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Article

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The impact of ESG controversies on the financial performance of firms: An analysis of industry and country clusters

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ABSTRACT

Stakeholders have become increasingly interested in sustainable practices, leading to intense investigation in the literature of their effects on companies' returns. However, not much information is available about the effect of environmental, social, and governance (ESG) controversy on companies' financial performance. Inappropriate social behavior and environmental scandals attract attention in the media and, consequently, among investors. Therefore, this study analyzes the impact of ESG controversy on companies' return on equity, identifying differences between companies that operate in different clusters such as environmentally sensitive industries (ESI) or non-environmentally sensitive industries and emerging/developed countries. To this end, we investigate 625 publicly owned companies for the period 2011 to 2022, using a four-dimensional hierarchical linear regression model, comprising time, firms, industries, and countries. ESG controversies negatively impact the financial performance of companies operating in ESI and developed countries.

1. Introduction

The topic of environmental, social, and governance (ESG) scores has become increasingly relevant in the strategic decisions of companies, industries, markets, and countries. The growth in the world's population and climate change indicate the need to address the social and environmental problems that it causes. ESG scores are associated with standards for best practices that define whether a company engages in sustainable, ethical, and responsible behavior (Bilyay-Erdogan & Ozturkkal, 2023; Wu et al., 2023). However, industries take a different view of sustainability, depending on the type of operating and business models that they develop (Kumar et al., 2021; Naeem et al., 2022). This topic is so important that markets and countries have progressively implemented voluntary and mandatory regulations, in order to standardize these procedures and expand disclosure about them, such as Global Reporting Initiatives and the International Financial Reporting Standards S1 (General requirements for disclosure of sustainability-related financial information) and S2 (Climate-related disclosures) (Caputo & Nuccio, 2024; ISSB, 2023; Kopnina et al., 2024; Nial & Parashar, 2024).

The adoption of sustainable practices by companies has many benefits for them, such as higher financial returns, risk mitigation, cost reduction, appreciation in share value, reputational enhancement, and brand strengthening in the long term. Several empirical studies analyze the impact on these effects of ESG scores overall and in terms of the individual components (Bruna et al., 2022; Chen et al., 2023; DasGupta, 2022). However, even companies that adopt sustainable practices are not immune to the impacts of potential corporate scandals. These events have environmental, social, and governance effects that can harm companies' finances, value, and reputation. Furthermore, they raise questions about the effectiveness of ESG scores for capturing the true ethical and sustainable aspects of their behavior (Dorfleitner et al., 2022; Treepongkaruna et al., 2022; Fu, 2023; Mendiratta et al., 2023a; Mendiratta et al., 2023b).

Therefore, new metrics have been developed to capture the confounding effects of ESG scores and firms' ethical and sustainable behavior. The ESG controversies score measures controversial aspects related to sustainability (LSEG, 2023; Xue et al., 2023). The controversies involve suspicious, harmful, or illicit behavior or corporate scandals that involve such behavior. The perception of the impact of

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these controversies depends on whether the firm is in an industry that is environmentally sensitive (ESI). Companies in ESI are more likely to cause social and environmental harm so they are usually more highly regulated (Gracia & Siregar, 2021; Liu, 2023, 2024; Nilipour et al., 2020; Yoon et al., 2019). Furthermore, ESG controversies also affect companies in emerging and developed countries differently. Developed countries are more attentive to sustainability issues, because their markets are more mature (DasGupta, 2022; Garcia et al., 2017; Naeem et al., 2022).

This study seeks to confirm the negative relationship between ESG controversy scores and the financial performance of companies. We also examine whether the impacts of these controversies differ between companies that operate in distinct clusters or, in other words, that are (and are not) in ESI and developed countries. Furthermore, we assess the influence of four dimensions—year, firm, industry and country—on the sample companies' financial performance. To do so, we use a multilevel or hierarchical linear model to analyze 625 public nonfinancial companies (totaling 7500 observations) in 29 countries with data is obtained from Refinitiv, Capital IQ, and World Bank for the period 2011 to 2022, and confirm our results using a robustness test. Previous studies analyze some of these dimensions separately (Dorfleitner et al., 2022; Fu, 2023; García-Meca & Martínez-Ferrero, 2021), but do not do so jointly, nor do they examine the impact of each of these dimensions on the companies' financial performance.

This study contributes to the literature by filling a gap on the impact of ESG controversies on companies' financial performance, considering the effects of countries, industries, companies, and time. Prior papers have examined the negative impact of ESG controversies on company returns for companies, investors, and the market. This implies that investment in sustainable practices—which mitigate environmental, social, and governance risks and damage—lead to effective returns for shareholders even in the short term. For industries, the results in prior studies indicate the need for greater control over events that could potentially cause environmental and, consequently, financial losses, especially in environmentally sensitive industries. Our findings should encourage countries and regulatory entities to adjust due to standardization in sustainable practices. When emerging country markets mature, they adhere to these practices to a greater degree, enabling them to attract new and larger investment.

The paper following this introduction is organized as follows. Section 2 presents the literature review, describing the main concepts and theories that support the hypotheses of the study. Section 3 presents the methodology, with the sample, variables, and econometric models. Then, Section 4 analyzes and discusses the results. Finally, Section 5 gives our conclusion.

2. Literature review and hypothesis development

2.1. ESG controversies

ESG controversies arise following events or practices—associated with companies' products or operations—that may create risks for their reputation, due to their potential negative impacts related to environmental, social, or governance practices. These issues typically give rise to lawsuits, fines, and legal disputes and are widely covered by the global media. The dissemination of negative publicity about a company has greater repercussions than more positive publicity does. Furthermore, these controversies have a financial impact on companies (Dorfleitner et al., 2022; Schwoy et al., 2023; Shakil, 2021; Xue et al., 2023).

According to a seminal paper by Spence (1973), companies emit signals in order to inform the market and consumers about their activities and the quality of their products and services. This occurs to avoid problems caused by information asymmetry, in which one of the parties involved in an economic relationship has more information than the other (Akerlof, 1970). Thus, to better understand a firm's motivations in undertaking and communicating ESG activity, the signaling theory

suggests that sustainable activities serve as indicators of firm quality (Connelly et al., 2011).

Hence, corporate scandals send negative signals to the market, damaging the image of companies. This raises investors' perception of risk, increasing their cost of capital and reducing the liquidity of their shares and returns to shareholders. In contrast, a low level of ESG controversy indicates firms' greater commitment to their sustainable practices. Nirino et al. (2021) and Naeem et al. (2022) find a negative correlation between ESG and ESG controversy scores. Moreover, Mendiratta et al. (2023a) and Wu et al. (2023) believe that ESG controversies weaken a firm's resource efficiency, subsequently diminishing its performance.

