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Environmental performance and firm performance in Europe: The moderating role of board governance

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Abstract

This research presents novel insights into the relationship between environmental performance and firm performance, focusing on the moderating role of board governance. Unlike the single-dimensional examination in previous studies, we examine five board variables collectively in our moderator analysis. Employing ordinary least squares regression and a series of robustness tests, we investigate 582 European listed firms across various industries from 2016 to 2021. Our findings reveal a positive influence of environmental performance on firm performance, measured by Tobin's *Q* and ROA. Furthermore, we find that board independence, gender diversity and audit committee independence moderate this relationship. To address potential endogeneity issues, we employ GMM modelling. This study significantly contributes to the environmental performance and firm performance literature by offering evidence on the moderating role of board mechanisms. Moreover, it offers valuable insights for policymakers and practitioners, highlighting the need to monitor corporate boards for improved environmental and financial outcomes.

KEYWORDS
board governance, environmental performance, Europe, firm performance

1 | INTRODUCTION

Europe is increasingly committed to promoting environmental investment and providing funding for green initiatives. It has implemented policies such as the 2015 Paris Climate Agreement, providing clear guidelines for firms to adopt environmental practices that reduce the negative impact of their activities on the environment (Federal Ministry of Finance, 2021).

However, firms are aware that environmental practices require a trade-off between costs and potential benefits (Fernández-Kranz & Santaló, 2010). This awareness, often formulated as the question "Does it pay to be green?", has been the subject of intensive research for decades, but due to mixed results different perspectives persist (Ambec & Lanoie, 2008; Zaied & Lahouel, 2021). While some scholars argue that environmental practices improve financial outcomes (Liang & Renneboog, 2020; Siedschlag & Yan, 2020), others suggest that it may reduce profitability (Ambec & Lanoie, 2008; Hart & Ahuja, 1996; King & Lenox, 2001). This inconsistency is attributed to differences in sample selection, methodology and the choice of appropriate dependent, independent and control variables (Iazzolino et al., 2023; Lee et al., 2016).

Despite establishing the link between environmental and firm performance remains challenging, scholars advocate for the expansion of this analysis (Nguyen et al., 2021; Wagner, 2007). Previous studies

may not be capturing the true picture of this relationship (Dixon-Fowler et al., 2013); therefore, answering the simple question "Does it pay to be green?" may have become outdated or might be insufficient. Rather, researchers increasingly recognise the importance of identifying variables that may moderate the relationship between environmental and firm performance (Russo & Fouts, 1997; Wu et al., 2022). Baron and Kenny (1986) suggest that the inclusion of moderator variables shows the potential to clarify the observed differences between dependent and independent variables. This is confirmed by Wu and Zumbo (2008), who argue that latent moderating factors may underlie the lack of a linear causality. Hence, to overcome these inconsistencies, in this study we focus on identifying variables that may moderate the relationship between environmental performance and firm performance.

Among the various factors influencing environmental practices, board governance emerges as a crucial factor in guiding companies towards greater sustainability. It is widely recognised that the composition of a company's board serves as a reflection of its practices and resulting outcomes, influencing its commitment to environmental initiatives (de Villiers et al., 2011; Husted & de Sousa-Filho, 2019; Lu, 2021; Nguyen et al., 2021; Post et al., 2011). Furthermore, corporate boards are crucial in developing sustainability strategies by keeping an eye on the actions of senior management (Jo & Harjoto, 2011). Ultimately, boards stand out as one of the most important governance mechanisms employed to oversee and regulate organisational management, safeguarding stakeholder's interests (Saleh et al., 2020). Consequently, we argue that the influence of environmental performance on firm performance varies depending on the composition of the board.

Empirically, only a few studies, mainly carried out in China and the United States, have explored the moderating role of board governance on the relationship between environmental performance and firm performance. In the European context, the moderating influence of board governance on this relationship has been largely overlooked, leaving a gap in academic research. Therefore, conclusions drawn from previous studies may not be applicable to the European context due to variations in governance practices, laws and policies. Additionally, prior research has employed diverse methodological approaches. While some studies focused on individual board governance variables, others aggregated multiple board attributes into a governance index when examining their moderating influence (Lu, 2021; Nguyen et al., 2021). Our study differs from previous ones in that we include five board variables together into the regression analysis to account for their mutual influences. According to Aguilera et al. (2012) the interdependence among board governance variables needs a comprehensive analysis that considers their collective influence. Hence, we argue that the methodological approaches used to date in previous studies additionally result in insufficient clarity regarding the moderating influences of board governance variables.

The identified inconsistencies and weaknesses of previous studies motivated us to conduct this study. Therefore, the objective of our research is to extend the literature by not only offering novel insights into the influence of environmental performance on firm performance, but also by exploring if and how board governance moderates this relationship in Europe. Using environmental and financial data from the Thomson Reuters ASSET4 database, we analyse 582 European firms with 2255 firm-year observations covering the years 2016–2021. To enhance robustness, we employ two measures of firm performance: Return on Assets (ROA) and Tobin's *Q*. To investigate the moderating role of board governance, we examine five board attributes: board size, board independence, chief executive officer (CEO) duality, gender diversity and audit committee independence.

Our research makes several contributions to the current body of literature. First, we expand upon existing insights regarding the enduring discourse on the profitability of environmental initiatives. This is achieved by using a relatively large-scale sample from 17 European nations. In light of the mixed findings in previous studies and the evolving landscape of environmental practices in Europe, which is especially influenced by political pressures and regulations, our research advances these academic discussions. Our empirical findings show that enhancing environmental performance has a significant influence on firm performance, becoming evident after a one- to two-year time period. These results are consistent with previous research, emphasising the time-lagged influence of environmental practices on financial outcomes (Chen & Ma, 2021; King & Lenox, 2001). Our results highlight a significant influence on both dependent variables Tobin's Q and ROA, demonstrating a positive relationship between environmental performance and firm performance.

Building on what previous studies have lacked, to the best of our knowledge, this is the first study to empirically investigate how board governance moderates the relationship between environmental performance and firm performance in Europe. This gap presents a great opportunity to introduce new insights and offer practical implications. According to our results, board independence strengthens the relationship between environmental performance and firm performance, whereas gender diversity and audit committee independence weaken it. These results differ from the findings of prior research conducted in China and the US. Furthermore, our methodological approach distinguishes itself from previous studies. By incorporating five board attributes into the regression model, our study comprehensively examines the interplay of these variables together within this relationship. Finally, our results offer valuable insights for policymakers and regulators by emphasising the impact of proactive measures taken by European countries on the composition of corporate boards and their alignment with policy objectives. Our study provides evidence that European firms should improve their monitoring of board governance attributes because these could influence their environmental and financial outcomes.

The rest of the paper is structured as follows: Section 2 reviews relevant literature and develops the hypotheses. Section 3 describes the methodology and sample. Section 4 presents the empirical findings. In Section 5 we conduct additional analysis and robustness tests. Finally, Section 6 concludes.

2 | THEORETICAL LITERATURE AND HYPOTHESES

In corporate governance research, the following theories provide a comprehensive understanding of how board governance influences the environmental performance: agency theory, resource dependence theory, stakeholder theory and stewardship theory.

Agency theory suggests that conflicts of interest arise between principals and agents in organisations, due to differences in goals and risk preferences (Jensen et al., 1976). Agency conflicts might occur when managers prioritise their own interests over those of shareholders. Effective monitoring mechanisms, such as good board governance structures, may help in aligning the interests of both principals and agents and therefore mitigate such agency problems (Fama & Jensen, 1983). Hillman and Dalziel (2003) argue that corporate boards oversee management, support strategic decision making and ensure such decision-making aligns with shareholder's interests. Hence, corporate boards can lead to increased involvement in environmental practices and therefore improve environmental performance. In addition, resource dependence theory argues that organisations seek to mitigate the vulnerability of external factors by diversifying resources and enhancing relationships with resource providers (Mitchell et al., 1997). Accordingly, firm's resources, abilities and skills are essential to determine its competitiveness and success (Saleh & Maigoshi, 2024). Board members offer guidance and support the company's efforts in augmenting access to crucial information and important resources (Hillman & Dalziel, 2003). In this regard, corporate boards can provide a range of perspectives and experiences that can be useful in increasing a firm's environmental engagement (Al-Jaifi et al., 2023).

