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Board characteristics and effects on ESG performance: empirical evidence from the European banking system

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Abstract
This study examines the influence of board characteristics, including diversity, independence, board size, diligence, and board experience, on the environmental, social, and governance (ESG) performance of European banks. Data were collected for 472 European banks between the years 2017–2020. The set of explanatory variables consisted of corporate governance features labelled as best practices in the literature. Our study provides new understanding and insights into the importance of governance features on ESG performance. Our findings overall indicate that banks' ESG score is associated with gender diversity, independent directors, board diligence and Corporate Social Responsibility (CSR) committee. Based on this study, shareholders and policymakers will have a deeper knowledge of the significant roles that some board characteristics play as determinants of ESG performance in the banking system. To the best of our knowledge, most of the studies on the environmental theme are focused on the business world; our study intends to fill this further gap in the literature by focusing on the banking system. Indeed, our focus on the banking industry allows for a more homogeneous reference population and is important because banks, in transferring substantial funds, represent one of the main economic drivers that can enhance the transition towards a more sustainable economy. Our research contributes to the strand of literature focusing on ESG disclosure of European banks and the relationship with performance measures to help in closing the gap identified in previous research, mainly focusing on the business world.

Keywords Banking system · Board · ESG score · GLS estimator · Governance · Sustainability

1 Introduction

Despite a wide choice of tools for investing sustainably, there is a growing need to understand how these tools make an economy more resilient and allow communities to move towards a green transition. ESG criteria (i.e., environmental, social and governance standards) have recently entered the academic debate, as they may not capture companies'

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actual social and environmental impact (Arici et al. 2024). The research analyses and compares the SDG score with traditional ESG ratings, to evaluate three particular areas: (1) Alignment with the sustainable preferences of investors; (2) Alignment with European taxonomy and (3) Alignment with ambitions to limit climate change. In this scenario, the role of the European banking system is crucial to sustainable communities and its impact fosters citizens' social change. "*Fundamentally*, *getting culture and conduct right is not merely a supervisory requirement. It is necessary for banks and banking's economic and social sustainability*" (G30 2018). Traditional accounting practices focus only on the firms' financial results of business activities, but in today's world business environment, investors but as all stakeholders, demand nonfinancial reports and standard financial statements. This demand has led firms to raise their awareness by disclosing sustainability reports to reflect the results of their non-financial initiatives. For this reason, many companies have started to prepare sustainability reports as stakeholders demanded greater disclosure of environmental, social and governance (ESG) issues. Our study focuses on the European banking system. Concerning banks and following previous research (Chang et al. 2021; Ye et al. 2022), ESG disclosure can enhance their reputation, image, and brand awareness and increase trust. In addition, banks also have a fundamental impact on the financial system and overall economy (Adams and Mehran,2002), and trust in banking (even from an ESG perspective) becomes extremely important. On the other hand, a company's success primarily depends on the board of directors (Birindelli et al. 2018), given that they are responsible for approving and overseeing the implementation of strategic goals. The bank's board is the key mechanism for setting and implementing strategies, and it is essential for ensuring the effectiveness of operations and aligning the interests of management and shareholders (Arora and Sharma 2016). In addition, the related literature finds a strong positive relationship between a company's sustainability performance and profitability: companies with high sustainability ratings significantly outperform their competitors. So, adopting environmental, social and governance (ESG) best practices leads to a long-term advantage in the business world. Indeed, some studies (Campanella et al. 2021) find that CSR is valuable to investors and that markets penalise profitable firms with poor CSR activities. Based on these considerations, this study aims to identify the board of directors' characteristics which raise corporate social responsibility (CSR) performance. More specifically, our analysis examines the impact of a board's characteristics (gender diversity, independence, board size, board activity, CSR sustainability committee, and board age) on ESG performance in the banking industry from 2017 to 2020. This study aims to answer the following research question: *What is the relation*, *if any*, *between board diversity and ESG performance?* This research is motivated by the low number of works in the context concerning corporate social responsibility, giving an important contribution to the academic literature by adding to the limited body of research on the relationship between corporate governance and sustainable initiatives. Moreover, to the best of our knowledge, most of the studies on the environmental theme are focused on the business world; our study intends to fill this further gap in the literature by focusing on the banking system. Indeed, our focus on the banking industry allows for a more homogeneous reference population and is important because banks, in transferring substantial funds, represent one of the main economic drivers that can enhance the transition towards a more sustainable economy. Our research contributes to the strand of literature focusing on ESG disclosure of European banks and the relationship with performance measures to help in closing the gap identified in previous research, mainly focusing on the business world.

