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Adriana Bruscato Bortoluzzo, Andrea Maria Accioly Fonseca Minardi, Vinicius Francisco Samartin Botezelli

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**Sustainability pays: How ESG performance lowers the cost of debt in Brazil**

**Adriana Bruscato Bortoluzzo<sup>1</sup>**

<https://orcid.org/0000-0003-2872-031X>

Email: [adrianab@insper.edu.br](mailto:adrianab@insper.edu.br)

**Andrea Maria Accioly Fonseca Minardi<sup>2</sup>**

<https://orcid.org/0000-0003-3528-910X>

Email: [minardi@insper.edu.br](mailto:minardi@insper.edu.br)

**Vinicius Francisco Samartin Botezelli<sup>1</sup>**


<https://orcid.org/0009-0004-1247-9220>

Email: [viniciusfb1@al.insper.edu.br](mailto:viniciusfb1@al.insper.edu.br)

<sup>1</sup> Insper, Faculdade de Administração, Departamento de Métodos Quantitativos, São Paulo, SP, Brazil

<sup>2</sup> Insper, Faculdade de Administração, Departamento de Finanças, São Paulo, SP, Brazil

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## ABSTRACT

This study investigates the relationship between environmental, social, and governance (ESG) practices and the cost of debt (CoD) for publicly traded non-financial Brazilian companies from 2014 to 2023. This study analyzes the relationship between ESG quality and the CoD, a topic less explored than the link between ESG and the cost of equity. Existing research mainly focuses on developed economies or cross-country analyses, providing limited evidence for emerging markets. By examining Brazil – where regulators have long encouraged and recently mandated ESG disclosure and its use in credit assessments – the study addresses this gap. It offers timely evidence on how ESG transparency and performance affect credit pricing, financial outcomes, and the mitigation of institutional weaknesses, especially in industries with higher environmental and social risk exposure. Understanding how ESG factors shape financing conditions is vital for investors, lenders, and corporate managers seeking to align sustainability with capital allocation and risk management, especially in markets with higher institutional uncertainty. The empirical analysis uses panel regressions with firm fixed effects as the main approach, complemented by the difference-generalized method of moments to address endogeneity and simultaneity, with consistent results. The CoD is measured by interest expenses over interest-bearing liabilities, ESG performance by Refinitiv Eikon scores, and controls include firm characteristics and macroeconomic variables. Empirical evidence shows that superior ESG performance is significantly associated with a lower CoD for Brazilian firms. The governance pillar has the strongest and most consistent impact, while the environmental pillar has marginal significance and the social pillar shows no meaningful relationship. These findings underscore that strong governance reduces perceived credit risk and financing costs in emerging markets. They also highlight the need for greater standardization of ESG taxonomies and the integration of environmental and social risks into credit risk assessments.

**Keywords:** ESG, cost of debt, governance, emerging market.

## 1. INTRODUCTION

The growing concern with environmental, social, and governance (ESG) issues has transformed the global business landscape. Companies across a range of sectors have begun to adopt sustainable practices not only as a corporate responsibility strategy but also as competitive differentiators. The acronym ESG – which refers to a company's environmental, social, and governance practices – has become a crucial indicator for investors and stakeholders seeking to align their investments with ethical and sustainable values (Friedman, 1970; Porter & Kramer, 2011).

The ESG concept emerged from a series of developments in the fields of sustainable investment and corporate responsibility, which have gained significant prominence in recent decades. The acronym was initially popularized by an initiative led by the United Nations Global Compact (UNGC), in collaboration with several international financial institutions, with the aim of formulating guidelines to integrate sustainability considerations into financial investment decisions (UNGC, 2004).

Corporate debt is one of the main sources of financing for publicly traded companies and plays an important role in their capital structure. A company's ability to access debt financing at competitive costs is essential for its expansion and financial sustainability (Diamond, 1989; Modigliani & Miller, 1958). Obtaining favorable credit terms can allow companies to make strategic investments, expand operations, and

improve their competitive position in the market (Megginson et al., 2008; Santos et al., 2023).

The cost of debt (CoD) is influenced by several factors, including a company's solvency, macroeconomic conditions, and its ESG performance. Poor ESG performance may translate into material harm with clearly negative consequences for creditors, such as liabilities associated with lawsuits, government regulatory actions, and lost revenue. The ESG in credit risk and ratings initiative, launched by the Principles for Responsible Investment, was an important catalyst in establishing the integration of ESG factors into the credit risk assessment process as an international best practice (Henisz & McGlinch, 2019). Companies with better ESG practices tend to have a lower CoD, as this should result in better credit scores, since they are perceived as less risky and more resilient to economic and environmental crises (Chava, 2014; Cheng et al., 2014; Lavin & Pearce, 2022).

The adoption of robust ESG practices can provide significant competitive advantages, both in terms of access to capital and risk mitigation, contributing to the sustainability and long-term success of companies (Eccles & Serafeim, 2013). The integration of ESG criteria into corporate strategies is therefore proving to be not only a matter of social responsibility but also an essential practice for long-term sustainability and risk mitigation. This approach is shaping the way companies are evaluated in the market, influencing investment decisions, and impacting the financial performance and cost of capital of organizations (Minardi, 2023).

Although several studies provide evidence of a negative relationship between ESG ratings and the CoD (Henisz & McGlinch, 2019), there is no consensus in the literature (see, for instance, Gigante and Manglaviti [2022] and Kjerstensson and Nygren [2019]). The ESG taxonomy is still evolving, and significant divergences exist among the ESG scores assigned by different providers (Berg et al., 2022). Consequently, ESG factors are not yet fully incorporated into credit assessments. In short, the relationship between ESG and the CoD remains an emerging field of study that offers valuable insights for corporate financial management.

