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Environmental controversies, environmental fines and firms' default risk

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ABSTRACT

This paper aims to provide empirical evidence on the unexplored relationship between environmental controversies, environmental fines, and firms' default risk, as well as to test whether this relationship changes with firms' level of environmental commitment or the country's environmental awareness. Using a sample of 402 global firms over ten years, we show that an increase in environmental controversies, and thus greater media exposure of firms for environmental damage, increases firms' risk of default. Instead, environmental fines do not significantly influence default risk. Our results also point out that the effect of environmental controversies on default risk is heterogeneous: it is significant exclusively for firms with a higher environmental commitment to reducing carbon emissions and headquartered in countries with greater environmental attention. Our results present several implications for firms, policymakers, and financial institutions.

1. Introduction

Climate change, global warming and biodiversity loss are becoming increasingly financially relevant, threatening financial stability, asset price volatility, corporate profitability, and value chains (Chiaramonte et al., 2024; Battiston et al., 2021). Financial and non-financial firms are called to increasingly consider this in their strategic management to create a marriage of economic and environmental sustainability (Lee and Klassen, 2016; Flammer, 2013; Fiordelisi et al., 2023). Substantial attention is dictated by directives and regulations that push companies toward more sustainable practices and transparent reporting (Hummel and Jobst, 2024) and banks to integrate environmental and biodiversity risks into their risk management framework (European Banking Authority, 2025). Furthermore, investor and consumer decisions increasingly consider environmental sustainability, prompting companies to adapt to new market preferences (Cosma et al., 2023).

In response, more and more companies are using *greenization* to comply with regulatory standards and align with societal expectations, leading to inflation and overreporting of green practices (Peng and Kong, 2024; Du, 2015). Thus, a "new normal" has emerged in which the adoption of environmentally friendly behaviors no longer makes the news and is taken for granted by stakeholders. Despite this, firms' actions and choices not aligned with sustainability principles may result in controversies that can

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jeopardize corporate reputation (Walsh et al., 2009; Janney and Gove, 2011).

In the most generic sense, a controversy arises “when a firm is involved in actions or incidents that can adversely impact its stakeholders and the environment” (Li et al., 2019; Nirino et al., 2021). Environmental controversies (hereafter ECs) refer to “all those negative news stories related to the environmental impact of corporate activities” (Marsat et al., 2022). ECs may involve actions or incidents that result in the deterioration of the pre-existing state of water or air, soil, subsoil, an ecosystem, or biodiversity. ECs can be resolved through negotiations, public discourse, or legal action. In the latter case, ECs turn into litigations. Table 1 shows some examples of companies that have been in the media spotlight because of big ECs.

ECs can cause severe damage to corporate reputation. Their media resonance in recent times, exacerbated by the massive expansion of social networks, has the potential to determine turbulence and volatility, substantial declines in firms’ stock value due to adverse investor focus (Marsat et al., 2022), an increase in the cost of equity (La Rosa and Bernini, 2022) and a reduction in profitability (Jucá et al., 2024). From such preliminary evidence, it seems likely that ECs may impact the firms’ default risk, potentially undermining financial stability.

Default risk expresses the likelihood that a firm cannot fulfil its debt obligations as stipulated. The literature has highlighted several factors that can significantly influence firms’ default risk, including profitability, liquidity, and sales performance (Bonfim, 2009). Mixed results concern the influence of extra-financial variables. For example, Li et al. (2022) evidenced that higher ESG ratings mitigate firms’ default risk. Similarly, several studies found that good CSR or ESG performance can lower credit risk (Kabir et al., 2021; Oikonomou et al., 2014; Jiraporn et al., 2014; Attig et al., 2013; Maquieira et al., 2024; Shih et al., 2021). Contrasting evidence has been provided by Chava (2014) and Ayton et al. (2022), who found no statistically significant relationships between CSR and financial risk. Therefore, the relationship between ESG performance and default risk is still unclear and deserves further investigation.

Moreover, the literature has left some unsolved gaps in controversies. Previous studies have analyzed the impact of ESG controversies on financial variables (Kabir et al., 2021; Nirino et al., 2021; La Rosa and Bernini, 2022; Aouadi and Marsat, 2018) without a specific focus on firms’ default risk. The only exception is the article by Giráldez-Puig et al. (2024), which focuses on insurance firms. Moreover, most previous studies used ESG or ESG controversies scores as a proxy of companies’ ESG effort or commitment. However, as Berg et al. (2022) pointed out, there is often no consistency in the methods used by different providers in estimating ESG scores. Furthermore, greenwashing raises doubts about the robustness of companies’ environmental performance assessments (Galletta et al., 2024).

This study focuses on the point number of ECs, an objective indicator of firms’ environmental behaviour, aiming to analyze how and whether they affect the firms’ default risk. To investigate the relationship between ECs and default risk, we apply a panel data analysis on 402 global companies involved in environmental controversies at least once in the past ten years. Considering that ECs may or may not result in fines, we also test the effect of reported environmental fines (hereafter EFs) on the risk of default to test whether the EFs, which may or may not be disclosed by the media, can exacerbate default risk.

Our results show that increased ECs, and thus increased media exposure of companies due to environmental damage, leads to increased default risk. In contrast, reporting of EFs does not significantly influence the risk of default. Heterogeneity analyses also point out that the positive effect of ECs on default risk is significant only for firms environmentally committed or headquartered in countries with high environmental attention. Our results present several implications for corporate management, financial institutions, policymakers, and investors. Most importantly, the results suggest that sound environmental practices aim to prevent controversies rather than mitigate the adverse impacts of controversies.

The remainder of the paper is organized as follows. The second section reviews the literature on the topic and develops research hypotheses. The third section describes the dataset and the method used. The fourth section is dedicated to empirical results. The fifth section discusses the results and concludes.

2. Literature review and hypothesis development

In recent years, academic literature has extensively analyzed the link between financial and non-financial variables to understand

Table 1
Examples of recent environmental controversies.