Furthermore, stakeholder theory indicates that firms need to consider the interests of all their stakeholders, such as employees, suppliers and shareholders in decision-making processes (Al-Jaifi et al., 2023; Freeman, 1994). Failing to align with those stakeholder preferences could result in financial and reputational losses (Gallego-Álvarez & Rodriguez-Dominguez, 2023; Jo et al., 2015). The board is considered crucial for supervising the implementation of management's strategies to address the interests of various stakeholders (Harjoto et al., 2015; Nguyen et al., 2021). Moreover, corporate boards are beneficial in ensuring a variety of perspectives, including those related to environmental issues. Therefore, prioritising environmental issues not only enhances stakeholder relations but also improves long-term performance (Al-Jaifi et al., 2023). Finally, stewardship theory offers an alternative view to agency theory differing in their assumptions regarding the principal-agent relationship (Lu, 2021). Stewardship theory argues that agents have a strong organisational identification, fostering responsibility and commitment (van Puyvelde et al., 2012). It indicates that executives are motivated by factors beyond economic self-interest. Consequently, it suggests that the board of directors is inclined to embrace environmentally friendly practices driven by their concern for the organisation's success. Within this framework, the board's role is to assist management in advancing the company's objectives, collectively acting as stewards for the firm (Gavana et al., 2023). Therefore, environmental initiatives may be prioritised over those that offer immediate returns.

The preceding theoretical discussions highlight that none of these theories in isolation can fully explain the impact of board governance on environmental performance. Hence, to offer a more comprehensive understanding of this relationship a multidisciplinary approach becomes imperative.

In the following sections we examine the theoretical literature to build our hypotheses. We initially explore the relationship of environmental performance and firm performance. Following that, we elaborate on the moderating role of board governance (board size, board independence, CEO duality, gender diversity and audit committee independence).

2.1 | Environmental performance and firm performance in Europe

Despite years of extensive research, there remains no consensus regarding the profitability of going green. The preceding literature can be broadly classified into two distinct perspectives. The first strand of research is characterised by a positive inclination, indicating that environmental practices have the capacity to increase a firm's financial performance (Liang & Renneboog, 2020; Siedschlag & Yan, 2020). Furthermore, the adoption of green innovation activities fosters sustainable development, long-term advantages and economic performance (Ambec & Lanoie, 2008; Chariri et al., 2018; Porter & Van Der Linde, 1995; Zhang et al., 2019). In addition, firms that perform well in terms of the environment tend to have better market valuations and lower financial risk (Jo & Harjoto, 2011). In contrast with this first camp, the second category of literature argues that firms predominantly engage in environmental investments under the compulsion of policy regulation, which often result in heightened costs (Ambec & Lanoie, 2008; Hart & Ahuja, 1996). Moreover, such environmental investments could entail unforeseen risks, potentially undermining a firm's profitability (King & Lenox, 2001). For the European region, a growing body of evidence underscores a positive association between a company's environmental performance and its financial outcomes (Agoraki et al., 2023; Ben Lahouel et al., 2020; Cortez et al., 2022; Pekovic et al., 2018). This relationship is intensified by regulatory pressures of the European Union's sustainability agenda. Additionally, a notable statistic revealed that 66% of European consumers are willing to pay a premium for products from socially and environmentally responsible enterprises (Nielsen Global Responsibility Report, 2020). In conclusion, the positive relationship between environmental performance and firm performance in Europe arises from various factors, including investor preferences, regulatory pressures and consumer demands. This relationship is expected to strengthen, promoting a more sustainable and resilient corporate landscape within Europe. Therefore, we establish Hypothesis 1.

> **H1.** Environmental performance positively influences firm performance in Europe.

2.2 | Moderating role of board governance

Most previous studies have found a positive relationship between environmental performance and firm performance. However, the continued presence of contradictory results suggests a more complex relationship. Baron and Kenny (1986) advocate for incorporating moderator variables to clarify disparities between dependent and independent variables. Hence, as a means of addressing prior inconsistency, introducing moderating variables becomes crucial.

Corporate boards are widely considered to be important drivers of a company's environmental commitment (de Villiers et al., 2011; Post et al., 2011). Moreover, with the increasing importance of environmental concerns, it has become essential for boards to address environmental strategies (Kassinis & Vafeas, 2002). Therefore, it can be argued that board governance and environmental performance should be viewed as interrelated mechanisms. Extensive research on this relationship confirms this assumption (de Villiers et al., 2011; Husted & de Sousa-Filho, 2019; Post et al., 2011; Ryan et al., 2004). However, a major limitation found in the literature is that it does not consider how board governance moderates the relationship between environmental performance and firm performance (Lu, 2021; Nguyen et al., 2021). In other words, whether companies that prioritise the role of their board are more likely to adhere strictly to environmental standards, thereby influencing their firm performance.

This notion is supported by recent findings in the corporate governance literature. A study by Nguyen et al. (2021) examined how board governance moderates the nexus between environmental and financial performance in 100 Chinese companies. Their findings reveal that board governance has a mixed moderating influence on this relationship. Specifically, they reveal that only board size serves as a moderator in this relationship, whereas factors such as board meetings, board independence and gender diversity do not exert any moderating effect. Additional analyses conducted by Lu (2021) explored the moderating influence of corporate governance on the relationship between sustainability and financial performance at 456 US companies. Their results highlighted a positive moderating role of board governance in this relationship. However, the use of a governance index rather than individual variables limited the identification of specific attribute effects in their analyses.

Previous research has focused on China and the US, providing inconsistent and insufficient results for our purposes. Therefore, there is a need to examine the moderating role of board governance on the relationship between environmental and financial performance in Europe. We argue that the influence of environmental performance on firm performance varies depending on distinct board characteristics. Our analysis focuses on five key elements of board governance: board size, board independence, CEO duality, gender diversity and audit committee independence.

2.2.1 | Board size

Board size is recognised as an influencing factor in decision-making because larger boards tend to involve more experienced directors (de Villiers et al., 2011). According to stakeholder theory, larger boards that include experts on specific concerns may be more effective in monitoring managerial actions, thereby having a positive impact on environmental performance (Dalton et al., 1999; Kumar et al., 2022). Moreover, larger boards often exert greater diversity in skills, expertise and representation of stakeholders (Hillman & Dalziel, 2003). This can result in increased pressure on firms to prioritise environmentally friendly activities, fostering stronger relationships with influential stakeholders and securing access to essential resources. From a resource dependence theoretical perspective, larger boards have access to a wider range of information and expertise, which can be beneficial in addressing complex environmental challenges. Additionally, larger boards are more likely to have access to financial resources, enhancing their financial freedom to pursue environmental initiatives (de Villiers et al., 2011). Accordingly, we hypothesise the following:

> **H2.** Board size moderates the relationship between environmental performance and firm performance.

2.2.2 | Board independence

According to de Villiers et al. (2011) and Kock et al. (2012), the greater the concentration of independent directors on the board, the more effective the board's monitoring becomes. Agency theory indicates that the presence of external directors helps alleviate agency conflicts by strengthening oversight of the management team's strategies. In line with this theory, independent directors have more control and monitoring over the management team and can therefore reduce agency conflicts between managers and shareholders (Al-Jaifi et al., 2023). In accordance with resource dependence theory, external directors provide firms with essential expertise, which helps with establishing stronger relationships with influential stakeholders (Nguyen et al., 2021). From a stakeholder theoretical perspective, independent boards can help reconcile the differing interests of various stakeholder groups and are more likely to address environmental concerns (Al-Jaifi et al., 2023; de Villiers et al., 2011; Haque, 2017; Post et al., 2011). According to Kassinis and Vafeas (2002) independent directors are more concerned with the firm's management compliance with environmental regulations. They experience less pressure regarding the achievement of financial objectives and instead focus their attention on corporate social responsibility (CSR), effectively balancing financial and environmental goals (Angetidis & Ibrahim, 1995; Gavana et al., 2023). This demonstrates accountability to the wider community and ensures access to essential resources. Therefore, we propose the following hypothesis:

> **H3.** Board independence moderates the relationship between environmental performance and firm performance.