To proxy a bank's sustainability performance and following previous studies (Birindelli et al. 2018; Di Tommaso and Thornton 2020; El Khoury et al. 2021), we use Refinitiv's ESG Asset4 score, a broad and verified measure of CSR performance, used both for financial and non-financial firms. The ESG Asset4 database provides objective, relevant and auditable ESG information for over 3400 publicly listed companies covering major indices, such as the NASDAQ100, S&P500, FTSE 350, and MSCI World (Ye et al. 2025). In sum, this study contributes both to academic literature and to bank practices in several aspects. Firstly, current literature on the topic primarily concentrates on the business world, while this study focuses only on the banking industry. Then, to the best of our knowledge, existing studies on banks primarily deal with CSR disclosure, not CSR performance and generally cover an old-time interval. Conversely, our empirical research covers the years 2017–2020 and analyses a large sample of 108 listed banks in Europe, a region in which the economy notably contributes to sustainable development. The study is divided into discrete sections, with Sect. 1 introduction, followed by five sections. Section 2 provides a literature review and presents the research hypothesis. Section 3 presents the sample and research methodology. Section 4 discusses the findings of the empirical analysis. Section 6 presents the conclusion, implications, and scope for further study.

2 Literature review and hypothesis

Banks operate in a complex institutional environment, which relies on strong state regulation(. Carnevale and Mazzuca 2014), in which the CSR strategies of banks are an instrument of guaranteeing trust in relations with stakeholders. According to the existing literature (Goss et al., 2011; Mohammad and Wasiuzzaman 2021), the adoption of CSR strategies allows a bank to gain a differentiation advantage and the trust of investors, improving their reputational capital (Fafaliou et al. 2022), which stems from community involvement. This strategy means that a bank wants to go "beyond profits" (Godfrey 2005). In the literature (Birindelli et al. 2018; El Khoury et al. 2021), the composition of the bank's board is seen as the essential factor related to corporate governance that influences ESG strategies. So, this study aims to investigate the relationship between banks' board structure and sustainability performance. Following this target, we formulate the following research hypothesis: "*Banks' board structure statistically impacts sustainability performance*". For this reason, in the attempt to give an adequate response to the research hypothesis, we will first analyse the literature related to the link between the main elements of the bank's board of directors and the ESG performance.

2.1 Gender diversity

The gender diversity of the board of directors has received increasing attention for several years, since it is considered one of the most significant current themes in corporate governance research. In the literature (Adams and Mehran 2003; Campanella et al. 2021), it is often argued that it significantly impacts strategic planning. According to the literature, the presence of women on the board will boost firm performance(Serino et al. 2019). The empirical evidence shows that companies with a significant female presence on the board, on average, scored higher in financial performance than companies with no women

in management (Campanella and Serino 2019; Orazalin and Baydauletov 2020). Indeed, female board members have different perspectives compared to male board members, more oriented to a compassion-driven strategic decision like CSR, promoting ESG performance (Orazalin and Baydauletov 2020; Shakil et al. 2022). In this sense, a gendered board may stimulate management boards to promote environmental and social initiatives, helping the organisation gain a certain degree of social recognition and trust (El Khoury et al. 2021; Cornell and Shapiro 2021). For all these reasons, it is interesting to analyse the implications of gender diversity on a company's non-financial performance. We measure the total number of women on the board of directors divided by the total number of board members (Jin and Kim 2022).