Stakeholder theory states that all company stakeholders have legitimate interests. Responding to their demands leads to a company's wealth maximization (Freeman, 1984). From the perspective of this theory, high sustainable performance expresses the company's fulfillment of its stakeholders' expectations. This attracts more investment, improving their financial performance. Conversely, ESG controversies are understood as activities that may negatively impact it. After the dissemination of negative news about a company, stakeholders obtain information that helps them evaluate its misconduct and accountability (Aydogmus et al., 2022; DasGupta, 2022; Dorfleitner et al., 2022; Nirino et al., 2021).

In general, empirical studies indicate a negative relationship between the impact of ESG controversies and companies' financial performance. Thus companies suffer financial losses due to scandals or crises caused by unsustainable practices that are widely publicized in the media. They eventually try to place the blame for their misbehavior on a particular director, in an effort to deflect negative attention. By focusing on a single person, the media relieves the pressure on the company. The companies' financial performance declines because of damage to their reputation, the ineffectiveness of their operations, and the inefficient use of their (in)angible assets. Furthermore, extraordinary expenses are incurred to recover their image and brand as well as investors, customers, and other stakeholders (Mendiratta et al., 2023a; Nirino et al., 2021; Wu et al., 2023). Based on these considerations, we propose the following hypothesis:

Hypothesis 1. ESG controversies negatively affect companies' financial performance.

2.2. Environmentally sensitive industries

Environmentally sensitive industries (ESI) face high environmental exposure, competition, and public pressure and great political risk, due to the nature of their production chain and commercial operations. Their economic activities modify or tend to considerably affect the environment. Therefore, they have difficulty in establishing a reputation for responsible sustainability with their stakeholders. Empirical studies typically identify them with the following Global Industry Classification Standard (GICS) codes: 10 (energy), 15 (materials), 20 (industrials), and 55 (utilities) (Benjamin, Biswas, Wellalage, & Man, 2023; Gracia & Siregar, 2021; Liu, 2023, 2024; Nilipour et al., 2020; Yoon et al., 2019).

Therefore, they need to be more socially accepted and improve their image through the dissemination of environmental, social, and governance practices. However, some papers contend that the adoption of sustainability strategies is not entirely sincere. They argue that companies can use the disclosure of information about their ESG practices to change public perception of them or divert people's attention from environmentally negative issues. The more controversies they experience, the greater their engagement in sustainable activity. Indeed, García-Meca and Martínez-Ferrero (2021) identify a positive correlation between companies in ESI and their ESG controversy scores. In turn, Naeem et al. (2022) confirm that when the ESG controversy score is higher, the scores on the individual ESG components are lower for companies in ESI. This contradiction has a negative impact on financial

results, increasing their idiosyncratic risk (Benjamin et al., 2023; García-Meca & Martínez-Ferrero, 2021).

On the contrary, companies that do not operate in ESI have less need to invest in a more sustainable image. Actually, ESG scores are higher for companies in ESI than those that are not. Nevertheless, in both groups, the environmental score is not the highest one (García et al., 2017; Liu, 2024). As they are less regulated, they have more flexibility in choosing which information will be disclosed, doing so voluntarily. Therefore, information conveyed about their ESG practices is regarded by stakeholders as more credible. Thus it is possible that non-ESI companies spend less on addressing problems and reversing negative images that arise from sustainability controversies. By doing so, they mitigate the negative impact on their financial results (Naeem et al., 2022; Nilipour et al., 2020). Given the foregoing, we present the following hypothesis:

Hypothesis 2. The impact of ESG controversies on companies' financial performance differs between firms in environmentally sensitive industries and those in non-environmentally sensitive industries.

2.3. Developed and emerging countries

Financing for sustainable development has grown over the past two decades. Obviously, events such as the Covid-19 pandemic and the war in Ukraine slowed the flow of financing but did not interrupt it. However, developed countries face greater pressure than emerging countries to implement sustainable policies. This is due to the amplification of public attention to sociocultural topics related to diversity, climate change, environmental disasters, and other stakeholder concerns. Emerging countries confront less pressure regarding investment and ESG practices because, among other things, they lack legislation and reports on sustainability and are in the still early stage of implementation of these practices (Naeem et al., 2022; OECD, 2022).

Consequently, ESG scores are lower at companies in emerging countries than at those in developed countries. Emerging countries have less controversy related to ESG for various reasons, such as a lack of mandatory disclosure of sustainable practices for a longer period of time, less developed and less efficient markets, and greater vulnerability to fluctuation and crisis. However, these reasons reinforce the argument that, in order to compete with firms in developed countries, companies in emerging countries must focus on sustainable activities (Bilyay-Erdogan & Ozturkkal, 2023; Singhania & Saini, 2023).

The World Bank's gross national income per capita is among the criteria used for classifying countries' development level. Per capita income is more than US\$13,846 in developed countries and between US\$1136 and US\$13,845 in emerging countries (World Bank, 2024). Beckmann and Rogmann (2024) clarify that low-income or emerging countries have fewer ESG controversies than high-income or developed countries. In other words, when the income of the countries in which companies are located is higher, so is the level of ESG controversies. They give some possible explanations for this finding, such as that higher-income groups tend to impose stricter regulations, which can increase the probability of violations of sustainability standards, and the consequences of these violations tend to attract great media attention. It is noteworthy that huge communication groups have a more wide-reaching presence in developed countries than in emerging countries.

Furthermore, companies involved in ESG scandals may face legal problems, which affects their financial results. Thus investors in developed countries are more sensitive to ESG controversies than those in emerging countries, because they are disproportionately affected by this issue. Companies that face legal consequences related to sustainability problems—or that have negative news released about them—have diminished financial results and market value. These aspects signal that adequate ESG behavior (i.e., free of ESG controversies) enable companies and countries to achieve greater efficiency and profitability in the use of their assets (Beckmann & Rogmann, 2024; Naeem et al., 2022).

Hence, we hypothesize the following:

Hypothesis 3. The effect of ESG controversies on companies' financial performance differs between developed economies and emerging countries.

3. Methodology

This section describes the data, variables, and econometric models in the study.

3.1. Data

The final sample is made up of 625 nonfinancial public companies that have ESG controversy scores between 2011 and 2022, totaling 7500 observations. These companies in 29 countries have positive equity and total assets exceeding US\$1 million. The data is balanced and obtained from Refinitiv, Capital IQ (CIQ), and World Bank databases.

3.2. ESG controversy score

The ESG controversy score (ESGCT) captures the negative information disclosed about companies and is obtained from the Refinitiv Eikon database, a London Stock Exchange Group company. To ensure that the ESGCT is adjusted for the size of the company, we apply weights to indicate the relative degree of severity of controversies. To measure it, we use 23 metrics divided into 7 categories: community, human rights, management, product responsibility, resource use, shareholders, and workforce. The ESGCT is analyzed in the opposite way. A higher ESGCT indicates that a company has fewer ESG controversies, and a score of 100 means that it has zero controversies (Dorfleitner et al., 2022; LSEG, 2023; Shakil, 2021).

