

RESEARCH ARTICLE OPEN ACCESS

Corporate Environmental Responsibility, Environmental Policy Stringency and Debt Cost in Europe

Francisco José González Sánchez¹  | Gracia Rubio Martín¹ | Pedro López Sáez¹ | Alejandro Rodríguez Martín²¹Universidad Complutense, Madrid, Spain | ²Universidad CEU San Pablo, Madrid, Spain**Correspondence:** Francisco José González Sánchez (fragon18@ucm.es)**Received:** 10 July 2024 | **Revised:** 25 September 2025 | **Accepted:** 2 October 2025**Keywords:** corporate environmental responsibility | corporate social responsibility | cost of debt | environmental policy stringency | green institutions**ABSTRACT**

The financial implications of corporate environmental responsibility (CER) remain a subject of considerable debate, with empirical evidence often yielding mixed results. This ambiguity suggests that the relationship is contingent upon broader contextual factors, particularly the institutional environment. Grounded in a dual framework of stakeholder theory and institutional theory, this article investigates the joint effect of firm-level CER and country-level environmental policy stringency (EPS) on the cost of debt for European firms. Using a sample of 2025 listed firms from 18 European countries from 2017 to 2021, our analysis employs fixed effects, structural equation, and multilevel models. The findings reveal that higher CER significantly reduces a firm's cost of debt. More importantly, national environmental policy serves as a critical mechanism that both directly lowers debt costs and indirectly amplifies the financial benefits of CER by encouraging firms to improve their environmental performance. This research contributes by demonstrating the synergistic interplay between micro-level corporate actions and macro-level regulatory pressures, offering robust evidence that cohesive environmental strategies at both corporate and governmental levels yield tangible financial advantages.

1 | Introduction

Current societies are increasingly attentive to sustainable development goals, prompting investors, creditors, and other stakeholders to consider corporate social responsibility (CSR) in general, and corporate environmental responsibility (CER) in particular, as significant and growing concerns. In this context, firms can leverage CSR activities to enhance their reputation and appeal to stakeholders (Melo and Garrido-Morgado 2012; Perez 2015), reduce information asymmetries (Liu et al. 2021; Martínez-Ferrero et al. 2016), and mitigate agency problems, thereby achieving superior financial performance compared to their peers (Eccles and Krzus 2010; Giordino et al. 2024; Serafeim 2015; Velte 2025). However, while a general positive trend exists, the context matters more than a universal rule (García-Sánchez et al. 2020; Velte 2022).

In this vein, some evidence suggests that CER can reduce the cost of debt (Ali et al. 2023; Fonseka et al. 2019; Gao and Wan 2023; Palea and Drogo 2020; Sun et al. 2022), acting as an indicator of reduced risk and enhanced trust and reputation, while some authors report inconclusive findings or a positive relationship between CSR and the cost of debt that may harm overall performance (Desender et al. 2020; Fandella et al. 2023; Gigante and Manglaviti 2022; Magnanelli and Izzo 2017).

This article focuses on the joint effect of CER and environmental policy stringency (EPS) on the cost of debt for European firms, trying to provide a theoretical framework that positions this research within the broader academic debate. The study's methodological approach is specifically designed to address the complexities and mixed findings within this field. It primarily draws upon two well-established theoretical perspectives

This is an open access article under the terms of the [Creative Commons Attribution-NonCommercial-NoDerivs](https://creativecommons.org/licenses/by-nc-nd/4.0/) License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

© 2025 The Author(s). *Corporate Social Responsibility and Environmental Management* published by ERP Environment and John Wiley & Sons Ltd.

(stakeholder theory and institutional theory) to explain the relationship between CER, EPS, and the cost of debt.

Compared to other stakeholders, creditors are particularly sensitive to CER issues due to economic, regulatory, reputational, and risk-based considerations (Klaas Jagersma 2009). Global climate change concerns have led to increased pressure for green banking adoption worldwide (Bukhari et al. 2019). Consequently, regulators are increasingly requiring banks to thoroughly assess potential default and environmental risks before extending credit to firms (Giordino et al. 2025; Goss and Roberts 2011; Hummel and Jobst 2024; Li et al. 2022). Therefore, evaluating financial risks necessitates considering both firm-specific factors and contextual or institutional elements (Chen et al. 2025; DiMaggio and Powell 1983; García-Sánchez et al. 2022; Glynn and D'Annunzio 2023; Kordsachia et al. 2022; Zucker 1987). This perspective is crucial for understanding how environmental policies drive the adoption and diffusion of sustainability practices among firms, financial institutions, and markets (García-Sánchez et al. 2022).

The European Union's ambitious climate change goals and regulatory framework, including the Sustainable Finance Disclosure Regulation (SFDR) and the Corporate Sustainability Reporting Directive (CSRD), serve as a powerful institutional context for this research. By integrating institutional theory, the study provides a framework for understanding how the coexistence of varying regulatory landscapes in Europe influences the relationship between CER and firm debt cost.

To investigate the joint effect of CER and EPS, this study utilizes a large sample of 2025 European listed firms from 2017 to 2021, comprising 7417 observations. This dataset includes a broad range of industries and countries, utilizing easily replicable variables. The study employs three distinct methodological approaches to ensure the robustness of the findings: fixed effects, structural equations, and a multilevel model. Fixed effects and structural equations are used to disentangle the driving effect of EPS on CER and the direct and indirect effects of EPS on the cost of debt. The multilevel model is then applied to evaluate the influence of different EPS policies on creditors' investment decisions.

Our results consistently indicate that higher firm-level CER is associated with a lower cost of debt. Furthermore, we find that country-level EPS acts as a crucial conditioning factor, both directly reducing debt costs and indirectly amplifying the financial benefits of CER by fostering improved corporate environmental performance. This article offers three main contributions. First, it focuses exclusively on the environmental dimension of CSR, thereby contributing to the growing body of research on how CER reduces the financial cost of debt (Cheng et al. 2014; Gao and Wan 2023; Rupp and Mallory 2015). Second, it empirically demonstrates how the institutional context (EPS) influences and mediates the financial rewards of corporate environmentalism in Europe, addressing a significant gap in the literature and shedding light on how green policy drives the adoption and diffusion of sustainability-associated environmental practices among firms, financial institutions, and markets (Jennings and Zandbergen 1995). Third, it provides easily replicable evidence using a large, multi-country sample and a complementary set

of advanced analytical techniques, offering actionable recommendations for managers and policymakers seeking financial advantages from environmentally conscious decisions.

The remainder of this paper is structured as follows. Section 2 details the theoretical framework and develops the research hypotheses. Sections 3 and 4 describe the sample, data sources, key variables, empirical results, and findings. Finally, Sections 5 and 6 discuss the findings in relation to existing literature and present the conclusions, implications, and limitations of the study.

2 | Literature Review and Hypothesis Development

Corporate Social Responsibility is defined as a classification of business activities focusing on the impact of a company's performance and management on society (Wood 2010). Also known as ESG (Environmental, Social, and Governance), CSR encompasses voluntary business behaviors that integrate social and environmental concerns into core business operations and stakeholder interactions (Waddock and Graves 1997). CER represents the environmental dimension of CSR and is defined as a firm's behavior that transcends mere economic interests and legal requirements by incorporating environmental concerns into its core operations and stakeholder interactions (Cheng et al. 2014). More specifically, CER refers to the impact a company has on the natural environment, encompassing aspects such as environmental policies, waste generation, CO₂ emissions, renewable energy use, and potential environmental sanctions or fines (Limkriangkrai et al. 2016; Shrivastava and Addas 2014; Wilmshurst and Frost 2000; Yu and Tsai 2018). Given that CER is a specific component of CSR, the subsequent theoretical arguments will address CSR broadly, with a particular emphasis on CER for hypothesis development.

2.1 | Theoretical Framework

CSR enhances the company's legitimacy and image among stakeholders, and previous studies have highlighted the importance of disclosing CSR information (Cui et al. 2018; Zhu and Zhang 2015) for signaling positive corporate characteristics. ESG criteria are increasingly utilized in project finance (Gupta 2018) as investors, lenders, and market participants recognize that ESG information reflects firms' opportunities and risks (Limkriangkrai et al. 2016). This is largely because ESG disclosure policies promote corporate transparency, thereby reducing concerns about hidden adverse information (Raimo et al. 2021). This signaling effect has been demonstrated in studies such as Amarna et al. (2024), Huang et al. (2018), and Maaloul et al. (2023), which show a negative relationship between CSR and financing costs. Specifically focusing on environmental aspects, Fonseka et al. (2019) and Palea and Drogo (2020) found a negative relationship between CER and the cost of debt in the real estate and carbon emission industries, respectively.

Integrating ESG considerations into corporate reporting can also mitigate agency problems by offering a more comprehensive view of a company's long-term value creation potential (Eccles and Krzus 2010). This integration can reduce

information asymmetries and agency costs for these companies (Raimo et al. 2021), improve access to finance, lower capital costs (Cheng et al. 2014), and potentially lead to financial out-performance compared to peers (Serafeim 2015).

Stakeholder theory views firms as networks of relationships among interested parties who provide critical resources for survival and success (Ahmad et al. 2021; García-Sánchez et al. 2022; Giordino et al. 2025; Hörisch et al. 2020; Velte 2017). CSR policies offer various benefits, including the reduction of corporate risk (Albuquerque et al. 2019) and the subsequent risk for investors (He et al. 2013; Kazemi and Rahmani 2013; Li et al. 2022), preventing the loss of institutional investors (Chava 2014; Dhaliwal et al. 2011), and improving earnings quality (Choi et al. 2013; García-Sánchez and García-Meca 2017).

This holistic understanding of the different stakeholders' perspectives and their impacts on ESG requires an integrative theoretical framework for explaining the complex landscape of internal governance, external legitimacy, and diverse stakeholder expectations about CSR and CER actions (García-Sánchez et al. 2020, 2022; Giordino et al. 2024, 2025; Velte 2017, 2022, 2025).

Complementing previous theories, institutional theory provides a macro level perspective by emphasizing the powerful influence of external institutional elements on firm and market behavior. This theory suggests that organizational decisions are not solely driven by a rational pursuit of efficiency but also by a need for social legitimacy and conformity to societal norms and governmental regulations (DiMaggio and Powell 1983). Thus, firms must align with societal values and expectations through a "social contract" (Velte 2025).

Within the context of this study, institutional theory is crucial for understanding how environmental policies and regulatory frameworks shape corporate sustainability practices and their financial outcomes. The European Union, with its ambitious climate goals and comprehensive regulatory initiatives, provides a powerful institutional context that drives the adoption of sustainability practices among both firms and financial institutions. This aligns with research showing that government regulations and institutional pressures are key drivers of eco-innovation and corporate sustainability reporting (García-Sánchez et al. 2022).

By integrating stakeholder and institutional theories, our study provides a framework for analyzing how the coexistence of varying EPS levels across European countries influences the CER debt cost relationship.

2.2 | Hypotheses Development

Banks are critical stakeholders for a wide range of projects and companies, as they serve as a key source of financing. Consequently, banks have become highly sensitive to environmental issues due to economic, regulatory, reputational, and risk-based considerations (Klaas Jagersma 2009). If their borrowers are exposed to environmental risks (e.g., regulatory, physical climate risks, or reputational scandals), the bank's loans or investments may become non-performing or devalued.

