gender

In light of the growing popularity of environmental, social, and governance (ESG) initiatives throughout the world, it is critical to delve into other governance mechanisms that can have an impact on the relationship between board gender diversity and company performance. For example, the gender of the CEO itself can have a significant effect on firm performance. Gender diversity in management is increasingly seen as a key value driver since talented women executives add significant value to firms by accelerating board decision-making and improving sustainable performance. In contrast with males, female CEOs develop stronger relationships with their employees. As Hofstede (1998) argues "Men are achievement-oriented while women are relation oriented". Indeed, Cristian L. Dezso & David Gaddis Ross (2012) point out that placing women in managerial positions enhances managerial task

performance and serves as a source of inspiration in lower positions within the firm to take more initiative and outperform. They also find that these effects are even more profound in innovative corporations. Similarly, Tiago Cruz Gonçalves, Cristina Gaio and Micaela Rodrigues (2022) conclude that female leaders create firm value and prove that the most profitable corporations are located in countries where women are encouraged by law countries where women hold managerial positions.

According to upper echelons theory (UET), executives' characteristics, values and experiences form their perceptions, decisions, actions and risk development strategies in a way that ultimately affects the overall firm performance (e.g., Hodgkinson & Sparrow, 2002; Wang, Holmes, Oh, & Zhu, 2016; Neely Jr, et al., 2020). Additionally, according to the same hypothesis, leaders from various backgrounds can enrich the company with fresh viewpoints that result in more creative plans, innovative investments and results-driven strategies. Consequently, more and more women are stepping towards leadership positions, especially in countries where women are constitutionally favoured and encouraged by the state. Their contribution help corporations to achieve a better overall performance and, therefore, by the possibility of having more female CEOs placements, the impact of board gender diversity on ESG ratings is enhanced is getting even more profound.

As prior literature supports, female directors are more corporate social responsibility orientated, in contrast to male executives who are more focused on the economic performance of a company (Ibrahim & Angelidis, 1994). Furthermore, regarding Khan & Vieito's (2013) study, they demonstrate that female executives tend to engage in sustainable investments to a greater extent compared to male CEOs, resulting this way in higher ESG ratings while the degree of risk level is noticeably lower. In the same narrative, Richard B., Joel F. Houston & Andy N. (2014) by investigating whether CEOs' personal traits, such as gender, age, tenure, ownership etc, influence ESG initiatives, report that female executives increase investment activity in terms of social responsible investments (Mikko H. Manner, 2010). In fact, according to Mi-Hee Lim Jee & Yong Chung (2020), female executives are more involved in CSR activities, not only due to the different values and backgrounds they possess but also because of the need for external support. In addition to that, they have also revealed evidence the beneficial effect of having females in management positions is weakened when directors' influence is rather strong.

Apart from return and risk, nowadays firms should factor in impact as a third dimension accordingly making ESG aspects an integral part of the strategic decisions of an organisation. Towards the same direction, Sila et al. (2016) prove that female board members are more effective in making strategic decisions compared to their male counterparts. In fact, women executives put more emphasis on achieving environmental and social sustainability goals to get further access to financial resources and receive essential support from the blackholders (Branco and Rodrigues, 2006; Haque and Ntim, 2018). The difference in leadership styles between the two genders can explain why more women in management lead to boards which are more receptive to CSR initiatives (Bear et al., 2010). More specifically, women exhibit a more participative, democratic leadership style as opposed to men's authoritarian and task-oriented leadership style, making gender-diverse boards more likely to engage in information-sharing and decision-making (Li et al., 2017). Hence, the female characteristics above-mentioned promote the overall variety of viewpoints and enable diverse perspectives on the significance of sustainability goals, which helps boards better meet the needs of all stakeholders (Nielsen & Huse, 2010).

Empirical evidence remains somewhat inconclusive though. More precisely, Aabo, T., & Giorici, I. C. (2022) report that the impact of CEO gender on the firm's sustainability outcomes varies depending on the database used in the research measure sustainability indicators since they found both positive results regarding the correlation between female CEOs and ESG performance in some cases and non-significant ones in other cases. The effect of the CEO's gender was proved to be insignificant by further researchers again (Glass et al., 2016; Fizzah Malik et al., 2020) implying that no link can be claimed to exist between CEO gender and non-financial outcomes. There are also several analyses which examine again CEO characteristics with a different approach. More specifically, these studies investigate the potential moderating role of women leaders on the baseline relationship. For instance, Birindelli, G., Iannuzzi, A. P., & Savioli, M. (2019) indicate that, in the context of critical mass theory, CEO females intensify the board gender diversity-environmental performance association. Moreover, based on Chu, H. L., Liu, N. Y., & Chiu, S. C. (2023) paper, in which they study the effect of CEO characteristics as a moderator, confirm that the appointment of female CEOs alleviates the negative effect of powerful CEOs on CSR initiatives.

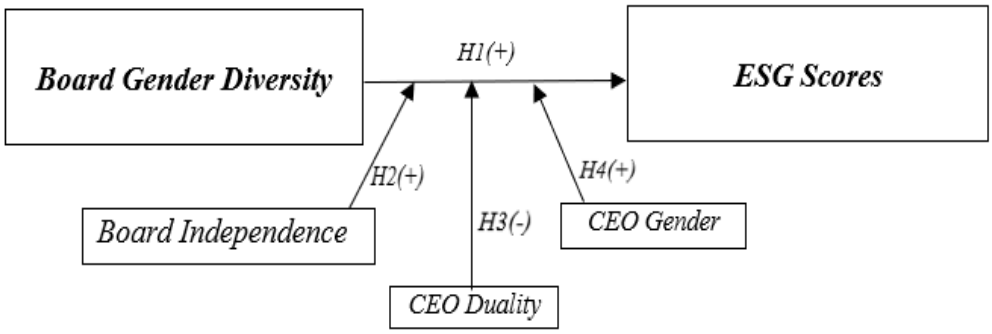
Based on the existing findings in the literature we can conclude that CEO gender serves as a key moderating factor in the relationship between board gender diversity and ESG performance within a company. Thus, the fourth hypothesis was formulated as follows:

H4: Female CEOs will positively moderate the relationship between board gender diversity and ESG performance.

2.5. Conceptual framework

The formulation of the hypotheses above has laid the basis for the data analysis by providing a conceptual framework to be tested in this paper. Figure 1 illustrates the conceptual model of the relationship between board gender diversity and sustainability performance.

Figure 1. Conceptual Framework



3. Methodology and Data

To answer the research questions and provide unbiased results, following the appropriate research methodology is necessary. Hence, this chapter presents the research design applied to test the hypotheses. First, a description of the research sample, data sources and variables (dependent, independent, control and interaction terms) is provided. After that, the econometric estimator used will be introduced, and lastly, the regression models for each hypothesis will be discussed and analysed.

3.1 Data Analysis

3.1.1 Sample and Data Collection

The sample of this paper consists of S&P 1500 firms across the US, whereby the data from December 2015 until December 2021 is included to base the results on the newest and most accurate information. The S&P 1500 Index, is a stock market index of US stocks which includes all stocks in the S&P 500, S&P 400, and S&P 600 and incorporates firms from the large-cap, mid-cap, and small-cap segments covering this way approximately 90% of the market capitalization of U.S. stocks. In regards to the timeframe, due to the insufficient data from ESG-rating providers, the analysis could not have been performed prior to 2015, and therefore years from 2015 onwards were considered for the assessment of the four hypotheses stated in the paper. The lack of widespread adoption or standardisation of ESG reporting and disclosure in the earlier years might be a potential explanation. In general, a model's parameters can be estimated more precisely by a more extended period of observation (Ballinger, 2004).