This study aims to investigate the relationship between ESG practices and the CoD in publicly traded companies in an emerging market: Brazil. While the relationship between ESG performance, cost of equity, and firms' operating performance has been extensively examined, the link between the quality of ESG practices and the CoD remains less explored (Henisz & McGlinch, 2019). Moreover, most existing studies focus on developed economies or comparative analyses between developed and emerging markets. As a result, there is limited evidence on whether and how ESG transparency and performance are priced in credit markets within emerging economies, particularly across industries with differing exposure to environmental and social risks. By focusing specifically on Brazil, this study addresses this gap by providing evidence from an emerging market context and examining how voluntary ESG disclosure, together with the quality of ESG practices, can mitigate information asymmetries, compensate for institutional voids, and influence the CoD, especially in sectors where ESG-related risks are more salient.

The proactive stance of Brazilian regulators in mandating transparency regarding ESG risks and opportunities (Comissão de Valores Mobiliários [CVM], 2009, 2023) and in integrating ESG factors into credit decision-making processes (Banco Central do Brasil [BCB], 2024; Mattos Filho, 2023) provides a particularly relevant context for this analysis. Given the importance of debt as a primary source of corporate financing, understanding the determinants of the CoD is essential for financial managers, investors, and policymakers seeking to foster sustainable and fiscally sound business practices.

Using annual data from 261 publicly traded, non-financial Brazilian companies from 2014 to 2023, we estimate panel regression models with firm fixed effects as the main specification. As a robustness check, the models are additionally estimated using the generalized method of moments (GMM) to mitigate potential endogeneity and simultaneity bias. We find a significant negative relationship between both the existence and the level of ESG scores and the CoD.

This study contributes to the academic literature by providing empirical evidence that superior ESG performance in Brazil, an emerging market, is significantly associated with a lower CoD for publicly listed firms. These findings contrast with the absence of a significant relationship reported for European companies by Gigante and Manglaviti (2022) and for Nordic firms by Kjerstensson and Nygren (2019). ESG performance can mitigate risk perception in emerging countries, such as Brazil, because higher institutional uncertainty amplifies the value of non-financial signals. Accordingly, the evidence suggests that stronger ESG practices help reduce the CoD for Brazilian firms, despite the more pronounced financial constraints they face relative to their counterparts in developed markets.

Our results reveal a significant and consistent relationship between the governance (G) pillar score and the CoD. In contrast, we find only a marginal association for the environmental (E) pillar and no significant relationship for the social (S) pillar. These findings suggest that environmental and social risks are not yet fully integrated into credit risk assessments and underscore the need for greater standardization of ESG taxonomies. The evidence provides practical implications for managers and policymakers, emphasizing the importance of adopting more robust environmental and governance practices to enhance the perception of financial risk and, consequently, obtain more favorable credit conditions.

## 2. LITERATURE REVIEW AND HYPOTHESES

Although Modigliani and Miller (1958) proposed the irrelevance of capital structure, the CoD remains important due to its direct influence on a company's profitability and financial health. Debt is cheaper than equity, provides tax benefits, and helps reduce agency costs between managers and shareholders (Jensen, 1986). However, as the debt-to-equity ratio increases, both bankruptcy costs and agency conflicts between shareholders and debtholders also rise. According to the trade-off theory, firms therefore seek an optimal capital structure that balances these effects (Frank & Goyal, 2009). Debt also serves as a signal to the market, and under the pecking order theory, firms prioritize internal financing through retained earnings, resort to debt when necessary, and consider equity issuance only as a last alternative (Myers & Majluf, 1984). A lower CoD allows the company to maintain greater financial flexibility to invest in growth and innovation projects, which can lead to increased competitiveness in the market (Lang et al., 1995). Companies with access to low-cost financing are also better able to withstand periods of economic instability, as they have less financial pressure to meet their debt obligations (Anderson et al., 2003; Dhaliwal et al., 2011). The quality of corporate disclosure also plays a crucial role in determining the CoD, as better disclosure can lead to lower financing costs by reducing information asymmetry between the company and its creditors (Francis et al., 2004).

The cost of corporate debt can be decomposed into two main components: the risk-free rate and the credit spread. The risk-free rate is typically represented by the yield on sovereign government bonds of the same maturity as the corporate debt, reflecting the baseline cost of borrowing in the market without default risk. The credit spread, in turn,

represents the additional premium required by lenders to compensate for the firm's creditworthiness and the expected loss in the event of default (Elton et al., 2001). As ESG factors can affect firms' cash flows and asset values, thereby influencing creditworthiness and expected losses, they ultimately affect the CoD (Chava, 2014; Cheng et al., 2014; Lavin & Pearce, 2022).

ESG practices refer to the strategies and policies that companies adopt to manage ESG issues. ESG performance is assessed based on several indicators that reflect a company's commitment to sustainability and corporate responsibility. These practices range from reducing carbon emissions to promoting diversity and inclusion in the workplace, as well as implementing effective governance policies that ensure transparency and accountability (Gibson et al., 2021; Lavin & Montecinos-Pearce, 2022).

The relationship between ESG practices and the CoD can be explained by some economic and finance theories. First, signaling theory suggests that companies with robust ESG practices send positive signals to the market about their risk management and corporate governance (Spence, 1973). These signals can reduce the perception of risk by creditors, leading to lower financing costs. In addition, stakeholder theory proposes that companies that meet the expectations of their stakeholders, particularly through ESG practices, tend to have better financial performance in the long term (Freeman, 1984). This is because these practices can lead to greater customer loyalty, talent attraction, and fewer conflicts with regulators and society, thus reducing the risk perceived by creditors (Firmino & Peixoto, 2025).

Another relevant approach is the agency cost theory, which suggests that good corporate governance practices, often encompassed within ESG practices, can mitigate conflicts of interest between shareholders and managers (Jensen & Meckling, 1979). More effective boards and better-aligned managerial incentives reduce the likelihood that executives pursue non-pecuniary interests that may harm the firm's long-term objectives and overall value. Such governance mechanisms also enhance the company's operational and financial efficiency, thereby reducing credit risk and, consequently, the CoD. Besides, higher transparency reduces information asymmetry between insiders and outsiders, and this results in a lower cost of capital.