Furthermore, European regulators are increasingly requiring banks to account for environmental risks in their stress testing, disclosure requirements, and capital allocation (Hummel and Jobst 2024). Therefore, a firm's sustainable development ability can reduce the possibility of loan default for its lenders, which translates into a lower risk premium for lending (Giordino et al. 2025; Li et al. 2022).

Environmental demands from consumers and investors also exert pressure on financial institutions, prompting them to develop ESG and CER strategies to enhance their reputational image. In the European banking sector, higher environmental risk negatively impacts bank value (Mandas et al. 2024), while improved environmental and social performance leads to higher return on equity (ROE) and lower beta coefficients (Horobet et al. 2024). In this vein, Alves and Meneses (2024) suggest that ESG investments yield greater debt-cost savings in bank-based economies with stable lending relationships than in market-based systems.

In line with the previous arguments, Cooper and Uzun (2015) found a negative relationship between ESG and corporate yield spread. Focusing on CER, Kleimeier and Viehs (2018) also showed a significant negative relationship between voluntary carbon disclosure and the cost of debt for listed companies globally in 2007–2013. Similar results are found in studies contrasting polluting versus non-polluting actions across different databases and periods: Sun et al. (2022), Gao and Wan (2023) with Chinese listed companies, Caragnano et al. (2020) in European non-financial industries, and Ali et al. (2023) using S&P 500 data. Thus, stakeholder theory suggests that high CSR performance correlates with a reduced financial risk and better performance.

Nevertheless, the impact of ESG on the cost of debt is still controversial. Some authors report inconclusive findings (Desender et al. 2020; Gigante and Manglaviti 2022). Other researchers argue that there is a positive relationship between ESG and cost of debt (Fandella et al. 2023; Magnanelli and Izzo 2017). Li et al. (2024) identified a non-linear, inverse U-shaped association between ESG scores and borrowing costs. Additionally, Zhang et al. (2025) found that ESG rating divergence among the six major rating agencies in China leads to higher debt costs. In sum, further research is needed to clarify CER's impact on financial performance (Gao and Wan 2023).

Based on the preceding arguments, we propose the following hypothesis:

H1. *Higher CER performance leads to a lower cost of debt for firms.*

ESG practices are often embedded in deep-seated institutions rather than being solely influenced by firm-level factors (Eliwa et al. 2021). While agency and stakeholder theories focus on voluntary CSR strategies by firms, institutional theory suggests that firm and market decisions are strongly influenced by external institutional elements (Zucker 1987). Institutional theory would suggest that companies adopt ESG standards to comply with established moral and cultural norms regarding business operations (Amarna et al. 2024).

Governments and international organizations are increasingly interested in regulating CSR issues in response to the United Nations' Sustainable Development Goals (Amarna et al. 2024). We focus on EPS, a country-specific, internationally comparable measure of laws and policies reflecting green commitment (Botta and Koźluk 2014; Eliwa et al. 2021; Kruse et al. 2022). Although the state is one among many institutional pressures, it is particularly influential (Zucker 1987). Thus, EPS shows the green commitment of the institutional environment, fostering sustainable mindsets among stakeholders (Barbaglia et al. 2023).

Organizations respond to external institutional pressure in various ways, typically seeking conformity to the institutional environment to enhance positive evaluation, resource flows, and survival chances (Zucker 1987). From the seminal work of DiMaggio and Powell (1983) to recent research as Glynn and D'Aunno (2023) and Chen et al. (2025), institutional theory pays attention to three kinds of forces, with different degrees of organizations' conformity: isomorphic, strategic (partial or apparent), or minimal (nonconformity).

Institutional theory provides a framework for understanding how environmental concerns have been integrated into banking practices and policies (Zhou et al. 2023). Swedish banks underwent a significant shift in 1995, adopting environmental considerations as relevant to business success (Lundgren 1999). This change was driven by the societal institutionalization of environmental issues and mimetic isomorphism among banks. Similarly, global climate change concerns have led to increased pressure for green banking adoption worldwide (Bukhari et al. 2019). Thus, EPS influences financial institutions' investment decisions across sectors and countries, encouraging the market to value the positive externalities of renewable energy and penalize the negative externalities of fossil fuel investments, thereby reducing the cost of debt for companies in OECD countries (Zhou et al. 2023).

The European Union (EU) has established the most ambitious climate change goals globally, aiming to reduce emissions by at least 55% by 2030 compared to 1990 levels and achieve climate neutrality by 2050. A key pillar of the European Green Deal is its sustainable finance measures, which include an exhaustive regulatory framework primarily based on the Sustainable Finance Disclosure Regulation (SFDR, 2019) and the Corporate Sustainability Reporting Directive (CSRD, 2022). The SFDR requires financial institutions to disclose how they integrate ESG risks into their lending and investment decisions. The CSRD, in turn, expands sustainability reporting requirements for large companies, including financial institutions, focusing on the information companies generate regarding their ESG impacts and risks. Green loans, as financial products designed to finance environmentally positive projects, are particularly relevant here. The CSRD specifically requires financial institutions to report how their lending activities contribute to the transition to a more sustainable economy. For SFDR green loans, financial institutions must demonstrate that these loans meet clear and transparent sustainability criteria. To further support this, the EU has also developed the Taxonomy Regulation for classifying green investments, designed to stimulate private

sector investment in sustainable projects. In line with this, the European Banking Authority (EBA 2022), under its Pillar 3, mandates banks to report the Green Asset Ratio (GAR), that is, the percentage of their assets (including loans) that aligns with the EU Taxonomy. While not a lending quota, this mandate enforces transparency and encourages banks to increase green financing to improve their GAR scores.

European banks have developed environmental lending strategies to support sustainable development, though challenges remain in implementation. Environmental banking actions play a crucial role in extending the impact of EPS throughout businesses and the rest of the economy. European Sustainability Reporting Standards (ESRS) introduce the concept of double materiality in environmental banking policy, considering both the impact of climate risks on financial stability and the influence of financial institutions on climate scenarios (Gourdel et al. 2021).

Finally, the European Green Bond Standard (EUR-Lex 2023), approved in 2023, aims to provide clarity for investors and issuers. It ensures that green bonds finance sustainable investments aligned with the EU's climate and environmental goals, thereby increasing transparency, fostering market confidence, and reducing the risk of greenwashing.

Building on the preceding arguments, this article aims to examine the role of EPS in influencing the cost of financial debt, considering both banking lending and emissions in financial markets. Consequently, we propose the following hypothesis to capture the complex relationship between EPS and the effects of CER:

H2. *Higher EPS in a firm's country amplifies the negative impact of CER on its cost of debt.*

This effect could be based on three fundamental sub-hypotheses. First, regarding the impact of EPS on CER, we expect that higher EPS indicates significant normative pressures from customers and media, as well as peer pressure to follow industry best practices, leading to increased transparency and reporting requirements (Ebrahimi and Koh 2021). Baldini et al. (2018) find that country-level characteristics (e.g., legal framework, corruption, labor, and cultural systems) are important factors conditioning firms' ESG information. More specifically, with respect to environmental policies, Lu and Cheng (2023) show an increase in ESG scores following the implementation of the revised Environmental Protection Law in 2015. Recently, Chen et al. (2024) found a positive relationship between environmental prevention and control policies in selected Chinese regions and ESG scores.

As we have stated previously, in the EU, environmental concerns have prompted steps to make sustainability reporting mandatory, with the European Commission proposing ESRS. Therefore, we hypothesize:

H2.1. *Higher EPS scores in a firm's country are positively related to higher CER scores.*

Second, Porter and Linde's (1995) theory links environmental regulation to economic performance, positing that being

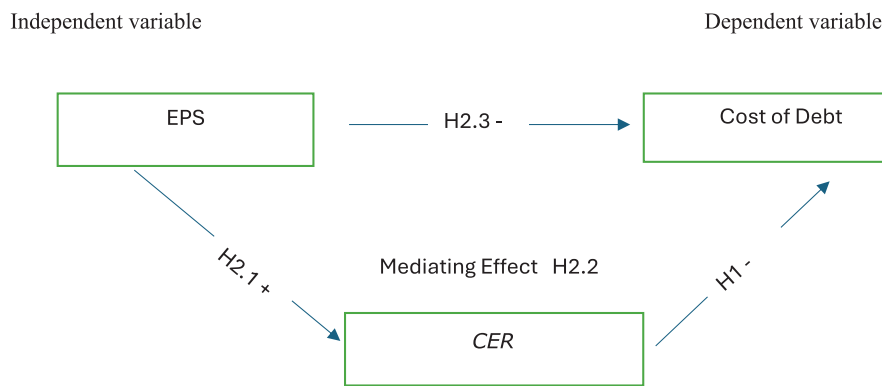


FIGURE 1 | Research framework.

“green” benefits both society as a whole and individual companies. This perspective suggests that well-designed environmental regulations can stimulate innovation, cost savings, efficiency improvements, and even create new market opportunities. Lu and Cheng (2023) and Testa et al. (2011) further suggest that institutional pressure is transferred to a company’s operating cycle, acting as a transmission mechanism for improving a firm’s environmental position and achieving other performance benefits.

Eliwa et al. (2021) suggest that ESG practices have a greater impact on the cost of debt in countries with higher institutional pressures. Finally, Li et al. (2022) provide other clear evidence in China, checking a negative relationship between the cost of debt and ESG scores after the implementation of the Green Financial System Guidelines in 2016.

Consequently, based on previous studies and Hypothesis H2.1, we suggest an indirect effect of EPS on the cost of debt:

H2.2. *EPS mediates the relationship between ESG performance and the cost of debt.*

Most studies focus on China, which has implemented a green credit policy since 2007. Liu et al. (2019) found that environmental regulatory pressure significantly reduces the financial capacity of polluting firms. Fan et al. (2021) showed that noncompliant firms experienced higher interest rates, reduced loan amounts, and greater difficulty accessing loans. Xu and Li (2020) found that the green credit policy significantly lowers the financial costs for green enterprises but increases costs for high-polluting enterprises. However, findings from certain countries may not be generalized to other markets due to differences in economic development, financial systems, and institutional frameworks (Li et al. 2022). Finally, along similar lines, the level of ESG performance, disclosure, and market rewards can vary across countries (Eliwa et al. 2021). Moreover, EPS could function as an overarching mechanism to ensure a minimum level of climate risk compliance within a specific territorial area (e.g., by offering a country risk discount). Therefore, we propose:

H2.3. *EPS directly reduces the cost of debt at the country level.*

Figure 1 collects a summary of our hypothesis formulation and the main relationships between variables.

3 | Research Methodology

The dataset was compiled from the Refinitiv EIKON database (Refinitiv 2022), focusing on EU public firms for the period 2017–2021. To avoid small groups of companies and to ensure the inclusion of only audited accounts for higher confidence and rigor, a minimum income of 12 million euros and 6 million euros of assets were required, consistent with Directive (EU) 2775 (2023). To reduce the influence of outliers on statistical calculations and improve the robustness of statistical inferences, winsorization was applied to the 2% of the extreme values of the dependent variable. As a result, a total of 2025 firms were included in the sample.