To analyse the relationship between board gender diversity and sustainability performance, four different databases were used. More specifically, data on sustainability performance, measured by firms' public ESG ratings, were collected from the Refinitiv Eikon database. Regarding its ESG data, Eikon provides accurate ESG information for over 3400 publicly listed companies covering major indices, such as the S&P 1500, NASDAQ100, MSCI World etc. Data on board composition is available in BoardEx and ExecuComp which are both accessible via Warton Research Data Service (WRDS). BoardEx was used to obtain information on board characteristics such as age, tenure, duality, size, independence etc, while through the Execucomp database, which is part of the Compustat database, data on individual characteristics of CEOs (e.g. CEO gender) were derived. Financial performance measures were retrieved from Compustat North America Fundamentals Annually and used to build the appropriate control variables for our model. Again, Compustat is available through Warton Research Data Service (WRDS) which serves as a data research platform for international institutions in 37 countries. Once all data from the four different datasets were gathered, the next step was to merge the separate datasets with unique identifiers and structure them as panel data, meaning that firm-level data is observed over multiple periods. In this case, ISIN and the particular year were used to combine all the data and form the final dataset which contains information for each of the variables. Afterwards, STATA software was used for additional

data analysis. Finally, after merging (1:1) all datasets, cleaning missing values and dropping duplicates, the sample size ended up containing 6,499 observations from 1,237 different companies all listed in S&P 1500 index from 2015 to 2021 (7 waves).

3.2 Measurement of variables

3.2.1 Dependent Variable

As thoroughly discussed, this paper aims to analyse the potential effects of board gender diversity on sustainability performance. Thus, yearly ESG ratings are taken as a proxy for the corporate sustainability performance of a firm. ESG performance is an aggregated score of a company's performance in multiple environmental, social and governance categories provided by a couple of ESG rating agencies that are specialised in evaluating companies based on their non-financial performance. However, there is an inconsistency among the different rating agencies which could be considered as a limitation. Despite these inconsistencies and disagreements, ESG scores are still considered to be one of the most extensive and reliable ways to quantify sustainability performance.

The ESG data for this analysis were collected from Thomson Reuter's Refinitiv Eikon database. Refinitiv extracts ESG information from numerous data sources, including annual reports or company websites, and based it on various models and approaches. Corporations receive an overall ESG score ranging from 0 (poor ESG performance) to 100 (excellent ESG performance) based on their performance in each one of the three dimensions. The composition of the Eikon ESG score with indicators, categories and the assigned weight of each category is presented in Table 1.

Table 1. Composition of the Eikon ESG score (Refinitiv, 2022)

Pillars	***Categories***	***Weights (%)***
Environmental	Emission	12
	Innovation	11
	Resource use	11
	Community	8

Social	Human Rights	4.5
	Product Responsibility	7
	Workforce	16
Governance	CRS strategy	4.5
	Management	19
	Shareholders	7

3.2.2 Independent Variable

The independent, or explanatory, variable used in the analysis was overall board gender diversity [BGD] which refers to the proportion of female directors on boards and has been carefully selected based on evidence in the existing literature. According to prior literature, the percentage of female representation in the board room has a quiet, positive, explanatory power on ESG performance (Velte, P., 2016; Manita, R. et al., 2018; Romano, M., Cirillo, A., Favino, C., & Netti, A., 2020; Khatri, I., 2023). A standard measure of diversity is gender diversity is computed by dividing the number of female directors by the total number of directors in a specific year.

All data collected for board gender diversity measure originate from Thomson Reuter's Refinitiv Eikon database. When the female presence ratio is close to 0 indicates a male-only board. In case the ratio equals 0.5, boards exhibit an equal percentage of both genders. Therefore, the higher the ratio, the more diversity there is on a board.

3.2.3 Moderating Terms

The impact of the independent on the dependent variable can be strengthened or weakened by a third variable, the moderating term. In other words, moderating terms allow us to examine whether the relationship between the dependent and the explanatory variable changes depending on the value of another independent variable. In the case of this study, since the aim is to explore whether board characteristics influence the relationship between board diversity and firm performance, three moderating variables were included in the regression model.

First, is the percentage of independent directors [IB] that have seats in boards (0-100%). A higher (lower) percentage of independent board members is anticipated to strengthen (weaken) the positive relationship between the independent and the dependent variable. Previous research on the interaction of board independence suggests that it is positively associated with sustainability initiatives taken by firms and boosts ESG scores (Jizi, M. I., et al., 2014; Al Amosh, H., & Khatib, S. F., 2022). Hence, it was hypothesised that the board independence moderator enhances the baseline relationship investigated.

Second, this analysis adopted CEO duality [DUAL] as a moderating term. A dummy variable was created that takes 1 when there is CEO duality on boards and 0 when there is a separation of duties between the CEO and chairman of the board. Indeed, based on existing findings, the existence of duality can have an impact on ESG performance by decreasing board effectiveness in monitoring CEO actions leading to a poorer ESG rating (Muttakin et al. 2015; Sundarasen et al. 2016; Lagasio, V., et al., 2019; Gungor N., & Şeker Y, 2022). Besides, the lack of audit efficiency, accountability and overall governance functions within firms caused CEO duality weakens the positive correlation between board gender diversity and ESG initiatives (Romano et al., 2020).

Third, the moderating effect of female CEO gender [FEMALE] on the baseline relationship was also investigated. The indicator variable of CEO gender was generated and equals 1 when the gender of the CEO is female and 0 otherwise. Women are considered to be interpersonally experienced, respectful and embrace changes. According to Hambrick & Mason (1984), executives' actions are based on their individual experiences, values, personalities and other related human factors and therefore we can assume that female managers pay more attention to CSR issues which ultimately affects the overall corporate sustainability performance and should be taken into account. Our argumentation states that in cases when the CEO of a firm is female, the relationship between board gender diversity and ESG performance is expected to be strengthened.

The percentage of independent board members and CEO duality were directly extracted from Datastream while the CEO gender indicator was obtained via Execucomp. It is important to note that the moderating variables will also be added to the regression models as control variables.

3.2.4 Control Variables

Control variables are added to the regressions due to their impact on the main independent variable and the dependent variable, hence, the likelihood of suffering from endogeneity in the form of omitted variable bias is reduced. These variables can be classified into two categories: the board and CEO characteristics and the ones related to financial performance. BoardEx, Execucomp and Refinitiv Eikon databases were used to extract data on the first group of variables, while the Compustat database was used for the second group.