Empirically, studies have shown that high ESG performance can serve as a mitigator of risk perception in weaker legal environments, helping to reduce the cost of capital for companies. Gibson et al. (2021) show that companies with better ESG practices are perceived as less risky and more resilient to economic and environmental crises, resulting in lower financing costs. Similarly, Eccles et al. (2014) point out that robust ESG practices are associated with a significant reduction in the cost of capital due to the perception of lower risk by investors and creditors. Goss and Roberts (2011) argue that companies with good social responsibility practices tend to face fewer regulatory and legal obstacles, which reduce perceived risk and, consequently, the CoD capital (Giannakaris et al., 2016).

The development of ESG rating systems has gained relevance in the financial market, especially for integrating environmental and social risks into traditional credit assessment models. According to Zeidan and Onabolu (2023), there is evidence that companies with better ESG practices enjoy more favorable credit conditions, such as reduced debt spreads. The model proposed by the authors, based on a hierarchical analysis system, emphasizes that the integration of socio-environmental criteria can improve the ability of financial institutions to price risks and opportunities. However, they highlight that current systems still lack standardization and often do not consider the positive potential of sustainable practices, focusing predominantly on risks (Cornell & Damodaran, 2020). This gap suggests that, in addition to providing richer information for

credit decisions, the standardization of these systems can facilitate the flow of capital to companies committed to sustainability, while reducing the cost of financing for these organizations (Zeidan & Onabolu, 2023).

Skog and Nyström (2022) investigated the relationship between ESG performance and the CoD in companies in Nordic countries. Their results support stakeholder and risk mitigation theories, indicating a negative relationship between ESG performance and the CoD. Companies with better ESG performance were rewarded with lower debt costs, suggesting that creditors value these practices due to the reduction of risks and the improvement in a company's reputation (Alves & Meneses, 2024).

Several academic studies report a negative association between ESG performance and the CoD (Henisz & McGlinch, 2019). However, these results are not a consensus in the literature. Kjerstenson and Nygren (2019) investigated the impact of ESG ratings on CoD financing in Nordic companies. The authors found no significant evidence that high ESG ratings are associated with lower yield spreads. Gigante and Manglaviti (2022) examined whether improvements in ESG scores affect CoD financing for European non-financial companies over the period 2018-2020. Contrary to many studies that positively associate high ESG performance with reduced debt costs, this study found no significant statistical evidence that discrete jumps in ESG scores correspond to reductions in the CoD.

The relationship between ESG practices and the CoD appears to be more complex and context-dependent than initially perceived, underscoring the importance of considering factors such as industry characteristics and local economic conditions that may influence this dynamic (Eliwa et al., 2021). The findings of these studies reveal a disconnect between the intended role of ESG metrics in signaling lower risk and the actual pricing behavior of lenders in developed markets. The absence of a direct impact supports the notion that the market has not yet fully internalized the potential benefits of ESG practices in credit risk assessment. This is consistent with the literature emphasizing the lack of standardization and subjectivity in ESG ratings, which may limit their usefulness as reliable indicators of financial risk (Berg et al., 2022).

Studying the relationship between ESG and the CoD in emerging markets presents unique challenges. These markets are characterized by greater economic and political instability, less developed regulatory systems, and greater market volatility. Implementing and measuring ESG practices can be more complex due to these conditions. In addition, the lack of standardization and transparency in the disclosure of ESG information can make it difficult to accurately assess ESG performance and its influence on the cost of financing.

Al Barrak et al. (2023) analyzed the relationship between ESG sustainability practices and the CoD in an emerging market context, specifically focusing on the influence of financial constraints as a moderator of this relationship. Their results revealed that ESG sustainability practices are generally associated with a lower CoD for companies, indicating that investors and creditors perceive these companies as less risky. However, this benefit of ESG practices on the CoD is less pronounced in companies that are experiencing financial distress. This finding suggests that while ESG practices can improve the financial health and image of companies, the state of financial distress may compromise the ability to fully capitalize on these benefits in terms of more favorable financing costs.

Zhang (2021) investigated the influence of ESG performance on the cost of corporate debt in emerging markets. Using an ESG measure constructed from 136 core metrics, he found that a one-standard deviation increase in a firm's ESG score is associated with a 6.3 basis-point decrease in its lending margin. The results also revealed

that better ESG scores predict lower financial misstatements due to fraud, accounting errors, and Securities and Exchange Commission (SEC) investigations. Wu (2023) found a significant negative relationship between ESG performance and the CoD capital in A-share listed firms in Shanghai and Shenzhen, especially for non-state-owned enterprises and those with high internal control quality and high external oversight.

Santos (2022) indicated that companies without sustainable controversies in the media tend to have a lower CoD. However, he did not find a statistically significant relationship between the level of sustainability and the CoD for Brazilian companies. Iglesias et al. (2025) showed a negative relationship between ESG disclosure and the CoD, with the expected sign, but without statistical significance, suggesting that although higher ESG transparency is associated with lower borrowing costs, this effect is not strong enough to be conclusive.

Brazil provides an interesting context to analyze the relationship between ESG practice and the CoD. The country has long been committed to aligning its financial system with international best practices in sustainable finance and risk management. Brazilian regulators have consistently encouraged publicly listed firms to disclose their ESG practices, while financial institutions and institutional investors are incentivized to incorporate ESG factors into credit risk assessment and investment decisions, given their potential implications for financial stability.