3.3. Variable definitions

Table 1 defines the variables used in the study, including data sources.

3.4. Econometric models

The hypotheses are tested with a multilevel regression model with panel data repeated or longitudinal measures. This model is also known as a linear mixed model (LMM) or hierarchical linear model (HLM). It is considered mixed because the explanatory variables have a combination of fixed and random effects. Whereas the estimated fixed effects parameters indicate the relationship between the explanatory variables and the dependent variable, the random effects involve a combination of explanatory variables and unobserved random terms. Furthermore, the results are confirmed with a robustness test in which the ESGCT variable is lagged by one year, in order to analyze the impact of sustainability scandals over time (Favero & Belfiore, 2019; Rabe-Hesketh & Skrondal, 2022).

The main advantage of multilevel models over traditional estimated regression models—for example, ordinary least squares (OLS)—is that they can take into account natural nesting in the data. In other words, multilevel models enable the identification and analysis of individual heterogeneity and heterogeneity among groups of these individuals, enabling specification of random components at every level of analysis. The general adequacy of the model is confirmed using the χ^2 likelihood ratio test (Favero & Belfiore, 2019).

Therefore, employing the HLM assumes that the observations are correlated over time. Because they are nested for a given firm, they have strong within-cluster correlation. Similarly, it makes sense to assume that firms have similar behavior regarding financial performance in the same industry but not across industries (Zaefarian et al., 2022).

The models have three levels: time (t), firm (j), and a combination of

Table 1

Variable definitions.

Variable label	Variable	Sign	Definitions	Data sources
Dependent variable				
ROE	Return on equity	n/a	ROE = NI/TE NI = Net income TE = Total equity	CIQ
Independent variable				
ESGCT	ESG controversies score	–	The ESG controversies score is calculated based on 23 ESG controversy topics. When the ESGCT is higher, the number of controversies is lower. A score of 100 means a company has no controversies.	Refinitiv
Control variables				
Firm				
SIZ	Size	+	SIZ = $\ln(TA)$ $\ln$ = Neperian logarithm TA = Total assets	CIQ
LEV	Leverage	–	LEV = TD/TA TD = Total debt (short term + long term) TA = Total assets	CIQ
LIQ	Liquidity	+	LIQ = CA/CL CA = Current assets CL = Current liabilities	CIQ
BETA	Systemic risk	–	BETA = $COV_{Rj,Rm}/VAR_{Rm}$ $COV_{Rj,Rm}$ is the covariance between stock and market returns for the last 60 months VAR_{Rm} is the variance of the market return for the past 60 months (S&P 500 index)	CIQ
Industry				
HHI	Herfindahl-Hirschman Index*	+	$HHI_{it} = \sum_{j=1}^n \left(\frac{Sales_{jit}}{Sales_{it}} \right)^2$ Sales = Sales' revenue j = firm i = industry t = time n = total number of companies in a certain industry	CIQ
MUN	Munificence**	+	$MUN_{it} = b_1/MV\ln S$ $\ln Sales_{it} = a_0 + b_1(Year)_{it} + u_{it}$ b_1 is the regression slope coefficient MVlnS is the mean value of industry sales revenue over the past 5 years of the period under analysis $\ln$ is the Neperian logarithm Sales are industry sales revenue over the past 5 years of the period under analysis Year is the past 5 years of the period under analysis u is the error term i is an industry t is time	CIQ
Country				
GDP	Gross domestic product per capita growth rate	+	GDP = $(GDP_t/GDP_{t-1}) - 1$ GDP_t = Gross domestic product per capita of current year GDP_{t-1} = Gross domestic product of previous year	World Bank

Table 1 (continued)

Variable label	Variable	Sign	Definitions	Data sources
WGI	Worldwide Governance Index	+	The value is between –2.5 and 2.5. A higher value is better. The WGI score is the estimated mean for six dimensions: control of corruption, government effectiveness, political stability and the absence of violence/terrorism, regulatory quality, rule of law, and voice and accountability.	World Bank

Notes: *HHI: In a highly concentrated industry, only a few players hold a large percentage of the market share, leading to a near-monopoly. A low degree of concentration means that the industry is closer to perfect competition. **MUN: Munificence is the abundance and availability of external resources that can support firm growth. A munificent context indicates external growth and expanded opportunities that enable a firm to create organizational resources through the accumulation of financial revenues.

industry (i) and country (c). Industry and country are at the same level as it makes no sense to suggest that industries are nested in countries or vice-versa. For example, a given firm j , for instance, can be nested in a combination of industry i with country c . However, another country could have a combination of the same kind of industry without firm j . The models are presented in an evolutionary order, in order to enable the analysis of each effect on the companies' financial performance (Kayo & Kimura, 2011).

Using Granger causality in panel data, we identify potential reverse causality problems. Granger causality is used to determine whether one time series can predict another time series. It measures the extent to which prior values of one variable provide valuable information for forecasting future behavior by another variable (Xiao et al., 2023). The null hypothesis, that ESGCT does not Granger-cause ROE, fails to be rejected at the 5 percent level of statistical significance ($P > |z| = 0.421$). This implies that prior values of ESGCT do not contain information that help to predict ROE beyond the information in prior values of ROE.

3.4.1. Null model

The null model is the first to be estimated (Model 1); see Equations (1a)–(1d). It enables variance decomposition of firms' financial performance at different levels. Thus, it shows the effect of higher levels (industries and countries) on lower ones (companies and time). To do so, we include no explanatory variables in the model, considering only the intercepts and error terms. Companies in a given industry and country tend to display similar behavior, as the impact on them of ESG controversies is comparable and is strongly correlated in their respective clusters. However, they differ from companies in different industries and countries.