Regarding board-level control variables, a set of individual-level control variables for proxies for directors' human capital on average board tenure [BoardTenure] and the standard deviation of the age of the company board members [BoardAge] are included. As for directors' age, which was also controlled, Byoung et al., (2009) & Sun et al., 2017 indicate that older directors are less effective monitors, which can result in weaker governance and lower ESG scores. Experience on boards matters as well since ESG activities for example can benefit from the specific expertise of board directors and affect the company's outcomes (Dass et al., 2014). Finally, to account for the potential impacts of board characteristics, we include board-level control variables such as board size [BoardSize], board independence, CEO duality and CEO gender. More specifically, the number of board members could positively influence ESG performance since larger boards are more likely to be diverse, to have expertise on certain CSR issues, and distribute work more efficiently increasing this way the quality of financial and non-financial performance (Carter et al., 2010; Cabeza-García et al., 2018; Gungor N., & Şeker Y., 2022). Also, the presence of independent directors positively influences engagement in ESG initiatives as suggested by several researchers (Jo & Harjoto, 2011; Chen et al., 2019). Independence impacts a firm's success and thus was recognised by including it as a control variable. CEO duality is related to the monitoring process meaning that the efficiency of monitoring may suffer when a company doubles as chairman, which in turn affects the regression analysis's findings and therefore was controlled (Hemingway & Maclagan, 2004). Lastly, CEO gender was included as a sixth board-level control variable to measure the impact of female board representation on a firm's ESG ratings since prior findings suggest that female executives can promote sustainability outcomes of a firm by being more inclined to CRS practices (Bear et al., 2010)

Firm-level variables should also be controlled to enhance internal validity as those variables could impact the dependent variables. First of all, a firm's size [FirmSize] influences ESG engagement since bigger firms can access more resources, expand their operations and subsequently get involved in CSR initiatives leading to better ESG performance. Therefore, firm size was incorporated into the empirical model as a controlling variable. With regards to the market value of equity, it is shown that firms which exhibit a higher market value usually receive better ESG ratings as well from a shareholder's perspective (Yaseen et al., 2019). The impact on sustainability outcomes allows us to control for this variable too. The next variables added to the empirical model as control variables in corporate sustainability performance studies are Tobin's Q [Tobins_Q] which has been determined as a market-based financial performance indicator and return on assets [ROA] as an accounting-based one. Managers of companies with solid financial outcomes possess extra funds available to use to actively cope with ESG standards to satisfy stakeholders and accomplish managerial goals. As a result, financial performance must be considered (Lim et al. 2007). Lastly, a firm's debt [LeverageRatio] and cash flows [CF] are associated with ESG performance. More specifically, Campbell, K. et al., (2008), Li, H., & Chen, P. (2018) & Bhatia, S. et al. (2022) demonstrate that highly leveraged firms score lower in environmental, social and governance dimensions because of the need to distribute a large proportion of the cash generated to the payments of debts. Consequently, their financial ability to support ESG initiatives might be weakened whereas, in contrast, the existence of cash flows can encourage investing in sustainability projects (Simionescu, L. N., Gherghina, Ş. C., Tawil, H., & Sheikha, Z.. 2021)

The variables, the type of variables, labels and their measurements are presented in Table 2.

Table 2. Variable Overview

Variable	*Description*	*Label*	*Source*
Dependent Variable			
ESG scores	Measured as a total score and on the three different pillars the ESG ratings are built upon environment, social and governance.	ESG	Refinitiv Datastream
Independent Variable			
Board Gender Diversity	The ratio of female board members to total board members.	BGD	BoardEx
Control Variables			
Board Size	Natural logarithm of the number of members on the board.	BoardSize	BoardEx
Tenure	Average tenure of the board members.	Tenure	BoardEx
Age	The standard deviation of the age of the board members.	Age	BoardEx
Firm Size	The logarithm of the total assets of the firm.	FirmSize	Compustat
Firm Value	Number of shares outstanding multiplied by the stock price	FirmValue	Compustat
Leverage Ratio	Total liabilities over total assets	Leverage	Compustat
Cash Flows	Net cash flow from operating activities divided by total assets.	CF	Compustat
Return on Assets (ROA)	Annual net income after tax divided by the book value of assets at the end of the year.	ROA	Compustat
Tobin's Q	Market value of equity and the book value of debt divided by total assets.	Tobin'sQ	Compustat
Moderating Variables			
Board Independence	The ratio of independent board members to total board members.	BGD*IB	BoardEx
CEO duality	Dummy variable. A firm with a CEO serving as chairman of the board score 1, otherwise 0.	BGD*DUAL	BoardEx
CEO gender	Dummy variable. Equals 1 if the CEO is female and 0 otherwise.	BGD*FEMALE	Execucomp

3.3 Research Design

To assess the impact of board gender diversity on corporate sustainability performance, a quantitative analysis was performed on panel data using a Pooled Ordinary Least Squares (POOLED OLS) estimator and Fixed Effects estimator. Hence, the data used for the study

allows the examination of the relationship of interest for multiple firms over several years. Moreover, by implementing fixed effects estimators, any present unobservable heterogeneity correlated with the independent variables among firms was erased. Besides, when the sample size is big, the statistical power is becoming higher and the overall efficiency of the model is increased. Lastly, regarding the structure of our panel data, the final dataset is presented to be unbalanced meaning that there is not the same number of observations available for each company in every year. Any attempt to balance the dataset could lead to the elimination of many observations threatening the accuracy of the results. However, it can still be considered a limitation of the analysis applied.

Before the interpretation of the results and intend to test whether the estimations are unbiased and efficient or not, the model requires fulfilling several assumptions. Those assumptions, concerning the results' unbiasedness or the efficiency of the estimation model, were tested before performing the regression analyses. Also, due to OLS sensitivity to outliers, several variables are previously winsorized in this study before moving to data analysis.

3.3.1 Linearity

One of the most important assumptions is the linearity of parameters between the dependent and the independent variables. Meeting the assumption of linearity means that there are no interactions between the explanatory variables. The likelihood of non-linear models is increased in multiple linear regressions because the dependent variables must have a linear relationship with each of the explanatory variables. To test whether a linear relationship exists between the two variables, a scatterplot of the dependent variable vs the independent variable can be used. Therefore, scatterplots were made for each correlation between the dependent variables and explanatory variables. These scatterplots demonstrated reasonable linearity in the plotted relationships.

3.3.2 Multicollinearity

The existence of high collinearity between explanatory factors causes multicollinearity issues which makes it difficult to determine the individual effect of each independent variable on the dependent variable in the regression analysis. In our case, the possibility of multicollinearity was assessed by using Pearson’s correlation (table 4). In general, an absolute correlation coefficient of >0.8 among two or more predictors indicates the presence of

multicollinearity. None of the correlation coefficients exceeded the 0.8 threshold. A second test for multicollinearity issues focused on the variance inflation factors (VIF) for all explanatory variables. To ensure that multicollinearity does not cloud the interpretability of regression results, VIF values should not exceed >3. As we see in the table below, there were no explanatory factors with VIF values greater than 3. As a result, since multicollinearity problems could not be detected by either approach, it was concluded that the assumption of multicollinearity is supported and therefore we can perform an adequate regression analysis.