2.2 Independent directors

The variable most frequently adopted by researchers to describe the structure of the board is the independence of the board. Independent directors are non-executive directors who have incentives to affect disclosure practices to maintain their reputation and to be viewed as a unique resource that connects the corporation with its stakeholders. So, the proportion of independent directors increases the effectiveness of the board in the monitoring of management, and it is considered an objective control mechanism (Shaukat et al. 2016). Following corporate governance literature (Arena et al. 2015; Amran et al. 2014), board independence improves investment efficiency and the quality of information disclosure. In addition, a company that has a certain proportion of outside directors who can bring a diversity of knowledge, skills, experience, and expertise is more likely to develop an effective CSR strategy leading to superior ESG performance (Shaukat et al. 2016; Amran et al. 2014). While inside directors are related to short-term financial performance, boards with higher independence tend to be more inclined towards social responsibility, encouraging management activities to maximise long-term value (Naciti 2019; Ho and Williams 2003). Based on what has been advanced, we can see that the board independence of companies positively and significantly influences ESG performance. We use the variable Board Independence, measured as the percentage of independent board members divided by the total number of board members (Lagasio and Cucari 2019; Gurol and Lagasio 2022).

2.3 Board size

The scholars agree on the fact that an effective board may lead to proactive managerial behaviour and reduce managerial opportunism to the detriment of shareholders, hence resulting in higher ESG performance. However, empirical studies can be classified into two categories: the first stream of research is in favour of smaller boards, whereas the second school of thought advocates larger boards. Although smaller boards foster good cohesion and coordination (Birindelli et al. 2018; Nekhili et al. 2021), the management control and the accuracy of the information provided require the presence of a considerable number of directors with a certain degree of diversification in terms of education, skills, experiences, expertise, gender, and stakeholder representation (Kao et al. 2018). So, only a sizable board can create diversification. According to previous studies, we believe in a positive relationship between board size and the breadth of sustainability practices. The variable used to

represent Board size is the number of its members (Hussain et al. 2018; Odriozola and Baraibar-Diez 2017).

2.4 Board diligence

Board diligence is another element of a bank's board that enhances its effectiveness (Suttipun 2021) and is usually determined by the number of board meetings. So, following previous studies (Kamaludin et al. 2022), we use the number of board meetings per year as a proxy for the level of board diligence to measure the relationship with ESG performance. For this relation, there is also no consensus about the impact on corporate sustainability performance. On the one hand, a high frequency of meetings allows the directors to better manage and assess corporate operations because meetings are a way to share financial and non-financial information as well as viewpoints, also improving the decision-making processes (Suttipun 2021). On the other hand, more frequent board meetings may denote the inefficacy of directors and lead to higher coordination costs (Hussain et al., 2018). Our research hypothesis aligns with the studies that found a positive relationship between board diligence and the performance of sustainability practices. Indeed, the banks in our sample work in a dynamic business environment, which requires increased meeting frequency and intense activity on the board to ensure the definition of an accurate operational strategy. As a proxy of board diligence, we use the number of meetings for the year (Disli et al. 2022).

2.5 CSR sustainability committee

In recent years, companies have more frequently chosen to establish a CSR committee to handle important sustainability duties. As noted by Hussain et al., "the existence of a CSR committee symbolises the board's orientation and commitment towards sustainable development" (p. 418). The establishment of a CSR committee helps to spread the CSR culture throughout the organisation, strengthening the corporate legitimacy within the community and becoming a source of competitive advantage (Arif et al. 2020). The existence of CSR committees makes visible to investors a commitment to environmental and social issues which go beyond mere economic profit (Baraibar-Diez and Odriozola 2019). Indeed, many authors find that a CSR committee enhances the quality of sustainability because its presence makes sustainability the key core strategy (Baraibar-Diez and Odriozola 2019; Suttipun 2021). On the contrary, only a limited number of studies (39) reveal a negative relationship between CSR committees and CSR disclosure. For these motivations, and under the prevalent literature, we believe that establishing a CSR sustainability committee positively affects ESG disclosure. In this case, we use a binary dummy equal to 1 if the firm has a CSR sustainability committee, and 0 otherwise (Amran et al. 2014; Naciti 2019).