Firm	Environmental controversies
Volkswagen	Dieselgate was a scandal involving Volkswagen in 2015 when it was discovered that the company had manipulated diesel vehicle emissions tests by installing software to reduce emissions during testing artificially.
Monsanto	Monsanto, now owned by Bayer, has faced numerous controversies regarding its best-selling herbicide, Roundup, containing the active ingredient glyphosate, which has been accused of being carcinogenic and causing environmental damage.
Glencore	Glencore has been involved in litigation concerning the exploitation of mineral resources in the Democratic Republic of Congo, with allegations of human rights violations, environmental damage, and exploitation of local communities.
British Petroleum	The explosion of the Deepwater Horizon oil rig in the Gulf of Mexico in 2010 triggered the most significant oil disaster in U.S. history.
Cargill	Cargill has been involved in litigation concerning the discharge of waste and chemicals into river waters, causing pollution and damage to aquatic ecosystems.
ExxonMobil	ExxonMobil has been involved in a controversy related to benzene contamination in groundwater in Jacksonville, Florida, due to leaks from fuel storage tanks, impacting people’s health and the local environment.
Shell	Shell has been involved in disputes and controversies with local communities in Nigeria’s Niger Delta due to oil extraction activities that have caused severe environmental damage, water pollution and social conflicts.

whether corporate social responsibility or adopting ESG practices can ensure that companies perform financially better and pose less risk. Theories supporting this relationship can be traced back to stakeholder theory (Freeman, 1999), legitimacy theory (Suchman, 1995), and the Natural-resource-based view (Hart, 1995).

According to legitimacy theory, organizations strive to conform to social expectations and cultural norms to be considered legitimate by stakeholders and society. An environmental controversy can lead to doubts about the legitimacy of a company, which then may face several negative consequences, including loss of stakeholder trust, reduced political support, public criticism, and regulatory pressures (Palazzo and Scherer, 2006; Treepongkaruna et al., 2022).

The attempt by companies to comply with regulations and respond to pressure from increasingly sustainability-conscious stakeholders has led to an inflation of green practices that can no longer make headlines or break through to the hearts of investors and consumers. Companies are becoming more and more “green” in their marketing efforts (Wu et al., 2020), and the practice of green advertising related to environmental practices and policies has increased dramatically in recent years (Du et al., 2015; Chen and Xie, 2022). This has resulted in the evolution of ESG factors from a niche subfield to a mainstream practice to the point where people are beginning to talk about the “end of ESG” (Edmans, 2023). This overreporting adds to concerns about greenwashing and may reflect efforts put in place by companies to hide questionable behavior or environmental transgressions (Du et al., 2015).

Companies can control their ESG performance more or less directly (Cicchello et al., 2023). ECs and their media resonance are significantly less controllable. ECs can severely undermine corporate reputation (Aouadi and Marsat, 2018; Marsat et al., 2022), often requiring companies to take costly actions to restore lost reputation (Becker-Olsen et al., 2006). How a company is perceived from the outside can be critical to its financial performance. Indeed, corporate controversies and the resulting negative stakeholder perception can increase the cost of debt, lawsuits, or lost revenues (Lange and Washburn, 2012).

Several studies in the literature have empirically analyzed the link between corporate controversies and financial performance. Nirino et al. (2021) observed a substantial and negative association between corporate Environmental, Social, and Governance (ESG) controversies and financial performance, as indicated by Tobin's Q, in their examination of 356 European listed companies. Jucá et al. (2024), focusing on a sample of 625 publicly owned companies, evidenced a negative relationship between ESG controversies and companies' return on equity. Focusing on the banking sector, Galletta and Mazzù (2023) found that banks increasing their ESG controversies tend to be more risky. Similarly, Galletta et al. (2024) highlighted that ECs have the power to decrease the banks' value, proxied by Tobin's Q. Contrasting evidence was provided by Agnese et al. (2024), who found a positive relationship between ESG controversies and banks' profitability. Using a sample of European companies, La Rosa and Bernini (2022) found that ESG controversies are likely to increase the cost of equity. Similar results were reached by Krüger (2015), who, studying the reaction of stock markets to CSR-related corporate events, highlighted investors' strongly negative response to negative CSR news, even more pronounced when the subject of the news is the community or the environment. Based on such evidence, we formulate the following hypothesis:

H₁: ECs are positively linked to the firm's default risk.

Intense media attention on corporate conduct and growing awareness of environmental issues increase the risk of fines (Kölbel et al., 2017). ECs can lead to lawsuits and stakeholder conflicts, resulting in product recalls, remediation processes, and administrative and financial penalties (Cicchello et al., 2023). Various attempts have been made in the scientific literature to analyse the link between fines of several types and the financial performance of fined companies. In the broadest sense, Aguzzoni et al. (2013), focusing on fines resulting from antitrust investigations, suggest that considering the numerous recidivism of firms in carrying out infractions, the impact of fines may be weak and very often does not result in management changes; much of the damage is determined by reputational losses. These findings align with those previously achieved by Bosch and Eckard (1991), who, analyzing data on U.S. firms, find that fines represent just 13 per cent of the overall decline in stock market value resulting from the firm's antitrust indictment.

Different results have been reached by studies analyzing the impact of other types of fines on firms' financial performance. Some evidence regarding fines for non-purely financial facts is provided by Fry and Lee (1989), whose study highlighted the decline in the stock value of firms affected by fines related to health and safety violations. In their research on the repercussions of General Data Protection Regulation (GDPR) infringement fines announcements for European listed companies' market value, Ford et al. (2022) found that the negative economic consequences far outweighed the actual monetary value of the fines imposed. Gowin et al. (2021), analyzing a sample of U.S. financial institutions, demonstrated that sanctions related to breaches of anti-money laundering regulations and economic sanctions could diminish the firm value of these institutions.