2.2.3 | CEO duality

CEO duality refers to the situation in which the same individual serves as both the CEO and the chairperson of the board of directors within

the company. The dual position of CEO and chairperson consolidates authority at the company's highest level, enhancing decision-making processes (Finkelstein & D'aveni, 1994). Under an agency perspective, more powerful CEOs may increase environmental performance to extract resources from the business, as good environmental performance enhances CEO pay (Berrone & Gomez-Mejia, 2009). Gavana et al. (2023) indicates that when CEOs hold dual roles, it becomes more tempting for them to exploit environmental initiatives for personal benefit instead of genuine progress. This arrangement can also lead to agency conflicts where managers prioritise their own interests over environmental concerns. Conversely, in line with stewardship theory, the transitioning of corporate governance from owners to capable managers can be seen as a positive move to navigate the intricacies of modern organisations. Managers are regarded as good stewards of a company, tasked with upholding its long-term sustainability (Gavana et al., 2023). Furthermore, stewardship theory underscores the long-term orientation inherent in executives who perceive themselves as stewards of the organisation. According to Jo and Harjoto (2011), CEO duality leads to increased involvement in corporate social responsibility (CSR) initiatives. This is due to the CEO's consolidated decision-making power, which enables them to more efficiently drive the company's strategic course, including its dedication to CSR initiatives. Based on the above discussion, we propose the following hypothesis:

> **H4.** CEO duality moderates the relationship between environmental performance and firm performance.

2.2.4 | Gender diversity

Gender diversity describes the presence of women directors on corporate boards (Mans-Kemp & Viviers, 2015). Saleh et al. (2020) argue that companies with diverse workforces, including gender diversity, gain access to a wider range of knowledge, perspectives and skills, leading to enhanced innovation and decision-making. According to Gavana et al. (2023) and Elmagrhi et al. (2019) organisations with more women on their boards tend to perform better in terms of the environment, possibly as a result of a wider variety of perspectives. Khatri (2023) supports this by providing evidence of a positive correlation between gender diversity and sustainability performance in Northern European nations. Furthermore, some countries have mandated gender diversity quotas to improve the female representation level on the board (Eliwa et al., 2023). From a theoretical perspective, stakeholder theory suggests that companies must consider the concerns of all stakeholders by fostering positive relationships through ethical and social engagements (Freeman, 1994). Gender diversity contributes to a more inclusive representation of diverse stakeholders' interests. Moreover, the increased presence of women on boards enhances the understanding of environmental issues (Gallego-Álvarez & Rodriguez-Dominguez, 2023; Zhong et al., 2022). According to agency theory, increasing the number of women directors serves as a crucial internal monitoring mechanism. This is because the presence of women directors could mitigate agency issues by increasing accountability and the monitoring of abilities (Iazzolino et al., 2023; Saleh & Maigoshi, 2024). According to Hillman and Dalziel (2003), agency theory implies that a greater number of women directors is associated with enhanced board independence, potentially resulting in beneficial effects on a company's environmental performance. Finally, resource dependence theory suggests that diversity enhances the decision-making process by leveraging the diverse experiences, values and perspectives of directors (Post et al., 2011). Similarly, Haque (2017) suggests that gender diversity promotes environmental concerns and thereby enables access to crucial resources. In summary, gender diversity facilitates the evaluation of various stakeholder preferences and enhances the board's ability to effectively address sustainability concerns (Gavana et al., 2023; Jo & Harjoto, 2011; Lu, 2021; Post et al., 2011). Hence, we propose the following hypothesis:

> **H5.** Gender diversity moderates the relationship between environmental performance and firm performance.

2.2.5 | Audit committee independence

The primary function of an audit committee is to provide oversight of the company's financial matters to align with the interests of shareholders and stakeholders (Karamanou & Vafeas, 2005). Audit committees plays a crucial role in identifying and preventing financial fraud and mismanagement (Saleh & Mansour, 2024). Audit committee independence is determined by the presence of external independent directors on the audit committee and refers to the degree to which these members are free from conflicts of interest that could compromise their effective oversight (Appuhami & Tashakor, 2017). An independent audit committee is typically viewed as beneficial for a company as it facilitates objective and impartial evaluations of financial statements (Saleh & Mansour, 2024). Research indicates that independent audit committees enhance the credibility of both financial and non-financial disclosures, such as CSR reports, by operating without influence from management (Consuelo Pucheta-Martínez & De Fuentes, 2007; Mangena & Pike, 2005). This is supported by the perspective of agency theory, where independent audit committees help alleviate conflicts of interest between management and shareholders, thereby ensuring the credibility of disclosures. Similarly, within the framework of stakeholder theory, independent audit committees play a crucial role in addressing the concerns of diverse stakeholders by fostering transparency and accountability in corporate disclosures, particularly those related to CSR (Appuhami & Tashakor, 2017). Resource dependence theory highlights the influence of external environments on organisations (Hillman & Dalziel, 2003). The theory suggests that having an independent audit committee can assist the firm in managing its relationships with external stakeholders, such as regulators, by providing credible assurance regarding environmental performance. The independent audit

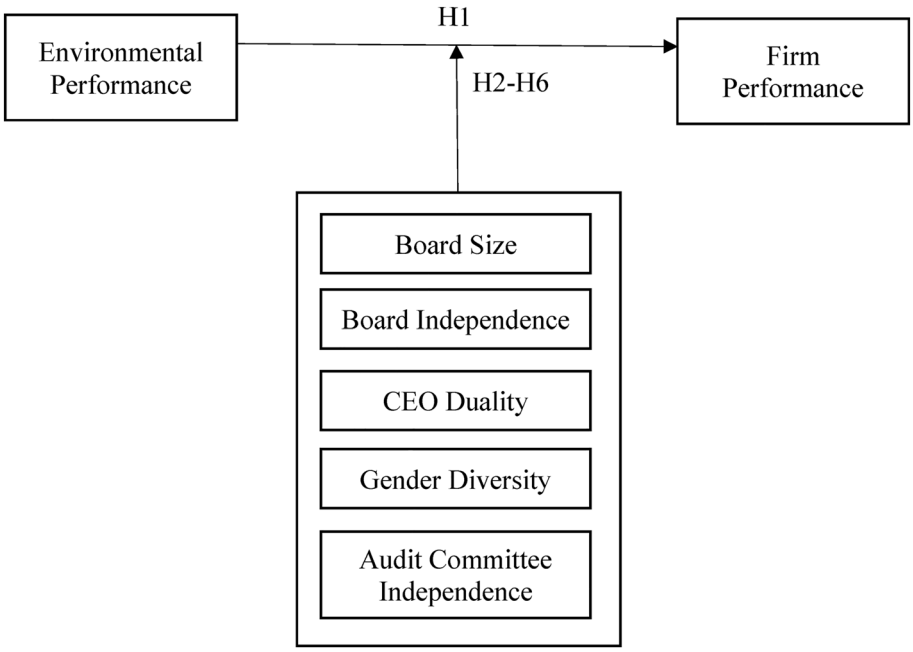

FIGURE 1 Conceptual framework. Source: Author's elaboration.

committee serves as a mechanism to secure resources and provides effective monitoring necessary to balance managerial and stakeholder expectations, demonstrating the firm's commitment to environmental responsibility (Appuhami & Tashakor, 2017). Therefore, we propose the following hypothesis:

> **H6.** Audit committee independence moderates the relationship between environmental performance and firm performance.

Figure 1 summarises the conceptual framework of this study.