2.6 Board experience

The business experience of the board committee members can be measured using the average age of the board members. It is thought that a higher board average age indicates a more experienced board, and a lower board average age indicates a board with more young directors (Nekhili et al. 2021). Following this thought, older board members can make accurate decisions with their experience (Anderson et al. 2004). However, young directors can be

more willing and braver to make new decisions creatively. While the role of board average age in determining corporate financial performance has been extensively investigated in the literature, the role of board age concerning ESG performance has not been subjected to in-depth analysis, highlighting that there is no significant relationship between the average age and ESG performance (Ismail and Latiff 2019; Cucari et al. 2018). Instead, another stream of research found that younger directors are more enthusiastic and supportive of emerging innovations in the market (Fahad and Rahman 2020), so they are more likely to incorporate more CSR activities than older directors (Kim and Meivitawanli 2022). Because we think that younger board members are risk-takers and more favourable toward new orientation and innovative business operations (Campanella and Serino 2019), we believe board experience negatively correlates with a bank's ESG performance. In our model, we use a proxy of board experience: the board's average age (Giannarakis 2014).

3 Methodology and analysis

Our methodological design, in brief, included the following phases. Starting from the existing data, we decided to carry out an analysis with a Panel model. After that, the Hausman test specifically suggested that we perform a random effects model. Subsequently, the Lagrange multiplier test (Breusch and Pagan 1980) showed us that there is no panel data structure and therefore a pooled model (namely the OLS model) is preferable (Johnson 1995). In the next step, after running an OLS model, based on the values of the Akaike Information Criterion (AIC) (Burnham and Anderson 1998), we decided to insert only 6 regressors in the model. Subsequently, a test of homoskedasticity was carried out, rejecting the null hypothesis and consequently, a generalised least squares (GLS) model was performed to solve the heteroskedasticity problem (Musau et al. 2015).

3.1 Econometric strategy and justification for GLS use

The choice of the Generalised Least Squares (GLS) estimator was driven by both empirical diagnostics and theoretical considerations. Preliminary testing (Hausman and LM tests) indicated that neither fixed nor random effects models offered superior explanatory power over pooled models, and heteroskedasticity in the residuals necessitated correction. GLS offers efficiency gains under these conditions by providing unbiased estimates in the presence of non-constant variance. While Generalised Method of Moments (GMM) could address dynamic endogeneity, its application was constrained by our panel's short time dimension ($T=4$). To strengthen our empirical strategy, we plan to include fixed-effects estimations and, where possible, apply Propensity Score Matching (PSM) to test the robustness of observed relationships (e.g., CSR committee effects).

3.2 Sampling and data collection

This paper investigates in depth the relationship between board diversity and ESG dimensions in Europe. Our final sample comprised 472 European banks, for which data on ESG performance were available on the date of analysis. We constructed a four-year panel dataset (from 2017 to 2020), including 1888 bank-year observations, after listwise deletion for

missing values. Data on ESG performance and corporate governance (women on the board of directors, independent directors, board size, number of board meetings, CSR committee, public disclosure) came from Refinitiv. Bank-specific financial data (total assets, financial performance, and leverage) was collected from Refinitiv Datastream; instead, the country variable (Gross Domestic Product (GDP) per capita) was collected from the World Bank Data.

3.3 Variables in the analysis

Dependent variable.

To proxy a bank's sustainability performance, and following previous studies, we use Refinitiv's ESG Asset4 score, a broad and verified measure of CSR performance used for financial and non-financial firms. An increasing number of investors worldwide have adopted ESG as a proxy for a company's CSR performance to consider environmental, social, and corporate governance issues in their investment decisions. The Refinitiv database was used in previous studies (Menicucci and Paolucci 2022; Grishunin et al. 2022; Arayakarnkul et al. 2022) because it has a clear and transparent methodology for ESG data available on its official website. Indeed, we chose Refinitiv as it is a trusted international database that contains one of the most comprehensive ESG databases. Instead, several control variables highlighting macroeconomic aspects were collected from the World Bank statistics. ESG Scores from Refinitiv are designed to objectively measure a company's relative ESG performance across 10 main themes (emissions, environmental product innovation, human rights, shareholders, etc.) based on publicly reported data. Consulting official corporate documents (but also company websites, newspapers, journals, and trade publications), Refinitiv's analysts collect 750 data points per firm that are used as inputs to calculate 250 key performance indicators. The final score (ESG Asset4) ranges from 0 to 100, with a higher score indicating better sustainability performance. ASSET4 also provides an overall ESG score composed of equally weighted pillars. In sum, the ESG performance score is an ethical rating that aims at certifying the firm's CSR quality, in other words, the non-financial performance of a company in three areas: environment, governance and social.