Brazilian National Monetary Council (Conselho Monetário Nacional [CMN]) Resolution No. 4,327 (BCB, 2014) marked an early step toward incorporating ESG considerations into financial institutions' risk management frameworks through the adoption of socio-environmental responsibility policies. This approach has been further strengthened in recent years through initiatives such as Public Consultation No. 85/2022 (BCB, 2022) and CMN Resolutions No. 4,943, 4,944, and 4,945 (BCB, 2021a, 2021b, 2021c), which establish guidelines for social, environmental, and climate risk management in financial institutions (BCB, 2024).

In the capital markets, Brazilian Securities and Exchange Commission (CVM) Instruction No. 480/2009 has required publicly traded firms, since 2010, to disclose information in the reference form on corporate governance, business activities, and material risk factors, including environmental, social, and regulatory risks, albeit in a largely qualitative and non-standardized manner. More recently, the CVM issued Resolution No. 193/2023, which standardized the preparation and disclosure of sustainability-related financial information by introducing a dedicated sustainability report, with mandatory adoption by publicly held companies as of 2026. The CVM is the first regulator in the world to adopt sustainability reporting rules aligned with the International Financial Reporting Standards (IFRS) S1 and S2 standards (Mattos Filho, 2023), positioning Brazil as a pioneer in this field. The process begins with the voluntary disclosure of sustainability aspects by issuers, promoting greater transparency, standardization, and comparability across markets.

Building on the preceding discussion, we propose the following hypothesis:

H<sub>1</sub>: Brazilian companies with better ESG practices have lower debt costs.

### **3. METHODOLOGY**

#### **3.1 Description of Variables**

We built a sample of publicly traded, non-financial Brazilian companies, using financial statement data from 2014 to 2023. The data were sourced from Valor PRO and

Refinitiv Eikon, which obtain information from capital markets regulatory authorities, in this case, the CVM. The selected analysis period reflects both the peak availability of ESG-related data and the growing relevance of ESG issues in the corporate landscape, in addition to the expansion of the Brazilian stock exchange itself.

The CoD represents the actual cost a firm incurs in borrowing money and can be calculated in a number of ways. We calculated it as the ratio between financial expenses and short- and long-term interest-bearing liabilities of the previous period, according to Eq. 1, as proposed by Sengupta (1998) and applied by Santos (2022) and Wu (2023). This methodology is widely used because of its simplicity and accuracy in reflecting the actual costs incurred by firms in obtaining financing.

$$\text{Cost of Debt} = \frac{\text{Financial Expenses}_t}{\text{Onerous Liabilities (Short and Long-Term)}_{t-1}} \quad (1)$$

This approach allows us to capture the financial burden that companies bear due to the loans and financing obtained, directly reflecting their efficiency and financial sustainability. The CoD variable will be treated annually for each company in the sample, ensuring data consistency over the course of the study.

However, this methodology has some limitations. First, the use of current-period financial expenses may not adequately capture changes in market conditions and interest rates over time. In addition, the formula does not consider the term structure of debt, which may result in an underestimation or overestimation of the actual CoD, especially for companies with highly variable debt maturity profiles (Barclay & Smith, 1995). The inclusion of miscellaneous financial expenses, such as bank fees and foreign exchange expenses, may introduce biases, since not all of these expenses are directly related to the effective CoD. Despite these limitations, this metric is widely accepted in the literature for its ability to reasonably reflect the costs incurred by companies when obtaining financing.

We used two complementary proxies related to ESG: (i) a dummy variable indicating whether the firm was covered by Refinitiv Eikon, capturing ESG disclosure and information availability, and (ii) the firm's ESG score, which reflects the relative assessment of ESG performance among covered firms. The Refinitiv Eikon score, also known as the LSEG ESG score, ranges from 0 to 100, with 0 indicating the lowest possible score and 100 the highest (Sikacz & Wolczek, 2018). The study also analyzes the E, S, and G pillars separately.

The Refinitiv Eikon ESG score methodology is described in LSEG Data & Analytics (2024). Based on publicly disclosed information, ESG metrics are constructed and grouped into 10 specific categories. Companies receive a percentile score in each category, comparing their performance with peers in the same industry and country. Refinitiv applies magnitude weights to each category, reflecting the materiality of that category for the respective industry and country. The category scores are then aggregated into three pillars – E, S, and G. The consolidated ESG score represents the weighted average of the E, S, and G pillars, adjusted for their relative materiality by sector and country.

Consistent with prior studies, we control for the following variables.

### 3.1.1 The four variables used to estimate the z-score of Brazilian companies in Altman et al. (1979)

Liquidity = (current asset – current liability)/total asset;  
 Operating profit = earnings before interest and taxes/total asset;  
 Equity ratio = book value of equity/total assets  
 Asset turnover = net revenue/total assets

### 3.1.2 Other variables that determine the CoD suggested by the literature (Rong & Kim, 2024)

Size = ln (total asset). There are indications that larger companies may have fewer financial constraints.  
 Leverage = total debt/total asset. It represents the financial debt due only to interest-bearing debt, and the data were collected directly from Valor PRO.  
 Market-to-book = market value of equity/book value of equity.  
 Volatility = ln(standard deviation of net revenue), calculated based on the variance of the firm's net revenue over the previous 12 years (or the maximum period available for each company).

### 3.1.3 Macroeconomic variables related to the sovereign CoD

Sistema Especial de Liquidação e Custódia (SELIC) (special settlement and custody system): reflects the annual interest rate targeted by the BCB. The values from 2014 to 2024 were collected directly from the BCB website.  
 Índice Nacional de Preços ao Consumidor Amplo (IPCA) (broad consumer price index): represents the accumulated inflation rate over 12 months (annual). This variable was also taken from the BCB.  
 10-year credit default swap (CDS.10) (credit default swap): daily closing values of the CDS derivative with a 10-year term. This security is insurance against default on Brazilian debt and is commonly used as a risk quantifier. Prices are available on the Investing.com website.  
 Interest coverage ratio (ICR): average ICR of all companies listed on the Brazilian stock exchange (Bolsa de Valores de São Paulo). The values were extracted from the Economatica database.