3 | METHODOLOGY

3.1 | Data and variables

To test our hypotheses, we collected accounting and environmental data from the Thomson Reuters ASSET4 ESG dataset. Given the initiation of the Paris Climate Agreement in 2015, we have incorporated data spanning from 2016 onwards. The Paris Climate Agreement is a political initiative with the aim to limit global warming by reducing greenhouse gas emissions. It significantly influenced the environmental behaviour of European companies by introducing clear emission reduction targets, prompting companies to realign their strategies accordingly, compelling them to embrace sustainability on the grounds of competitiveness and social responsibility. This has led to greener business models, integrating environmental considerations into operations and decision-making. Given the global significance of this climate pact, we believe it becomes imperative to thoroughly examine its efficacy. To conduct our study, we have focused on nations where firms have provided environmental and financial data relevant to our research objectives. Our initial sample selection involved 3004 firms with a total of 18,024 observations. After excluding firms with missing data, and in order to ensure consistency in sample size across all years, the final sample includes 582 European firms of 17 different countries for the years 2016–2021 with a total of 2255 observations. A comprehensive breakdown of our sample selection process is provided in Figure A1.

Following prior studies, firm performance (FP) is calculated by Return on Assets (ROA) and Tobin's *Q* (Chen & Ma, 2021; Hart & Ahuja, 1996; Surroca et al., 2010; Zhang et al., 2019). While ROA serves as a conventional economic performance measure, Tobin's *Q* provides a vivid representation of firm value (Chen & Dagestani, 2023). In other words, fluctuations in market dynamics and corporate governance are directly reflected in Tobin's Q. Nonetheless, to enhance the robustness of our results, we have employed both indicators for firm performance.

Additionally, ASSET4 ESG environmental score is used to measure environmental performance (EP) for each individual firm. The environmental score reflects the extent to which a company uses best management practices to avoid environmental risks, collecting combined ratings from three categories: Resource Use, Emissions and Innovation. EP is graded on a scale of 0–100. Lower ratings signify poor environmental performance, whereas higher scores signify improved environmental performance.

Consistent with existing literature, this study incorporates control variables that are theoretically linked to firm performance. These variables serve to account for additional factors that could influence the analysis and to mitigate model misspecification. We include firm size (Size) measured as the logarithm of total assets, leverage (Lev) measured as the ratio of total liabilities over total assets, firm age (Age) measured as the total number of days since the initial public offering (IPO) of the firm and executive incentives (EI), which is graded 1 if the company has a performance-based incentive policy for executives and 0 if it does not (Chen & Ma, 2021; Lee et al., 2016; Nguyen

TABLE 1 Variable definition.

Variable	Variable definition
Tobin's Q	(Market capitalization + Long term debt)/Total assets
ROA	Net income/Total assets
Environmental performance	Environmental score of the company
Firm size	Natural logarithm of total assets
Leverage	Total debt/Total assets
Executive incentives	Presence of a performance-oriented incentive policy
Firm age	Total number of days since the firms initial public offering (IPO)
Board size	Total number of board members
Board independence	Proportion of outside (independent) directors relative to total board members
CEO duality	CEO is also chairperson of the board
Gender diversity	Percentage of female on the board
Audit committee independence	Percentage of independent board members on the audit committee as stipulated by the company

et al., 2021; Wong et al., 2021). We further control for year and industry effects and include them as dummy variables.

Finally, for the moderator analysis board governance is measured by five key elements of the board: board size, board independence, CEO duality, gender diversity and audit committee independence. The variable definition is shown in Table 1.

3.2 | Research model

We align this study with established research practices by employing ordinary least squares regression models to test our hypotheses (Chen & Ma, 2021; Nguyen et al., 2021). To analyse the influence of environmental performance on firm performance (H1) we establish model (1), where the dependent variable $FP_{i,t+h}$ represents the financial performance of firm i in year $t + h$. The dependent variables, Tobin's Q and ROA, are analysed in years $t + h$, where h equals the time lag in years between the dependent and independent variables ($h = 0, 1, 2$). The reason for this is that the influence of EP on FP has often been identified as time-delayed in the past. This phenomenon of time-delayed effects is because there could be a delay between the start of emissions reductions and the realisation of a guaranteed return (Hart & Ahuja, 1996; Zhang et al., 2019). Therefore, we not only control for the influence of EP and FP within the same year, but also displace FP by two additional years.

The independent variable $EP_{i,t}$ represents environmental performance of firm i in year t. $Size_{i,t}$, $Lev_{i,t}$, $Age_{i,t}$ and $EI_{i,t}$ represent the control variables firm size, leverage, firm age and executive incentives respectively. ΣIndustry and ΣYear represent a vector of industry and year dummies. $\varepsilon_{i,t+h}$ is the error term.

$$FP_{i,t+h} = \beta_0 + \beta_1 EP_{i,t} + \beta_2 Size_{i,t} + \beta_3 Lev_{i,t} + \beta_4 Age_{i,t} + \beta_5 EI_{i,t} + \sum Industry + \sum Year + \varepsilon_{i,t+h}, \quad (1)$$

In addition, we use model (2) to analyse how board governance moderates the relationship between EP and FP (H2–H6). Where β_2–β_6, represent the model coefficients for the five board governance variables (board size, board independence, CEO duality, gender diversity and audit committee independence). β_7–β_{11} are the coefficients for the interaction terms of each board governance variable and EP.

$$\begin{aligned} FP_{i,t+h} = {} & \beta_0 + \beta_1 EP_{i,t} + \beta_2 BoardSize_{i,t} + \beta_3 BoardIndependence_{i,t} \\ & + \beta_4 CEODuality_{i,t} + \beta_5 GenderDiversity_{i,t} \\ & + \beta_6 AuditIndependence_{i,t} + EP_{i,t} \times \left(\beta_7 BoardSize_{i,t}\right. \\ & + \beta_8 BoardIndependence_{i,t} + \beta_9 CEODuality_{i,t} \\ & \left. + \beta_{10} GenderDiversity_{i,t} + \beta_{11} AuditIndependence_{i,t}\right) \\ & + \beta_{12} Size_{i,t} + \beta_{13} Lev_{i,t} + \beta_{14} Age_{i,t} + \beta_{15} EI_{i,t} \sum Industry \\ & + \sum Year + \varepsilon_{i,t+h}. \end{aligned} \quad (2)$$

Our methodological approach differs from previous studies particularly in terms of the moderator analysis. While prior research has examined board governance variables either in isolation or as part of an index, we have introduced five interaction terms into our model (2) for several reasons. Corporate governance mechanisms are believed to work together, meaning they enhance each other's effectiveness when combined (Aguilera et al., 2008; Misangyi & Acharya, 2014). Put simply, the presence or absence of one board mechanism can affect the presence or absence of others. Therefore, the concept of complementarity is based on the idea that the effect of an individual board mechanism depends on whether other board mechanisms influence it. This is supported by Aguilera et al. (2012), who argue that governance characteristics are interdependent and therefore should not be examined in isolation. The prevailing misconception that internal board mechanisms operate in isolation may explain inconclusive outcomes in the past. Moreover, our approach aligns with the methodology of Nguyen et al. (2021).

Consequently, our conceptualization of complementarity provides a robust framework for understanding the synergistic effects and interdependencies among board governance mechanism, EP and FP.

In summary, model (1) sets out to examine the relationship between EP and FP, while model (2) investigates the moderating influence of board governance on this association. This study further uses generalised method of moment (GMM) modelling to deal with potential endogeneity issues (Saleh et al., 2020).

4 | RESULTS

4.1 | Descriptive statistics

Descriptive statistics are presented in Table 2.

TABLE 2 Descriptive statistics.