3.4 Independent variables

The independent variables included in our econometric models are the share of women on the board of directors, the board size, the board average age, the share of independent directors on the board of directors, the number of board meetings per year and the establishment of a CSR sustainability committee To avoid model misspecification, we control for additional variables that could influence ESG performance. In line with existing literature, we identify the following most widely studied bank-specific control variables:

- - bank size (BANK_SIZE), measured as the natural logarithm of total assets (Euro) at the end of the year;
- - financial leverage (LEV), measured as the Tier 1 Capital as a percentage of total assets (a proxy for the Basel 3 leverage ratio);
- -financial performance (ROE), measured as the bank's net income divided by the value of its total shareholders' equity.

Then, since we think that disclosure constitutes very ethical behaviour per se, we also introduce a variable expressing the transparency of every board member concerning their own professional experience and skills. In detail, the variable "public disclosure (DISC)" is a dummy variable that is equal to 1 if the bank describes the professional experience or skills of every board member or provides information about the age of individual board members, and 0 otherwise. Since our banks are in different countries, we also control for the country-specific variable measuring the development level of the economy: GDP per capita based on purchasing power parity (PPP). Table 1 shows the summary of variables used in the Panel regression, their quantification and the expected relationship with the dependent variable, ESG performance.

4 The panel data

To estimate the effects of the selected variables, we resort to panel data analyses (or longitudinal data), where each entity is observed across two or more periods (Frees 2004). Panel data are data where the same observation is followed over time (like in time series) and where there are many observations (like in cross-sectional data). In this sense, panel data

Table 1 Summary of variables

Name of Variable	Measurement	Expected Relationship with ESG SCORE
Women on the board of directors (GENDER)	The total number of women on the board of directors divided by the total number of board members	Positive
Board Independence (BOARD_INDEP)	The percentage of independent board members divided by the total number of board members	Positive
Board size (BOARD SIZE)	Total number of directors on the board	Positive
Board diligence (MEET)	Number of board meetings held during the financial year	Positive
CSR sustainability committee (CSR_COMM)	Dummy variable that is equal to 1 The firm has a CSR sustainability committee, 0 otherwise	Positive
Board experience (EXP)	Board average age	Negative
Bank size (Bank SIZE)	the natural logarithm of total assets(Euro) at the end of the year	Positive
Financial Leverage (LEV)	Tier 1 Capital as a percentage of total assets (a proxy for the Basel 3 leverage ratio);	Negative
Corporate performance (ROE)	Bank's net income divided by the value of its total shareholders' equity	Positive
Public disclosure (DISC)	Dummy variable that is equal to 1 if the bank describes the professional experience or skills of every board member or provides information about the age of individual board members, 0 otherwise	Positive
Δ GDP	It measures the annual growth rate of the Gross Domestic Product (GDP). $\frac{GDP_t}{GDP_{t-1}} - 1$	Positive

Source: Authors' elaboration

combines the features of both time-series and cross-sectional data and methods. Checking the variations of the dependent variable over time, the panel data eliminates the effect of omitted variables, which, despite being different entities, do not vary over time (Bell and Jones 2015). According to (Hsiao, 1985), panel data assets are multiple, in particular:

a) Identify effects that are not identified in the cross-section data (Ben-Porath 1973);
b) The panel allows you to study the dynamics: while the cross-section allows you to estimate what proportion of the population is unemployed in a unit of time, the panel data show how this share varies over time (Baltagi and Levin 1992);
c) The panel data contains more information, variability, and efficiency than pure time series or cross-sectional data.
d) Allow controlling for variables constant over time (individual heterogeneity), unobserved (for which data are not available). (Baltagi and Levin 1992).

at the same time, the limits depend on:

a) *The difficulty in the sample design and data collection;*
b) *The distortion of the measurement errors;*
c) *The problem of selection, no answers or dissensions;*
d) *The limited dimension of the time series.*

4.1 The fixed and random effects

According to Park (2010), panel data models examine cross-sectional (group) and/or time-series (time) effects. These effects may be fixed and/or random. The fixed effects represent the effects of variables that are assumed to have a constant effect on the outcome variable, while the random effects represent the effects of variables that have a varying effect on the outcome variable across groups or individuals. The fixed effect model is:

$$Y_{it} = \beta_{i0} + \sum_{j=1}^{k} \beta_j x_{itj} + \varepsilon_{it} \tag{1}$$

where:

β_{i0} is the unknown intercept for each entity (*n* entity-specific intercepts).
Y_{it} is the dependent variable.
x_{itj} represents of *j*-th independent variable.
β_j is *j*-th coefficient to be estimated.
ϵ_{it} is the error term.