In scientific literature, corporate bond spreads and ratings have commonly been used as proxies for the cost of debt. However, according to data published by Eurostat (2025), debt issuance represents only 17% on average (2013–2023) of the financing for European companies, while 83% is loans. Accordingly, our model introduces the accounting interest rate of firms’ financial debt (Costdebt) as the dependent variable to include both financial resources. The cost of debt data was sourced from Refinitiv EIKON, which facilitates seamless integration with ESG scores.

The independent variables are CER and country EPS. CER is an aggregate measure derived from three distinct environmental components within the Refinitiv ESG scores on a scale of zero to one hundred: Emissions, which quantifies a company’s commitment and effectiveness in reducing environmental emissions throughout its production and operational processes; Resources, which reflects a company’s performance and capacity to reduce the use of materials, energy, or water, and to develop more eco-efficient solutions by improving supply chain management; and Environmental Innovation, which gauges a company’s capacity to reduce environmental costs and burdens for its customers, fostering new market opportunities through new environmental technologies and processes, or eco-designed products. In our study, the global variable CER has been transformed into a categorical variable that classifies the sample into three levels, as we expose in Table 1. Level 1 comprises companies that either have a zero score on the CER variable or choose not to report environmental information, representing our control group, while Level 2 includes those companies that have been assessed with a score higher than zero, but less than or equal to 50 points, and finally, Level 3 includes companies that achieve a score

TABLE 1 | Characteristics of independent variables.

Variables		References
Environmental variables		
CER	Level variable 1. Environment = 0 (No environmental responsibility) 2. $0 < \text{Environment} \leq 50$ (Low to medium environmental responsibility) 3. Environment > 50 (High environmental responsibility)	Fonseka et al. (2019) Palea and Drogo (2020) Sun et al. (2022) Gao and Wan (2023) Ali et al. (2023)
Green policy variables, EPS		
EPS	Individual Country Score about different green policies. The score is 0–6	Xu and Li (2020) Fan et al. (2021)
Market policy	Pollution taxes. The score is 0–6	Eliwa et al. (2021) Li et al. (2022)
Nonmarket policy	Emissions prohibition. The score is 0–6	
Tech policy	Technological supports and aids. The score is 0–6	
Control variables		
ROA	ROA = EBIT/total assets	Fonseka et al. (2019) Eliwa et al. (2021) Li et al. (2022) Hu et al. (2023)
INVLev	INVLev = Market capitalization/Total debt.	Huang et al. (2018) La Rosa et al. (2018) Fonseka et al. (2019) Desender et al. (2020) Hu et al. (2023) Maaloul et al. (2023)
MarginEBITDA	MarginEBITDA = EBITDA/Revenues	Goss and Roberts (2011) Palea and Drogo (2020) Gao and Wan (2023)
Marketcap	Marketcap—Categorical variable based on market capitalization in million euros 1. Alternative market (< €250 million) 2. Small capitalization (> €250 million to €2000 million) 3. Medium capitalization (> €2000 million to €10,000 million) 4. Large capitalization (> €10,000 million)	Magnanelli and Izzo (2017)

between 50 and 100 points. According to signaling theory, companies that do not report CER data would signal a lack of environmental commitment for stakeholders. Our study analyzes whether such behavior is viewed negatively by investors and results in higher debt financing costs.

EPS was measured using the OECD Environmental Policy Stringency Index, a country-specific measure that quantifies the degree to which environmental policies impose an explicit or implicit price on polluting or environmentally harmful behavior. The revised EPS index is constructed by selecting 13 distinct policy instruments, scoring their stringency on a scale of zero to six, and then aggregating these scores into a global index (Kruse et al. 2022). This EPS index covers a large cross-country panel of 40 countries, for which comprehensive data on climate change and air pollution policies is available.

The EPS comprises three sub-indices: Market-Based Instruments (e.g., taxes, permits, and certificates), which

pertain to policies that assign a price to pollution; Non-Market-Based Instruments, which entail policies regarding emission limits and standards; and Technology Support Instruments, which include policies supporting innovation in clean technologies and their adoption (e.g., public research and development expenditure, price support for solar and wind energy technologies from feed-in tariffs, and renewable energy auctions, relative to the global levelized cost of electricity). For further information on the construction of the index and its sub-indices, refer to Botta and Koźluk (2014) and Kruse et al. (2022). EPS variable and its subcategories are treated as ordinal variables, using the valuation range provided by the OECD (between 0 and 6); see Table 1.

The EPS is a widely used indicator that addresses the multidimensionality of environmental regulations (Ullah et al. 2023) and can be used to compare the rigor of environmental policies across nations (Khurshid et al. 2024). Recently, authors have analyzed its impact on bank risks (Lee et al. 2024), economic

TABLE 2 | Sample composition by industry and CER.

Sector/CER	CER mean	1	2	3	Total	%	% Cum.
Healthcare	48.12	304	128	154	586	7.9	7.9
Technology	39.34	737	266	212	1215	16.38	24.28
Consumer non-cyclicals	40.56	340	97	135	572	7.71	31.99
Industrials	44.5	934	327	422	1683	22.69	54.68
Utilities	64.32	86	45	110	241	3.25	57.93
Consumer cyclicals	35.57	991	227	320	1538	20.74	78.67
Basic materials	47.78	353	122	201	676	9.11	87.78
Energy	53.94	117	41	96	254	3.42	91.2
Real estate	31.23	436	75	123	634	8.55	99.75
Academic and education	16.67	15	3	0	18	0.24	100
		4313	1331	1773	7417	100	

growth (Mahajan and Majumdar 2023), the growth of environmentally friendly technologies (Khurshid et al. 2024), or the cost of debt and risk preferences across energy sources (Zhou et al. 2023).

The model also includes several control variables: the inverse of leverage, related to firms' risk (Bacha et al. 2021; Cooper and Uzun 2015); Return on Assets (ROA) and EBITDA margin, related to profitability (Eliwa et al. 2021; Hu et al. 2023); and firm size, covering different ranges of company capitalization (Magnanelli and Izzo 2017). Table 1 presents the definition, characteristics, and references for the variables included in the model.

We examine our hypotheses with several models:

1. Fixed effects model (using xtreg command in Stata to control the individual heterogeneity of enterprises). Independent variables have been lagged by one period to address endogeneity concerns in observational data (Hoepner et al. 2016; Hu et al. 2023; Magnanelli and Izzo 2017), obtaining 7417 observations.

$$\text{Costdebt}_{i,t} = \alpha + \text{CER}_{i,t-1} + \beta_3 \text{EPS}_{i,t-1} + \beta_4 \text{Control}_{i,t-1} + \text{Id}_i + \varepsilon_i \quad (1)$$

2. Structural equations (Maaloul et al. 2023), for the analysis of the possible driving of EPS on CER and the cost of debt (gsem model in Stata), controlled by country, sector and company hierarchy as a latent variable.

$$\text{CER}_{i,t-1} = \alpha + \beta_2 \text{EPS}_{i,t-1} + \beta_3 \text{Control}_{i,t-1} + C/S/Id_i + \varepsilon_i \quad (2)$$

$$\text{Costdebt}_{i,t} = \alpha + \beta_2 \text{CER}_{i,t-1} + \beta_3 \text{EPS}_{i,t-1} + \beta_4 \text{Control}_{i,t-1} + C/S/Id_i + \varepsilon_i \quad (3)$$

3. Although the degree of application of CER varies according to sector, country, and company size (Schaltegger and Wagner 2006; Shrivastava and Addas 2014), the fixed effects model does not allow us to introduce time-invariant

TABLE 3 | Descriptives of CER score.

CER	Freq.	Percent	Cum.
Level 1	4313	58.15	58.15
Level 2	1331	17.95	76.1
Level 3	1773	23.9	100
Total	7417	100	

variables for units of observation such as Country or Sector, nor variables related to green policies if any of them do not vary over time. Thus, to include invariant variables, but at the same time, to solve the problem of non-independence of residuals, we use a third model, a multilevel model (mixt-multilevel model in Stata), incorporating in Equation (1) the inherent hierarchy of firms across sectors and countries. In this form, the previous error ε_i is decomposed into four sources of volatility: $\varepsilon_C, \varepsilon_S, \varepsilon_E, \varepsilon_i$ (country, sector, enterprise, and residual). This part of the model is called random effects because each error can vary within its hierarchy, while the part which collects the dependent variables' coefficients are named fixed effects.

4 | Empirical Results

Tables 2–6 detail the sample composition. Table 2 presents the distribution of CER scores by industry sector. Category 1 represents the largest share for most industries, with the notable exception of Utilities. The final column of the table shows the average CER score for each industry. The Utilities industry exhibits the highest average CER score (64.32), followed by the Energy industry (53.94). The Academic and Education sector records the lowest average CER score (16.67). The Industrials sector, which has the largest number of firms in the sample, obtains an average score of 44.50.

Table 3 displays the distribution of observations across the different categories based on the CER score criteria. Category 1,

TABLE 4 | Sample composition by EPS and country.

EPS				
Country	Mean	Freq.	%	% Cum.
Ireland	2.63	187	2.52	2.52
Netherlands	3.40	284	3.83	6.35
France	4.59	1252	16.88	23.23
Germany	3.27	1318	17.77	41
Spain	2.42	394	5.31	46.31
Italy	3.82	720	9.71	56.02
Belgium	3.16	299	4.03	60.05
Austria	3.12	170	2.29	62.34
Denmark	3.79	230	3.1	65.44
Sweden	3.69	948	12.78	78.23
Finland	3.92	384	5.18	83.4
Portugal	2.56	124	1.67	85.07
Hungary	2.84	60	0.81	85.88
Greece	2.86	330	4.45	90.33
Poland	3.21	658	8.87	99.2
Slovenia	3.09	37	0.5	99.7
Czech Republic	2.92	18	0.24	99.95
Slovak Republic	2.48	4	0.05	100
Total	3.54	7417	100	

TABLE 5 | Descriptives of market capitalization.

Market capitalization	Freq.	Percent	Cum.
Level 1	3017	40.68	40.68
Level 2	2499	33.69	74.37
Level 3	1215	16.38	90.75
Level 4	686	9.25	100
Total	7417	100	

representing companies with a Refinitiv (formerly Thomson Reuters) score of 0 or no score reported, constitutes the largest segment of the sample, accounting for over 58% of total observations. Category 2 includes firms with a CER score between 0 and 50, representing nearly 18% of the sample. Finally, Category 3 comprises companies with CER scores ranging from 50 to 100, accounting for nearly 24% of the total observations.

Table 4 provides descriptive statistics for the EPS score by country. France exhibits the highest average EPS score (4.59), followed by Finland (3.92), Denmark (3.79), and Sweden (3.69). The countries with the lowest average scores are Spain (2.42), the Slovak Republic (2.48), and Portugal (2.56). The

overall average EPS score for the sampled European countries is 3.54. Examining the country distribution within the sample, Germany (17.77%) and France (16.88%) contribute the highest number of firms to the dataset, followed by Sweden (12.78%), Italy (9.71%), and Poland (8.87%). Conversely, the Slovak Republic (0.05%) and Czech Republic (0.24%) have the lowest representation.