The analysis uses the panel regression model with firm fixed effects and standard errors adjusted using clustering to account for potential intra-group correlation. The selection of the appropriate panel data specification was guided by the Hausman test, which assesses whether individual effects are correlated with the explanatory variables.

The regression model is given by Eq. 2:

$$CoD_{it} = \beta_0 + \beta_1 ESG_{t-1} + \sum_{k=2}^{13} \beta_k X_{kit} + \mu_i + \varepsilon_{it}. \quad (2)$$

where ESG is the main independent variable, and the following are used as proxies: a *dummy* that assumes the value 1 if the company has an ESG score in year t-1 and the consolidated ESG score in year t-1,  $X_{it}$  represents the control variables,  $\mu_i$  represents the company-specific fixed effects, and  $\varepsilon_{it}$  is the idiosyncratic error term.

The lag was applied exclusively to the ESG variable, as it represents the main explanatory variable of the study and is more directly subject to issues of simultaneity

and reverse causality. Changes in ESG practices and disclosure are unlikely to be immediately reflected in firms' financing conditions, as creditors typically require time to observe, process, and incorporate ESG-related information into their risk assessments and pricing decisions. Lagging ESG also helps mitigate concerns that contemporaneous financing conditions may influence current ESG investments rather than the opposite. By contrast, the remaining control variables were treated as contemporaneous, as they are commonly considered predetermined or exogenous in the short run, in line with the related literature (Cheng et al., 2014; Dhaliwal et al., 2011; Eliwa et al., 2021; Lavin & Montecinos-Pearce, 2022; Zhang, 2021).

Sector fixed effects are not included because they are perfectly collinear with firm fixed effects and are therefore omitted from the estimation. Likewise, time fixed effects are not incorporated, as they generate perfect multicollinearity with the macroeconomic variables included in the regressions (such as interest rates, inflation, and sovereign risk indicators), which already capture common time-specific shocks affecting all firms.

As an additional robustness check, the models were also estimated using the difference-GMM. This approach allows for the use of internal instruments based on lagged values of the explanatory variables, helping to address potential reverse causality and unobserved heterogeneity that may affect the relationship under investigation. The validity of the instrument set was assessed using the Hansen J test, which evaluates the joint null hypothesis that the instruments are exogenous. In addition, the Arellano-Bond tests for first- and second-order serial correlation were conducted to assess the consistency of the moment conditions.

#### 4. RESULTS

Table 1 presents the descriptive statistics of the variables used in the study, separating the sample into companies that have an ESG score and those that do not. It can be observed that companies that have an ESG score had, on average, a lower CoD than companies without one, i.e., the very existence of the score can be interpreted as a signal of lower risk by their stakeholders, creditors, shareholders, and investors.

However, the two subgroups exhibit quite different characteristics: companies with an ESG score have higher liquidity, equity ratio, and asset turnover, which may help explain the lower CoD.

**Table 1**

*Descriptive measures of the variables separated by companies that are and are not in the ESG score, and average comparison of groups (t-test)*

Variable	ESG	Average	SD	Min	Max	t-Statistic
Cod	Yes	0.21	0.16	0.01	1.01	-5.42***
	No	0.26	0.19	0.00	1.00	
Liquidity	Yes	0.09	0.32	-2.78	0.71	2.16**
	No	0.05	0.59	-8.73	1.00	
Operating profit	Yes	0.06	0.12	-0.99	0.80	1.67
	No	0.04	0.39	-14.60	1.76	
Equity ratio	Yes	0.95	1.41	-0.96	9.97	2.61***
	No	0.86	1.21	-0.89	15.58	
Asset turnover	Yes	0.76	0.72	0.02	8.84	4.50***
	No	0.62	0.51	-0.28	4.41	
Size	Yes	9.47	1.37	5.52	13.87	1.35
	No	8.92	1.51	1.79	10.28	

Leverage	Yes	0.33	0.21	0.01	2.23	-0.65
	No	0.34	0.31	0.01	3.02	
Market-to-book	Yes	1.02	0.18	0.01	2.21	-1.18
	No	1.03	0.42	0.04	7.40	
Volatility	Yes	14.18	1.95	6.82	18.56	1.84
	No	13.01	1.94	5.10	18.16	

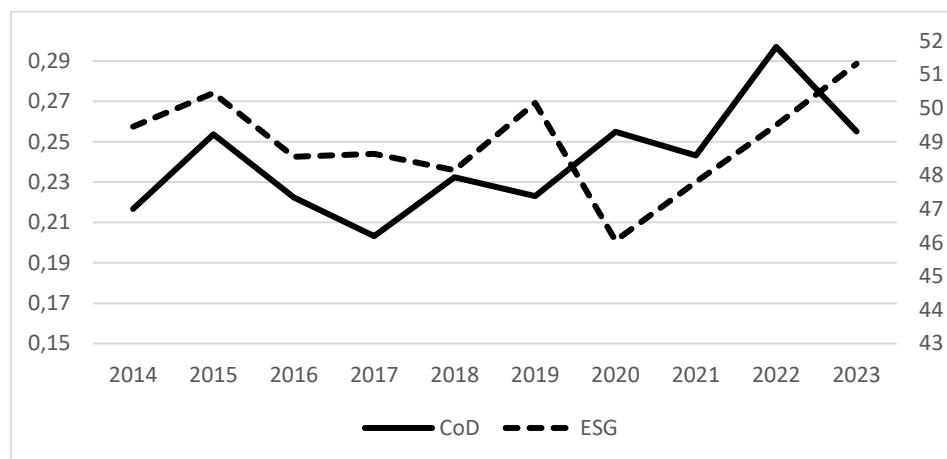
**Note:** 116 companies have ESG scores, while 145 do not.