Concerning environmental fines, Karpoff et al. (2005), using data from 478 environmental violations by publicly traded companies, show that environmental violations result in significant losses in firm market value. Such losses are similar in size to legally imposed sanctions. In contrast, the reputational loss from violations does not turn out to be decisive. Ma et al. (2022), in their analysis of environmental violation incidents involving Chinese listed companies between 2008 and 2020, provided evidence that the bond spread of firms breaching environmental regulations experiences a significant rise following sanctions. Based on such evidence, we make the following hypothesis:

H₂: EFs are positively linked to the firm's default risk.

3. Methodology

3.1. Sample description

We considered all financial and nonfinancial companies involved in environmental controversies at least once during 2013–2022, with data available on the Refinitiv database. We did not apply inclusion or exclusion criteria based on the geographic location of the

companies to provide comparisons across countries and continents. Next, we excluded all companies whose economic and financial data were unavailable to model corporate default risk (e.g., income, capitalization, and debt). The final sample includes 402 companies headquartered in 42 countries. The geographic distribution of the sample is shown in Table 2.

The sectoral distribution of companies is presented in Table 3. The table shows that most companies involved in ECs belong to the Materials and Energy sectors (20.83 % and 20.59 % of companies, respectively), followed by the Utilities (12.75 %) and Industrial (9.31 %) sectors.

3.2. Variables

As a proxy of firms' default risk, we use the natural logarithm of Probability of Default (PD) from Credit Research Initiative, built on the forward intensity model by Duan et al. (2012) (Do, 2022; Stepankova and Teply, 2023; Badayi et al., 2021).

As the first independent variable of interest, we use the proxy *Environmental Controversies* (ECs) from Refinitiv. It expresses the "number of controversies related to the environmental impact of companies' operations on natural resources or local communities that put them under the media spotlight". For instance, incidents related to the adverse effects of a company's operations on biodiversity or the environmental implications of its products (Marsat et al., 2022) are categorized as ECs. As the second independent variable of interest, we use the proxy *Environmental Fines* (EFs) from Bloomberg, which measures the number of fines for environmentally damaging conduct paid by firms and drawn from reports and financial statements. For both independent variables, following the approach of Mendiratta et al. (2023), Aouadi and Marsat (2018), Barnett and Salomon (2012) or Buchanan et al. (2018), in years when no ECs or EFs were available, we set the value to zero.

In line with the extant literature, we also collected several firm-specific and country-specific control variables that can affect firms' default risk. These include size, leverage, liquidity ratio, sales growth, solvency ratio, return on equity, and GDP growth rate (Bonfim, 2009; Aouadi and Marsat, 2018). We obtain financial information at the firm level from Orbis by Bureau van Dijk. Country-level data on GDP growth rate was retrieved from the World Bank database. Table 4 lists the variables in our dataset, describing their computation and source.

As shown in Table 5, which provides descriptive statistics, the variable ECs ranges between 0 and 16, depicting a situation where the maximum number of ECs involving a particular firm in a single year is 16, while the minimum is 0. Conversely, the variable EFs ranges between 0 and 638, with an average value of 2.19. Hence, firms in the sample pay an average of 2 ECs per year, with a variability that is, however, very high. The descriptives of the other variables analyzed are consistent with the literature on the topic.

Table 6 reports the correlation matrix. We do not find any significantly high correlation across dependent, independent, and control variables. Prior research indicates that the lack of correlations exceeding 0.8 rules out multicollinearity among variables (Li et al., 2008).

3.3. Empirical models

To explore our hypotheses, we introduce the following baseline panel regression models:

$$Default_{i,t} = \beta_{EC} ECs_{i,t} + \sum_{j=1}^6 X'_{i,t} \theta_j + u_{it}$$

Table 2

Geographical distribution of the sample.

Country	% of observations	Country	% of observations
United States of America	34.08	Chile	0.5
Canada	7.71	Colombia	0.5
United Kingdom	6.97	Indonesia	0.5
Japan	6.22	Israel	0.5
China	5.97	Mexico	0.5
Australia	5.22	New Zealand	0.5
India	4.73	Poland	0.5
Germany	4.23	Thailand	0.5
Brazil	3.23	Austria	0.25
France	2.99	Belgium	0.25
Netherlands	1.49	Bermuda	0.25
Russian Federation	1.49	Denmark	0.25
Spain	1.24	Iceland	0.25
Switzerland	1.24	Luxembourg	0.25
Hong Kong SAR, China	1	Panama	0.25
Malaysia	1	Singapore	0.25
Republic of Korea	1	South Africa	0.25
Cayman Islands	0.75	Sweden	0.25
Italy	0.75	Turkey	0.25
Norway	0.75	Vietnam	0.25
Philippines	0.75	Virgin Islands (British)	0.25

Table 3
Sectoral distribution of the sample.

Sector	% of firms
Materials	21.14 %
Energy	20.40 %
Utilities	12.69 %
Industrials	9.45 %
Consumer Discretionary	8.96 %
Consumer Staples	8.71 %
Financials	7.21 %
Health Care	6.72 %
Information Technology	2.49 %
Communication Services	1.24 %
Real Estate	1.00 %

Table 4
Description of variables.

Variable	Description	Source
<i>Dependent variable</i>		
Default	Natural logarithm of Probability of Default estimate	Credit Research Initiative
<i>Independent variables</i>		
ECs	Number of controversies related to the environmental impact of companies' operations on natural resources or local communities have put them under the media spotlight	Refinitiv
EFs	Number of environmental fines paid by the firm, as disclosed in reports and financial statements	Bloomberg
<i>Control variables</i>		
SolvencyRatio	The ratio of EBIT to interest expenses	Orbis by Bureau van Dijk
LiquidityRatio	The ratio of current assets to current liabilities	Orbis by Bureau van Dijk
ROE	Return on Equity	Orbis by Bureau van Dijk
Size	The logarithm of total assets	Orbis by Bureau van Dijk
SalesGrth	Yearly sales growth rate	Orbis by Bureau van Dijk
Leverage	The ratio of total liabilities to total assets	Orbis by Bureau van Dijk
Gdpgrth	Yearly GDP growth rate	World Bank

Table 5
Descriptive statistics.