Table 5 provides a breakdown of Market Capitalization into four categories based on firm size. The largest segment is Level 1, representing companies listed in alternative markets (with market capitalization of less than €250 million), comprising over 40% of the sampled firms. This is followed by Level 2 (small-caps, between €250 million and €2000 million), which represents nearly 34% of the observations. Level 3 (mid-caps, between €2000 million and €10,000 million) comprises over 16% of the observations, while Level 4 (large-caps, over €10,000 million) accounts for approximately 9%. The distribution is notably skewed towards lower market capitalization levels, with the cumulative share of Levels 1 and 2 exceeding 74% of the sample.

Table 6 presents the main descriptive statistics for the continuous variables used in our analysis. As shown, the dependent variable, *Costdebt*, has an average value of 0.04, with values ranging from 0.00 up to 0.36. ROA exhibits values within the interval from -1.84 to 0.81, with an average of 0.06. *MarketCap* is shown here in its continuous form, with the highest market capitalization reaching 314,411.80 million euros.

Table 7 presents the Pearson correlation matrix for all variables. Consistent with expectations, the correlations between several independent variables and the *Costdebt* variable are negative; the negative correlation between CER and *Costdebt*, and between EPS and *Costdebt*, is particularly noteworthy. The overall relationship between EPS and CER is positive, although the NonMarkpolicy sub-index, representing emission limits and standards, shows a negative correlation with CER. This could suggest that firms require some time to adjust their environmental practices to meet stringent non-market policies. Regarding the relationship between *MarketCap* and CER, the positive correlation implies that firms with higher market capitalization tend to exhibit better environmental performance. Importantly, the correlations among the independent variables are predominantly weak, and all VIF values are below 4, indicating that multicollinearity is not a significant issue in our sample.

Model *Costdebt.1* in Table 8 indicates that the CER variable has a negative and statistically significant impact on the cost of corporate debt. Bearing in mind that our base category is always Level 1, we can consider the interpretation of the CER variable as the reduction in the cost of debt over the base category (-0.0076 for Level 2, and -0.0116 for Level 3), thus supporting Hypothesis H1. Given the average financial cost rate of 4% in our sample, companies with a CER score below 50 points (Level 2) exhibit an average debt cost reduction of approximately 19% (calculated as $0.0076/0.04$) compared to those with no reported score (Level 1). Furthermore, companies with a CER score above 50 points (Level 3) achieve a larger reduction of approximately 29% (calculated as $0.0116/0.04$).

TABLE 6 | Descriptives of continuous variables.

Variable	Obs	Mean	SD	Minimum	Maximum
Costdebt	7417	0.04	0.04	0.00	0.36
Techpolicy	7417	2.72	1.30	0.50	5.00
Marketpolicy	7417	2.36	1.18	0.83	4.17
NonMarkpolicy	7417	5.55	0.15	5.50	6.00
EPS	7417	3.54	0.63	2.28	4.89
ROA	7417	0.06	0.09	-1.84	0.81
INVLev	7417	6.95	228.17	0.00	17,933.60
MarginEBITDA	7417	0.16	0.45	-16.45	7.93
MarketCap	7417	4335.81	14,801.14	0.03	314,411.80

Model Costdebt.2 demonstrates the significant negative impact of EPS on the cost of debt, aligning with Hypothesis H2.3. This effect, corresponding to an average decrease of approximately 39% (0.0156/0.04), suggests that stringent government environmental policies instill a high level of confidence among capital market participants and firms seeking capital. The inclusion of EPS appears to attenuate the standalone impact of CER levels observed in Model Costdebt.1 (similar significant results were obtained when substituting the aggregate CER score with its subcomponents: Emissions, Resources, and Environmental Innovation).

However, when Model Costdebt.3 includes CER, EPS, and the interaction term between them, the interaction term is not statistically significant. This suggests that, in this contemporaneous model, the interaction does not capture unique variance beyond the individual effects of CER and EPS. Therefore, while these results do not support a direct moderating effect of EPS on the CER-cost of debt relationship, the possibility remains that EPS influences the cost of debt indirectly by driving or mediating the level of firm-level CER. This aligns with the theoretical expectation that stricter environmental policies can encourage firms to enhance their environmental performance (CER), which in turn influences their cost of debt.

Model Costdebt.4 investigates a non-contemporaneous interaction between current CER (CER(n)) and lagged EPS (EPS($n-1$)). The significant negative coefficient for this interaction term suggests a dynamic relationship. Specifically, it indicates that firms with higher current CER experience greater reductions in the cost of debt when EPS from the previous period (EPS($n-$)) was higher. This could imply that companies benefit more from their environmental efforts after they have had time to adjust to prior changes in green policy. While this dynamic interaction is significant, it is important to note that, as discussed earlier, the contemporaneous interaction term in Model Costdebt.3 was not significant, suggesting the primary pathway through which EPS influences the CER-cost of debt link in the current period is likely not one of direct moderation, but potentially mediation or driving CER levels.

We further confirmed the direct and indirect effects of EPS and CER on the cost of debt using structural equation modeling (SEM), presented in Table 9. This analysis, performed in Stata

using the 'gsem' command with 'bootstrap indirect', allowed us to estimate the pathways simultaneously. Specifically, the first equation models the direct relationship between EPS and CER (column CER.EE) using an ordered logistic model, appropriate given that CER is a categorical variable. The second equation models the direct effects of both CER and EPS on the Cost of debt (column Costdebt.EE), while controlling for country, sector, and firm-level effects.

The CER.EE column in Table 9 shows that, after accounting for control variables, EPS has a positive and significant effect on CER, with a coefficient of 0.25. Given the ordered logistic model, this coefficient can be interpreted in terms of odds: an exponentiated coefficient of $e^{0.25} = 1.28$ suggests that a one-unit increase in EPS is associated with 1.28 times higher odds of a firm being in a superior CER level category, holding other variables constant. The results in the second column (Costdebt.EE) indicate that higher CER is negatively and significantly related to the cost of debt, with coefficients of -0.0053 for Level 2 CER and -0.0070 for Level 3 CER (relative to Level 1). These findings align with the results presented in Model Costdebt.2 in Table 8. Furthermore, the Costdebt.EE column also reveals a direct, negative, and significant relationship between EPS and the cost of debt (coefficient = -0.0102), consistent with the results from Model Costdebt.2 in Table 8. This supports the notion that EPS policies have a direct effect on firms' borrowing costs.

Finally, the third column, Indirect.EPS, presents the results of the bootstrap analysis conducted to examine the indirect effect of EPS on the cost of debt via CER. These results demonstrate that, after controlling the effects of covariates, the indirect effect of EPS on the cost of debt through CER is statistically significant and negative ($\beta = -0.0031$, $p < 0.01$). As noted by VanderWeele (2011), this specific coefficient is not directly interpretable in linear terms because the EPS \rightarrow CER pathway is estimated by using an ordered logistic model. However, its significance confirms that EPS exerts an indirect influence on the cost of debt by increasing the likelihood of firms achieving higher CER scores, which in turn leads to a reduction in borrowing costs.

Table 10 presents the results from the multilevel model (Equation 1), offering an alternative approach to address the

TABLE 7 | Correlation matrix.

	1	2	3	4	5	6	7	8	9	10	11
1. Costdeb	1										
2. CER	-0.081***	1									
3. EPS	-0.126***	0.038***	1								
4. Techpolicy	-0.08***	0.058***	0.789***	1							
5. Marketpolicy	-0.102***	0.002	0.772***	0.152***	1						
6. NonMarkpolicy	-0.103***	-0.048**	0.141***	0.108***	-0.018	1					
7. ROA	-0.07***	0.096***	-0.02	-0.056***	0.04***	-0.018	1				
8. INV.Lev	-0.006	0.006	-0.02	-0.008	-0.019*	-0.007	0.003	1			
9. MarginEBITDA	-0.074***	0.016	-0.04***	-0.046***	-0.014	0.012	0.08***	0	1		
10. MarketCap	-0.081***	0.715***	0.001	0.051***	-0.045***	-0.084***	0.158***	0.003	0.008	1	
11. Sector	-0.085***	-0.019*	-0.04***	-0.046***	-0.022*	0.008	-0.007	-0.001	0.009	-0.04***	1

Note: * p-value < 10%, ** p-value < 5%, *** p-value < 1%.

lack of independence of residuals inherent in standard OLS regression while allowing for the inclusion of time-invariant, multilevel variables. This modeling technique overcomes the limitation of fixed effects models, which cannot estimate coefficients for time-invariant variables. In this multilevel framework, we specified Country as a time-invariant variable and modeled the hierarchical structure between firms and industries as random effects. The fixed effects coefficients for the control variables in Models Costdeb.5, 6, and 7 are largely consistent with the results reported in the previous tables.

Model Costdeb.7 includes the EPS sub-indices: NonMarkpolicy, Marketpolicy, and Techpolicy. The multilevel framework allows for the estimation of coefficients for these variables within the fixed effects part, even if they exhibit limited variation over time within countries. Consistent with Hypothesis H2.3, all three sub-indices are negatively and significantly related to the cost of debt, indicating that stricter policies within each category are associated with lower borrowing costs. NonMarkpolicy, representing emission limits and standards, demonstrates the largest negative impact on the cost of debt. Marketpolicy, based on pollution taxes, has the second largest impact, followed by Techpolicy, which pertains to technology support measures. Regarding the random effects components, the standard deviations for firm-level and industry-level variance remain relatively stable across the three models, indicating significant heterogeneity at these levels. The variance accounted for by the country-level random effect is notably smaller. This could be attributed to the inclusion of country-level policy covariates (EPS and its sub-indices) in the fixed effects, and potentially the increasing convergence of environmental policies across EU countries following common guidelines. While some variance remains unexplained at the country's level, the overall magnitudes of the random effects coefficients are not excessively large, suggesting a reasonable statistical fit for the model. The pseudo R² GLMM Conditional (Nakagawa and Schielzeth 2013) shows model fit figures close to 60%.

In summary, across all models (Tables 8–10), our findings consistently demonstrate that firms with higher CER scores experience a reduction in their cost of debt. This robust result validates Hypothesis H1, indicating that financial markets positively value companies exhibiting a strong environmental commitment. Furthermore, the empirical results confirm that stringent environmental policies implemented by governments are associated with a reduction in the cost of debt for affected firms (Tables 8–10). Specifically, Table 9 provides support for the proposed pathways: higher EPS is positively associated with higher CER (confirming Hypothesis H2.1), and there is a significant indirect effect of EPS on the reduction of the cost of debt via CER (confirming Hypothesis H2.2). Additionally, Tables 8 and 9 show a significant direct effect of EPS on firms' debt cost, suggesting that EPS also contributes to a reduction in borrowing costs independently of firm-level CER, potentially acting as a risk valuation umbrella, particularly beneficial for companies with lower environmental performance. This direct effect is consistent with Hypothesis H2.3.

An important consideration when assessing the joint effects of CER and EPS on the cost of debt is the dynamic adaptation of firms in response to increasingly stringent environmental

TABLE 8 | The impact of CER score and green policies on the cost of debt. Fixed Effects model.