The first-level specification is expressed in Equation (1a), which divides the variation in firm financial performance (ROE_{tjic}) into four components: year (t), firm (j), industry (i), and country (c). β_{0jic} is the mean ROE of firm j in industry i and country c over time. Additionally, e_{tjic} is the time-level random error, denoted as a residual and also referred to as the variance over time. It is normally distributed, with a zero mean and variance of σ^2 .

$$ROE_{tjic} = \beta_{0jic} + e_{tjic} \quad (1a)$$

The second level of analysis is expressed in Equation (1b). The mean financial performance over time of a firm for j in i and c (β_{0jic}) is a function of the mean financial performance of i in c (γ_{00ic}), adding a random error term (r_{0jic}) that represents variations among companies.

$$\beta_{0jic} = \gamma_{00ic} + r_{0jic} \quad (1b)$$

The third level of analysis is expressed in Equation (1c). The mean financial performance of i in c (γ_{00ic}) is a random variable, as a function of the overall mean of the sample (δ_{0000}). It is influenced by random errors associated with the industry (s_{00i0}), country (τ_{000c}), and random crossover error of the industry and country (u_{00ic}).

$$\gamma_{00i} = \delta_{0000} + s_{00i0} + \tau_{000c} + u_{00ic} \quad (1c)$$

Equation (1d) combines the foregoing as a mixed model, in which s_{00i0} , τ_{000c} , u_{00ic} , r_{0jic} , and e_{tjic} are random effects. Their variances show the relative importance of the industry, country, interaction between industry and country, firm, and time levels, respectively, denoted as Model 1.

$$ROE_{tjic} = \delta_{0000} + s_{00i0} + \tau_{000c} + u_{00ic} + r_{0jic} + e_{tjic} \quad (1d)$$

In which.

$$ROE_{tjic} = \delta_{0000} + \delta_{0001}Z_{0001} + \gamma_{01ic}W_{00ic} + \beta_{1jic}YEAR_{tjic} + \beta_{2jic}ESGCT_{tjic} + \beta_{3jic}X_{tjic} + s_{00i0} + \tau_{000c} + u_{00ic} + r_{0jic} + e_{tjic} \quad (2d)$$

t = time (level 1)
 j = firm (level 2)
 i = industry (level 3)
 c = country (level 3)
 ROE = financial performance as the dependent variable (level 1)
 e_{tjic} , r_{0jic} , u_{00ic} , s_{00i0} , τ_{000c} are random errors at levels 1, 2, and 3, respectively
 β_{0jic} , γ_{00ic} , δ_{0000} are intercepts at levels 1, 2, and 3, respectively

3.4.2. Random intercept models

Model 2 includes random intercepts—see Equations (2a)–(2d). In Equation (2a), we add explanatory variables as determinants of the random intercepts. They are added gradually in subsequent models, based on the hierarchical level of the variables. Every dummy year—except the first one—is incorporated. The firm variables are included in the first level of analysis because they vary, not only between companies but also within companies over time. The independent variable is the ESG controversy score (ESGCT), and the control variables (X) are size (SIZ), leverage (LEV), liquidity (LIQ), and systemic risk (BETA).

$$ROE_{tjic} = \beta_{0jic} + \beta_{1jic}YEAR_{tjic} + \beta_{2jic}ESGCT_{tjic} + \beta_{3jic}X_{tjic} + e_{tjic} \quad (2a)$$

Model 3, Equation (2b), adds the control variables related to the industry level (W): the Herfindahl-Hirschman Index (HHI) and munificence (MUN). The mean financial performance at the firm level (β_{0jic}) is a random variable determined by industry-specific factors, plus a random error term (r_{0jic}), which captures the variance among firms.

$$\beta_{0jic} = \gamma_{00ic} + \gamma_{01ic}W_{00ic} + r_{0jic} \quad (2b)$$

Model 4, Equation (2c), incorporates the country level. It shows that the mean financial performance of i in c (γ_{00ic}) is the result of certain country-level control variables (Z)—the gross domestic product per capita growth rate (GDP) and the World Governance Index (WGI). Random errors are considered within industries (s_{00i0}) and countries (τ_{000c}) and between industries and countries (u_{00ic}).

$$\gamma_{00ic} = \delta_{0000} + \delta_{0001}Z_{0001} + s_{00i0} + \tau_{000c} + u_{00ic} \quad (2c)$$

Finally, Equation (2d) combines Equations (2a), (2b), and (2c), yielding a mixed model in which the intercepts of the three levels are random. Therefore, financial performance should be considered as a function of firm, industry, and country levels, as well as their respective random errors.

In which.

t = time (level 1)
 j = firm (level 2)
 i = industry (level 3)
 c = country (level 3)
 ROE = financial performance as the dependent variable (level 1)
 $YEAR$ = year dummy independent variable (level 1)
 $ESGCT$ = ESG controversy score (level 2)
 X = firm control variables (level 2)
 W = industry control variables (level 3)
 Z = country control variables (level 3)
 e_{tjic} , r_{0jic} , u_{00ic} , s_{00i0} , τ_{000c} are random errors at levels 1, 2, and 3, respectively
 β_{0jic} , γ_{00ic} , δ_{0000} are intercepts at levels 1, 2, and 3, respectively

3.4.3. Random intercept and coefficient model

The next step involves constructing a comprehensive hierarchical model, incorporating random intercepts and slopes for firm-level variables, which are influenced by industry and country factors. By doing this, we confirm the indirect effects of industry and country characteristics on financial performance. In addition to the random intercept, Equation (3a) considers time-related explanatory variables (YEAR), firm-specific, independent (ESGCT), and control variables (X): size (SIZ), leverage (LEV), liquidity (LIQ), and systemic risk (BETA).

Table 2
Summary statistics.

Variables	Full sample		ESI = 1		ESI = 0		EMC = 1		EMC = 0	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
ROE	0.0898	0.2480	0.0828	0.2745	0.0983	0.2113	0.0955	0.1344	0.0868	0.2914
ESGCT	91.194	21.899	90.851	22.295	91.608	21.406	95.780	15.722	88.720	24.239
SIZ	8.8337	1.5052	8.8792	1.4741	8.7786	1.5405	8.7470	1.4057	8.8804	1.5545
LEV	0.2667	0.1456	0.2722	0.1432	0.2601	0.1483	0.2567	0.1465	0.2721	0.1449
LIQ	1.6525	1.2300	1.5946	1.2197	1.7224	1.2389	1.7367	1.3864	1.6071	1.1343
BETA	0.8769	0.4628	0.8976	0.4698	0.8519	0.4529	0.7980	0.4290	0.9194	0.4746
HHI	0.1184	0.0586	0.1354	0.0616	0.0979	0.0471	0.1122	0.0598	0.1218	0.0576
MUN	0.0045	0.0050	0.0047	0.0063	0.0043	0.0028	0.0046	0.0044	0.0045	0.0053
GDP	0.0309	0.0345	0.0278	0.0337	0.0348	0.0351	0.0541	0.0316	0.0185	0.0292
WGI	0.7584	0.8332	0.8690	0.7947	0.6247	0.8588	−0.321	0.2364	1.3408	0.2652
No. of obs.	7500		4104		3396		2628		4872	

Notes: SD = standard deviation, ESI = environmentally sensitive industries, EMC = emerging countries.

$$ROE_{tjic} = \beta_{0jic} + \beta_{1jic}YEAR_{tjic} + \beta_{2jic}ESGCT_{tjic} + \beta_{3jic}X_{tjic} + e_{tjic} \quad (3a)$$

Equation (3b) includes the random intercept models, adding industry factors as covariates. The control variables (W) are the Herfindahl-Hirschman Index (HHI) and munificence (MUN).