Variable	Mean	Std. Dev.	Min	Max
Default	-7.551	2.511	-13.816	-.052
ECs	.334	1.025	0	16
EFs	2.232	25.028	0	638
SolvencyRatio	38.986	21.534	-99.284	99.254
Liquidityratio	1.42	2.388	.04	70.901
ROE	12.663	17.163	-25.559	50.702
Size	16.864	2.014	6.072	22.458
SalesGrth	1.13	1.347	0	69.076
Leverage	.599	.272	.007	8.117
Gdpgrth	2.322	3.078	-17.668	15.836

Notes: The table shows the descriptive statistics of the main variables investigated.

$$Default_{i,t} = \beta_{EF}EFs_{i,t} + \sum_{j=1}^6 X_{i,t}^j \theta_j + u_{it}$$

for $i = 1, 2, \dots, N$ and $t = 1, 2, \dots, T$ and where u_{it} is the error term consisting of the idiosyncratic part and different combinations of firm, year, country and sector fixed effects. β_{EC} and β_{EF} are the parameters of interest, capturing the effect of ECs and EFs on the dependent variable, i.e. the default risk. X^j represents the vector of firm-specific and country-specific control variables.

Table 6
Pearson's correlation matrix (significance at the 5 % level).

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Default	1.000									
(2) ECs	0.032*	1.000								
(3) EFs	0.020	0.018	1.000							
(4) SolvencyRatio	-0.251*	-0.013	-0.026	1.000						
(5) Liquidityratio	-0.059*	-0.034*	-0.021	0.232*	1.000					
(6) ROE	-0.257*	0.012	0.002	-0.063*	-0.101*	1.000				
(7) Size	0.001	0.160*	0.065*	-0.341*	-0.306*	0.162*	1.000			
(8) SalesGrth	0.014	-0.010	-0.006	0.016	-0.008	0.009	-0.029	1.000		
(9) Leverage	0.241*	0.014	0.023	-0.761*	-0.207*	0.094*	0.082*	0.001	1.000	
(10) Gdpgrth	-0.047*	-0.046*	-0.025	0.096*	0.002	0.125*	-0.057*	0.056*	-0.091*	1.000

Notes: This table shows the selected variables correlation. ***, ** and * denote statistical significance at the 1 %, 5 %, and 10 % levels, respectively.

4. Empirical results

4.1. Environmental controversies and fines and firms' default risk

Table 7 shows the results of our empirical models with several combinations of fixed effects. Results highlight a positive effect of the number of ECs (ECs) on firms' default risk, consistent in columns 1, 2, and 3. In the first column, in which firm and time-fixed effects are included, for a one-unit increase in the number of ECs, our dependent variable decreases by 0.06, with a statistical significance of 5 %. The effect becomes stronger if we consider country and time fixed effects (column 2) or industry and firm fixed effects (column 3), with a statistical significance at the 1 % level. These results confirm hypothesis H1. Instead, the number of EFs reported by the firm never significantly influences the risk of default (columns 4, 5, and 6). These results do not allow us to confirm hypothesis H2.

The initial results suggest that the effect on the risk of default of ECs occurs only if there is media resonance and the questionable behavior is discussed and debated, regardless of a possible fine. The reporting by companies of EFs in financial statements and disclosure does not significantly affect the default risk. The impact of the control variables on default risk is in line with other studies on the topic (Bonfim, 2009; Shih et al., 2021).

Table 7
Effects of ECs and EFs on firms' default risk.

	Dependent variable: Default					
	(1)	(2)	(3)	(4)	(5)	(6)
ECs	0.0612** (0.0276)	0.1072*** (0.0333)	0.0977*** (0.0298)			
EFs				0.0000 (0.0016)	0.0003 (0.0014)	0.0001 (0.0017)
SolvencyRatio	-0.0021 (0.0045)	-0.0025 (0.0030)	-0.0042 (0.0050)	-0.0023 (0.0045)	-0.0026 (0.0030)	-0.0046 (0.0050)
Liquidityratio	-0.0309* (0.0180)	-0.0501** (0.0212)	-0.0108 (0.0196)	-0.0309* (0.0180)	-0.0499** (0.0213)	-0.0105 (0.0197)
ROE	-0.0209*** (0.0019)	-0.0429*** (0.0021)	-0.0190*** (0.0020)	-0.0209*** (0.0019)	-0.0431*** (0.0021)	-0.0189*** (0.0020)
Size	0.4030*** (0.0919)	-0.2218*** (0.0255)	0.7556*** (0.0924)	0.4130*** (0.0919)	-0.2023*** (0.0248)	0.7822*** (0.0922)
SalesGrth	0.0457** (0.0179)	0.0390 (0.0241)	0.0341* (0.0195)	0.0459** (0.0179)	0.0386 (0.0241)	0.0341* (0.0196)
Leverage	5.0601*** (0.4882)	4.9718*** (0.3242)	5.6274*** (0.5331)	5.0628*** (0.4887)	4.9358*** (0.3245)	5.6421*** (0.5341)
Gdpgrth	0.0143 (0.0158)	0.0137 (0.0231)	-0.0778*** (0.0093)	0.0151 (0.0158)	0.0152 (0.0232)	-0.0788*** (0.0093)
Observations	3179	3184	3169	3179	3184	3169
Industry FE	No	No	Yes	No	No	Yes
Country FE	No	Yes	No	No	Yes	No
Firm FE	Yes	No	Yes	Yes	No	Yes
Time FE	Yes	Yes	No	Yes	Yes	No
R2	0.7577	0.4193	0.7576	0.7573	0.4174	0.7572