ESG = environmental, social, and governance; SD = standard deviation.

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

**Source:** Elaborated by the authors.

Figure 1 shows the evolution of the average CoD and the average ESG score from 2014 to 2023. It can be observed that the average cost fluctuates over the period, with a drop from 2014 to 2017, followed by a rise in 2018. In 2022, the cost reached its highest value during the period, before a slight reduction in 2023. These peaks may be related to macroeconomic factors, such as variations in interest rates and economic instability, which affect the cost of financing for companies. The ESG score also shows variation, with a drop from 2015 to 2020 and a recovery from 2021 onwards, reaching its highest value in 2023.



**Figure 1** Average cost of debt (CoD) and average environmental, social, and governance (ESG) score (2014-2023)

**Source:** Elaborated by the authors.

Table 2 presents the correlation matrix of the model variables. ESG shows a negative and weak correlation with CoD (-0.09), suggesting that firms with better ESG performance tend to exhibit a lower CoD. This descriptive evidence supports the idea that ESG acts as a signal of lower financial risk to creditors ( $H_1$ ). CoD is negatively correlated with leverage, profitability, and equity ratio, implying that more profitable, better-capitalized, and less constrained firms tend to face lower debt costs. Among the control variables, there are acceptable levels of multicollinearity.

**Table 2***Correlation matrix of variables*

	CoD	ESG	Liquidity	Operating profit	Equity ratio	Asset turnover	Size	Leverage	Market-to-book	Volatility	
CoD	1										
ESG	-0.09	1									
Liquidity	-0.06	0.11	1								
Operating profit	-0.07	0.09	0.01	1							
Equity ratio	-0.10	0.09	0.14	0.16	1						
Asset turnover	-0.08	0.07	0.13	0.13	0.17	1					
Size	0.12	0.27	-0.24	0.10	-0.10	0.06	1				
Leverage	-0.30	0.01	-0.12	-0.07	-0.55	0.01	0.08	1			
Market-to-book	0.05	0.05	-0.03	0.35	0.00	0.15	-0.06	0.09	1	1	
Volatility	-0.07	0.13	-0.15	0.09	-0.23	0.45	0.62	0.09	-0.04	-0.04	1

*ESG = environmental, social, and governance; CoD = cost of debt.***Source:** *Elaborated by the authors.*

The results of the regression models with panel data are presented in Table 3. We use firm fixed effects with standard error adjustment by clustering and apply the logarithmic transformation to the CoD and the ESG score. We present the results of the Hausman test in Table 3.

**Table 3***Results of panel regression models for ln of CoD – fixed effects*

<b>Variable</b>	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>	<b>Model 4</b>	<b>Model 5</b>
ESG score (dummy)	-0.039** (0.023)				
Ln(ESG)		-0.065** (0.031)			
Ln(E)			-0.056* (0.034)		
Ln(S)				-0.041 (0.036)	
Ln(G)					-0.107*** (0.045)
Liquidity	-0.025 (0.036)	-0.061 (0.214)	-0.076 (0.219)	-0.107 (0.214)	-0.133 (0.213)
Operating profit	-0.016 (0.054)	-0.426 (0.338)	-0.133 (0.359)	-0.349 (0.339)	-0.329 (0.337)
Equity ratio	-0.022** (0.010)	-0.046 (0.04)	-0.047 (0.040)	-0.046 (0.039)	-0.041 (0.039)
Asset turnover	-0.045*** (0.015)	0.194** (0.087)	0.201** (0.087)	0.204** (0.086)	0.193** (0.085)
Size	0.013** (0.006)	0.284*** (0.049)	0.274*** (0.0497)	0.278*** (0.049)	0.274*** (0.048)
Leverage	-0.279*** (0.045)	-0.896*** (0.228)	-0.949*** (0.231)	-0.907*** (0.228)	-0.873*** (0.227)
Market-to-book	0.018 (0.020)	0.007 (0.164)	0.118 (0.176)	0.008 (0.164)	0.0005 (0.163)
Volatility	-0.039*** (0.009)	-0.218*** (0.046)	-0.196*** (0.046)	-0.207*** (0.046)	-0.198*** (0.045)
SELIC	0.188** (0.087)	1.925*** (0.617)	1.803*** (0.633)	1.830*** (0.609)	1.838*** (0.609)
IPCA	0.104 (0.151)	0.598 (0.773)	0.356 (0.804)	0.504 (0.770)	0.544 (0.771)
CDS.10	0.001** (0.0005)	0.001* (0.0004)	0.001* (0.0005)	0.001** (0.0005)	0.001* (0.0005)
ICR	0.002** (0.001)	0.0005 (0.0008)	0.0002 (0.001)	0.0004 (0.001)	0.0003 (0.001)
Intercept	0.405*** (0.077)	-1.4165*** (0.522)	-1.666*** (0.527)	-1.503*** (0.515)	-1.326** (0.518)
Firm fixed effect	Yes	Yes	Yes	Yes	Yes
R <sup>2</sup>	0.35	0.14	0.13	0.13	0.13
n	780	648	648	648	648
Hausman test	60.71***	48.20***	40.01***	42.77***	45.46***

**Notes:** Robust standard errors in parentheses. Dependent variable:  $\ln(\text{CoD})$ .

*CDS.10 = 10-year credit default swap; CoD = cost of debt; ESG = environmental, social, and governance; ICR = interest coverage ratio; IPCA = Índice Nacional de Preços ao Consumidor Amplo; SELIC = Sistema Especial de Liquidação e Custódia. \* =  $p < 0.1$ ; \*\* =  $p < 0.05$ ; \*\*\* =  $p < 0.01$ .*

**Source:** *Elaborated by the authors.*

Model 1 shows a negative and significant relationship between the existence of an ESG score and the CoD, even after controlling for other determinants of the CoD. This finding aligns with the argument that ESG disclosure reduces information asymmetry and provides relevant signals to creditors (Eccles et al., 2014). In line with signaling theory (Spence, 1973), ESG reporting serves as a mechanism through which firms convey their commitment to sustainability and corporate responsibility. By disclosing ESG information, companies demonstrate the existence of managerial processes to address material ESG risks. Consequently, the presence of ESG scores appears to enhance creditors' and investors' perceptions of managerial quality, potentially leading to more favorable financing conditions. This result is consistent with Zhang (2021), who finds that ESG scores can lower financing costs by reducing perceived risk, particularly in countries with weaker legal environments – such as Brazil – where higher institutional uncertainty amplifies the value of non-financial signals.