$$\beta_{0jic} = \gamma_{00ic} + \gamma_{01ic}W_{00ic} + r_{0jic} \quad (3b)$$

Moreover, Equation (3c) includes random intercept models with country factors. It adds the control variables (Z): gross domestic product per capita growth rate (GDP) and the World Governance Index (WGI).

$$\gamma_{00ic} = \delta_{0000} + \delta_{0001}Z_{0001} + s_{00i0} + \tau_{000c} + u_{00ic} \quad (3c)$$

Equation (3d) gives the consolidated mixed effects model with all the variables simultaneously at the time, firm, industry, and country levels.

$$ROE_{tjic} = \delta_{0000} + \delta_{0001}Z_{0001} + \gamma_{01ic}W_{00ic} + \beta_{1jic}YEAR_{tjic} + \beta_{2jic}ESGCT_{tjic} + \beta_{3jic}X_{tjic} + s_{00i0} + \tau_{000c} + u_{00ic} + r_{0jic} + r_{2jic}ESGCT_{tjic} + e_{tjic} \quad (3d)$$

In which.

t = time (level 1)

j = firm (level 2)

i = industry (level 3)

c = country (level 3)

ROE = financial performance as the dependent variable (level 1)

YEAR = year dummy independent variable (level 1)

ESGCT = ESG controversy score (level 2)

X = firm control variables (level 2)

W = industry control variables (level 3)

Z = country control variables (level 3)

$e_{tjic}, r_{0jic}, u_{00ic}, s_{00i0}, \tau_{000c}$ are random errors at levels 1, 2, and 3, respectively

$\beta_{0jic}, \gamma_{00ic}, \delta_{0000}$ are intercepts at levels 1, 2, and 3, respectively

H2 is confirmed with two subsamples: first, companies in ESI and, second, companies that are non-ESI (ESI = 0). The GICS codes for ESI are 10 (energy), 15 (materials), 20 (industrials), and 55 (utilities), and those for non-ESI, other than banks, are 25 (consumer discretionary), 30 (consumer staples), 35 (health care), 45 (information technology), 50 (communication services), and 60 (real estate) (Benjamin et al., 2023; Gracia & Siregar, 2021; Liu, 2023; 2024; Nilipour et al., 2020; Yoon et al., 2019).

Finally, H3 is tested with two subsamples: emerging countries and developed countries. Emerging countries have per capita income between US\$1136 and US\$13,845, and developed countries have per capita income above US\$13,846.

4. Results and discussion

This section describes the results of descriptive statistics, as well as null, random intercept and random intercept and coefficient multilevel models.

4.1. Descriptive statistics

Table 2 lists the mean and standard deviation of the full sample and subsamples of ESI and non-ESI, as well as emerging and developed countries. The number of companies and observations of industries and countries are listed in Appendix Tables A1 and A2 and, respectively. The average ROE of companies located in 29 countries and 10 industries in the full sample is of 8.98 percent, whereas the mean ESGCT is 91.19. This shows the high average level of ESG practices, because a higher score indicates a lower level of controversies.

The HHI is low (11.84%). However, the degree of munificence

(MUN), only 0.45 percent, does not imply an abundance and availability of external resources that can support organizational growth. The GDP per capita growth rate is positive (3.45%), even considering the impact of Covid-19. Finally, WGI is also positive (0.75), showing that, on average, countries pay attention to the control of corruption, government effectiveness, and other governance aspects. However, WGI is negative for emerging countries, as they still face persistent problems with corruption, low-quality public services, and a lack of credibility regarding the government's commitment to its policies.

The results also show that companies in ESI are larger and more highly leveraged. But companies in non-ESI have more liquidity and more systemic risk. ESI companies might require high investment in tangible assets, financed by debt, which is tax deductible. Furthermore, companies in emerging countries have more liquidity and less systemic

risk. Companies in developed countries are bigger and more highly leveraged. These results show greater conservatism among companies in less mature markets.

Fig. 1 compares the annual change in ESGCT and the ROE of ESI and non-ESI companies (Panels A and B) located in emerging and developed countries (Panels C and D). Panel A shows a decline over time in the ESGCT in both ESI and non-ESI industries, but the decline is greater at ESI companies. This means that they are more affected by scandals due to sustainability problems in terms of publicity.

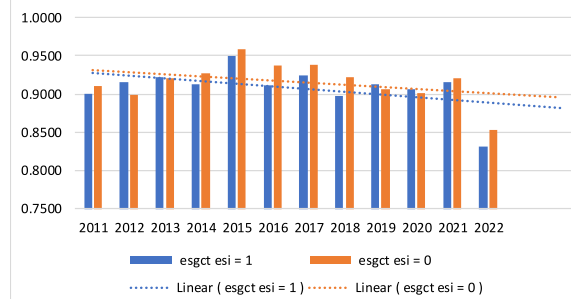
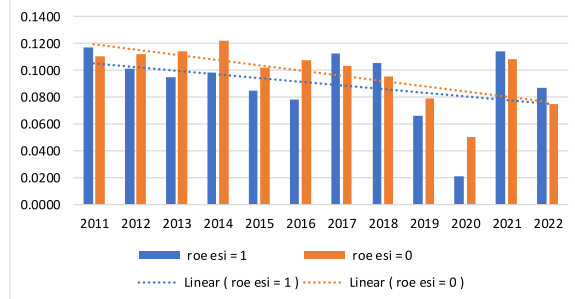
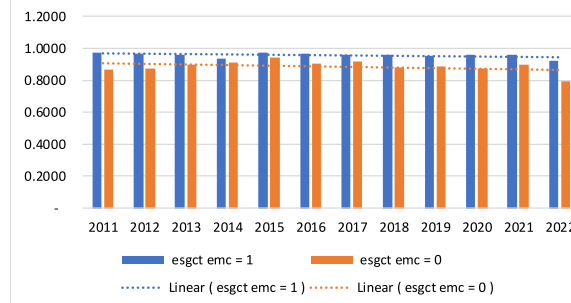
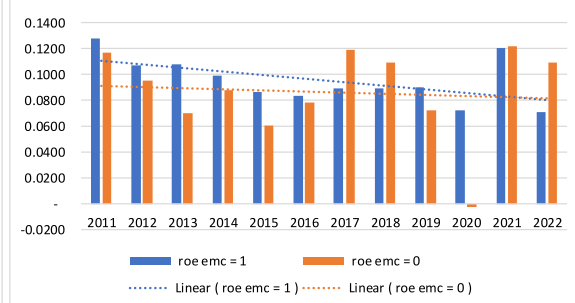
Panel B indicates that non-ESI companies have higher ROE, but ESI companies have a smaller decline in ROE over time. In Panel C, the ESGCT of emerging countries are more stable, and those for developed countries show a greater drop, which demonstrates deterioration in the sustainability activity by companies located there. Finally, Panel D shows that ROE has a downward trend in both emerging and developed countries, especially during the Covid-19 pandemic, with a larger drop in emerging countries.