Notes: The table shows the regression analysis results with fixed effects over 2013–2022. The dependent variable is the probability of default, while the main variables of interest are environmental controversies (ECs) in columns (1), (2) and (3) and environmental fines (EFs) in columns (4), (5) and (6). Clustered standard errors in parentheses. ***, ** and * denote statistical significance at the 1 %, 5 %, and 10 % levels, respectively

4.2. Robustness tests

4.2.1. Environmental controversies and fines and the term structure of default risk

In our baseline models, we use the 1-year PD. However, as stated by [Shih et al. \(2021\)](#), the forward intensity model by [Duan et al. \(2012\)](#) allows the calculation of the forward PDs “with different maturities and provision of consistent term structure for PDs”. So, as a robustness test, we estimate our model using, as a dependent variable, the 3-months, 6-months, 2-years, 3-years, and 5-years PD from CRI database. The results in [Table 8](#) (Panel A) provide greater robustness to the previous results, showing a consistently positive relationship between ECs and default risk (at the 5 % and 1 % level). Furthermore, consistent with the idea that controversies result in negative media exposure that can harm firms, the magnitude of the coefficient estimate of ECs decreases with the maturity of the PD ([Do, 2022](#)). ECs tend to immediately impact stakeholder perceptions (investors, customers, regulators), leading to a greater increase in PD in the short term. In contrast, when the reference time horizon expands, media coverage dissipates, and thus, the negative effect of controversies on PD may be less. Consistent with our previous results, no statistically significant relationship emerges between default risk and EFs (Panel B).

4.2.2. Sample re-composition: exclusion of US companies

As a further robustness check, we re-estimated the baseline models by removing US companies from the sample to avoid their presence (around 34 % of our sample), driving our results ([Aresu et al., 2023](#)). Results obtained after the sample re-composition ([Table 9](#)) are consistent and robust to baseline findings in [Section 4.1](#). Indeed, ECs positively and significantly influence firms’ default risk (column 1), while EFs do not exert any significant effect (column 2).

4.2.3. Sensitivity test

4.2.3.1. Alternative dependent variables. Following [Nguyen and Nguyen \(2022\)](#), we test the robustness of our results by using a different specification of firms’ default risk. Specifically, we use ROA Volatility and Z-Score, whose use in the literature is strongly established ([Faccio et al., 2011](#); [Liu and Zhang, 2024](#); [Maquieira et al., 2024](#)). We compute ROA Volatility as the standard deviation of ROA over a 5-year rolling period and apply a logarithmic transformation to handle extreme values ([Liu and Zhang, 2024](#)). We compute the Z-Score as the sum of ROA and capitalisation (equity on total assets) divided by the standard deviation of ROA calculated using five-year rolling windows ([Alves and Meneses, 2024](#); [Maquieira et al., 2024](#)). A higher z-score implies a lower probability of default. The results in [Table 10](#) show the effect of ECs and EFs on the new dependent variables and confirm the results previously highlighted.

4.2.3.2. Different specifications of the independent variables. To further test the significance effect of ECs on the probability of default, we replaced the explanatory variable (a) with the ESG Controversies Score (*ESGContr*) from Refinitiv, which is measured on a scale from 0 to 100, where a company with no controversies will have a score of 100 ([Galletta and Mazzù, 2023](#)), (b) with a *DummyContr* variable from Refinitiv, which takes value 1 in years when firms have been subject to environmental controversies, and 0 otherwise. The results in [Table 11](#) (columns 1 and 2) fully confirmed the previous findings. Similarly, we replaced the EFs variable with a

Table 8
Effects of ECs and EFs on the term structure of default risk.

Panel A: Environmental Controversies					
	(1)	(2)	(3)	(4)	(5)
	Default3m	Default6m	Default2Y	Default3Y	Default5Y
ECs	0.0738** (0.0318)	0.0876*** (0.0323)	0.0501** (0.0244)	0.0436** (0.0195)	0.0358** (0.0141)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	2745	2968	3276	3281	3281
Industry FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
R2	0.6785	0.6917	0.7319	0.7457	0.7705
Panel B: Environmental Fines					
	(1)	(2)	(3)	(4)	(5)
	Default3m	Default6m	Default2Y	Default3Y	Default5Y
EFs	0.0006 (0.0017)	0.0004 (0.0018)	−0.0000 (0.0014)	0.0000 (0.0011)	0.0002 (0.0008)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	2745	2968	3276	3281	3281
Industry FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
R2	0.6778	0.6908	0.7315	0.7453	0.7699

Notes: The table shows the regression analysis results with fixed effects over the period 2013–2022. The dependent variable is the 3-months, 6-months, 2-years, 3-years, and 5-years probability of default, while the main variables of interest are environmental controversies (ECs) (Panel A) and environmental fines (EFs) (Panel B). Clustered standard errors in parentheses. ***, ** and * denote statistical significance at the 1 %, 5 %, and 10 % levels.

Table 9
Baseline results excluding US companies.

	Dependent variable: Default	
	(1)	(2)
ECs	0.0551* (0.0283)	
EFs		0.0002 (0.0014)
SolvencyRatio	0.0365 (0.0283)	0.0369 (0.0283)
Liquidityratio	-0.0183 (0.0165)	-0.0181 (0.0165)
ROE	-0.0138*** (0.0020)	-0.0137*** (0.0020)
Size	0.7383*** (0.1101)	0.7513*** (0.1100)
SalesGrth	0.0279* (0.0166)	0.0277* (0.0166)
Leverage	9.2526*** (2.8284)	9.3330*** (2.8309)
Gdpgrth	-0.0545*** (0.0084)	-0.0549*** (0.0084)
Observations	2187	2187
Industry FE	Yes	Yes
Firm FE	Yes	Yes
R2	0.7534	0.7530

Notes: The table shows the regression analysis results with fixed effects over the period 2013–2022, excluding US companies. The dependent variable is the probability of default, while the main variables of interest are environmental controversies (ECs) in columns (1), and environmental fines (EFs) in columns (2). Clustered standard errors in parentheses. ***, ** and * denote statistical significance at the 1 %, 5 %, and 10 % levels, respectively

DummyFines that takes value 1 in years when firms received environmental fines, and 0 otherwise. Again, no significant relationship with the probability of default emerged (Table 11, column 3).