Table 3. VIF values of explanatory variables

Variable	***VIF values***
Board Size	1.34
Board Age	1.09
Board Tenure	1.09
Firm Size	1.56
Tobin's Q	1.34
Firm Value	2.67
FCF	2.37
Leverage Ratio	1.38
ROA	2.5

3.3.3 Homoscedasticity

The assumption of homoscedasticity is central to linear regression models and subsequently to our model. Homoscedasticity occurs when error terms are the same across all values of the independent variables. When this assumption is violated, the residuals change and are not constant for all observations which leads to heteroscedasticity. This phenomenon can impact the accuracy of the interpretation of the regression analysis results. To investigate whether the assumption of homoscedasticity is violated, a Breusch-Pegan test was performed. The results of applying the Breusch-Pagan test are the following: Probability > F = 0.0015, F-statistic = 5.34 which indicates that at a 1% significance level, the null hypothesis that heteroskedasticity is present, is rejected. There are many ways to account for violations of the homoscedasticity assumption, but one popular method to ensure unbiased standard errors is by using robust standard errors in the regression models.

3.3.4 Random Sampling

The fourth assumption of random sampling indicates that the observed data used for the analysis should represent a random sample from the population. Hence, the sample should be randomly extracted from the population of all firms, be independent of each other and be representative to ensure the accuracy of the results. The S&P 1500 index, which is used in this case, is a market capitalization-weighted index, meaning that firms are selected based on their market capitalization. Moreover, the S&P 1500 index covers over 90% of the U.S. equity market and given that U.S. companies also accounted for over 50% of the market capitalization in most global industries we can argue that S&P 1500 firms consist of a representative sample of the overall U.S. economy. In other words, it includes a wide variety of industries and sizes of companies, which makes it a good representation of the overall U.S. economy.

3.3.5 Normality

The fifth assumption is the normality assumption. The normality assumption means that the collected data follows a normal distribution, which is essential for linear regression models. We visualised the data into graphs such as frequency distributions to examine whether the data has been sampled from a normal distribution. Graphs are a powerful means of assessing data distribution and are widely used. Plotting the data into a histogram seems to be a bell-shaped curve (see Appendix A). As a result, we can argue that our data is most likely sampled from a normal distribution and due to the size of our dataset, this can be easily observed.

3.3.6 Zero Conditional Mean

One of the major issues in assessing the relationship between board gender diversity and sustainability firm performance is that the results are unbiased. This assumption cannot hold for 2 main reasons and can lead to a misinterpretation of the results. The first is due to an incorrect functional form of the model. To solve this issue, an extensive review of existing literature and previous models has been done and applied in this thesis. The second reason is related to endogeneity caused by omitted variable, reverse causality, and collider bias. Concerns about the omitted variable bias mean there are variables influencing the regression model which are not being taken into consideration. To mitigate the issue of omitted variables bias, variables and estimators used in existing literature was analysed, and therefore was used in this study. As a result, a fixed effects estimator was employed in the analysis to account for

the presence of time-invariant, cross-sectional omitted variables. A Hausman test was conducted to choose between the fixed effect model and the random effect model the most appropriate model. The results indicated that we need to carry a fixed-effect model and, hence, time, firm and industry fixed-effect models were applied in the regressions. By including year fixed effects we account for time-varying factors which are common to all the firms in the sample while firm fixed-effects allow us to detect heterogeneity among firms by controlling for unobservable factors that vary across firms in the panel but do not change over time. Furthermore, according to Griffin & Mahon (1997), industry characteristics can have a substantial impact on overall corporate sustainability performance and should be included in our analysis. Industry-fixed effects help to avoid any common trend in the variables between industries so the use of them enhances the coefficients. The second concern that ignites the endogeneity issues is the adverse causality problem. This problem arises when it is unclear whether having more women on boards results in better firm performance or vice versa. To address the issue of reverse causality all variables are one year lagged. Moreover, adding lagged variables to our model minimizes the omitted variable bias and autocorrelation issues. Finally, the third concern in the collider bias, which can be found when some of the variables included in the model can opened the door to other endogeneity problems. As explained before, to solve this issue, an extensive review of existing literature and previous models has been done and applied in this thesis to control for every endogeneity issue.

Based on the explanations above, the empirical models to test the outcomes of female directorship on ESG performance are defined as follows:

- To test the first hypothesis:

$$ESGit = \alpha + \beta 1 * BGDi,t-1 + \theta * CONTROLSi,t-1 + \varepsilon it$$

$ESGit$= The environmental, social, and corporate governance ratings of the firm.

$BGDi,t-1$ = the gender ratio in the board of directors at a firm-year level.

Board Independence, CEO duality, and CEO gender act as moderators for hypotheses 2,3 & 4 respectively.

- To test the second hypothesis:

$$ESGit = \alpha + \beta 1 * BGDi,t-1 + \beta 2 * IBi,t + \beta 3 * BGDi,t-1 * IBi,t + \theta * CONTROLSi,t-1 + \varepsilon it$$

$IBi,t-1$= an indicator variable that shows the proportion of independent directors over the total number of board members.

$BGDi,t-1 * IBi,t$ = an interaction term that indicates the moderating effect that the board independence has on the dependent variable

- To test the third hypothesis:

$$ESGit = \alpha + \beta 1 * BGDi,t-1 + \beta 2 * DUALi,t + \beta 3 * BGDi,t-1 * DUALi,t + \theta * CONTROLSi,t-1 + \varepsilon it$$

$DUALi,t-1$= an indicator variable that equals 0 when there is role separation between a chairman of the board of directors and the CEO of the firm, and contrarily, equal to 1 when the same individual serves both positions.

$BGDi,t-1 * DUALi,t$ = an interaction term that indicates the moderating effect that CEO duality has on the dependent variable.

- To test the fourth hypothesis:

$$ESGit = \alpha + \beta 1 * BGDi,t-1 + \beta 2 * FEMALEi,t + \beta 3 * BGDi,t-1 * FEMALEi,t + \theta * CONTROLSi,t-1 + \varepsilon it$$

$FEMALEi,t-1$= an indicator variable that equals 1 if the CEO is female and 0 otherwise.

$BGDi,t-1 * FEMALEi,t$ = an interaction term that indicates the moderating effect that CEO gender has on the dependent variable.

Where i stands for the firm; t represents the year; β is the parameter; ε denotes the disturbance. The vector $CONTROLSi,t-1$ represents all the control variables described in section 3.2.4.

4. Results and Discussion

In this chapter, the descriptive statistics and the Pearson correlation matrix coefficients for ESG performance and diversity measures together with the controlling variables, respectively. Thereafter, the results for each hypothesis will be adequately interpreted, analysed and discussed.

4.1 Correlation Matrix and Descriptive Statistics

4.1 Descriptive Statistics and Correlation Matrix

Table 4 displays a summary of the descriptive statistics of the final dataset generated after removing the missing values and winsorizing extreme observations at 1% and 99% for S&P 1500 firms from 2015 to 2021. After the treatment was applied, the sample decreased from 1500 to 1237 U.S firms. ESG scores range between a minimum of 0 and a maximum of 100, where high ESG scores lead to better ESG performance. In our case, the sample's average ESG score of 47.2 and a median of 45.66 demonstrated an acceptable ESG performance even though the standard deviation of 19.07 indicated a considerable variance. The minimum ESG score rated is 1.3 while the highest-scoring company rated 94.7 on ESG performance. Regarding the board gender diversity, the mean is equal to 21.91 with a standard deviation of 11.19 which suggests that boards in the sample are lowly diversified. The maximum ratio is equal to 50 per cent while the minimum is 0 meaning that there are boards where no female directors are present. When analysing the board-level variables, an average rate of 82.17 for board independence with a variance of 10.35 was found revealing high autonomy within boards. Besides, interestingly, the maximum percentage of independent directors is 100, which shows that there are companies whose board members are all independent. Moreover, approximately 10 directors per board on average was proposed with an average board tenure of 9 and a mean standard deviation of age equal to 7.32. The mean and standard deviation of CEO duality, calculated as a dummy variable where CEO duality=1 and non-duality=0, are both close to 0.5, 0.59 and 0.49 respectively. This indicates that approximately half of the CEOs are performing dual roles as CEO and chairman of the board.