Variable	Observations	Mean	Median	SD	Minimum	Maximum
Tobin's Q	2255	1.266	0.919	2.033	0.019	60.77
ROA	2255	0.044	0.036	0.091	−0.955	2.518
Environmental performance	2255	64.23	69.07	23.38	0	98.89
Board size	2255	11.30	11	3.710	3	28
Board independence	2255	60.95	62.5	24.09	0	100
CEO duality	2255	0.218	0	0.413	0	1
Audit committee independence	2255	78.40	85.71	27.02	0	100
Gender diversity	2255	29.83	30	11.97	0	66.66
Lev	2255	0.236	0.220	0.156	0	1.502
Size	2255	10.21	10.09	0.803	7.804	12.57
Age	2255	11,259	8090	9797	19	59,533
Executive incentives	2255	0.966	1	0.180	0	1

Regarding the indicators of firm performance, the mean of Tobin's *Q* is 1.266, indicating that, on average, the market values of the selected firms is slightly higher than its book value. A Tobin's *Q* above 1 suggests that investors perceive the company as valuable and expect future growth. In the case of ROA, firms have a return of approximately 4.4% on their assets. Similar to Tobin's *Q*, the mean and median are very close, indicating that the data is approximately symmetrically distributed. The mean value of EP is 64.23 and the median value is 69.07 indicating that while most firms have an above-average environmental performance score, a few underperforming firms are significantly lowering this mean value. According to the moderating variables, the mean and median of board size is around 11, with a minimum and maximum of 3 and 28. On average 60.95% of firms have boards member that are independent directors. Furthermore, 21.8% of firms have a CEO who also serves as a chairperson of the board. On average 29.83% of the boards consist of female directors. Lastly, 78.40% have members of an audit committee that are free from conflicts of interest and external influences. Regarding the control variables, the median leverage value is 0.220, and the average leverage value is 0.236, indicating that most companies in the sample have a strong capital structure and are not in danger of running out of funds. The mean (10.21) and median (10.09) of firm size suggest that the distribution of firm sizes is relatively symmetric. In case of firm age, the mean is 11,259 days and the median is 8090 days; the distribution is right-skewed as expected. Finally, in our sample, the majority of firms (96.6%) applies an executive incentive policy.

Table 3 shows the initial industry distribution among the total sample of 582 firms, demonstrating that a majority of the firms are Industrial (113) and Financial (99) firms, whereas fewer firms come from Real Estate (27) and Utilities (26). Further, Table 4 demonstrates the distribution of all firms among the 17 European countries. It can be observed that most of the firms in the sample come from the United Kingdom (155), followed by France (77) and Germany (64). In contrast, Poland (9), Ireland (8), and Portugal (7) have the fewest firms.

TABLE 3 Industry distribution.

Industry	Distribution
Industrials	113
Financials	99
Consumer cyclicals	82
Basic materials	61
Technology	54
Consumer non-cyclicals	45
Healthcare	39
Energy	36
Real estate	27
Utilities	26
Total	582

Table 5 shows the correlation matrix for all variables used in this study. The Variance Inflation Factor (VIF) test is used to assess the multicollinearity. All results indicate that multicollinearity is not an issue in this study.

4.2 | Regression results

4.2.1 | Environmental performance and firm performance

Table 6 shows the regression results of model (1).

To study the influence of EP on FP, the dependent variables Tobin's *Q* and ROA all use data from year $t+0$, $t+1$ and $t+2$, and are shown in columns (1)–(6). According to the regression results in columns (1), (3) and (5) the coefficients of EP are positive for Tobin's *Q* at the 5% significance level in $t+0$, $t+1$ and $t+2$, demonstrating a positive association between EP and Tobin's *Q* in all analysed years. In columns (2), (4) and (6) the coefficients of EP

TABLE 4 Country distribution.

Country	Distribution
United Kingdom	155
France	77
Germany	64
Sweden	33
Switzerland	48
Finland	28
Netherlands	24
Denmark	28
Norway	21
Italy	19
Belgium	19
Spain	18
Greece	12
Austria	12
Poland	9
Portugal	7
Ireland	8
Total	582

on ROA are positive but not significant in all years, only in $t + 0$ (2) there is a significant influence of EP on ROA. Instead, $t + 1$ (4) and $t + 2$ (6) show no significant influence. As a result, EP and FP have a significantly positive association in all years for Tobin's Q while EP shows a significant and positive correlation with ROA in $t + 0$. A possible explanation for the difference in the results is that ROA, being a financial metric, may be impacted by more immediate financial considerations that may not fully reflect the strategic and societal impacts of sustainability efforts. Tobin's *Q*, as a market-based and forward-looking measure, is more likely to capture the perceived long-term benefits of positive environmental performance. This result aligns with the assumption of Chen and Dagestani (2023) in that Tobin's *Q* may better reflect the actual firm value of a firm. In addition, the regression results provide support for the findings of Hart and Ahuja (1996) and Zhang et al. (2019), indicating that environmental practices result in improving financial outcomes after a few years. Overall, the results demonstrate that EP has a positive influence on FP in Europe. Therefore, H1 is supported.

4.2.2 | The moderating influence of board governance

In this section, we add the five board governance variables and their interaction terms with environmental performance to our main analysis. H2–H6 predicts that board size, board independence, CEO Duality, gender diversity and audit committee independence moderate the relationship of EP and FP. The results of the moderating regression analysis are presented in Table 7.

Our results show that the influence of EP on FP remains to be positive and significant in all years for Tobin's *Q*. For ROA it is positive and significant at a 1% level in $t + 0$ and at a 5% significance level in $t + 2$. Moving to the potential moderators, our findings indicate that board size and CEO duality do not seem to have a moderating influence. Consequently, H2 and H4 are rejected. Conversely, board independence, gender diversity and audit committee independence show a significant moderating influence on the relationship between environmental performance and firm performance.

The results reveal that board independence has a significant and negative influence on FP across all analysed years for both Tobin's *Q* and ROA. This means that the presence of a higher independent board has a negative influence on FP. Additionally, the results show that board independence has a positive moderating influence on the relationship between EP and FP, with a statistical significance at the 10% level in year $t + 0$ for Tobin's *Q* and ROA, and at the 5% level in $t + 1$ and $t + 2$ for both dependent variables. This finding suggests that when a company's board of directors includes a higher proportion of independent members, the link between environmental performance and firm performance is strengthened. This finding is consistent with the stakeholder theory in that independent board members typically offer diverse perspectives, often prioritising stakeholder interests (Al-Jaifi et al., 2023; Gavana et al., 2023; Haque, 2017; Kassinis & Vafeas, 2002). Their objective oversight and strategic guidance help ensure that environmental initiatives are effectively integrated into the company's broader goals, resulting in an improved translation of environmental performance to financial outcomes. Therefore, H2 is supported.

Furthermore, gender diversity shows a significant and positive influence on FP at a 1% level for both Tobin's *Q* and ROA in all analysed years. This result implies that having more women on the board increases FP. In addition, the moderating influence of gender diversity proves to be significant at the 1% level in $t + 0$, $t + 1$ and $t + 2$ when FP is measured by Tobin's *Q*. At the same time, it is significant at a 1% level in $t + 0$ and at a 5% level in $t + 1$ and $t + 2$ when FP is measured by ROA. Subsequently, H5 is supported. The results reveal a negative coefficient on the interaction term between gender diversity and EP. This indicates that as the number of women on the board increases, the influence of EP on FP decreases. While gender diversity brings valuable perspectives and enhances decision-making, it weakens the immediate relationship between environmental performance and firm performance. This may be caused by longer decision-making processes, potential conflicts in priorities, a focus on compliance over proactive strategies, or a larger effect of gender diversity on environmental performance. These factors would mitigate the potential positive impact of environmental performance on overall firm performance. This finding is further inconsistent with resource dependence theory, which argues that through the promotion of environmental concerns, gender diversity might facilitate access to crucial financial resources.

Finally, the results indicate that audit committee independence has a significant and positive influence on FP at a 1% level in all analysed years for both Tobin's *Q* and ROA. Moreover, audit committee

TABLE 5 Correlation matrix.