As a further robustness test, we winsorized all the continuous variables at 1 % and 99 % (Aresu et al., 2023). This type of transformation is intended to mitigate the influence of outliers, ensuring a more stable data analysis (Aslan et al., 2022). Overall, the untabulated but available upon request results are consistent with the leading results. The effect of ECs on firms' risk of default remains positive and statistically significant in the various combinations of fixed effects considered (at the 5 % and 1 % levels). In the case of EFs, their impact on firms' default risk is never statistically significant.

4.2.4. Removing pandemic noise

The literature is in relative agreement that the COVID-19 pandemic has placed ESG concerns at the top of the priorities of companies and investors (Liu et al., 2024), also highlighting a negative relationship between ESG performance and financial risk during the crisis period (Broadstock et al., 2021). In light of these considerations, we test whether the relationships previously highlighted might be influenced by the pandemic “noise” (Liu et al., 2024). In particular, it may be possible that the significant relationship between ECs and default risk is driven by the pandemic period, in which there was increased attention to ESG issues. The results, untabulated but available upon request, confirm our main findings.

4.3. Additional analysis

4.3.1. Addressing endogeneity: instrumental variable approach

To give more robustness to the highlighted relationship between ECs and firms' default risk, we perform a two-stage least square (2SLS) model to better deal with potential endogeneity concerns due to reverse causality problems (Altunbas et al., 2022). In particular, following Liu et al. (2015) and Garcia-Appendini et al. (2023), we instrument the ECs of a specific firm in a given year by using: i) the average ECs of other firms in the same industry and the same year (*EC_Sector*) and ii) the average ECs of other firms in the same country and the same year (*EC_Country*). This choice stems from the fact that, very likely, the environmental controversies of firms in the same industry exhibit a high correlation by having a similar environmental impact. Similarly, among firms in the same country, an isomorphism could result in them behaving similarly, thus leading to a high correlation between their environmental controversies. At the same time, it is very unlikely that industry or country environmental controversies would influence the default risk of the individual firm.

The results of the first stage regression (Table 12, column 1), in which ECs are regressed against our independent variables, highlight the validity of our instrumental variables, presenting a statistically significant relationship with the dependent variable. The results of the second stage regression, in which we replace the endogenous variable with its predicted values in the first stage

regression, continue to support our Hypothesis H1. Indeed, the positive and statistically significant effect of ECs on default risk emerges again (at the 1 % level).

4.4. Firm heterogeneity analysis

According to [Capelle-Blancard and Petit \(2019\)](#), firms facing controversies suffer a decline in their market value. However, the extent of the loss is reduced if the company has disclosed more positive ESG information compared to its competitors. [Nirino et al. \(2021\)](#) show that controversies have less negative impact on performance when companies implement strategies to protect the environment and the community. For eco-friendly firms, market reaction is less damaging, and the possible effects of such events (boycott, fines, etc.) are expected to be less important ([Flammer, 2013](#)). [Marsat et al. \(2022\)](#) highlight that prior high environmental performance significantly helps firms recover more quickly from the shock due to an EC. To provide more empirical evidence, we investigated the possible role of a firm's approach toward the environment in the relationship between ECs and default risk. To do so, we perform a heterogeneity analysis using firms' carbon emission score by Refinitiv, which measures a company's commitment toward reducing environmental emissions in the production and operational process to discriminate between the best and worst performers in environmental practices ([Ardia et al., 2023](#); [Kabir et al., 2021](#)). This investigation aims to understand whether recognizing environmentally responsible conduct can protect against increased risk of default resulting from controversies.

The results in [Table 13](#) reveal that ECs positively and significantly affect the default risk for firms with higher carbon emission scores., while they do not affect the default risk of firms with a lower emission score or, in other words, with a lower commitment to reduce carbon emissions (column 3). This confirms, in principle, the insights of [Baron and Diermeier \(2007\)](#) and [Baron \(2009\)](#) that companies engaging in visible CSR initiatives are subject to greater public scrutiny and risk encountering a "boomerang effect" if they fail to meet expectations. The results are also the same when we split the sample using another environmental performance indicator, such as the Environmental Pillar Score provided by Refinitiv.

4.5. Country heterogeneity analysis

According to [Xiao et al. \(2018\)](#), the financial effect of corporate sustainability performance is negatively affected by sustainability performance at the national level. To corroborate our results and respond to [Nirino et al.'s \(2021\)](#) call for further investigation of national contexts, following [Garel et al. \(2024\)](#), we perform a heterogeneity analysis to understand whether the effect of ECs on firms' default risk differs between countries. We use the Environmental Performance Index (EPI) median value to distinguish between leader and laggard countries in environmental performance [Aresu et al. \(2023\)](#). The EPI, by the Yale Center for Environmental Law & Policy and Columbia University's Earth Institute in collaboration with the World Economic Forum, measures in a range from 0 to 100, countries' attention to environmental protection and regulatory pressure from regulators on these issues ([Wolf et al., 2022](#)).

Table 10
Effect of ECs and EFs on the ROA Volatility and Z-Score.