Statistics of financial control variables at the firm level are also provided in Table 4 recommending an average size of $8.38 million, measured as the natural log of total assets.

Regarding the profitability indicators, Tobin's Q and ROA, the mean for Tobin's Q was found to be 2.36 and 0.489 for ROA implying that firms in our sample are quite profitable. Furthermore, as is obvious from the mean and median of the leverage ratio, the sampled firms use equity as a main source to finance their operations depending less on debt financing. Finally, the relatively low average percentage of Free Cash Flows, 0.055, indicates that there is no money lying around within firms whereas the mean market value of equity is equal to 3.7 implying a high-power market.

Table 4. Descriptive Statistics

	N	Mean	SD	Min	Max	Median
ESG	6499	47.18699	19.07054	1.3	94.7	45.66
BGD	6499	21.91234	11.19254	0	50	22.22
Board_Ind	6499	82.17214	10.35277	25	100	85.71
Board_Size	6499	9.640868	2.099106	5	15	10
Board_Tenure	6499	9.000639	3.873603	0	30.75	8.6
Board_Age	6499	7.322143	2.156519	3.2	13.485	7
CEO_DUALITY	6499	.5963994	.4906569	0	1	1
CEO_FEMALE	6499	.0550854	.2281644	0	1	0
Firm_Size	6499	8.385896	1.579948	2.496753	14.42661	8.24273
Tobin's	6499	2.366623	1.958636	.4568586	27.89637	1.765815
FCF	6499	.0550502	.0746335	-.2538074	.2710049	.0564925
Leverage_Ratio	6499	.183411	.1461792	0	.6312236	.1556517
ROA	6499	.0489077	.0759544	-.2458005	.2830479	.0473463
logMV_Equity	6499	3.707492	.636595	2.533794	5.372567	3.622561

Table 5 depicts the correlation matrix of the sample which practically shows the correlation between the variables used in the study. A correlation higher than 0.8 between different independent variables, could reveal multicollinearity issues, which impede the

interpretation of the results. After performing a Pearson correlation coefficient test for possible correlations between independent variables, the results in Table 5 suggest that there are no correlations higher than 0.8. More specifically, there is a significant and positive association between board gender diversity and ESG performance and financial performance which aligns with prior existing literature and the hypotheses made in this study. Besides, profitable firms are financially stable and typically exhibit more access to financial resources which subsequently leads to greater control from shareholders and better sustainability outcomes. A positive and significant at the same time correlation was also detected between board gender diversity and board independence, board size and CEO gender. In addition to it, the same corporate governance variables seem to be positively associated with the sustainability performance (ESG) of firms. On the contrary, board age and tenure interestingly show a negative relation with both ESG performance and board gender diversity implying that the older the directors are or their tenure is the harder radical changes to be made that can encourage gender equality in bords or engage in CRS practices to increase ESG ratings.

Table 5. Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) ESG	1.0000																
(2) BGD	0.4175***	1.0000															
(3) Board Size	0.3269***	0.1662***	1.0000														
(4) Tenure	-0.1170***	-0.1518***	-0.0576***	1.0000													
(5) IB	0.3739***	0.2583***	0.1202***	-0.2016***	1.0000												
(6) Age	-0.2206***	-0.1589***	-0.0358**	0.1469***	-0.2965***	1.0000											
(7) DUAL	-0.0230	-0.0212	0.0707***	0.2742***	-0.1168***	-0.0074	1.0000										
(8) Gender	0.0642***	0.2628***	0.0078	-0.0516***	0.0459***	-0.0443***	-0.0532***	1.0000									
(9) FCF	0.0946***	0.0429***	0.0004	0.0897***	0.0269*	0.0188	0.0454***	-0.0371**	1.0000								
(10) Firm Size	0.5964***	0.2586***	0.4616***	-0.1019***	0.1965***	-0.1606***	0.0980***	0.0172	-0.0570***	1.0000							
(11) Tobin's Q	-0.0275*	0.0197	-0.0801***	0.0368**	-0.0149	0.0409***	-0.0057	-0.0054	0.3004***	-0.2467***	1.0000						
(12) Leverage Ratio	0.0401**	0.0398**	0.1200***	-0.1619***	0.0007	-0.0125	-0.0008	-0.0003	-0.3100***	0.2767***	-0.4214***	1.0000					
(13) MV_Equity	0.4266***	0.1645***	0.2598***	-0.0541***	0.1169***	-0.0777***	0.0900***	0.0208	0.1405***	0.6012***	0.1752***	-0.0991***	1.0000				
(14) ROA	0.0667***	0.0412***	0.0043	0.1461***	0.0017	0.0021	0.0905***	-0.0146	0.7557***	-0.0144	0.3340***	-0.3394***	0.1643***	1.0000			
(15) BGD*IB	0.4529***	0.7832***	0.1695***	-0.1727***	0.4230***	-0.2029***	-0.0405**	0.2713***	0.0457***	0.2726***	0.0166	0.0351**	0.1739***	0.0425***	1.0000		
(16) BGD*DUAL	0.1885***	0.4781***	0.1315***	0.1288***	0.0408***	-0.0875***	0.7662***	0.0940***	0.0510***	0.2058***	0.0116	-0.0045	0.1672***	0.0828***	0.4539***	1.0000	
(17) BGD*FEMALE	0.0729***	0.3322***	0.0127	-0.0508***	0.0521***	-0.0415***	-0.0396**	0.7406***	-0.0244*	0.0252*	-0.0056	0.0098	0.0122	0.0021	0.3458***	0.1373***	1.0000

4.2 Hypothesis Testing

4.2.1 ESG Performance & Board Gender Diversity

The relationship between board gender diversity and corporate ESG performance was investigated by performing a multiple regression analysis. Hence, 3 different models were created. The first one was a simple pooled OLS regression analysis with ESG ratings (ESG) as the dependent variable, board gender diversity (BGD) as the independent variable and several control variables considered. Model 2 added firm and year fixed effects while in model 3 industry and year fixed effects were included. The validity for each model was determined by assessing the adjusted R-square which factors in changes in the explanatory power of the model as independent or control variables are added or removed.

Model 1 provided an adjusted R-squared of .481, implying that 48.1% of the proportion of the variance in ESG scores can be explained by the board's gender diversity. Moreover, a statistically significant positive effect (.426) was identified at the 1% level and thus it is reasonable to predict that the higher female representation on boards will improve the sustainability performance of a company. All the control variables' coefficients, with the exception of the Leverage_Ratio, were all significant, indicating their impact on ESG ratings and the additional value given to the model by considering them. Prior pieces of evidence on the impacts of Board_Size, Firm_Size, Firm_Value and FCF were confirmed by the positive coefficients of these variables. In contrast, the negative coefficients of board tenure and ROA were opposed to theoretical expectations that more profitable firms or more experienced boards would experience more pressure to enhance ESG performance and possess more resources to operationalise sustainability goals.