	Tobin's Q	ROA	Board size	Board independence	CEO duality	Environmental performance	Audit committee independence	Executive incentives	Gender diversity	Lev	Size	Age
Tobin's Q	1***											
ROA	0.5921***	1***										
Board size	−0.1430***	−0.0753***	1***									
Board independence	0.0176	0.0224	−0.1772***	1***								
CEO duality	0.0208	−0.0003	0.1182***	−0.0971***	1***							
Environmental performance	−0.0363**	−0.0143	0.3229***	0.1474***	0.1371***	1***						
Audit committee independence	0.0389**	0.0728***	−0.1510***	0.7233***	−0.0584***	0.0680***	1***					
Executive incentives	0.0482***	0.0506***	0,0001	0.1553***	−0.0645***	0.1508***	0.1123***	1***				
Gender diversity	0.0555***	0.0457***	0.0954***	0.1571***	0.0772***	0.2033***	0.1267***	0.0556***	1***			
Lev	−0.0056	−0.1756***	−0.0134	0.0370**	0.0449***	0.0282*	0.0341**	−0.0017	0.0621***	1***		
Size	−0.2443***	−0.1240***	0.4715***	0.0822***	0.0335**	0.4311***	0.0314*	−0.0111	0.1777***	−0.0911***	1***	
Age	−0.0179	0.0127	0.0399**	0.0041	−0.0467***	0.1393***	−0.0116	−0.0771***	0.1010***	−0.0468***	0.2366***	1***

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

TABLE 6 Environmental performance on firm performance.

Variables	(1) Tobin's Q ($t+0$)	(2) ROA ($t+0$)	(3) Tobin's Q ($t+1$)	(4) ROA ($t+1$)	(5) Tobin's Q ($t+2$)	(6) ROA ($t+2$)
Environmental performance	0.0042** (2.0685)	0.0001* (1.7080)	0.0038** (2.1187)	0.0000 (1.0045)	0.0042** (2.1537)	0.0001 (1.2070)
Lev	−0.4649* (−1.6552)	−0.0754*** (−5.8638)	−0.4464* (−1.8227)	−0.0653*** (−5.3719)	−0.5418** (−2.0349)	−0.0462*** (−3.4614)
Size	−0.6246*** (−8.9371)	−0.0180*** (−5.6332)	−0.5655*** (−9.2798)	−0.0112*** (−3.7258)	−0.5761*** (−8.6956)	−0.0134*** (−4.0154)
Age	0.0000* (1.9472)	0.0000*** (3.0339)	0.0000** (2.2519)	0.0000*** (3.5925)	0.0000** (2.1852)	0.0000*** (3.5501)
Executive Incentives	0.3175 (1.3960)	0.0183* (1.7585)	0.3505* (1.7676)	−0.0000 (−0.0023)	0.3788* (1.7574)	0.0086 (0.7956)
Constant	6.8723*** (9.9821)	0.2038*** (6.4650)	6.3899*** (10.6447)	0.1640*** (5.5000)	6.2951*** (9.6462)	0.1717*** (5.2264)
Year/Industry	Control	Control	Control	Control	Control	Control
Obs.	2255	2255	2255	2255	2255	2255
Multiple R^2	0.1173	0.0783	0.1419	0.0970	0.1301	0.0656

Note: t values are in parentheses.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

independence shows a significant and negative moderating influence at a 5% level in $t+0$, and at a 1% level in $t+1$ and $t+2$ when FP is measured by Tobin's Q. When FP is measured by ROA, it shows a significant and negative influence at a 10% level in $t+0$ and $t+1$ and at a 5% level in $t+2$. Hence, H6 is supported. The negative coefficients indicate that an increased proportion of independent members on the audit committee, weakens the relationship between EP and FP. While audit committee independence promotes strong financial oversight and accountability, it weakens the relationship between environmental performance and firm performance. Plausible explanations might include an increased focus on financial and compliance issues, lack of environmental expertise, risk aversion and resource allocation priorities. These factors could reduce the impact of environmental performance on firm performance. This result is inconsistent with stakeholder and resource dependence theory. These theories argue that independent audit committees help firms in managing relationships with external stakeholders by offering credible assurance on environmental concerns and therefore serve as a mechanism to secure important resources (Appuhami & Tashakor, 2017).

Our results differ from previous studies conducted in both China and the US. For example, contrary to the findings of Nguyen et al. (2021) which indicate that board independence and gender diversity do not moderate the relationship between EP and FP in China, our research suggests otherwise. The lack of significance in the study of Nguyen et al. (2021) may be attributed to weak corporate governance practices and the limited representation of female directors within Chinese companies. Additionally, Lu (2021) suggests that enhanced corporate governance practices, such as a more independent board and a greater presence of women on boards, strengthens the relationship between EP and FP. While our results align in terms of the strengthening influence of board independence, we differ in that in our study gender diversity weakens the relationship between EP and FP. The positive association of gender diversity in the study of Lu (2021) could be driven by factors such as a greater recognition of the benefits of diverse perspectives and a more encouraging regulatory environment to promote gender diversity in the US.

In summary, we find that three of our five examined board governance variables have a moderating influence on the relationship between EP and FP. On the one hand, the influence of EP on FP increases when European firms have a higher representation independent board member. On the other hand, a higher number of women on the board and a higher number of independent members in the audit committee weakens the influence of EP on FP. The differences between our results and those of previous studies may be attributed to variations among the analysed countries and regions. According to Aguilera et al. (2012) the number of potential combinations of corporate governance practices and their complementarities is extensive. This means that a particular corporate governance mechanism may have opposite effects in different institutional contexts. In light of these results, different cultural and institutional contexts may influence corporate governance practices that lead to variations in the relationship between EP and FP between China, US and Europe.

The results of H1–H6 are presented in Table 8.

5 | ADDITIONAL ANALYSIS

5.1 | Endogeneity

In our study, fixed-effects estimation was employed in the primary analysis as it is recognised for its effectiveness in mitigating unobserved heterogeneity among different groups within the model

TABLE 7 Moderating role of board governance.

Dependent variable	(1) Tobin's Q ($t+0$)	(2) ROA ($t+0$)	(3) Tobin's Q ($t+1$)	(4) ROA ($t+1$)	(5) Tobin's Q ($t+2$)	(6) ROA ($t+2$)
Environmental performance	0.0168** (2.2803)	0.0009*** (2.7567)	0.0180*** (2.8048)	0.0003 (1.1258)	0.0184*** (2.6426)	0.0007** (2.1754)
Board size	−0.0658* (−1.818)	−0.0009 (−0.5418)	−0.0614* (−1.9486)	−0.0020 (−1.2933)	−0.0800** (−2.3364)	−0.0009 (−0.5535)
Board independence	−0.0172** (−2.3979)	−0.0008*** (−2.5884)	−0.0175*** (−2.8027)	−0.0010*** (−3.3187)	−0.0188*** (−2.7843)	−0.0008** (−2.3541)
CEO duality	0.1157 (0.3286)	0.0070 (0.4416)	0.1927 (0.6288)	−0.0008 (−0.0539)	0.2078 (0.6241)	0.0019 (0.1160)
Gender diversity	0.0416*** (4.4533)	0.0022*** (5.2668)	0.0349*** (4.3004)	0.0012*** (3.1352)	0.0378*** (4.2820)	0.0012*** (2.8296)
Audit committee independence	0.0182*** (3.0381)	0.0008*** (3.1098)	0.0192*** (3.6754)	0.0008*** (3.2936)	0.0211*** (3.7077)	0.0008*** (2.9468)
Environmental performance × Board size	0.0004 (0.9841)	0.0000 (0.0372)	0.0003 (0.7135)	0.0000 (0.3690)	0.0004 (1.0090)	−0.0000 (−0.4463)
Environmental performance × Board independence	0.0001* (1.7259)	0.0000* (1.8730)	0.0001** (2.0651)	0.0000** (2.3991)	0.0002** (2.0873)	0.0000** (2.0525)
Environmental performance × CEO duality	−0.0011 (−0.2323)	−0.0001 (−0.4613)	−0.0017 (−0.4094)	0.0000 (0.0692)	−0.0017 (−0.3896)	−0.0000 (−0.0323)
Environmental performance × Gender diversity	−0.0004*** (−3.2246)	−0.0000*** (−4.0504)	−0.0003*** (−3.1457)	−0.0000** (−2.5572)	−0.0004*** (−3.1888)	−0.0000** (−2.3668)
Environmental performance × Audit committee independence	−0.0002** (−2.1604)	−0.0000* (−1.7554)	−0.0002*** (−2.7722)	−0.0000* (−1.6963)	−0.0002*** (−2.7963)	−0.0000** (−2.0019)
Lev	−0.46707* (−1.6564)	−0.0763*** (−5.9303)	−0.4357* (−1.7757)	−0.0650*** (−5.3245)	−0.5296** (−1.9860)	−0.0459*** (−3.4069)
Size	−0.5541 *** (−7.2793)	−0.0157 *** (−4.5391)	−0.4755 *** (−7.1774)	−0.0079** (−2.4158)	−0.4714 *** (−6.5486)	−0.0092** (−2.5360)
Age	0.0000 (1.5822)	0.0000 *** (2.6983)	0.0000* (1.8686)	0.000*** (3.3105)	0.0000* (1.7980)	0.000*** (3.2711)
Executive incentives	0.2781 (1.1967)	0.0138 (1.3078)	0.3181 (1.5730)	−0.0017 (−0.1754)	0.3390 (1.5423)	0.0045 (0.4080)
Constant	5.4360*** (6.2532)	0.1220*** (3.0769)	4.8022*** (6.3474)	0.1143*** (3.0352)	4.6205*** (5.6198)	0.0940** (2.2597)
Year/industry	Control	Control	Control	Control	Control	Control
Obs.	2255	2255	2255	2255	2255	2255
Multiple R^2	0.1357	0.1035	0.1629	0.1158	0.152	0.0807