	ROA Volatility		Z-Score	
	(1)	(2)	(3)	(4)
ECs	0.0272** (0.0112)		-0.1065* (0.0619)	
EFs		0.0007 (0.0007)		-0.0020 (0.0037)
SolvencyRatio	-0.0035** (0.0018)	-0.0036** (0.0018)	-0.0003 (0.0097)	0.0001 (0.0097)
Liquidityratio	0.0260*** (0.0074)	0.0260*** (0.0074)	-0.0461 (0.0412)	-0.0461 (0.0412)
ROE	-0.0017** (0.0007)	-0.0017** (0.0007)	0.0760*** (0.0041)	0.0760*** (0.0041)
Size	-0.0853*** (0.0317)	-0.0786** (0.0316)	-0.2570 (0.1758)	-0.2832 (0.1753)
SalesGrth	0.0099 (0.0074)	0.0099 (0.0074)	-0.0318 (0.0412)	-0.0319 (0.0412)
Leverage	0.3267* (0.1862)	0.3278* (0.1863)	-4.5534*** (1.0320)	-4.5582*** (1.0324)
Gdpgrth	0.0060* (0.0035)	0.0057 (0.0035)	0.0275 (0.0196)	0.0285 (0.0196)
Observations	3366	3366	3365	3365
Industry FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
R2	0.7267	0.7262	0.6073	0.6070

Notes: The table shows the results of the regressions over the period 2013–2022 with the new dependent variables. The dependent variables are the ROA Volatility (columns 1–2) and Z-Score (columns 3–4). The main variables of interest are environmental controversies (ECs) in column (1) and (3) and environmental fines (EFs) in columns (2) and (4). Clustered standard errors in parentheses. ***, ** and * denote statistical significance at the 1 %, 5 %, and 10 % levels, respectively.

Table 11
Baseline results using different specifications of independent variables.

	Dependent variable: Default		
	(1)	(2)	(3)
ESGContr	-0.0035*** (0.0010)		
DummyContr		0.2770*** (0.0689)	
DummyFines			-0.0692 (0.1351)
SolvencyRatio	-0.0025 (0.0054)	-0.0022 (0.0053)	-0.0046 (0.0050)
Liquidityratio	-0.0031 (0.0196)	-0.0028 (0.0196)	-0.0106 (0.0197)
ROE	-0.0187*** (0.0021)	-0.0186*** (0.0021)	-0.0189*** (0.0020)
Size	0.8178*** (0.1004)	0.8155*** (0.1000)	0.7830*** (0.0922)
SalesGrth	0.0334* (0.0194)	0.0333* (0.0194)	0.0341* (0.0196)
Leverage	5.9919*** (0.5772)	5.9967*** (0.5767)	5.6425*** (0.5341)
Gdpgrth	-0.0790*** (0.0093)	-0.0788*** (0.0093)	-0.0788*** (0.0093)
Observations	3043	3043	3169
Industry FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
R2	0.7110	0.7116	0.7082

Notes: The table shows the regression analysis results with fixed effects over the period 2013–2022. The dependent variable is the probability of default, while the main variables of interest are: ESG controversies score (ESGContr) in columns (1) and two dummies (DummyContr and DummyFines) that are equal to 1 in years when controversies or fines occurred, and 0 in years when they did not (in columns (2) and (3), respectively). Clustered standard errors in parentheses. ***, ** and * denote statistical significance at the 1 %, 5 %, and 10 % levels, respectively.

The results in [Table 14](#) indicate that the effect of ECs on default risk is statistically significant only in countries characterized by high environmental attention. This result is, in principle, aligned with [Xiao et al. \(2018\)](#) that in countries with high environmental consciousness, stakeholders perceive companies' efforts in improving environmental performance less, as they see such action as a fiduciary duty. Our results add further evidence, suggesting that breaking this fiduciary duty generates significant financial harm that, in contrast, does not exist in countries where there is already low environmental consciousness.

5. Discussion and conclusions

Using panel regression models on a sample of 402 listed companies worldwide from 2013 to 2022, this study revealed a positive and significant relationship between ECs and default risk, confirming the first Hypothesis (H1), and the substantial absence of a significant relationship between monetary fines and default risk, not confirming the second Hypothesis (H2).

The negative impact of controversies on default risk compared to reporting fines may have several justifications. The first is that fines may come long after controversies when the market has discounted the loss. The second is that companies, after an environmental controversy, make capital provisions for the expected fine, preventing trauma from a balance sheet perspective that captures the stakeholder's attention. Finally, the absence of a significant influence of reported environmental fines on the risk of default may also result from overreporting. In other words, reporting adverse events in companies' channels can be overwhelmed by excessive reporting of positive green practices (greenwashing) to offset questionable business conduct ([Du, 2015](#)).

Our results emphasize the media relevance of negative news stories on firms' default risk and align with [Nirino et al. \(2021\)](#) and [Galletta et al. \(2024\)](#) on the detrimental effects of controversies on corporate financial performance. On the other hand, our results contrast with those of [Karpoff et al. \(2005\)](#) and [Ma et al. \(2022\)](#) on the negative consequences of environmental fines on corporate health.

The significant effect of ECs on default risk, which withstands numerous robustness tests, holds even when we test the effect on the term structure of default risk and when we use an instrumental variable approach to address endogeneity. The heterogeneity analysis contradicts the insurance hedging effect of a good environmental reputation found by [Pástor et al. \(2021\)](#), [Marsat et al. \(2022\)](#), [Ardia et al. \(2023\)](#) and confirms the results of [Gatti et al. \(2021\)](#), and [Du \(2015\)](#): a more substantial commitment in reducing carbon emission does not avoid the increased risk of default related to ECs. This, therefore, reveals the presence of a boomerang effect. Stakeholders of the greenest firms may feel betrayed, perceiving green disclaimers as lies, claims of environmental responsibility belied by misconduct and questionable behavior, and react much worse than investors in firms with lower environmental performance, where environmental impact risk is an expected risk that is not surprising. Similarly, the country-level heterogeneity analysis reveals that the

Table 12
Instrumental variable approach.