Moving to the second model which includes fixed effects (firm & year), the adjusted R-square value provided was equal to 0.326 which is lower compared to the one provided in Model 1. However, despite the relatively low adjusted R-squared, a highly significant and positive correlation between the female board representation (BGD) and ESG ratings (.515) was demonstrated at the 1% level. Regarding control variables, the coefficients of Board_Size, Board_Tenure, Firm_Size and Firm_Value, FCF and Leverage_Ratio are statistically significant and positively affect the ESG scores of a firm. Surprisingly, ROA seems to have a weaker but still negative impact on sustainability outcomes while Tobin’s Q indicator does not influence the outcomes.

Lastly, in Model 3 industry and year-fixed effects were added this time to examine the effects of board gender diversity on ESG performance. As results indicate, the increased adjusted R-squared of 0.489 indicates that adding industry-fixed effects enhanced the model's ability to explain the variance in ESG scores. Also, the effect size of diverse boards (BGD) on ESG decreased (.424) but remained statistically significant at the 1% level. Therefore, the relationship between the existence of female directors on boards and ESG performance could still be assumed to be positive aligning with the viewpoint that diverse boards negatively influence sustainability performance. The coefficients of the control variables are very identical to the ones in Model 1 with the only exception that their impact on ESG is slightly lower and their valuable contribution to the model is reduced. Another divergence was spotted in the case of board tenure which is presented to be statistically insignificant in Model 3.

Overall, based on the results above, it can be concluded that gender diversity within a corporate board has a positive influence on a firm's sustainability performance despite the different strengths of the effect size across the regression models. Besides, all three models suggested a significant relationship between BGD and ESG confirming the H1 which states that greater female presence on boards improves a firm's ESG ratings. In other words, our results are aligned with the existing findings in the literature supporting a positive relationship between board gender diversity and ESG performance.

Table 6. Regression Analysis: Female Board Representation & ESG Performance

	(1) ESG	(2) ESG	(3) ESG
BGD	0.426***	0.515***	0.424***
	(0.0161)	(0.0161)	(0.0161)
Board_Size	0.501***	0.289**	0.529***
	(0.0942)	(0.110)	(0.0936)
Board_Tenure	-0.110*	0.352***	-0.0506
	(0.0459)	(0.0794)	(0.0454)
Board_Age	-0.857***	-0.166	-0.875***
	(0.0816)	(0.0922)	(0.0810)
Firm_Size	2.272***	3.946***	3.531***
	(0.360)	(0.650)	(0.374)
Tobins_Q	-0.589***	0.102	-0.433**
	(0.137)	(0.141)	(0.136)

FCF	32.05***	8.033**	24.02***
	(3.529)	(3.016)	(3.633)
Leverage_Ratio	-2.143	10.67***	-1.966
	(1.588)	(2.638)	(1.602)
ROA	-26.47***	-6.481*	-19.36***
	(3.570)	(2.739)	(3.603)
log of MV_Equity	10.73***	6.554***	8.182***
	(0.864)	(1.306)	(0.889)
Constant	-17.24***	-28.56***	-19.28***
	(1.415)	(3.028)	(1.410)
Observations	6499	6499	6499
Adjusted R^2	0.481	0.326	0.489
Firm Fixed-Effects	No	Yes	No
Year Fixed-Effects	No	Yes	Yes
Industry Fixed-Effects	No	No	No

4.2.2 The moderating effect of Board Independence

Based on corporate governance theories and more specifically the impact of board composition and board characteristics on financial and sustainability corporate performance, there are reasons to argue that the degree of board independence positively moderates the relationship between female board representation and sustainability performance. In order to statistically examine the abovementioned statement, H2 was formulated. As a result, the variable IB*BGD which serves as an interaction term was included in the analysis to capture the moderating effect that the independent directors have on the relation between board gender diversity and a firm's ESG ratings.

Again, in Model 1, Table 8 shows the outcomes of pooled OLS concerning the influence of board gender diversity on ESG without including fixed effects as done in Models 2 and 3. More specifically, Model 2 accounts for firm and year-fixed effects while industry and year-fixed effects are added to Model 3. The adjusted R-squared for all of the three models presented below (Table 7) are representing a low goodness of fit by providing a low explanation of the variance in ESG by BGD. According to Models 1 and 3, the results indicate a both negative and insignificant coefficient of the interaction term IB*BGD which means that despite the

positive and statistically important influence of the diverse boards in terms of gender in corporate ESG performance, the presence of independent boards does not appear to strengthen the baseline regression, as it was hypothesised. The said theoretical expectation could not be supported by the empirical findings in this study since the effect size was negative and, most importantly, insignificant. Regarding the control variables, they all seem to be significant valuable additions to the model by affecting sustainability incentives except for Board_Tenure and Leverage_Ratio.

However, in Model 2 where firm and year-fixed effects were applied, the results show the coefficient of the interaction term turns positive (.00523). Even though the effect is low, it has statistical significance at the 1% level. Therefore, it can be said that the positive relationship between board gender diversity and the sustainability performance of a corporation tends to be strengthened by the presence of board independence as expected. Consequently, the second hypothesis can be accepted. Finally, all of the rest control variables included in the model impact the results except for Tobin's Q.

Table 7. Regression Analysis: The Moderating Effect of Board Independence

	(1) ESG	(2) ESG	(3) ESG
BGD	0.403***	0.527***	0.426***
	(0.0955)	(0.0163)	(0.0942)
Board Independence	0.353***	0.150***	0.356***
	(0.0269)	(0.0272)	(0.0266)
Board_Size	0.437***	0.275*	0.468***
	(0.0916)	(0.108)	(0.0910)
Board_Tenure	0.0178	0.350***	0.0725
	(0.0451)	(0.0782)	(0.0445)
Board_Age	-0.470***	-0.0598	-0.501***
	(0.0817)	(0.0912)	(0.0810)
Firm_Size	2.437***	4.049***	3.612***
	(0.350)	(0.641)	(0.364)
Tobins_Q	-0.474***	0.115	-0.334*
	(0.133)	(0.139)	(0.133)
FCF	29.42***	7.910**	21.63***
	(3.432)	(2.969)	(3.531)

Leverage_Ratio	-1.532	8.979***	-1.316
	(1.543)	(2.600)	(1.557)
ROA	-23.68***	-7.277**	-17.09***
	(3.473)	(2.699)	(3.503)
log of MV_Equity	9.709***	6.106***	7.373***
	(0.841)	(1.286)	(0.865)
BGD_IB	-0.000383	0.00532***	-0.000710
	(0.00113)	(0.000987)	(0.00111)
Constant	-46.40***	-39.60***	-48.53***
	(2.582)	(3.604)	(2.552)
Observations	6499	6499	6499
R^2	0.541	0.376	0.548
Firm Fixed-Effects	No	Yes	No
Year Fixed-Effects	No	Yes	Yes
Industry Fixed-Effects	No	No	Yes

4.2.3 The moderating effect of CEO Duality

Besides board independence, another key institutional factor affecting the functionality of the boards and the corporate governance choices is the leadership structure or CEO duality. Hence, the next step would be to statistically examine the effect of CEO duality on the positive relationship between board gender diversity and ESG performance. Hypothesis 3 was created for that purpose. The interaction term DUAL*BGD was included in the regression model to capture the moderating effect that the occurrence of serving both as CEO and chair of the board has on the baseline relationship.