	Costdebt.1	Costdebt.2	Costdebt.3	Costdebt.4
Level 2 CER _(n-1)	-0.0076*** (0.0017)	-0.0051*** (0.0017)	-0.0106 (0.0090)	-0.0116 (0.0090)
Level 3 CER _(n-1)	-0.0116*** (0.0028)	-0.0078*** (0.0028)	-0.0158* (0.0092)	-0.0165* (0.0092)
Level 2 CER _(n-1) #EPS _(n-1)			0.0016 (0.0024)	0.0021 (0.0024)
Level 3 CER _(n-1) #EPS _(n-1)			0.0022 (0.0023)	0.0027 (0.0023)
Level 2 CER _(n) #EPS _(n-1)				-0.0009** (0.0005)
Level 3 CER _(n) #EPS _(n-1)				-0.0010* (0.0006)
EPS _(n-1)		-0.0156*** (0.0021)	-0.0163*** (0.0025)	-0.0158*** (0.0025)
Control variables				
ROA _(n-1)	0.0088 (0.0124)	0.0042 (0.0121)	0.0044 (0.0121)	0.0039 (0.0121)
INV Lev _(n-1)	-2.72E-06*** (1.93E-07)	-2.73E-06*** (1.97E-07)	-2.74E-06*** (1.98E-07)	-2.74E-06*** (1.98E-07)
MarginEBIT _(n-1)	-0.0065** (0.0027)	-0.0058** (0.0027)	-0.0058** (0.0027)	-0.0057** (0.0027)
Level 2 Market Cap. Category _(n-1)	-0.0055** (0.0028)	-0.0056** (0.0027)	-0.0057** (0.0028)	-0.0055** (0.0027)
Level 3 Market Cap. Category _(n-1)	-0.0088** (0.0040)	-0.0091** (0.0039)	-0.0090 (0.0039)	-0.0087** (0.0039)
Level 4 Market Cap. Category _(n-1)	-0.0147*** (0.0057)	-0.0146*** (0.0057)	-0.0145 (0.0056)	-0.0142** (0.0056)
Constant	0.0444*** (0.0022)	0.0985*** (0.0079)	0.1012*** (0.0093)	0.1005*** (0.0093)
N	7417	7417	7417	7417
Rho	0.6282	0.6286	0.6284	0.6302
F-statistic	29.30	31.97	26.57	23.05
Prob > F	0.0000	0.0000	0.0000	0.0000

Note: Standard errors are in parentheses. Hausman Test for all models is Prob > $\chi^2 = 0.0000$.

*p-value < 10%.

**p-value < 5%.

***p-value < 1%.

regulations. As shown by the significant non-contemporaneous interaction term between current CER and lagged EPS in Model Costdebt.4 (Table 8), companies appear to achieve greater

reductions in debt cost in subsequent periods, after they have had time to adapt their structures and operations to comply with more demanding country-level legislation.

5 | Discussion

In general, the results of this research support a general global consistency trend in Europe pointing to a universal mechanism: when firms demonstrate a strong commitment to environmental sustainability, they signal reduced operational and reputational risk to financial stakeholders, leading to more favorable lending terms and a lower risk premium. This is also demonstrated by the meta-analysis review on CSR of Velte (2022) that suggests that high CSR performance and reporting quality improve firm reputation and stakeholder relations, which is consistent with legitimacy theory's aim of

gaining social acceptance, albeit this relationship might not be universal but highly contingent on specific conditions and contexts (Velte 2022).

Financial institutions in Europe are driven by regulation and public scrutiny, and governments by their social welfare mandate, and this external pressure appears to align their investment strategies with ESG (Chen et al. 2024; Giordino et al. 2024, 2025; Kordsachia et al. 2022). Our research focuses on creditors as a key stakeholder, focusing on the direct effect of national regulatory frameworks and on their indirect effect on firm debt markets, which includes borrowing and lending actors.

TABLE 9 | Direct and indirect effects of EPS on CER and cost of debt, performed on STATA.

Variables	Standardized direct effects		Standardized indirect effect		
	CER.EE	Costdebt.EE	Indirect.EPS	Lower	Upper
Level 2 CER _(n-1)		-0.0053*** (0.0013)			
Level 3 CER _(n-1)		-0.0070*** (0.0016)			
EPS _(n-1)	0.2505*** (0.0457)	-0.0102*** (0.0010)	-0.0031*** (0.0008)	-0.0046	-0.0016
Control variables					
ROA _(n-1)	-1.5776*** (0.3193)	-0.0090* (0.0056)			
INV Lev _(n-1)	0.0000 (0.0000)	0.0000 (0.0000)			
MarginEBITDA _(n-1)	0.2675*** (0.0679)	-0.0047*** (0.0013)			
2. Market Cap. Category _(n-1)	2.6215*** (0.0838)	-0.0024* (0.0013)			
3. Market Cap. Category _(n-1)	4.4424*** (0.0978)	-0.0035* (0.0019)			
4. Market Cap. Category _(n-1)	6.2112*** (0.1452)	-0.0053** (0.0026)			
Constant		0.0771*** (0.0037)			
Country effect	Yes	Yes			
Sector effect	Yes	Yes			
Individual effect	Yes	Yes			
N	7417	7417			

Note: Standard errors are in parentheses.

*p-value < 10%.

**p-value < 5%.

***p-value < 1%.

TABLE 10 | The impact of CER score and each type of green policies on the cost of debt. Multilevel model.

	Costdebt.5	Costdebt.6	Costdebt.7
Fixed effects			
Level 2 CER _(n-1)	-0.0065*** (0.0013)	-0.0053*** (0.0013)	-0.0053*** (0.0012)
Level 3 CER _(n-1)	-0.0080*** (0.0016)	-0.0059*** (0.0016)	-0.0060*** (0.0016)
EPS _(n-1)		-0.0104*** (0.0010)	
Marketpolicy _(n-1)			-0.0042*** (0.0006)
Techpolicy _(n-1)			-0.0025*** (0.0005)
NonMarkpolicy _(n-1)			-0.0316*** (0.0049)
Control variables			
ROA _(n-1)	-0.0098* (0.0056)	-0.0114** (0.0056)	-0.0110** (0.0056)
INV Lev _(n-1)	-1.81E-06 (0.0000)	-2.01E-06 (2.09E-06)	-2.13E-06 (2.08E-06)
MarginEBITDA _(n-1)	-0.0032** (0.0013)	-0.0033*** (0.0013)	-0.0031** (0.0013)
2. Market Cap. Category _(n-1)	-0.0018 (0.0013)	-0.0023* (0.0013)	-0.0028** (0.0013)
3. Market Cap. Category _(n-1)	-0.0027 (0.0019)	-0.0038 (0.0019)	-0.0044** (0.0019)
4. Market Cap. Category _(n-1)	-0.0053** (0.0026)	-0.0064** (0.0026)	-0.0075*** (0.0026)
Constant	0.0415*** (0.0020)	0.0781*** (0.0041)	0.2338*** (0.0275)
Random effects			
σ1 (Sector/Id)	0.0050	0.0050	0.0053
σ2 (Id)	0.0300	0.0297	0.0293
σ3 (Country)	2.50E-08	5.41E-10	2.53E-11
σ4 (Residual)	0.0265	0.0263	0.0263
N	7417	7417	7417
Wald X ² -statistic	88.03	195.57	231.86
Prob > X ²	0.0000	0.0000	0.0000
LR test vs. linear model	2566.73	2547.28	2508.65
Prob > X ²	0.0000	0.0000	0.0000
R ² _{GLMM} conditional	0.57	0.58	0.58

Note: Standard errors are in parentheses.

*p-value < 10%.

**p-value < 5%.

***p-value < 1%.

Academic interest in the impact of EPS on the cost of debt, and its relationship with CER, is relatively recent, with limited empirical evidence to date. Previous studies have demonstrated how EPS influences creditors' investment decisions by directing resources towards industries with positive externalities, such as renewable energy (Zhou et al. 2023), and by diminishing the financial capacity of polluting enterprises in China (Fan et al. 2021; Liu et al. 2019; Xu and Li 2020). Eliwa et al. (2021) and Li et al. (2022) suggest that ESG practices have a greater impact on the cost of debt in China with higher institutional pressures. Nevertheless, the effects of EPS, particularly through CER, on firm debt costs in Europe (a context characterized by the coexistence of multiple countries with varying regulatory landscapes) remain largely unexplored.

The European Union's ambitious climate goals and comprehensive regulatory framework serve as a powerful institutional context that drives the adoption of sustainability practices among both firms and financial institutions. This way, our findings support the arguments of institutional theory, which posit that firms must conform to external institutional elements to enhance their legitimacy and secure resources (i.e., Chen et al. 2025; García-Sánchez et al. 2022; Kordsachia et al. 2022). The relevance of institutional context is also highlighted in our research when acknowledging varying regulatory landscapes within Europe that explain why the link between ESG and financial performance is not uniform. The distinction between "substantive" and "symbolic" CSR, as highlighted by Velte (2025), is also relevant here, as our categorical analysis of CER levels shows that firms with the highest CER scores achieve the greatest financial benefits.

Our empirical analysis shows that the country-level EPS plays a critical role, not just by directly reducing debt costs at a country level but by amplifying the financial benefits of firm-level CER. Specifically, the fixed effects model results demonstrate a notable reduction in the magnitude of the CER coefficient when EPS is included in the model, while the EPS coefficient remains statistically significant. This suggests a driving or mediating role for EPS on CER's effect, which is further supported and quantified by our structural equation modeling results, addressing a significant gap in existing literature and offering a novel perspective that complements previous studies. This work contributes to the academic debate by providing a framework that can reconcile the mixed findings in the literature, positioning the CER-debt cost relationship as highly contingent on both firm-level actions and macro-level regulatory pressures, including the effects of EU regulations in our analysis, as recommended by Velte (2017, 2025).

6 | Conclusions

This study investigates the implications of CER and government EPS for firms' financial performance, specifically focusing on the cost of debt. By employing a consistent methodology and a large sample, we have demonstrated that higher CER performance significantly reduces the cost of debt. More importantly, our research reveals that national environmental policy acts as a crucial conditioning factor, both directly

lowering debt costs and indirectly amplifying the financial benefits of CER.

6.1 | Theoretical Implications

We employ two main theoretical frameworks to simultaneously analyze the influence of 'green institutions' at both micro (firm) and macro (country) levels: stakeholder theory to understand firm-level motivations and outcomes, and institutional theory to account for the broader governmental and regulatory environment. Our empirical findings contribute to testing these theoretical frameworks by focusing on the impacts of CER and EPS, thereby enhancing the understanding of the complex interplay between firm-level environmental initiatives and country-level environmental factors.

First, consistent with Hypothesis H1, higher CER performance significantly reduces the cost of debt for listed companies. This reaffirms the applicability of stakeholder theory in the context of Europe, showing that firms can achieve financial benefits aligning with critical stakeholders, specifically creditors in the corporate loan market. The finding aligns with previous studies conducted in Europe (e.g., Caragnano et al. 2020; Palea and Drogo 2020) and corroborates evidence from other regions, such as China (Kleimeier and Viehs 2018) and the US (Ali et al. 2023).

Second, by integrating institutional theory, we show that the relationship between CER and the cost of debt is not a purely firm-level phenomenon but is deeply embedded within and shaped by the country's institutional environment. Our analysis uniquely disentangles the direct and indirect effects of EPS on the cost of debt, a novel contribution that complements previous studies (e.g., Eliwa et al. 2021; Li et al. 2022; Lu and Cheng 2023; Xu and Li 2020; Zhou et al. 2023), confirming Hypothesis and sub-hypothesis H2.1, H2.2 and H2.3.