As the study of Anderson and Hsiao (1982) shows, to estimate the model parameters, two procedures are commonly used:

1) The estimator within B: The estimator B takes the name *within* the estimator because it considers the individual effects through this processing done, but it deletes them from the model using the information resulting from temporal variations (variation in groups).

2) The estimator dummy variables (LSVD): where the researcher can consider the i0 as equivalent to introducing a separate dummy variable for each group (Carlino and Voith, 1992).

The *within* and LSVD estimators produce the same numeric value (Torres-Reyna 2007). The constants β_{i0} with $i = 1, \ldots, n$ capture the effect of those variables that vary between individuals, but remain unchanged over time.

In the random effects model, otherwise from the fixed effects one, the variation across entities is assumed to be random and uncorrelated with the predictor or independent variables included in the model (Park 2010). An advantage of random effects is that you can include time-invariant variables (i.e., gender) while the intercept absorbs these variables in the fixed effect model.

The random effect model is:

$$Y_{it} = \gamma_0 + \sum_{j=1}^{k} \gamma_j x_{itj} + (\delta_i + \varepsilon_{it}) \tag{2}$$

where δ_i is the vector of the individual effects. Model (2) can be rewritten as:

$$Y_{it} = \gamma_0 + \sum_{j=1}^{k} \gamma_j x_{itj} + \varphi_{it} \tag{3}$$

Let's $\varphi_{it} = \delta_i + \epsilon_{it}$ the error of the random effect model, we notice that this error is composed of a component that varies among the individuals-entities (but constant over time), and another one that varies stochastically among individuals-entities and across time. The choice between using the fixed effects model or the random effects model is made using the result of the Hausman test. See the next section for the test (Hausman 1978). The Hausman test is a specification test that helps determine whether the unique errors are correlated with the regressors. The null hypothesis supports the use of the random effects model, as it assumes no correlation between individual effects and the regressors; rejection of the null hypothesis suggests that the fixed effects model is more appropriate. For the identification of a panel structure, tests are necessary: the F test (intercept test) for the fixed effect model and the Breusch-Pagan Lagrange Multiplier (LM) test for the random effect model. According to (Park 2010), the generally accepted way of choosing between fixed and random effects is by running its H-test. Statistically, fixed effects are always reasonable with panel data (they always give consistent results) but may not be the most efficient model to run. Random effects will give you better P-values as they are a more efficient estimator, so you should run random effects if it is statistically justifiable to do so. The Hausman test can be used to differentiate between the fixed effects model and the random effects model in panel analysis. In this case, Random effects (RE) are preferred under the null hypothesis due to higher efficiency, while the alternative Fixed effects (FE) are at least as consistent and thus preferred.

4.2 ESG ratings and greenwashing concerns

Although Refinitiv's ESG Asset4 score is widely used and methodologically robust, it remains susceptible to limitations inherent in ESG disclosure-based ratings. ESG scores may be influenced by the volume and style of disclosure rather than actual ESG perfor-

Table 2 Displays regression results for the GLS model

GLS	ESG score
Gender	0.578(2.48) **
B_Indep	18.135(28.26) ***
Meet	0.035(2.03) **
CSR_Comm	7.293(17.09) ***
ROE	0.767(1.31)
Disc	37.411 (61.08)***
cons	25.455(34.17)***

Notes: **Correlation is significant at the 0.01 level

**Correlation is significant at the 0.05 level

*Correlation is significant at the 0.10 level

Source: Authors' elaboration

mance, raising concerns about greenwashing. Moreover, differences in ESG reporting standards across jurisdictions introduce comparability issues. To address these limitations, we acknowledge that our results may reflect a blend of performance and disclosure quality. Future research should incorporate alternative validation measures, such as textual analysis of sustainability reports or external assurance metrics. Additionally, where possible, a comparison between mandatory and voluntary ESG disclosure environments could help isolate genuine ESG performance effects.