Model 2 also indicates a negative and significant relationship between ESG performance and the CoD, suggesting that the quality of ESG practices matters for creditors (Eccles et al., 2014; Giannakaris et al., 2016; Goss & Roberts, 2011). As Gibson et al. (2021) argue, ESG performance can mitigate risk perceptions, particularly in countries with weaker legal environments, such as Brazil, where higher institutional uncertainty amplifies the value of non-financial signals.

In summary, Models 1 and 2 provide evidence consistent with  $H_1$ , indicating that both the existence and the quality of ESG practices are associated with a lower CoD. These results suggest that ESG disclosure and performance provide positive signals to creditors, reducing information asymmetry and perceived risk, especially in institutional environments characterized by higher uncertainty, such as Brazil.

The effectiveness of ESG signaling, however, may vary significantly across sectors and regions, reflecting differences in regulatory frameworks, market expectations, and the salience of environmental and social issues. Companies should therefore focus not only on the disclosure of ESG scores, but also on ensuring that their sustainable practices are substantive, well integrated into operations, and clearly communicated to stakeholders. Overall, the empirical findings support  $H_1$  and extend the existing literature showing that effective ESG practices can serve as significant risk mitigators, particularly in emerging markets (Wu, 2023; Zhang, 2021). Moreover, access to cheaper debt can alleviate financial constraints and support firm performance during periods of instability (Anderson et al., 2003; Dhaliwal et al., 2011). Finally, our results are consistent with evidence from developed markets, where studies such as Rong and Kim (2024) and Skog and Nyström (2022) also find a negative association between ESG performance and the CoD, reinforcing stakeholder theory (Freeman, 1984).

To deepen the analysis, Models 3, 4, and 5 were estimated using individual scores for the E, S, and G pillars. The environmental pillar reflects the company's ability to manage environmental impacts and adopt sustainable practices, thereby reducing regulatory and reputational risks (Chava, 2014). The social pillar captures stakeholders' engagement, diversity, and working conditions, which influence talent attraction and risk mitigation (Dhaliwal et al., 2011; Eccles et al., 2014). Governance relates to transparency, shareholder protection, and board effectiveness, which lower agency costs and financial

risks (Jensen & Meckling, 1979). Companies that perform well in these pillars tend to obtain better financing conditions and lower debt costs. Model 3 revealed a negative and marginally significant relationship (10% significance level) with the CoD. Brazil's strict environmental regulation generates potential material losses from poor environmental performance, and credit risk assessment should integrate the environmental pillar. However, we find only modest effects. According to Zhang (2021), environmental practices entail high implementation costs and produce long-term rather than immediate benefits, limiting their short-term impact on financing conditions. Similarly, Goss and Roberts (2011) argue that creditors may not promptly adjust risk perceptions due to difficulties in quantifying environmental outcomes in the short run.

Gibson et al. (2021) further note that while robust environmental practices enhance corporate reputation, their direct impact on the cost of capital is often overshadowed by macroeconomic and regulatory factors. Greater standardization and comparability of environmental metrics could strengthen their influence on debt pricing. Consequently, companies may benefit from integrating environmental management into their core strategy and disclosing quantifiable results that demonstrate risk reduction and long-term profitability, thereby attracting investors sensitive to the "green premium" (Eccles & Serafeim, 2013).

Model 4 shows a negative but statistically insignificant relationship between social performance and the CoD. This result aligns with Gigante and Manglaviti (2022), who emphasize the challenges of integrating social indicators into risk assessment models due to limited measurability and standardization. Although social practices such as diversity, inclusion, and community engagement enhance reputation and organizational stability, their benefits are often perceived as intangible and difficult for creditors to value (Eccles et al., 2014). Dhaliwal et al. (2011) further argue that converting social legitimacy into financial advantages requires markets where social compliance and transparency are deeply institutionalized, a condition not yet fully met in many emerging economies.

Model 5 exhibits a negative and statistically significant relationship between governance quality and the CoD, indicating that governance plays a decisive role in firms' financing conditions. This finding is consistent with Wu (2023) and with the theoretical framework of Jensen and Meckling (1979), which emphasizes that governance attributes – such as transparency, accountability, board effectiveness, and shareholder protection – reduce agency costs and enhance creditor confidence. Importantly, the stronger and more robust effect observed for the governance pillar may reflect the fact that these attributes are already central components of traditional credit risk assessment and are therefore more readily priced by creditors than the environmental and social dimensions. By contrast, environmental and social factors, which are generally less standardized and more difficult to quantify in credit models, appear to be only partially incorporated into debt pricing, reinforcing the view that governance represents the ESG dimension most closely aligned with established financial risk mitigation mechanisms.

Additionally, some coefficients of the control variables – particularly firm size, leverage, and volatility – may appear counterintuitive. Firm size showed a positive and significant relationship with the CoD in the models, suggesting that larger firms, although generally seen as more stable, may face higher debt costs due to higher organizational complexity, agency costs, and monitoring challenges associated with larger and more diversified structures which can increase creditor risk assessment and contract structuring costs. This finding is consistent with studies that highlight the ambivalence of size as an indicator of risk (Rong & Kim, 2024).