The study employs a battery of alternative analytical approaches yielding converging results, enhancing the robustness of our findings and facilitating replication or extension in different settings.

6.2 | Implications for Managers and Policy Makers

Our findings offer actionable insights for both corporate managers and policymakers. For managers, the message is clear: actively engaging in substantive CER activities, such as reducing resource use, increasing green innovations, and minimizing emissions, provides positive signals to financial institutions. As financial creditors are identified as sensitive environmental stakeholders (Bukhari et al. 2019; Li et al. 2022), firms can pursue environmental responsibility while simultaneously achieving financial benefits (e.g., Fandella et al. 2023; Gao and Wan 2023; Gigante and Manglaviti 2022). Our results suggest that Financial Institutions interpret higher CER as a signal of reduced business risk, lower information asymmetry, and increased legitimacy, thereby rewarding firms with higher CER scores with a lower cost of debt.

Our categorical analysis of CER levels suggests that, at the top level, a genuine and comprehensive approach is more financially rewarding than a superficial or symbolic one. For obtaining better results, a strong and true commitment to CER is needed, avoiding more symbolic CER strategies (Gao and Wan 2023; Velte 2025), unethical practices, and greenwashing.

For policymakers, this research provides evidence that stringent environmental policies are not a hindrance to economic activity but can be a catalyst for it. Stricter environmental policies not only incentivize companies to improve their environmental performance but also create a more favorable financial environment by reducing perceived risk for creditors. This highlights the importance of well-designed cohesive environmental strategies at the national and supranational levels to support a sustainable economy.

Furthermore, the impact of environmental policies on the cost of debt appears to increase over time as regulatory requirements become more fully integrated into the decision-making processes of both firms and debt markets. Institutional environments are inherently dynamic, evolving at varying paces (Glynn and D'Autunno 2023). For instance, European EPS continues to strengthen in pursuit of the European Green Deal's objectives. Consequently, firms require time to adapt to new institutional norms and regulations, as complete adaptation or compliance may not be immediate. Prior research supports this notion; for example, Liu et al. (2017) observed an initial increase in short-term loan interest rates for targeted industries following the implementation of a green credit policy in China. Similarly, Ni et al. (2022) also found that the introduction of the Emissions Trading System (ETS) in China between 2010 and 2016 led to a significant increase in firms' cost of debt.

Our study contributes to addressing the call by Li et al. (2022) for more cross-country investigations into the impact of green regulations by incorporating data from a wide range of industries across 18 European countries. Environmental policies exhibit considerable variation across countries, reflecting the inherent complexity of the European regulatory landscape. Countries implementing more stringent environmental policies, potentially coupled with more generous financial incentives, are likely to exert a greater direct impact on reducing the cost of debt for firms operating within those jurisdictions and adapting accordingly. Such firms may be perceived as more credible and genuinely committed to sustainability, further mitigating the perceived risk for lenders compared to other firms with similar CER levels but operating in less stringent environments.

Furthermore, we have examined the effects of different types of green policies as classified by Kruse et al. (2022), including market-based instruments (e.g., taxes, permits, and certificates), non-market-based instruments (e.g., performance standards), and technology support policies (e.g., R&D support, feed-in tariffs, and auctions), assessing both their individual and aggregate impacts. While our results suggest that various types of environmental policies are associated with reduced debt costs, our findings specifically indicate that non-market instruments, those entailing emission limits and standards, exert the highest impact in Europe. These instruments have indeed constituted a fundamental pillar of the European Green Deal. Building on the

insights of Jennings and Zandbergen (1995), effectively embedding sustainability within the economic ecosystem and transforming it into widely accepted practice among diverse actors, including financial institutions and firms, necessitates strengthening and harmonizing market-based policies (like taxes and permits), tax aid, and grants to incentivize green investments across Europe.

Beyond the comprehensiveness of policy measures, policymakers must also recognize that modifying institutional arrangements involves more than simply increasing the stringency of laws and regulations. For example, top-down mandates, while effective in driving adoption, may not foster substantive ESG that generates real value, as it highlights the potential for “greenwashing” or “policy-washing” driven by compliance rather than genuine strategic intent (Chen et al. 2025; Velte 2025).

6.3 | Limitations and Future Lines of Research

As with any empirical study, this research has certain limitations that simultaneously suggest promising avenues for future investigation. First, focusing solely on a single dependent variable—the cost of debt—may provide only a partial understanding of the complex economic consequences of CER and environmental policies. CER can yield numerous other benefits relevant to various stakeholders, including shareholders, customers, and suppliers, each operating within distinct institutional contexts. Indeed, CSR is often integrated into firms' marketing strategies (Bätae et al. 2021). Future research could also explore the potential costs associated with CER, such as the allocation of resources away from other potentially profitable projects. Furthermore, from an agency theory perspective, CER engagement could potentially be used by management to obscure inefficiencies or justify discretionary spending, leading to suboptimal resource allocation decisions.

Firms compete not only in product markets but also in the credit market, where CER can serve as a valuable instrument for gaining competitive advantage. Accordingly, listed firms may be incentivized to enhance their CER performance to fully realize these financial benefits. However, the extent to which non-listed European firms can leverage green bank loans and CER initiatives to achieve similar advantages remains an unexplored area, representing a promising direction for future research.

Future research could also apply these models to analyze the effects of EPS divergence across a broader territorial base. While evidence is accumulating that capital and credit markets incorporate CER into their investment criteria in various contexts (e.g., Ali et al. 2023; Caragnano et al. 2020), additional research is needed to ascertain whether the institutional dynamics concerning the interplay between EPS and CER manifest in similar or distinct patterns in other global regions characterized by different cultural, economic, and regulatory frameworks, such as the Americas or the Asia-Pacific.

In line with these proposals, it would be valuable to explore the impact of other variables captured by international indices, such as the degree of efficiency of state institutions or other development indicators like digital transformation. These factors could

also potentially influence how lenders and other stakeholders evaluate firm-level CER.

References

- Ahmad, N., A. Mobarek, N. N. Roni, and A. W. K. Tan. 2021. "Revisiting the Impact of ESG on Financial Performance of FTSE350 UK Firms: Static and Dynamic Panel Data Analysis." *Cogent Business & Management* 8, no. 1: 1900500.
- Albuquerque, R., Y. Koskinen, and C. Zhang. 2019. "Corporate Social Responsibility and Firm Risk: Theory and Empirical Evidence." *Management Science* 65, no. 10: 4451–4469. <https://doi.org/10.1287/mnsc.2018.3043>.
- Ali, K., M. Nadeem, R. Pandey, and G. S. Bhabra. 2023. "Do Capital Markets Reward Corporate Climate Change Actions? Evidence From the Cost of Debt." *Business Strategy and the Environment* 32, no. 6: 3417–3431. <https://doi.org/10.1002/bse.3308>.
- Alves, C. F., and L. L. Meneses. 2024. "ESG Scores and Debt Costs: Exploring Indebtedness, Agency Costs, and Financial System Impact." *International Review of Financial Analysis* 94: 103240.
- Amarna, K., R. Garde Sánchez, M. V. López-Pérez, and M. Marzouk. 2024. "The Effect of Environmental, Social, and Governance Disclosure and Real Earning Management on the Cost of Financing." *Corporate Social Responsibility and Environmental Management* 31: 3181–3193. <https://doi.org/10.1002/csr.2740>.
- Bacha, S., A. Ajina, and S. Ben Saad. 2021. "CSR Performance and the Cost of Debt: Does Audit Quality Matter?" *Corporate Governance* 21, no. 1: 137–158. <https://doi.org/10.1108/CG-11-2019-0335>.
- Baldini, M., L. D. Maso, G. Liberatore, F. Mazzi, and S. Terzani. 2018. "Role of Country-and Firm-Level Determinants in Environmental, Social, and Governance Disclosure." *Journal of Business Ethics* 150: 79–98. <https://doi.org/10.1007/s10551-016-3139-1>.
- Barbaglia, M., R. Bianchini, V. Buttice, S. Elia, and M. M. Mariani. 2023. "The Role of Environmental Sustainability in the Relocation Choices of MNEs: Back to the Home Country or Welcome in a New Host Country?" *Journal of International Management* 29, no. 5: 101059. <https://doi.org/10.1016/j.intman.2023.101059>.
- Bătae, O. M., V. D. Dragomir, and L. Feleagă. 2021. "The Relationship Between Environmental, Social, and Financial Performance in the Banking Sector: A European Study." *Journal of Cleaner Production* 290: 125791. <https://doi.org/10.1016/j.jclepro.2021.125791>.
- Botta, E., and T. Koźluk. 2014. *Measuring Environmental Policy Stringency in OECD Countries: A Composite Index Approach*. OECD Economics Department Working Papers No. 1177. <https://doi.org/10.1787/5jxrjnc45vgv-en>.
- Bukhari, S. A. A., F. Hashim, and A. Amran. 2019. "Determinants of Green Banking Adoption: A Theoretical Framework." *KnE Social Sciences* 22, no. 3: 1–14. <https://doi.org/10.18502/KSS.V3I22.5041>.
- Caragnano, A., M. Mariani, F. Pizzutilo, and M. Zito. 2020. "Is It Worth Reducing GHG Emissions? Exploring the Effect on the Cost of Debt Financing." *Journal of Environmental Management* 270: 110860. <https://doi.org/10.1016/j.jenvman.2020.110860>.
- Chava, S. 2014. "Environmental Externalities and Cost of Capital." *Management Science* 60, no. 9: 2223–2247. <https://doi.org/10.1287/mnsc.2013.1863>.
- Chen, C., L. Lv, and C. Xu. 2025. "Forced or Willing: A Study of Corporate ESG Peer Effects and Value From the Perspective of Institutional Isomorphism." *BRQ Business Research Quarterly*: 23409444251339767.
- Chen, G., C. Xu, L. Wu, and F. Yu. 2024. "The Role of Environmental Regulations in Shaping Companies' ESG Performance: Evidence From China's Prevention and Control of Atmospheric Pollution." *Polish Journal of Environmental Studies* 20: 1–15. <https://doi.org/10.15244/pjoes/192763>.
- Cheng, B. T., I. Ioannou, and G. Serafeim. 2014. "Corporate Social Responsibility and Access to Finance." *Strategic Management Journal* 35, no. 1: 1–23. <https://doi.org/10.1002/smj.2131>.
- Choi, B. B., D. Lee, and Y. Park. 2013. "Corporate Social Responsibility, Corporate Governance and Earnings Quality: Evidence From Korea." *Corporate Governance: An International Review* 21, no. 5: 447–467. <https://doi.org/10.1111/corg.12033>.
- Cooper, E. W., and H. Uzun. 2015. "Corporate Social Responsibility and the Cost of Debt." *Journal of Accounting and Finance* 15, no. 8: 2158–3625.
- CSRD (2022). Directive (EU) 2022/2464 of the European Parliament and of the Council of 14 December 2022 (Text with EEA relevance). <https://eur-lex.europa.eu/eli/dir/2022/2464/oj/eng>.
- Cui, J., H. Jo, and H. Na. 2018. "Does Corporate Social Responsibility Affect Information Asymmetry?" *Journal of Business Ethics* 148, no. 3: 549–572. <https://doi.org/10.1007/s10551-015-3003-8>.
- Desender, K. A., M. López Puertas-Lamy, P. Pattitoni, and B. Petracci. 2020. "Corporate Social Responsibility and Cost of Financing—The Importance of the International Corporate Governance System." *Corporate Governance: An International Review* 28: 207–234. <https://doi.org/10.1111/corg.12312>.
- Dhaliwal, D., O. Z. Li, A. Tsang, and Y. G. Yang. 2011. "Voluntary Nonfinancial Disclosure and the Cost of Equity Capital: The Initiation of Corporate Social Responsibility Reporting." *Accounting Review* 86, no. 1: 59–100. <https://doi.org/10.2308/accr.00000005>.
- DiMaggio, P. J., and W. W. Powell. 1983. "The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields." *American Sociological Review* 48, no. 2: 147–160.
- Directive (EU) 2775 (2023). Commission Delegated Directive (EU) 2023/2775 of 17 October (2023) https://eur-lex.europa.eu/eli/dir_del/2023/2775.
- EBA. 2022. "Draft ITS on Pillar 3 Disclosures on ESG Risks." https://www.eba.europa.eu/publications-and-media/press-releases/eba-publishes-binding-standards-pillar-3-disclosures-esg?utm_source=chatgpt.com.
- Ebrahimi, S. M., and L. Koh. 2021. "Manufacturing Sustainability: Institutional Theory and Life Cycle Thinking." *Journal of Cleaner Production* 298: 126787. <https://doi.org/10.1016/j.jclepro.2021.126787>.
- Eccles, R. G., and M. P. Krzus. 2010. *One Report: Integrated Reporting for a Sustainable Strategy*. John Wiley and Sons.
- Eliwa, Y., A. Aboud, and A. Saleh. 2021. "ESG Practices and the Cost of Debt: Evidence From EU Countries." *Critical Perspectives on Accounting* 79: 102097. <https://doi.org/10.1016/j.cpa.2019.102097>.
- EUR-Lex. 2023. "Regulation (EU) 2023/2631 of the European Parliament and of the Council of 22 November 2023 on European Green Bonds and Optional Disclosures for Bonds Marketed as Environmentally Sustainable and for Sustainability-Linked Bonds." <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32023R2631>.
- Eurostat. 2025. "Non-Financial Corporations – Statistics on Financial Assets and Liabilities." <https://ec.europa.eu/eurostat/databrowser/bookmark/a0ed308b-45ba-4d45-92aa-4d840d148475?lang=en>.
- Fan, H., Y. Peng, H. Wang, and Z. Xu. 2021. "Greening Through Finance?" *Journal of Development Economics* 152: 102683. <https://doi.org/10.1016/j.jdeveco.2021.102683>.
- Fandella, P., B. S. Sergi, and E. Sironi. 2023. "Corporate Social Responsibility Performance and the Cost of Capital in BRICS Countries. The Problem of Selectivity Using Environmental, Social and Governance Scores." *Corporate Social Responsibility and Environmental Management* 30, no. 4: 1712–1722. <https://doi.org/10.1002/csr.2447>.