Note: *t* values are in parentheses.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

(Saleh et al., 2022). However, it is important to acknowledge that unobserved heterogeneity, correlations and endogeneity concerns may influence the data in our research. Endogeneity arises when an independent variable correlates with the unexplained residual (error term) of the dependent variable (Hill et al., 2021). Consequently, the conclusions drawn from the primary analysis could be potentially misleading. This means that the coefficients are just as likely to be overestimated as underestimated.

To address potential endogeneity concerns, an effective approach is to employ a dynamic system GMM estimation. GMM is widely recognised for mitigating potential endogeneity issues, ensuring the sensitivity and robustness of the main results (Saleh & Maigoshi, 2024). These models produce parameter estimates that are not only more accurate than those derived from fixed-effect models but also resilient to issues like heteroskedasticity and autocorrelation (Saleh et al., 2020). In our study we use the commonly used instrumental variable approach to deal with potential endogeneity issues (Lu et al., 2018). Considering our study's emphasis on board governance and environmental performance, we aim to find a suitable exogenous instrumental variable (IV). This IV should be correlated with the suspected endogenous variable but unrelated to the error term of the dependent variable (Wooldridge, 2015). Hence, we use lagged environmental performance ($EP_{i,t-1}$) as an instrumental variable.

As presented in Tables 9 and 10, the outcomes of GMM modelling have no major differences from the results of the main analysis using ordinary least squares regression methods. Additionally, the Durbin–Wu–Hausman test indicates that endogeneity is not an issue in our study.

5.2 | Covid

This study further explored the influence of having incorporated the years of the COVID-19 crisis into the analysis. Given the occurrence of a worldwide pandemic in 2020, with repercussions including effects on the global economy, there was a need to evaluate whether this factor could introduce scrutiny into our results. Consequently, we excluded data from the years 2020 and 2021 from the analytical framework. The outcomes of this supplementary analysis show that the findings maintain their resilience.

TABLE 8 Hypotheses results.

Hypotheses		Approved
1	Environmental performance positively influences firm performance in Europe	Yes
2	Board size moderates the relationship between environmental performance and firm performance	No
3	Board independence moderates the relationship between environmental performance and firm performance	Yes
4	CEO duality moderates the relationship between environmental performance and firm performance	No
5	Gender diversity moderates the relationship between environmental performance and firm performance	Yes
6	Audit committee independence moderates the relationship between environmental performance and firm performance	Yes

6 | CONCLUSION

Our study examines the moderating role of board governance in the relationship between environmental performance and firm performance. Using a fixed effects model and a series of robustness tests, our findings suggest that environmental performance significantly influences firm performance. Our results confirm the time-lagged influence that environmental performance has on firm performance. In addition, we find that board independence, gender diversity and audit committee independence moderate the environmental performance and firm performance relationship. While board independence strengthens this relationship, gender diversity and audit committee independence weaken it.

This study contributes to the existing literature on the ongoing academic discussion concerning the profitability of environmental practices. Moreover, our findings have confirmed that analysing the direct relationship of environmental performance and firm performance might be insufficient and highlight the importance of identifying potential moderators that influence this association. Considering this, our study extends the understanding of the relationship between environmental performance and firm performance in having identified board independence, gender diversity and audit committee independence as moderators in this relationship. Furthermore, our results offer different perspectives to existing theories such as agency,

TABLE 9 Environmental performance on firm performance.

Variables	(1) Tobin's Q ($t+0$)	(2) ROA ($t+0$)	(3) Tobin's Q ($t+1$)	(4) ROA ($t+1$)	(5) Tobin's Q ($t+2$)	(6) ROA ($t+2$)
Environmental performance	0.0040* (1.7931)	0.0001 (1.3440)	0.0038** (1.9934)	0.0000 (0.4912)	0.0043** (2.0450)	0.0001 (1.2682)
Lev	−0.4663* (−1.666)	−0.0755*** (−5.8948)	−0.4461* (−1.8281)	−0.0656*** (−5.4090)	−0.5413** (−2.0404)	−0.0463*** (−3.4681)
Size	−0.6200*** (−8.7109)	−0.0176*** (−5.4048)	−0.5666*** (−9.1298)	−0.1056*** (−3.4237)	−0.5779*** (−8.5664)	−0.0136*** (−4.0239)
Age	0.0000* (1.9559)	0.0000*** (3.0479)	0.0000** (2.2601)	0.0000*** (3.6106)	0.0000** (2.1930)	0.0000*** (3.5620)
Executive Incentives	0.3205 (1.4135)	0.0185* (1.7898)	0.3498* (1.7691)	−0.0000 (−0.0463)	0.3776* (1.7567)	0.0084 (0.7811)
Constant	6.8421*** (9.8780)	0.2011*** (6.3406)	6.3970*** (10.5921)	0.1593*** (5.3085)	6.3074*** (9.6066)	0.1735*** (5.2493)
Year/Industry	Control	Control	Control	Control	Control	Control
Obs.	2255	2255	2255	2255	2255	2255

Note: t values are in parentheses.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

TABLE 10 Moderating role of board governance.