In summary, ROE is more sensitive to ESG controversies at ESI companies than at non-ESI firms. Furthermore, over time ROE is impacted by ESGCT more at companies in developed countries than at those in emerging countries.

4.2. Null model

Table 3 presents the variance decomposition analysis of the models presented in Section 3.3. The results of the null model, Model 1, indicate that variance is greater among companies (12.1%) than among countries (0.1%), industries (0.9%), and country-industries (1.7%). This means that a company's ROE is influenced, above all, by its own characteristics. The time variance (85.2%) demonstrates the relevance of economic scenarios; for example, the Covid-19 pandemic in 2020 and 2021 had a strong and negative impact on all countries.

Model 2 includes explanatory variables at the firm level. Models 3 and 4 add those at the industry and country levels. In all of them, variance is greater among companies than among the other dimensions. In Model 4, for example, the variance in companies' ROE between countries and industries is 1.3 percent, whereas that among firms is 11.5 percent. In any case, in Models 1 and 4, the addition of explanatory variables at each level increases the intraclass correlation or the variance proportion of country and industry levels. This demonstrates the importance of its inclusion in the analysis, which confirms the significance of chibar2 (0.0000). Therefore, the null hypothesis is rejected. This result shows that a multilevel model should be used, rather than a traditional linear regression model.

A. ESGCT of ESI**B. ROE in ESI****C. ESGCT of EMC****D. ROE in EMC****Fig. 1.** Mean ESGCT and ROE by industry and country

Notes: ESGCT = ESG controversy score, in decimal scale or divided by 100 to facilitate comparison with ROE, ROE = return on equity, ESI = environmentally sensitive industries, EMC = emerging countries.

Table 3

Variance decomposition of the full sample.

Levels	Model 1 (null)	Model 2 (firm)	Model 3 (industry)	Model 4 (country)
Variance decomposition				
Country	0.000070	0.000123	0.000126	0.000533
Industry	0.000527	0.000954	0.001215	0.001150
Country_industry	0.001016	0.000998	0.000758	0.000859
Firm	0.007428	0.007374	0.007412	0.007342
Time*	0.052213	0.054268	0.054229	0.054153
Prob>chibar2	0.0000	0.0000	0.0000	0.0000
Percentage of total variance or residual intraclass correlation				
Between countries	0.1%	0.2%	0.2%	0.8%
Between industries	0.9%	1.5%	1.9%	1.8%
Between countries and industries	1.7%	1.6%	1.2%	1.3%
Between firms	12.1%	11.6%	11.6%	11.5%
Over time*	85.2%	85.2%	85.1%	84.6%
Total	100.0%	100.0%	100.0%	100%

Note: *Time is analogous to error term in the variance component analysis.

4.3. Random intercept models

Table 4 presents the results of the multilevel models, including fixed effects for the year, firm, industry, and country. Model 1 adds only the random intercepts of the models. Models 2, 3, and 4 successively add variables for companies, industries, and countries, respectively. Models 5 and 6 use the subsamples of ESI and non-ESI companies. Models 7 and 8 give the results for subsamples of companies in emerging and developed countries.

Model 1 presents the results of the null model. The intercept estimate indicates that the average financial performance (ROE) of companies is 8.66%. Models 3 and 4 show that for every one-point increase in the ESG controversies score, the companies' ROE drops 0.04%. The interpretation of the index must be done in reverse. According to Dorfleitner et al. (2022) and Naeem et al. (2022), the higher the ESGCT score, the lower the level of controversies the company has. Furthermore, when the company is not involved in any scandals related to its sustainable

practices, it receives an ESGCT of 100.

In contrast to the results by Nirino et al. (2021), our results suggest that controversies have not only a negative but also a significant impact on the financial performance of companies, due to a loss of reputation and negative effects on their activities. In Model 4, the company-level variables, except for the liquidity index (LIQ), are statistically significant and have the expected signs. This shows that the size (SIZ), debt level (LEV), and systemic risk (BETA) of companies effectively impact their financial performance. Among the control variables at the country level, the HHI is high, which indicates that industries have high concentration, signaling the attractiveness and profitability of this market, and only per capita GDP growth affects companies' ROE.

Model 5 shows that the ESGCT of companies in ESI reduces companies' ROE by 0.07 percent, however, in Model 6, it is not significant. This suggests that ESG scandals and controversies have the greatest impact on the industries that suffer most from public exposure and environmental pressure inherent in their operational activities. These results, unlike those by Naeem et al. (2022), are statistically significant and signal the importance to the market of maintaining high sustainability standards in ESI. Model 5 shows that HHI is especially important in ESI.

Finally, the results for Models 7 and 8—which cover companies in emerging and developed countries—show that the ESGCT negatively affects ROE, and this impact is greater in developed countries. This result corroborates that obtained by Beckmann and Rogmann (2024), who state that developed countries have more ESG controversies than emerging countries do. In fact, companies that face legal proceedings due to issues related to sustainability compromise their financial results.

Furthermore, investors in developed countries are more sensitive to ESG controversies than those in emerging countries because of their share of this impact, which is confirmed by the WGI. Contrary to expectations, in emerging countries, a higher WGI reduces companies' ROE. Almaqtari et al. (2022) also identify a negative relationship between WGI and companies' ROE, but they also agree with Kaufmann and Lafarre (2021) that countries with higher-quality governance engage in more sustainable corporate behavior. Therefore, with evolution in

Table 4

Multilevel results with random intercepts for the full sample and subsamples.

ROE	Model 1 (null)	Model 2 (firm)	Model 3 (industry)	Model 4 (country)	Model 5 ESI = 1	Model 6 ESI = 0	Model 7 EMC = 1	Model 8 EMC = 0
Fixed effects								
Intercept	0.0866***	0.1036***	0.0731*	0.0644	0.0359	0.0644	0.0759	0.0279
YFE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm variables								
ESGCT ^a		0.0004	0.0004 ***	0.0004 ***	0.0007 ***	0.0000	0.0003 **	0.0005 ***
SIZ		0.0068**	0.0070 **	0.0075 **	0.0082 *	0.0057	0.0037	0.0101 **
LEV		−0.2401 ***	−0.2371 ***	−0.2389 ***	−0.2309 ***	−0.2345 ***	−0.2691 ***	−0.2513 ***
LIQ		0.0045	0.0046	0.0046	0.0038	0.0067	0.0037 *	0.0044
BETA		−0.0351 ***	−0.0360 ***	−0.0362***	−0.0564 ***	−0.0081	−0.0041	−0.0507 ***
Industry variables								
HHI			0.2189 **	0.2343 **	0.4330 ***	0.1820	0.2961	0.2627 **
MUN			0.7309	0.6862	−0.0831	2.5331	0.5275	0.4291
Country variables								
GDP				0.3983 **	0.2740	0.3766 **	0.7823 ***	0.0436
WGI				−0.0105	−0.0160	0.0063	−0.0792 ***	0.0515 *
No. of obs.	7500	7500	7500	7500	4104	3396	2628	4872

Notes: ^a reverse scored, i.e., the higher the score, the lower the level of controversies. YFE = Year fixed effects, ESI = environmentally sensitive industries, EMC = emerging countries. ***, ** and * statistical significance at 1%, 5%, and 10%, respectively.