The third hypothesis argued that the CEO duality phenomenon would moderate the positive impact of board gender diversity on ESG performance. The results of Models 1 and 2 however, showed an insignificant regression coefficient of the interaction term DUAL*BGD (Table 8). Subsequently, CEO duality does not have any impact on the influence of female board presence on ESG performance. Based on this result, H3 could not be accepted. The positive effect of overall board diversity on CSR performance could not be assumed to be strengthened or moderated by CEO duality.

On the contrary, in the case of the third model where industry and year-fixed effects are applied, the coefficient of the interaction term DUAL*BGD is negative and statistically significant at the 10% level as anticipated. In other words, it is proven that by appointing the same person as CEO and chairman of the board the positive association between board gender diversity and sustainability performance will be weakened. As a result, H3 could be accepted and the aforementioned theoretical expectation was supported by the empirical findings in this study since the effect size was both negative and significant. To conclude, all control variables showed significant coefficients and thus a significant contribution to the model except Leverage_Ratio in cases of Models 1 and 3.

Table 8. Regression Analysis: The Moderating Effect of CEO Duality

	(1) ESG	(2) ESG	(3) ESG
BGD	0.455***	0.535***	0.466***
	(0.0243)	(0.0216)	(0.0241)
CEO_Duality	-2.026**	-3.913***	-1.595*
	(0.754)	(0.741)	(0.743)
Board_Size	0.534***	0.314**	0.558***
	(0.0937)	(0.109)	(0.0931)
Board_Tenure	0.00196	0.468***	0.0617
	(0.0475)	(0.0794)	(0.0469)
Board_Age	-0.881***	-0.152	-0.897***
	(0.0812)	(0.0911)	(0.0805)
Firm_Size	2.197***	3.959***	3.475***
	(0.358)	(0.643)	(0.372)
Tobins_Q	-0.628***	0.0474	-0.468***
	(0.136)	(0.139)	(0.136)
FCF	31.38***	8.619**	23.19***
	(3.510)	(2.981)	(3.611)
Leverage_Ratio	-1.513	10.48***	-1.359
	(1.582)	(2.610)	(1.595)
ROA	-25.19***	-7.049**	-18.03***
	(3.555)	(2.707)	(3.585)
log of MV_Equity	11.18***	6.594***	8.613***

	(0.861)	(1.292)	(0.885)
BGD_DUAL	-0.0507	-0.0491	-0.0721*
	(0.0297)	(0.0256)	(0.0293)
Constant	-18.23***	-27.51***	-20.62***
	(1.463)	(3.007)	(1.459)
Observations	6499	6499	6499
R^2	0.487	0.342	0.496
Firm Fixed-Effects	No	Yes	No
Year Fixed-Effects	No	Yes	Yes
Industry Fixed-Effects	No	No	Yes

4.2.4 The moderating effect of CEO Gender

Existing theories in corporate governance, the upper echelons theory (UET) for instance, provide incentives and ground for further investigation on how executives' CEO's personal characteristics such as gender, age, background etc can be factored in the examination of the association between board gender diversity and the sustainability performance of a company. Based on this piece of evidence, the theoretical expectation could be that the existence of females in managerial positions would positively moderate the relationship between board gender diversity and ESG development. Hypothesis 4 was established to examine this moderating effect and therefore the variable FEMALE*BGD was added as an interaction term in the analysis. As in the previous tables, Model 1 was a simple pooled OLS regression analysis without including fixed effects, firm and year-fixed effects for Model 2 and industry and year-fixed effects for Model 3 respectively.

All three models provided a relatively low adjusted R-squared implying a poor goodness of fit which could potentially negatively affect the interpretability of the regression coefficients. The results of Model 1 though documented a statistically significant regression coefficient of the interaction term FEMALE*BGD (Table 9) at the 5% level. More specifically, the coefficient was negative meaning that the positive effect of board gender diversity on sustainability outcomes was weakened by the appointment of female CEOs. However, when fixed effects were included in our Models 2 and 3 (firm, industry and year-fixed effects) the coefficients of the interaction terms appeared to be negative again but statistically and economically insignificant this time. As a result, it cannot be assumed that the placement of female CEOs can either positively or negatively impact the baseline relationship. Based on

these results, H4 could not be accepted. Lastly, for the rest of the variables controlled, the coefficients of most of them are significant and highly expected, except for the Board_Tenure and the ROA which are shown to negatively influence the engagement in sustainability success.

Table 9. Regression Analysis: The Moderating Effect of CEO Gender

	(1) ESG	(2) ESG	(3) ESG
BGD	0.459***	0.516***	0.457***
	(0.0173)	(0.0164)	(0.0172)
CEO Gender	10.01***	-0.139	9.377***
	(1.989)	(2.162)	(1.959)
Board_Size	0.482***	0.288**	0.507***
	(0.0940)	(0.110)	(0.0934)
Board_Tenure	-0.0950*	0.353***	-0.0365
	(0.0458)	(0.0794)	(0.0453)
Board_Age	-0.840***	-0.165	-0.857***
	(0.0815)	(0.0923)	(0.0809)
Firm_Size	2.242***	3.947***	3.516***
	(0.359)	(0.651)	(0.373)
Tobins_Q	-0.598***	0.102	-0.438**
	(0.136)	(0.141)	(0.136)
FCF	31.62***	8.024**	23.80***
	(3.524)	(3.016)	(3.626)
Leverage_Ratio	-1.882	10.68***	-1.844
	(1.585)	(2.643)	(1.599)
ROA	-25.63***	-6.475*	-18.77***
	(3.563)	(2.740)	(3.595)
log of MV_Equity	10.70***	6.553***	8.117***
	(0.862)	(1.307)	(0.887)
BGD_FEMALE	-0.319***	-0.00255	-0.0311
	(0.0535)	(0.0545)	(0.5812)
Constant	-17.63***	-28.56***	-19.62***
	(1.414)	(3.029)	(1.409)
Observations	6499	6499	6499

R^2	0.484	0.326	0.492
Firm Fixed-Effects	No	Yes	No
Year Fixed-Effects	No	Yes	Yes
Industry Fixed-Effects	No	No	Yes

4.2.2 Robustness Check

To address the robustness problem, the current research will implement an alternative measure for board gender diversity (BGD) as well. The latter method will be to measure the board gender diversity in absolute terms of female directors on the supervisory corporate board. More specifically, the absolute number of women on boards was calculated by multiplying the proportion of the women on board, i.e. board gender diversity variable (BGD) by the total number of directors on corporate boards of each and one firm (Board_Size). As a result, a new variable was created called FBR which stands for female board representation.

As the pooled OLS regressions results show in Table 10, again there is a statistically positive correlation between female board representation and ESG performance as expected. A potential conclusion drawn by applying a robustness check and using an alternative variable to capture the impact of women directors' presence in corporate boards would be that the higher the female proportion the higher the ESG scores for an organization and subsequently the greater its sustainability development.