5 Results and discussion

In our research, we calculated both the fixed effects and random effects to decide which is the best solution using the Hausman Test. The results suggest the development of random effects because, unlike the fixed effects model, the variation across entities is assumed to be random and uncorrelated with the predictor or independent variables included in the model. The following Table 2 shows the GLS statistical results. To see if there are random effects, we carried out the Breusch-Pagan Lagrange Multiplier (LM) test. The LM test helps you decide between a random effects regression and a simple OLS regression. The null hypothesis is that individual-specific or time-specific error variance components are zero (i.e., no panel effect). If the null hypothesis is not rejected, the pooled OLS is preferred; otherwise, the random effect model is better. In our case study, the test suggests we prefer the pooled OLS (P-value = 0.447). In addition, in this paper, to choose the best regressors and build a parsimonious model, we perform a statistical Model Selection Rules, namely AIC (Akaike Information Criterion). Based on the AIC values, we consider six independent variables to insert into our regression model. Then, we perform the Breusch-Pagan test to determine if heteroscedasticity is present. The test uses the following null and alternative hypotheses:

- Null Hypothesis (H0): Homoscedasticity is present (the residuals are distributed with equal variance).
- Alternative Hypothesis (HA): Heteroscedasticity is present (the residuals are not distributed with equal variance).

In our research, we reject the null hypothesis and conclude that heteroscedasticity exists and, as a consequence, we decide to perform a GLS model.

Of the four independent variables proposed to test our hypotheses, all are statistically significant. So, our hypothesis is confirmed. The Gender variable, representing gender diversity, has a positive effect on the extent of ESG performance. B_indep variable, representing the board independence level, is positively linked to the dependent variable. The Meet variable, representing the diligence of the Board, is positively related to the dependent variable. The CSR_Comm variable, representing the existence of a CSR sustainability committee in the company, is positively linked with the dependent variable. Of the two control variables incorporated in our model, one is statistically significant, namely Disc. The variable Disc indicates the transparency of every board member concerning their own professional experience and skills. has a positive effect on the extent of the ESG performance score.

5.1 Theoretical implications for ESG governance in banking

While prior studies have established the relevance of Stakeholder Theory, Agency Theory, and Resource Dependence Theory to corporate governance and ESG performance, this study extends their application by contextualising them within the specific institutional and operational environment of the European banking sector. Unlike general industrial firms, banks are highly regulated entities whose ESG disclosures are not only tools for stakeholder engagement but also strategic instruments to comply with tightening regulatory regimes and gain reputational capital. We propose that board characteristics (e.g., independence, gender diversity, diligence) function not only as governance mechanisms but also as strategic conduits through which banks signal commitment to ESG goals in a heavily scrutinised environment. This perspective refines existing theories by incorporating institutional pressures and ESG signalling functions that are more salient in financial institutions.

6 Conclusions

In the last years, a growing interest in the literature (Rossi et al. 2021; Pozzoli et al. 2022) suggests that the composition of a firm's board of directors can influence its environmental, social and governance (ESG) performance. Based on prior literature demonstrating that boards play a key monitoring role in financial institutions, our study investigates the influence of boards' characteristics for diversity, independence, board size, diligence, and board experience on the environment, society, and governance (ESG) performance among European banks. Examining the results of our measurement reveals several contributions both for researchers and practitioners. The Gender variable, representing gender diversity, positively affects the extent of ESG performance. Moreover, the study made by Al Amosh and Khatib (2021) argues that the relationship between board gender diversity and ESG performance is pertinent to how well women directors' intellectual and interpersonal traits (Serino and Campanella 2023) are aligned with and encompass compassion to undertake ESG activities in US banks. As Al Amosh and Khatib (2021) stated, the independent boards seek to enhance their reputation through sustainability activities and contribute to educating owners about ESG disclosure in gaining trust with stakeholders and enhancing their legitimacy. As our measurement model confirmed, the board diligence expressed by the average