	(1) ECs	(2) Default
EC_Sector	0.3702*** (0.0613)	
EC_Country	0.2958*** (0.6734)	
EnvCC		0.6658*** (0.1483)
SolvencyRatio	-0.0033 (0.0041)	-0.0007 (0.0077)
Liquidityratio	-0.0016 (0.0042)	-0.0139 (0.0151)
ROE	0.0004 (0.001)	-0.0186*** (0.0020)
Size	0.1618*** (0.0519)	0.6235*** (0.1313)
SalesGrth	-0.0034 (0.0031)	0.0317*** (0.0089)
Leverage	-0.0839 (0.2675)	5.4914*** (0.8437)
Gdpgrth	-0.0029 (0.0065)	-0.0778*** (0.01)
Observations	2904	2904
Fixed Effects	Yes	Yes
Kleibergen-Paap LM stat	28.18	
Cragg-Donald F-Stat	63.54	

Notes: Results of empirical models able to handle endogeneity. Column 1 and 2 report the results of the 2SLS regression with probability of default as dependent variable Standard errors in parentheses. ***, ** and * denote statistical significance at the 1 %, 5 %, and 10 % levels, respectively.

Table 13
Effect of ECs on firms' default risk. Heterogeneity analysis based on the firm's environmental commitment.

	Dependent variable: Default	
	More committed	Less committed
	(1)	(2)
ECs	0.0910*** (0.0326)	0.1077 (0.0722)
SolvencyRatio	0.0058 (0.0083)	-0.0154** (0.0076)
Liquidityratio	0.0767 (0.0643)	-0.0124 (0.0217)
ROE	-0.0186*** (0.0027)	-0.0225*** (0.0033)
Size	1.3630*** (0.1809)	0.5098*** (0.1389)
SalesGrth	0.0748 (0.0551)	0.0260 (0.0214)
Leverage	6.7963*** (0.8759)	4.3233*** (0.8128)
Gdpgrth	-0.0761*** (0.0118)	-0.0811*** (0.0157)
Observations	1682	1433
Industry FE	Yes	Yes
Firm FE	Yes	Yes
R2	0.7366	0.7254

Notes: The table shows the regression analysis results with fixed effects over the period 2013–2022. The dependent variable is the probability of default, while the main variable of interest is environmental controversies (ECs). Columns (1) and (2) evaluate the effect of controversies on the default risk of companies with high (column 1) and low (column 2) carbon emission scores. ***, ** and * denote statistical significance at the 1 %, 5 %, and 10 % levels, respectively.

Table 14
Effect of ECs on firms' default risk. Heterogeneity analysis based on countries' environmental performance.

	Dependent variable: Default	
	High EPI Countries	Low EPI Countries
	(1)	(2)
ECs	0.0964*** (0.0347)	0.0937 (0.0613)
SolvencyRatio	-0.0057 (0.0054)	0.0394 (0.0397)
Liquidityratio	-0.0085 (0.0215)	0.0149 (0.0716)
ROE	-0.0214*** (0.0025)	-0.0117*** (0.0033)
Size	0.7704*** (0.1133)	0.7555*** (0.1608)
SalesGrth	0.0382* (0.0218)	-0.0149 (0.0521)
Leverage	5.7172*** (0.5957)	9.5184** (3.9601)
Gdpgrth	-0.0864*** (0.0128)	-0.0648*** (0.0126)
Observations	2152	1032
Industry FE	Yes	Yes
Firm FE	Yes	Yes
R2	0.6541	0.7898

Notes: The table shows the regression analysis results with fixed effects over the period 2013–2022. The dependent variable is the probability of default, while the main variable of interest is environmental controversies (ECs). Columns (1) and (2) evaluate the effect of controversies on the default risk of companies headquartered in countries with high (column 1) and low (column 2) Environmental Performance Index (EPI). ***, ** and * denote statistical significance at the 1 %, 5 %, and 10 % levels, respectively

relationship between ECs and default risk exists only for companies in countries with a high environmental focus. In such countries, improving environmental performance is typically perceived as a simple fiduciary duty (Xiao et al., 2018). However, companies are punished with increased default risk when they fail to fulfill this duty.

The results support the Legitimacy Theory: companies must conform to social and environmental norms to maintain stakeholder support. Failing to meet these expectations compromises the “social license to operate”, generating a more significant negative impact than the lack of a declared environmental commitment.

Our finding has relevant policy implications. This constitutes the first evidence on a large sample that news about environmental issues could affect default risk, potentially undermining the firm's ability to obtain credit. This is a more significant deterrent than regulatory and legal sanctions and empties them of their “punitive” function.

Furthermore, these findings have important implications for corporate executives, who should pay more attention to controversies management since stakeholders attach it a substantial value.

Our results, showing that the negative consequences of ECs are not mitigated by previous good environmental performance, also prove that investing in preventing environmental impacts is the path to pursue. Companies need to consider environmental sustainability as an integral part of their business strategy to ensure long-term financial performance and meet the growing expectations of investors and consumers. Managers should then prioritize minimizing or preventing controversies.

Our findings can also help banks and financial institutions reconsider lending and risk assessment policies. Previous studies have shown that banks' exposure to green loans is negatively correlated with insolvency risk (Umar et al., 2021), or that climate transition risk inhibits bank performance (Li and Pan, 2022). Incorporating a more thorough assessment of corporate customers' environmental histories and controversies could help banks better identify potential default risks and mitigate environmental-related losses.

From a theoretical perspective, the study contributes to the literature on environmental management and the determinants of default risk by highlighting the role of ECs. The study enhances our understanding of the “dark side” of environmental performance, contrasting strands of literature that indicate that good ESG practices adopted by a firm in the past can protect a firm from the effect of controversies on default risk.

Although the evidence provided in the article has numerous implications, further research is needed on the possible channels through which controversies turn into default risk or how individual environmental controversies impact stock market volatilities. Similarly, it would be interesting to analyze the steps companies put in place in the aftermath of controversies to regain market confidence and the time it takes for this to happen. Finally, even if fines appear to have no impact on corporate default risk, specific analysis should be done considering the amount of individual fines and how such fines may impact middle channels of financial performance.

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CRedit authorship contribution statement

Rimo Giuseppe: Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Cosma Simona:** Writing – review & editing, Writing – original draft, Validation, Supervision, Conceptualization. **Schwizer Paola:** Writing – review & editing, Validation, Project administration, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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