- Fonseka, M., T. Rajapakse, and G. Richardson. 2019. "The Effect of Environmental Information Disclosure and Energy Product Type on the Cost of Debt: Evidence From Energy Firms in China." *Pacific-Basin Finance Journal* 54, no. 3: 159–182. <https://doi.org/10.1016/j.pacfin.2018.05.001>.
- Gao, L., and L. Wan. 2023. "Does Corporate Environmental Responsibility Contribute to Financial Performance? A Dual Path Analysis Through Operational Efficiency and the Cost of Debt." *Corporate Social Responsibility and Environmental Management* 30, no. 1: 308–323. <https://doi.org/10.1002/csr.2356>.
- García-Sánchez, I. M., C. Aibar-Guzmán, and B. Aibar-Guzmán. 2020. "The Effect of Institutional Ownership and Ownership Dispersion on Eco-Innovation." *Technological Forecasting and Social Change* 158: 120173.
- García-Sánchez, I. M., C. Aibar-Guzmán, M. Núñez-Torrado, and B. Aibar-Guzmán. 2022. "Are Institutional Investors "In Love" With the Sustainable Development Goals? Understanding the Idyll in the Case of Governments and Pension Funds." *Sustainable Development* 30, no. 5: 1099–1116.
- García-Sánchez, I. M., and E. García-Meca. 2017. "CSR Engagement and Earnings Quality in Banks. The Moderating Role of Institutional Factors." *Corporate Social Responsibility and Environmental Management* 24, no. 2: 145–158. <https://doi.org/10.1002/csr.1405>.
- Gigante, G., and D. Manglaviti. 2022. "The ESG Effect on the Cost of Debt Financing: A Sharp RD Analysis." *International Review of Financial Analysis* 84: 102382. <https://doi.org/10.1016/j.irfa.2022.102382>.
- Giordino, D., F. Jabeen, N. Nirino, and S. Bresciani. 2024. "Institutional Investors Ownership Concentration and Its Effect on Disclosure and Transparency of United Nations Sustainable Development Goals." *Technological Forecasting and Social Change* 200: 123132.
- Giordino, D., A. Sestino, D. Zàmek, and D. Yahiaoui. 2025. "The Impact of Institutional Ownership Structure on Corporate ESG Performance: Empirical Evidence for the European Capital Market." *Review of Managerial Science* 19: 1–42.
- Glynn, M. A., and T. D'Aunno. 2023. "An Intellectual History of Institutional Theory: Looking Back to Move Forward." *Academy of Management Annals* 17, no. 1: 301–330. <https://doi.org/10.5465/annals.2020.0341>.
- Goss, A., and G. S. Roberts. 2011. "The Impact of Corporate Social Responsibility on the Cost of Bank Loans." *Journal of Banking and Finance* 35, no. 7: 1794–1810. <https://doi.org/10.1016/j.jbankfin.2010.12.002>.
- Gourdel, R., I. Monasterolo, N. Dunz, A. Mazzocchetti, and L. Parisi. 2021. "Assessing the Double Materiality of Climate Risks in the EU Economy and Banking Sector." Available at SSRN, 3939895. <https://doi.org/10.2139/ssrn.3939895>.
- Gupta, K. 2018. "Environmental Sustainability and Implied Cost of Equity." *Journal of Business Ethics* 147: 343–365. <https://doi.org/10.1007/s10551-015-2971-z>.
- He, W. P., A. Lepone, and H. Leung. 2013. "Information Asymmetry and the Cost of Equity Capital." *International Review of Economics and Finance* 27: 611–620. <https://doi.org/10.1016/j.iref.2013.03.001>.
- Hoepner, A., I. Oikonomou, B. Scholtens, and M. Schröder. 2016. "The Effects of Corporate and Country Sustainability Characteristics on the Cost of Debt: An International Investigation." *Journal of Business Finance and Accounting* 43, no. 1–2: 158–190. <https://doi.org/10.1111/jbfa.12183>.
- Hörisch, J., S. Schaltegger, and R. E. Freeman. 2020. "Integrating Stakeholder Theory and Sustainability Accounting: A Conceptual Synthesis." *Journal of Cleaner Production* 275: 124097. <https://doi.org/10.1016/j.jclepro.2020.124097>.
- Horobet, A., B. Rahat, A. M. Floarea, and L. Belascu. 2024. "Green Banks, Golden Returns? Unraveling the ESG–Financial Performance Nexus in European Banking." *Review of Accounting and Finance* 24: 259–285. <https://doi.org/10.1108/raf-09-2024-0373>.
- Hu, J., W. Long, Y. Wang, and L. Zhou. 2023. "Do Participants in the Bond Market Care About Corporate Social Responsibility? Evidence From China." *International Journal of Emerging Markets* 18, no. 9: 2912–2933. <https://doi.org/10.1108/IJOEM-01-2021-0156>.
- Huang, J., W. Hu, and G. Zhu. 2018. "The Effect of Corporate Social Responsibility on Cost of Corporate Bond: Evidence From China." *Emerging Markets Finance and Trade* 54: 255–268. <https://doi.org/10.1080/1540496X.2017.1332591>.
- Hummel, K., and D. Jobst. 2024. "An Overview of Corporate Sustainability Reporting Legislation in the European Union." *Accounting in Europe* 21, no. 3: 320–355. <https://doi.org/10.1080/17449480.2024.2312145>.
- Jennings, P. D., and P. A. Zandbergen. 1995. "Ecologically Sustainable Organizations: An Institutional Approach." *Academy of Management Review* 20, no. 4: 1015–1052. <https://doi.org/10.2307/258964>.
- Kazemi, H., and F. Rahmani. 2013. "Relationship Between Information Asymmetry and Cost of Capital." *Management Science Letters* 3, no. 1: 321–328. <https://doi.org/10.5267/j.msl.2012.10.026>.
- Khurshid, A., Y. Huang, J. Cifuentes-Faura, and K. Khan. 2024. "Beyond Borders: Assessing the Transboundary Effects of Environmental Regulation on Technological Development in Europe." *Technological Forecasting and Social Change* 200: 123212. <https://doi.org/10.1016/j.techfore.2024.123212>.
- Klaas Jagersma, P. 2009. "The Strategic Value of Sustainable Stakeholder Management." *Business Strategy Series* 10, no. 6: 339–344. <https://doi.org/10.1108/17515630911005619>.
- Kleimeier, S., and M. Viehs. 2018. "Carbon Disclosure, Emission Levels, and the Cost of Debt." <https://doi.org/10.26481/umagsb.2016003>.
- Kordsachia, O., M. Focke, and P. Velte. 2022. "Do Sustainable Institutional Investors Contribute to Firms' Environmental Performance? Empirical Evidence From Europe." *Review of Managerial Science* 16, no. 5: 1409–1436.
- Kruse, T., A. Dechezleprêtre, R. Saffar, and L. Robert. 2022. "Measuring Environmental Policy Stringency in OECD Countries: An Update of the OECD Composite EPS Indicator." *OECD Economic Department Working Papers* 1703: 1–56. <https://doi.org/10.1787/90ab82e8-en>.
- La Rosa, F., G. Liberatore, F. Mazzi, and S. Terzani. 2018. "The Impact of Corporate Social Performance on the Cost of Debt and Access to Debt Financing for Listed European Non-Financial Firms." *European Management Journal* 36, no. 4: 519–529. <https://doi.org/10.1016/j.emj.2017.09.007>.
- Lee, C. C., C. W. Wang, P. H. Hong, and W. Lin. 2024. "Environmental Policy Stringency and Bank Risks: Does Green Economy Matter?" *International Review of Financial Analysis* 91: 103040. <https://doi.org/10.1016/j.irfa.2023.103040>.
- Li, W., P. Padmanabhan, and C. H. Huang. 2024. "ESG and Debt Structure: Is the Nature of This Relationship Nonlinear?" *International Review of Financial Analysis* 91: 103027. <https://doi.org/10.1016/j.irfa.2023.103027>.
- Li, Y., R. Chen, and E. Xiang. 2022. "Corporate Social Responsibility, Green Financial System Guidelines, and Cost of Debt Financing: Evidence From Pollution-Intensive Industries in China." *Corporate Social Responsibility and Environmental Management* 29, no. 3: 593–608. <https://doi.org/10.1002/csr.2222>.
- Limkriangkrai, M., S. Koh, and R. B. Durand. 2016. "Environmental, Social, and Governance (ESG) Profiles, Stock Returns, and Financial Policy: Australian Evidence." *International Review of Finance* 17, no. 3: 461–471. <https://doi.org/10.1111/irfi.12101>.
- Liu, J. Y., Y. Xia, Y. Fan, S. M. Lin, and J. Wu. 2017. "Assessment of a Green Credit Policy Aimed at Energy-Intensive Industries in China