Table 5

Multilevel results with random intercepts and coefficients for the full sample and subsamples.

ROE	Model 1 (null)	Model 2 (firm)	Model 3 (industry)	Model 4 (country)	Model 5 ESI = 1	Model 6 ESI = 0	Model 7 EMC = 1	Model 8 EMC = 0
Fixed effects								
Intercept	0.0866***	0.1033***	0.0729 *	0.0666	0.0359	0.0562	0.1297	−0.0259
YFE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm variables								
ESGCT ^a	0.0004 ***	0.0004 ***	0.0004 ***	0.0004***	0.0007 ***	−0.0000	−0.0001	0.0005***
SIZ		0.0069 **	0.0071 **	0.0078 **	0.0082 *	0.0067	0.0036	0.0101**
LEV		−0.2409***	−0.2379 ***	−0.2410 ***	−0.2309 ***	−0.2327 ***	−0.2685 ***	−0.2495***
LIQ		0.0046	0.0047	0.0048 *	0.0038	0.0073 *	0.0037 *	0.0045
BETA		−0.0351 ***	−0.0360 ***	−0.0365 ***	−0.0564***	−0.0080	−0.0037	−0.0506 ***
Industry variables								
HHI			0.2194**	0.2361 **	0.4330 ***	0.2142	0.2736	0.2604**
MUN			0.7253	0.6790	−0.0831	2.4321	0.5264	0.4216
Country variables								
GDP				0.4148 **	0.2740	0.3772 *	0.8201***	0.0487
WGI				−0.0140	−0.0160	0.0126	−0.0710***	0.0511 *
No. of obs.	7500	7500	7500	7500	4104	3396	2628	4872

Notes: ^a reverse scored, i.e., the higher the score, the lower the level of controversies. YFE = year fixed effects, ESI = environmentally sensitive industries, EMC = emerging countries. ***, **, and * statistical significance at 1%, 5%, and 10%, respectively.

governance policies, companies' financial performance rises over the long term. Conversely, in developed countries, high-quality governance signals institutional stability, which contributes to better financial performance by companies.

4.4. Model with random intercepts and coefficients

Table 5 includes the random effects for the intercepts and the coefficients or slopes of the models. This does not affect the influence on the companies' financial performance of individual variables at the company, industry, and country levels. Rather, the slope effects show important additional relationships. The results take the same patterns as those seen in Table 4.

Models 1–4 indicate that the ESGCT negatively impacts companies' financial performance, confirming H1. This result is in line with that obtained by Mendiratta et al. (2023a) and means that events that create risk for a company's reputation affect it financially. Furthermore, these results support the signaling and stakeholder theories. The release of news about the poor execution of sustainability practices by companies sends a negative signal to the market and shows the firm's failure to meet the expectations of all stakeholders.

The investors' perception of a company's increased risk reduces its ROE, as it can increase the cost of capital and other related expenses. Model 4 reinforces the importance of a liquidity buffer (LIQ) in

companies' financial performance and the possible legal consequences of ESG controversies.

Like the results obtained in Table 4, those in Table 5 confirm H2. The ESGCT of companies in ESI (Model 5) negatively impacts their ROE. For every one-point increase in the ESGCT, financial performance declines 0.07 percent. ESG controversies at firms in non-ESI (Model 6) do not have any effect on their ROE.

According to Benjamin et al. (2023) and García-Meca and Martínez-Ferrero (2021), companies in ESI engage in activities that make them more susceptible to media coverage of environmental issues. Therefore, they are expected to invest more in publicizing their environmental activity. However, not all stakeholders believe that these activities are credible, because they can be performed in an attempt to change their public perception. This creates increased risk of litigation and attracts fewer investors, hence it has a negative impact on a firm's financial results.

Model 7 shows that the ESGCT does not have a statistically significant effect on the ROE of companies in emerging countries. However, Model 8 indicates that in developed countries, for every one-point increase in the ESGCT, the financial performance of these companies falls 0.05 percent. This result confirms H3.

The standards and development of sustainable practices in emerging countries are more recent than those in developed countries. Furthermore, sociocultural and economic differences impose even more

Table 6

Multilevel results with random intercepts and coefficients for the full sample and subsamples—Lagged ESGCT.

ROE	Model 1 (null)	Model 2 (firm)	Model 3 (industry)	Model 4 (country)	Model 5 ESI = 1	Model 6 ESI = 0	Model 7 EMC = 1	Model 8 EMC = 0
Fixed effects								
Intercept	0.0866***	0.0793**	0.0529	0.0468	−0.0071	0.0659	0.1156*	0.0004**
YFE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm variables								
ESGCT_L1 ^a	0.0004 ***	0.0003**	0.0003**	0.0003**	0.0007***	−0.0001	−0.0002	0.0005**
SIZ		0.0082**	0.0083**	0.0091***	0.0095**	0.0080*	0.0045	0.0113**
LEV		−0.2349***	−0.2324***	−0.2348***	−0.2256***	−0.2299***	−0.2656***	−0.2442***
LIQ		0.0048	0.0049	0.0050	0.0040	0.0062	0.0038*	0.0044
BETA		−0.0371***	−0.0379***	−0.0383***	−0.0595***	−0.0100	−0.0040	−0.0505***
Industry variables								
HHI			0.1841*	0.1963*	0.4353**	0.1730	0.2453	0.2234*
MUN			0.8274	0.7816	−0.0227	2.7651	0.6751	0.4937
Country variables								
GDP				0.4487***	0.3386	0.3460	0.8063***	0.0636
WGI				−0.0132	−0.0158	0.0102	−0.0807***	0.0572**
No. of obs.	7500	6875	6875	6875	3762	3113	2409	4466

Notes: ^a reverse scored, i.e., the higher the score, the lower the level of controversies. YFE = year fixed effects, ESI = environmentally sensitive industries, EMC = emerging countries. ***, **, and * statistical significance at 1%, 5%, and 10%, respectively.

pressure on developed countries. Therefore, the effects of climate change, environmental disasters, and other catastrophes that undermine companies' sustainability have greater repercussions in higher-income countries. Naeem et al. (2022) also show the statistical insignificance of the ESGCT and ROE of companies in emerging countries.