Dependent variable	(1) Tobin's Q ($t+0$)	(2) ROA ($t+0$)	(3) Tobin's Q ($t+1$)	(4) ROA ($t+1$)	(5) Tobin's Q ($t+2$)	(6) ROA ($t+2$)
Environmental performance	0.0163** (2.1431)	0.0009*** (2.5940)	0.0163** (2.1431)	0.0009*** (2.5940)	0.0163** (2.1431)	0.0009*** (2.5940)
Board size	−0.0705* (−1.8668)	−0.0001 (−0.6537)	−0.0705* (−1.8668)	−0.0011 (−0.6537)	−0.0705* (−1.8668)	−0.0001 (−0.6537)
Board independence	−0.0178** (−2.3866)	−0.0008** (−2.5743)	−0.0178** (−2.3866)	−0.0088** (−2.5743)	−0.0178** (−2.3866)	−0.0008** (−2.5743)
CEO duality	0.6504 (0.1746)	0.0063 (0.3716)	0.6504 (0.1746)	−0.0006 (−0.3716)	0.6043 (0.1746)	0.0063 (0.3716)
Gender diversity	0.0425*** (4.3281)	0.0023*** (5.3071)	0.0425*** (4.3281)	0.0023*** (5.3071)	0.0425*** (4.3281)	0.0023*** (5.3071)
Audit committee independence	0.0189*** (3.0191)	0.0008*** (3.0216)	0.0189*** (3.0191)	0.0008*** (3.0216)	0.0189*** (3.0191)	0.0008*** (3.0216)
Environmental performance × Board size	0.0005 (1.0720)	0.0000 (0.1926)	0.0005 (1.0720)	0.0000 (0.1926)	0.0005 (1.0720)	0.0000 (0.1926)
Environmental performance × Board independence	0.0001* (1.7481)	0.0000* (1.9019)	0.0001* (1.7481)	0.0000* (1.9019)	0.0001* (1.7481)	0.0000* (1.9019)
Environmental performance × CEO duality	−0.0033 (−0.0645)	−0.0008 (−0.3617)	−0.0033 (−0.064)	−0.0000 (−0.3617)	−0.0033 (−0.0654)	−0.0000 (−0.3617)
Environmental performance × Gender diversity	−0.0004*** (−3.1412)	−0.0000*** (−4.1306)	−0.0004*** (−3.1412)	−0.0000*** (−4.1306)	−0.0004*** (−3.1412)	−0.0000*** (−4.1306)
Environmental performance × Audit committee independence	−0.0002** (−2.1742)	−0.0000* (−1.7214)	−0.0002** (−2.1742)	−0.0000* (−1.7214)	−0.0002** (−2.1742)	−0.0000* (−1.7214)
Lev	−0.4667* (−1.6636)	−0.0762*** (−5.9553)	−0.4667* (−1.6636)	−0.0762*** (−5.9553)	−0.4667* (−1.6636)	−0.0762*** (−5.9553)
Size	−0.5492*** (−7.1405)	−0.0153*** (−4.3733)	−0.5492*** (−7.1405)	−0.0015*** (−4.3733)	−0.5492*** (−7.1405)	−0.0015*** (−4.3733)
Age	0.0000 (1.5975)	0.0000 *** (2.7295)	0.0000 (1.5975)	0.000*** (2.7295)	0.0000 (1.5975)	0.000*** (2.7295)
Executive Incentives	0.2536 (1.2330)	0.0143 (1.3547)	0.2853 (1.2330)	0.0014 (1.3547)	0.2853 (1.2330)	0.0014 (1.3547)
Constant	5.4132*** (6.1191)	0.1189*** (2.9453)	6.4132*** (7.2496)	1.1189*** (27.7141)	7.4132*** (8.3800)	2.1189*** (52.4829)
Year/Industry	Control	Control	Control	Control	Control	Control
Obs.	2255	2255	2255	2255	2255	2255

Note: *t* values are in parentheses.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

stakeholder, stewardship and resource dependence theory, suggesting that certain board governance mechanisms weaken the relationship between environmental performance and firm performance. Moreover, our results differ from comparable studies in China and the US. This confirms the assumption that particular corporate governance mechanisms may have opposite effects in different institutional contexts and that previous results cannot be equated. Consequently, further empirical research should be conducted to identify these relationships.

This contribution has practical implications for various stakeholders, including policymakers, regulators, practitioners and academics. Our findings may confirm the effectiveness of European climate policy. Firms should put more effort into enhancing their environmental performance. By elevating their environmental standards, they not only promote a green image but also adeptly navigate regulatory landscapes, ensuring sustained compliance and enhancing their overall firm value. In addition, European policymakers and managers could further promote compliance with board governance structures by issuing clear guidelines and enforcing stricter measures. Moreover, practitioners should monitor the influence of the implementation of corporate governance regulations because these could influence their environmental and financial outcomes. Finally, our study can benefit academics as it extends the significance of identifying moderator variables in the relationship of environmental performance and firm performance, highlighting the need for further empirical research.

This study has certain limitations. The research is limited to European firms, potentially limiting the applicability of its findings to a broader international context. Furthermore, the moderating influence

of board independence, gender diversity and audit committee independence may be influenced by various other factors. A more detailed examination of specific board dynamics is necessary to gain a comprehensive understanding. Hence, this research highlights the necessity for further exploration into identifying potential moderators in the direct relationship between environmental performance and firm performance. Future studies might consider integrating additional corporate governance mechanisms, such as ownership structure and executive compensation.

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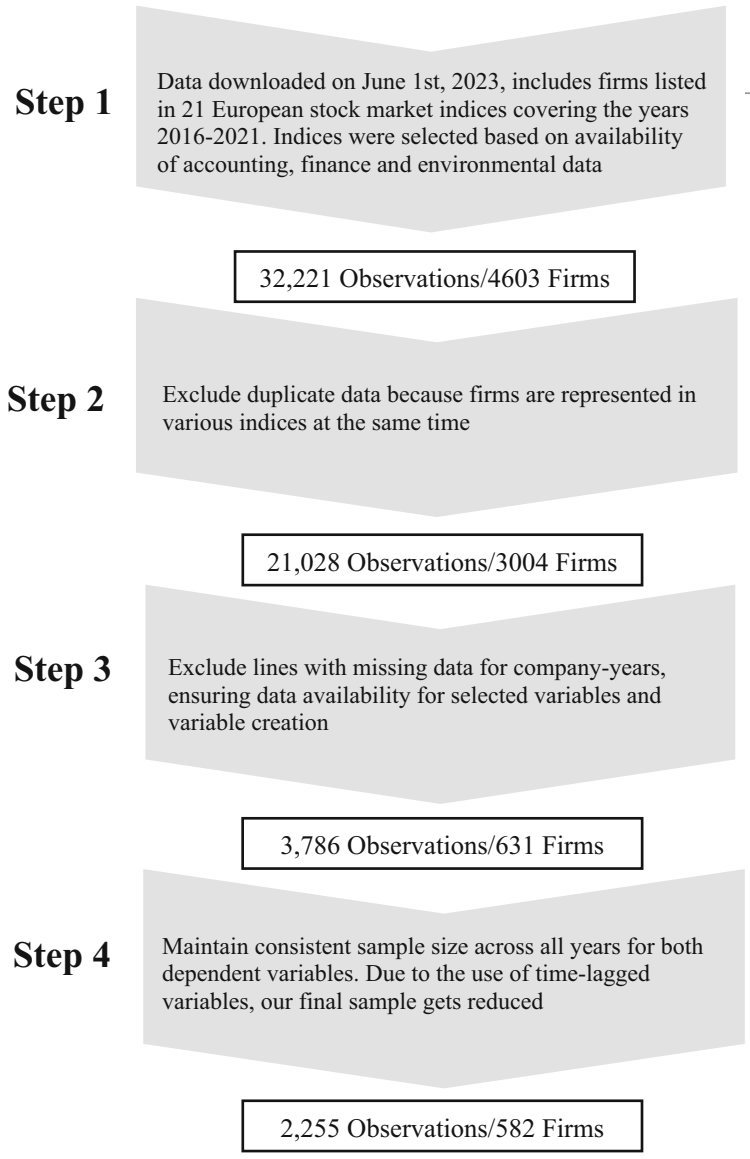
APPENDIX A



Initial Download - Data Distribution		
Index	Companies	Country
AAX	132	Netherlands
ATG	60	Greece
ATX	20	Austria
BSPT	123	Belgium
BVL	37	Portugal
CACT	230	France
CDAX	383	Germany
FTLC	350	United Kingdom
FTMC	250	Italy
ISEQ	33	Ireland
OMXCPI	130	Denmark
OMXHPI	141	Finnland
OMXSPI	395	Sweden
OSEAX	195	Norway
PAX	382	France
PRIME	305	Germany
RETM	60	France
SSHI	216	Swiss
SSIR	228	Swiss
WIG	333	Poland
STOXX 600	600	Europe

FIGURE A1 Sample selection. Source: Author's elaboration.