Table 10. Regression Analysis: Female Board Representation & ESG Performance

	(1) ESG
FBR	4.704***
	(0.170)
Board_Size	-0.425***
	(0.103)
Board_Tenure	-0.108*
	(0.0459)
Board_Age	-0.889***
	(0.0814)
Tobins_Q	-1.180***
	(0.101)

FCF	29.83***
	(3.514)
Leverage_Ratio	3.431*
	(1.348)
ROA	-27.49***
	(3.566)
log of MV_Equity	15.74***
	(0.324)
Constant	-7.859***
	(1.411)
Observations	6499
Adjusted R^2	0.481

5. Conclusion

5.1 Summary

All in all, nowadays, topics such as sustainability and gender equality have worldwide emerged as critical components and gained great attention both in academic literature and practice leading to a radical change in terms of the corporate strategic decision-making process. Besides, corporate boards support the interaction between the shareholder and an organization since they are an essential part of the company. More and more Western nations have adopted quota laws to establish gender equality in the workplace. Therefore, it is crucial for firms to embody CSR-oriented practices given the fact that economic results are not the only criteria anymore by which they are valued for success. Based on that, the goal of this study is to investigate the relationship between board gender diversity and sustainability performance and how the moderating effect of board and executive characteristics can impact that relationship. In other words, the role of female directors' presence is taken into consideration to test whether there is an association between the two variables and whether greater gender diversity improves the ESG ratings of a corporation. The next step was an effort to draw clearer inferences regarding potential factors that are linked to board diversity and corporate sustainability performance and could influence the strength of the baseline regression. Based on existing literature several factors can significantly moderate this correlation between the appointment

of females on boards and the ESG outcomes. This paper focuses on characteristics such as board independence, CEO duality and CEO gender.

For a more reliable estimate of the quality of the results, measures proposed by Thomson Reuters Refinitiv Eikon and WRDS (BoardEx, CompuStat and Execucomp). Furthermore, a panel data analysis using POOLED Ordinary Least Square and fixed effects regressions were performed in firms listed in S&P 1500 index from 2015 to 2021 to mitigate endogeneity concerns. The main conclusions of the empirical analysis are as follows. First, board gender diversity has a positive and significant impact on the sustainability success of a firm. Second, board independence and CEO duality function as critical moderating factors to explain the link between female board representation and ESG performance while CEO gender does not influence the abovementioned relationship. More precisely, the presence of independent directors on boards significantly and positively moderates the positive relationship between diversified boards and ESG corporate ratings is positively moderated by board independence when firm and year-fixed effects were considered. CEO duality has no impact when we run a pooled OLS regression model. The same happened when we include firm and year-fixed effects. However, when industry and year-fixed effects were added, the results altered and the relationship between board gender diversity and sustainability performance was significantly weakened when the roles of chairperson and CEO are simultaneously held by the same individual. Finally, CEO gender did not either improve or moderate the link between gender-diverse boards and ESG ratings as it was anticipated.

The findings of this research have made several theoretical contributions. First, the existing literature on board composition and ESG performance was extended. Second, the current analysis also emphasizes the moderating role of the board and executives traits such as board independence, CEO duality and CEO gender which are factors that had not been investigated before, enriching the existing research and providing more suggestions for companies to modify and improve their ESG performance. Lastly, this research incentivizes S&P 1500 listed firms to recognize how ESG impacts their corporate value, enabling them to concentrate on their own sustainable development business philosophy.

5.2 Implications

This study provides various theoretical and practical implications for corporations and governments for better improvement of sustainability success. Based on a substantial body of

literature, organizational theories were explored with the purpose of formulating the research's hypotheses. The statistically significant positive relationship between board gender diversity measure and ESG performance supported these theories. More specifically, according to stakeholder theory, diverse boards can better represent stakeholders' interests and needs of stakeholders. Therefore, a better representation which can originate from diversity on boards can influence sustainability performance in a beneficial way. The findings of this analysis are consistent with stakeholder theory argumentation since all models concluded on a positive effect.

This positive effect is also consistent with agency theory which supports the inclusion of diverse viewpoints within the boards which enhances effective oversight, mitigating this way the agency problems that might arise between the shareholders and the management of a firm. On top of that, a board's ability to control management and protect shareholder interests can be ensured by board independence. Additionally, more board independence results in a board's ability to protect shareholder interests through controlling management. Therefore, to examine whether a CEO with ties to the directors or a CEO with both a leadership and management function influences ESG rating, board independence and CEO duality were included as control variables and moderating terms in the analysis. A significant effect was found for board independence and CEO duality indicating that both independence from management and duality affects sustainability development.

Lastly, the results of this paper confirm the positive association between the female board representation and the firm's sustainability performance following the resource dependence theory. According to it, a higher level of diversity within boards generates more available resources for the company. As a result, the positive effect of board diversity can determine to a great extent corporate decisions regarding engagement in sustainability incentives and overall firm success and profitability in the long term.

There are also some practical implications that can be made by the study. Due to the fact that board gender diversity and sustainability have gained prominence over the past years, firms are actively embodying and promoting the existence of diverse boards and ESG practices by implementing quotas and engaging in more sustainable projects. Therefore, companies are being more transparent regarding ESG reporting, board composition etc and taking more responsibility for the impact of their business philosophy and practices. Based on the results, board independence can also enhance firm success by leading to more effective supervision of

the management and greater accuracy. On the contrary, CEO duality can destroy value for shareholders due to a lack of supervision and agency problems that may arise. For CEO gender, no conclusions can be drawn. Overall, board diversity can be expected to be beneficial for sustainability performance, and therefore diversity and independence between directors and the firm's management structure should be strategically implemented when pursuing higher ESG ratings.

5.3 Limitations & Future Research

Despite the valuable implications and contributions to the literature, there are also some limitations in this study that should be addressed. Recommendations for future research were created to adverse these limitations. First of all, regarding yearly ESG ratings, which were taken as a proxy for the corporate sustainability performance, there is an inconsistency among the different rating agencies which could be considered as a limitation. These disagreements among the different rating agencies could be considered as a limitation since there is the possibility of altered results by using a different ESG provider. Secondly, the validity of the regression models was poor indicating that there is room for improvement in the models established for the empirical analysis even though significant results on the main relationships were reported. Thirdly, despite the fact that the data used for the analysis conducted in this paper were structured as panel data so as to mitigate endogeneity concerns, the panel was unbalanced meaning that there were not provided the same number of observations for each company. Another drawback could be the fact that the current study was unable to provide more insight into the complexity of the relationships since CEO gender, one of the many factors that may have an impact on the board gender diversity- ESG performance, did not present conclusive results. Last but not least, this analysis covers only a seven-year reporting period and therefore it offers only limited insights into the long-term effects of board gender diversity on ESG performance.

To extend the findings of this study, future research could attempt to address both issues and limitations. Further research into the complexity of the relationships by exploring the moderating effects of other board or managerial characteristics focusing on other diversity attitudes such as nationality, background, experience and skills would be recommended in order to provide a deeper understanding of the board's influence on sustainability success. Besides, providing more insights into the drivers of sustainability performance is of interest to

sustainability policymakers. Additionally, future studies can first increase the sample and repeat the same analysis in the European context by taking into consideration this time the differences between countries with regards to ESG practices and the different corporate governance systems. Lastly, would be interesting to investigate the effects of board diversity on CSR strategies focusing on emerging economies and design a comparative analysis across developing and developed countries to assess ESG performance.

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6. Appendix A

A. ESG Normality