Beckmann and Rogmann (2024) find that high-income countries have a higher level of ESG controversies (see Table 2). Developed countries have more regulations related to sustainability, which can generate greater noncompliance with them and publicity about it. Companies' financial results face legal consequences due to these controversies.

4.5. Robustness test

We perform a robustness test by lagging the ESGCT variable by one year in order to capture the effect of controversies related to sustainability practices—reported in the media—on companies' financial performance in the year after they occur. The results in Table 6 are similar to those in Table 5, reconfirming all three hypotheses. In conclusion, our findings demonstrate that ESG issues harm financial performance, particularly for businesses in ESI and developed countries.

5. Conclusion

The measurement and disclosure of sustainability practices have been in the process of international standardization, enabling better comparability among companies (ISSB, 2023). This demonstrates the growing relevance of this topic to investors, markets, governments, and society in general. Empirical studies for more than a decade have analyzed the impact of sustainable practices on companies' value creation and financial performance (Chen et al., 2023; DasGupta, 2022). Even companies that have high ESG scores are not exempt from reputational problems due to scandals related to poor social or governance practices as well as environmental disasters (Liu, 2024; Xue et al., 2023).

Controversy related to sustainability can be measured with ESG controversy scores (LSEG, 2023). When a company has fewer controversies, its ESGCT is higher. However, understanding of these harmful behaviors differs depending on whether companies are in environmentally sensitive industries as well as whether they are in emerging or developed countries (Liu, 2023; Naeem et al., 2022). Therefore, this study examines the negative impact of ESG controversies on companies' financial performance to identify these differences.

To do so, we use a multilevel regression, with a sample comprising 625 public and nonfinancial companies in 29 countries from 2011 to 2022. The data come from the databases of Refinitiv, Capital IQ, and the

World Bank. We also assess the influence on the companies' financial performance in terms of four levels—time, firm, industry, and country—and confirm all of our hypotheses.

Table 3 indicates that the variance is greater between companies (14.1%) than the other levels—industry (0.8%), countries (2%), and country plus industries (5.9%). Furthermore, the time variance (77%) demonstrates the relevance of the economic environment. The Covid-19 period imposed losses on all countries between 2020 and 2021. With the gradual inclusion of the different levels, intraclass correlation increases, demonstrating its importance in understanding each of their effects on companies' ROE.

Models 1 to 4 in Table 5 confirm H1. They show that for every one-point increase in the ESG controversies score, the companies' ROE declines 0.04 percent. Corporate scandals damage companies' reputation, increasing their risk. This signal increases investors' rate of return and, consequently, the companies' cost of capital. However, meeting stakeholder expectations regarding their environmental, social, and governance performance attracts investors and increases companies' returns.

In Table 5, Models 5 and 6 confirm H2. A one-point increase in the ESGCT for companies in ESI reduces their ROE by 0.07 percent. But ESG controversies at non-ESI firms do not have any effect on their financial performance. The paradox of ESI is that the firms can invest in sustainable practices in order to divert attention from their exposure to environmental risk, which is inherent in their operational activities. Firms that face more controversies have greater engagement in sustainable activity. This contradiction has a negative impact on financial results, as it causes an increase in idiosyncratic risk.

Models 7 and 8 in Table 5 confirm H3. The ESGCT of companies in emerging countries has no impact on their ROE, firms in developed countries experience a 0.05 percent reduction in their financial performance for every one-point increase in their ESGCT. Emerging countries face fewer ESG controversies than developed countries (see Table 2). Furthermore, the mainstream media in high-income countries plays a larger role in global communications. Companies facing legal consequences related to sustainability problems—or that have negative news reported about them—suffer a reduction in their financial results and market value. The results from the robustness tests in Table 6 also confirm our three hypotheses.

Furthermore, they confirm the effect of ESG controversies on companies' ROE, from the perspective of the different levels, as well as the environmental sensitivity of industries and the countries' level of development. The study contributes to the literature by empirically supporting corporate finance theories on signaling, information asymmetry, and stakeholders. Companies and investors can analyze the impact of ESG controversies on their financial performance and

investment returns, respectively. The results also encourage regulators and countries to standardize metrics and disseminate sustainable practices at the global level. This enables companies to be comparable, to facilitate attracting foreign investment to emerging countries, in particular.

The study has some limitations, due in part to the low number of companies that have an ESG controversy score, making it difficult to use a larger and more diverse sample. Further research on this topic could analyze specific factors associated with ESG controversies that can impact firms' value, risk of bankruptcy, and cost of capital—such as business ethics, human rights, tax fraud, responsible marketing, and insider dealings. Other possible topics include analysis of the relationship between ESG regulations and noncompliance with them as well as comparison of the impact of voluntary and mandatory standards on ESG controversies. These aspects could shed light on the potential role of sustainability standards in countries' transition to taking environmental and social responsibility into account.

Declarations of interest

None.

Appendixes

CRediT authorship contribution statement

Michele Nascimento Jucá: Conceptualization, Methodology, Validation, Formal analysis, Resources, Investigation, Writing – original draft, Visualization, Project administration, Funding acquisition. **Polona Domadenik Muren:** Conceptualization, Methodology, Validation, Formal analysis, Writing – review & editing, Supervision, Project administration. **Aljoša Valentinčič:** Conceptualization, Methodology, Validation, Formal analysis, Writing – review & editing, Supervision. **Riste Ichev:** Conceptualization, Methodology, Validation, Formal analysis, Resources, Investigation, Writing – review & editing, Supervision, Funding acquisition.

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Table A1
Descriptive statistics by industry

GC	Industry	No. of firms	No. of obs.
10	Energy*	44	528
15	Materials*	91	1092
20	Industrials*	137	1644
25	Consumer discretionary	77	924
30	Consumer staples	43	516
35	Health care	30	360
45	Information technology	59	708
50	Communication services	37	444
55	Utilities*	70	840
60	Real estate	37	444
Total		625	7500

Note: *Environmentally sensitive industries, GC = GICS code.

Table A2
Descriptive statistics by country

Countries	No. of firms	No. of obs.
Australia	9	108
Austria	6	72
Belgium	10	120
Bermuda	2	24
Brazil*	28	336
Canada	46	552
Chile	9	108
China*	162	1944
Denmark	4	48
Finland	10	120
France	34	408
Germany	33	396
Ireland	6	72
Israel	3	36
Japan	29	348
Luxembourg	3	36
Malaysia*	12	144
Netherlands	11	132
Norway	3	36
Poland	6	72
Russia*	2	24
Singapore	14	168

(continued on next page)

Table A2 (continued)

Countries	No. of firms	No. of obs.
South Africa*	9	108
Spain	14	168
Sweden	6	72
Switzerland	18	216
Thailand*	6	72
United Kingdom	46	552
United States	84	1008
Total	625	7500

Note: * Emerging countries.

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