board meeting attendance rate has an important effect. Regarding this variable, other studies suggest the use of a board meeting attendance rate (Shakil et al., 2022). According to (Uyar et al. 2020), unlike the number of meetings, directors' participation reflects the efficiency of corporate board meetings. They stated that the higher the directors' meeting attendance rate, the higher the composite CSR performance (CSRP), including environmental, social, and governance performance. Studies by Baraibar-Diez and Odriozola (2019) confirmed that the impacts of CSR committees also triggered better non-financial performance, since they transmit and ensure the social concerns of all stakeholders, and show a greater predisposition to compliance with social principles and the adoption of global standards. Lastly, we have considered public disclosure as a dummy variable that describes the transparency of every board member concerning their own professional experience and skills. Scholars (Fatemi et al. 2018) argue that in the presence of ESG strengths, high ESG disclosure weakens the positive valuation effect of the strengths and vice versa. Disclosures help firms to legitimate their actions by explaining to investors the appropriateness of their ESG policies. Rather, firms convince investors that they have made credible commitments to change their operations and thus overcome ESG weaknesses. Therefore, sustainable communities play a vital role in achieving a more resilient and environmentally friendly economy. In the context of the European banking system, the characteristics of the board of directors can have a significant impact on the environmental, social, and governance (ESG) performance of banks. Our empirical evidence (i.g, gender diversity that has a positive effect on the extent of ESG performance) suggests that boards with certain characteristics are more likely to promote sustainable practices and contribute to positive ESG outcomes. The board characteristics are associated with better ESG performance in the European banking system. Banks with boards that prioritise sustainability and have diverse, independent, and knowledgeable directors tend to perform better in terms of environmental impact, social responsibility, and governance practices.

7 Future research directions

Building on our findings, several promising avenues for future research emerge. First, future studies could explore the integration of Artificial Intelligence in ESG assessments, e.g., how banks use machine learning for ESG risk scoring. Second, longitudinal studies spanning a longer timeframe could help uncover lagged effects of board characteristics on ESG outcomes. Third, the role of ESG activism (e.g., shareholder proposals, NGO campaigns) in shaping governance structures warrants investigation. Finally, comparative analyses between European and non-European banks, especially in jurisdictions with differing ESG regulatory maturity, would help validate the theoretical generalizability of our findings.

8 Limitations and future research

According to (Hsiao, 1982), the benefits of panel data depend on the extent and reliability of the information it contains as well as on the validity of the restrictions upon which the statistical methods have been built. Although tests for some assumptions may be performed in certain limited senses (Chamberlain 1984; Hausman 1978; Ruud 1984), there are no

general nonparametric testing procedures. Moreover, (Hill et al. 2020) provide a critical discussion of 12 limitations (among them, the culture of omission, low statistical power, limited external validity, restricted periods, measurement error, time invariance, undefined variables, unobserved heterogeneity, erroneous causal inferences, imprecise interpretations of coefficients, imprudent comparisons) on the limitations of fixed-effects models for panel data. Lastly, our findings are based on empirical studies and may not apply universally to all banks or regions. However, they highlight the importance of board composition and governance in promoting sustainable practices and contributing to the green transition in the banking industry. In the future, by the spreading of our measurement model, the aim is to expand in the scientific community and managerial practice the existing debate on the dimensionality and generalizability of quantitative research (Aydelotte et al. 2015; Polit and Beck 2010) on ESG performance, also considering other industries or country settings (Polit and Beck 2010; Jha 2019). Moreover, it could be useful to investigate the impacts of ESG performance regarding also considering the CSR performance (Bodhanwala and Bodhanwala 2023) and the spreading of the financial and social reports (Hsu and Chen 2015; Basile 2022).

8.1 Institutional heterogeneity across European markets

While the focus on European banks enhances the study's homogeneity, we recognise that national differences in regulatory stringency, ESG reporting mandates, and governance codes may influence the generalizability of findings. For instance, Northern European countries often lead in ESG integration due to more developed sustainability regulations. In future research, it would be useful to apply multilevel modelling or introduce institutional variables, such as the World Bank's governance indicators or an ESG regulatory index, to capture this heterogeneity. This approach would allow deeper insights into how country-specific contexts mediate the governance-ESG relationship.

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Declarations

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