- Based on a Financial CGE Model.” *Journal of Cleaner Production* 163: 293–302. <https://doi.org/10.1016/j.jclepro.2015.10.111>.
- Liu, T., Y. Zhang, and D. Liang. 2019. “Can Ownership Structure Improve Environmental Performance in Chinese Manufacturing Firms? The Moderating Effect of Financial Performance.” *Journal of Cleaner Production* 225: 58–71. <https://doi.org/10.1016/j.jclepro.2019.03.267>.
- Liu, Z., W. Li, C. Hao, and H. Liu. 2021. “Corporate Environmental Performance and Financing Constraints: An Empirical Study in the Chinese Context.” *Corporate Social Responsibility and Environmental Management* 28, no. 2: 616–629. <https://doi.org/10.1002/csr.2073>.
- Lu, S., and B. Cheng. 2023. “Does Environmental Regulation Affect Firms’ ESG Performance? Evidence From China.” *Managerial and Decision Economics* 44, no. 4: 2004–2009. <https://doi.org/10.1002/mde.3796>.
- Lundgren, M. 1999. “Bankens natur: miljöfrågans genomslag i svenska banker.” (Doctoral dissertation, Stockholm University).
- Maaloul, A., D. Zéghal, W. Ben Amar, and S. Mansour. 2023. “The Effect of Environmental, Social, and Governance (ESG) Performance and Disclosure on Cost of Debt: The Mediating Effect of Corporate Reputation.” *Corporate Reputation Review* 26, no. 1: 1–18. <https://doi.org/10.1057/s41299-021-00130-8>.
- Magnanelli, B. S., and M. F. Izzo. 2017. “Corporate Social Performance and Cost of Debt: The Relationship.” *Social Responsibility Journal* 13, no. 2: 250–265. <https://doi.org/10.1108/SRJ-06-2016-0103>.
- Mahajan, A., and K. Majumdar. 2023. “Toxic Trade and Environmental Stringency: Exploring the Impact on Economic Growth in the G20.” *Journal of Cleaner Production* 422: 138516. <https://doi.org/10.1016/j.jclepro.2023.138516>.
- Mandas, M., O. Lahmar, L. Piras, and R. De Lisa. 2024. “ESG Reputational Risk and Market Valuation: Evidence From the European Banking Industry.” *Research in International Business and Finance* 69: 102286. <https://doi.org/10.1016/j.ribaf.2024.102286>.
- Martínez-Ferrero, J., D. Ruiz-Cano, and I.-M. García-Sánchez. 2016. “The Causal Link Between Sustainable Disclosure and Information Asymmetry: The Moderating Role of the Stakeholder Protection Context.” *Corporate Social Responsibility and Environmental Management* 23, no. 5: 319–332. <https://doi.org/10.1002/csr.1379>.
- Melo, T., and A. Garrido-Morgado. 2012. “Corporate Reputation: A Combination of Social Responsibility and Industry.” *Corporate Social Responsibility and Environmental Management* 19, no. 1: 11–31. <https://doi.org/10.1002/csr.260>.
- Nakagawa, S., and H. Schielzeth. 2013. “A General and Simple Method for Obtaining R² From Generalized Linear Mixed-Effects Models.” *Methods in Ecology and Evolution* 4, no. 2: 133–142. <https://doi.org/10.1111/j.2041-210x.2012.00261.x>.
- Ni, X., Q. Jin, and K. Huang. 2022. “Environmental Regulation and the Cost of Debt: Evidence From the Carbon Emission Trading System Pilot in China.” *Finance Research Letters* 49: 103134. <https://doi.org/10.1016/j.frl.2022.103134>.
- Palea, V., and F. Drogo. 2020. “Carbon Emissions and the Cost of Debt in the Eurozone: The Role of Public Policies, Climate-Related Disclosure and Corporate Governance.” *Business Strategy and the Environment* 29, no. 8: 2953–2972. <https://doi.org/10.1002/bse.2550>.
- Perez, A. 2015. “Corporate Reputation and CSR Reporting to Stakeholders: Gaps in the Literatura and Future Lines of Research.” *Corporate Communications: An International Journal* 20, no. 1: 11–29. <https://doi.org/10.1108/CCIJ-01-2014-0003>.
- Porter, M. E., and C. V. D. Linde. 1995. “Toward a New Conception of the Environment-Competitiveness Relationship.” *Journal of Economic Perspectives* 9, no. 4: 97–118. <https://doi.org/10.1257/jep.9.4.97>.
- Raimo, N., A. Caragnano, M. Zito, F. Vitolla, and M. Mariani. 2021. “Extending the Benefits of ESG Disclosure: The Effect on the Cost of Debt Financing.” *Corporate Social Responsibility and Environmental Management* 28, no. 4: 1412–1421. <https://doi.org/10.1002/csr.2134>.
- Refinitiv. 2022. “Environmental, Social and Governance Scores From Refinitiv.” https://www.lseg.com/content/dam/marketing/en_us/documents/methodology/refinitiv-esg-scores-methodology.pdf.
- Rupp, D. E., and D. B. Mallory. 2015. “Corporate Social Responsibility: Psychological, Person-Centric, and Progressing.” *Annual Review of Organizational Psychology and Organizational Behavior* 2, no. 1: 211–236. <https://doi.org/10.1146/annurev-orgpsych-032414-111505>.
- Schaltegger, S., and M. Wagner. 2006. “Integrative Management of Sustainability Performance, Measurement and Reporting.” *International Journal of Accounting, Auditing and Performance Evaluation* 3, no. 1: 1–19. <https://doi.org/10.1504/IJA.APE.2006.010098>.
- Serafeim, G. 2015. “Integrated Reporting and Investor Clientele.” *Journal of Applied Corporate Finance* 27, no. 2: 34–51. <https://doi.org/10.1111/jacf.12116>.
- SFDR (2019). Regulation 2019/2088 of the European Parliament and of the Council of 27 November 2019 on sustainability-related disclosures in the financial services sector (Text with EEA relevance). <https://eur-lex.europa.eu/eli/reg/2019/2088/oj>.
- Shrivastava, P., and A. Addas. 2014. “The Impact of Corporate Governance on Sustainability Performance.” *Journal of Sustainable Finance & Investment* 4, no. 1: 21–37. <https://doi.org/10.1080/20430795.2014.887346>.
- Sun, H., G. Wang, J. Bai, et al. 2022. “Corporate Sustainable Development, Corporate Environmental Performance and Cost of Debt.” *Sustainability* 15, no. 1: 228. <https://doi.org/10.3390/su15010228>.
- Testa, F., F. Iraldo, and M. Frey. 2011. “The Effect of Environmental Regulation on Firms’ Competitive Performance: The Case of the Building and Construction Sector in Some EU Regions.” *Journal of Environmental Management* 92, no. 9: 2136–2144. <https://doi.org/10.1016/j.jenvman.2011.03.039>.
- Ullah, S., R. Luo, M. Nadeem, and J. Cifuentes-Faura. 2023. “Advancing Sustainable Growth and Energy Transition in the United States Through the Lens of Green Energy Innovations, Natural Resources and Environmental Policy.” *Resources Policy* 85: 103848. <https://doi.org/10.1016/j.resourpol.2023.103848>.
- VanderWeele, T. J. 2011. “Causal Mediation Analysis With Survival Data.” *Epidemiology* 22, no. 4: 582–585. <https://doi.org/10.1097/ede.0b013e31821db37e>.
- Velte, P. 2017. “Does ESG Performance Have an Impact on Financial Performance? Evidence From Germany.” *Journal of Global Responsibility* 8, no. 2: 169–178. <https://doi.org/10.1108/JGR-11-2016-0029>.
- Velte, P. 2022. “Meta-Analyses on Corporate Social Responsibility (CSR): A Literature Review.” *Management Review Quarterly* 72, no. 3: 627–675. <https://doi.org/10.1007/s11301-021-00211-2>.
- Velte, P. 2025. “Corporate Social Responsibility (CSR) Decoupling and Tax Avoidance: Symbolic Use of Sustainable Boards in the European Union?” *Corporate Social Responsibility and Environmental Management* 32, no. 3: 4179–4193. <https://doi.org/10.1002/csr.3172>.
- Waddock, S., and S. B. Graves. 1997. “Quality of Management and Quality of Stakeholder Relations.” *Business and Society* 36, no. 3: 250–279. <https://doi.org/10.1177/000765039703600303>.
- Wilmshurst, T. D., and G. R. Frost. 2000. “Organizational Environmental Reporting: A Test of Legitimacy Theory.” *Accounting, Auditing & Accountability Journal* 13, no. 1: 10–26. <https://doi.org/10.1108/09513570010316126>.
- Wood, D. J. 2010. “Measuring Corporate Social Performance: A Review.” *International Journal of Management Reviews* 12, no. 1: 50–84. <https://doi.org/10.1111/j.1468-2370.2009.00274.x>.

- Xu, X. K., and J. S. Li. 2020. "Asymmetric Impacts of the Policy and Development of Green Credit on the Debt Financing Cost and Maturity of Different Types of Enterprises in China." *Journal of Cleaner Production* 264: 121574. <https://doi.org/10.1016/j.jclepro.2020.121574>.
- Yu, H. C., and B. Y. Tsai. 2018. "Environmental Policy and Sustainable Development: An Empirical Study on Carbon Reduction Among Chinese Enterprises." *Corporate Social Responsibility and Environmental Management* 25, no. 5: 1019–1026. <https://doi.org/10.1002/csr.1499>.
- Zhang, X., Y. G. Shan, Y. Zhang, and C. Xing. 2025. "Does ESG Rating Divergence Affect the Cost of Corporate Debt?" *Accounting and Finance* 65: 2244–2280. <https://doi.org/10.1111/acfi.13400>.
- Zhou, X., B. Caldecott, and G. Shrimali. 2023. "An Empirical Analysis of Climate and Environmental Policy Risk, the Cost of Debt and Financial Institutions' Risk Preferences." Available at SSRN 4405562. <https://doi.org/10.2139/ssrn.4405562>.
- Zhu, Q., and Q. Zhang. 2015. "Evaluating Practices and Drivers of Corporate Social Responsibility: The Chinese Context." *Journal of Cleaner Production* 100: 315–324. <https://doi.org/10.1016/j.jclepro.2015.03.053>.
- Zucker, L. G. 1987. "Institutional Theories of Organization." *Annual Review of Sociology* 13, no. 1: 443–464. <https://doi.org/10.1146/annurev.so.13.080187.002303>.