Leverage, in turn, showed a significantly negative relationship with the CoD in all models. This result may seem counterintuitive at first glance, but it may be associated

with financial constraints. It is consistent with the notion that firms with greater and sustained access to debt markets may signal stronger credit quality and established lender relationships, allowing them to operate with higher leverage while obtaining financing at lower marginal costs (Frank & Goyal, 2009).

Finally, the negative association between volatility and the CoD may reflect measurement and institutional features typical of emerging markets. In particular, stock return volatility may capture growth opportunities, higher information production, and greater market scrutiny rather than purely higher default risk. Firms with more actively traded equity and higher market visibility may reduce information asymmetry *vis-à-vis* creditors, facilitating access to debt at more favorable terms. Additionally, in environments where capital markets are less developed and bank-based lending prevails, lenders often rely more heavily on balance-sheet fundamentals and relationship lending than on equity market risk indicators, which may weaken the expected positive relationship between market volatility and borrowing costs (Anderson et al., 2003; Lavin & Montecinos-Pearce, 2022). The results for profitability were less consistent, varying in significance across models.

When analyzing the magnitude of the effect of ESG practices in Brazil, we conclude that firms covered by an ESG rating exhibit, on average, a CoD approximately 3.9% lower than non-covered firms, controlling for other factors. While economically meaningful, this magnitude is smaller than those reported in studies for developed markets, where ESG-related effects on debt pricing tend to be stronger (Eliwa et al., 2021; Goss & Roberts, 2011; Zhang, 2021). Consistent with this interpretation, the elasticities associated with ESG performance are also modest: a 1% increase in the aggregate ESG score is associated with a 0.065% reduction in the CoD. When disaggregated, governance exhibits the strongest effect, with a 1% increase in the governance score reducing the CoD by approximately 0.107%, whereas the environmental pillar shows only marginal significance, and the social pillar does not present a statistically significant effect. Taken together, these findings suggest that, although ESG information and performance are priced in the Brazilian credit market, their economic impact remains limited relative to more mature financial systems, reflecting differences in institutional development, market depth, and the degree of ESG integration into credit risk assessment.

Table 4 presents the results of the robustness analysis using the difference-GMM for the ESG specifications and the individual E, S, and G pillars. Overall, the estimated coefficients are qualitatively similar in sign and statistical significance to those obtained from the fixed-effects models, reinforcing the robustness of the main findings. In particular, the ESG variables maintain their expected negative association with the CoD, with governance remaining the most economically and statistically relevant pillar. Regarding model diagnostics, the Arellano-Bond tests indicate the presence of first-order serial correlation in differences, as expected, and the absence of second-order serial correlation, supporting the consistency of the moment conditions. In addition, the Hansen J test does not reject the null hypothesis of instrument validity across all specifications, indicating that the instrument sets are appropriate. Taken together, these results suggest that the main conclusions of the study are not driven by endogeneity concerns.

**Table 4**

*Results of panel regression models for ln of CoD – Difference-GMM*

<b>Variables</b>	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3</b>	<b>Model 4</b>	<b>Model 5</b>
ESG score (dummy)	-0.028** (0.014)				

Ln(ESG)	-0.045*				
	(0.024)				
Ln(E)	-0.067*				
	(0.034)				
Ln(S)	-0.036				
	(0.061)				
Ln(G)	0.098***				
	(0.022)				
Liquidity	-0.106	-0.050	-0.095	-0.021	-0.066
	(0.295)	(0.075)	(0.057)	(0.052)	(0.052)
Operating profit	-0.088	-0.399	-0.253	-0.386	-0.363
	(0.108)	(0.241)	(0.261)	(0.234)	(0.234)
Equity ratio	-0.038*	-0.493	-0.534	-0.497	-0.521
	(0.019)	(0.495)	(0.397)	(0.391)	(0.391)
Asset turnover	-0.068	0.211**	0.067	0.178*	0.184**
	(0.266)	(0.105)	(0.079)	(0.089)	(0.090)
Size	0.449***	0.619***	0.639***	0.620***	0.588***
	(0.088)	(0.119)	(0.122)	(0.118)	(0.118)
Leverage	-0.274***	-0.241***	-0.244***	-0.238***	-0.243***
	(0.052)	(0.081)	(0.080)	(0.0799)	(0.0799)
Market-to-book	-0.069	0.199	0.151	0.185	0.197
	(0.127)	(0.173)	(0.171)	(0.170)	(0.170)
Volatility	-0.158**	-0.309***	-0.241**	-0.298***	-0.308***
	(0.066)	(0.099)	(0.098)	(0.097)	(0.097)
SELIC	2.001***	0.743	0.605	0.798	0.741
	(0.573)	(0.736)	(0.752)	(0.728)	(0.728)
IPCA	-0.768	-0.491	-0.194	-0.483	-0.445
	(0.553)	(0.7397)	(0.760)	(0.732)	(0.732)
CDS.10	0.0006	0.0016**	0.0015**	0.0016**	0.0017***
	(0.0005)	(0.0006)	(0.0007)	(0.0006)	(0.0006)
ICR	0.0006	-0.0018**	-0.0016*	-0.0018**	-0.0019**
	(0.0006)	(0.0008)	(0.0008)	(0.0008)	(0.00078)
Intercept	-3.075***	-3.504***	-4.651***	-3.547***	-3.632***
	(0.875)	(1.292)	(1.352)	(1.279)	(1.278)
R <sup>2</sup>	0.27	0.12	0.10	0.04	0.15
n	780	648	648	648	648
AR(1) – p-value	0.004	0.015	0.008	0.018	0.009
AR(2) – p-value	0.258	0.450	0.294	0.367	0.263
Hansen J – p-value	0.580	0.453	0.429	0.411	0.589

**Note:** Dependent variable:  $\ln(\text{CoD})$ .

CDS.10 = 10-year credit default swap; CoD = cost of debt; ESG = environmental, social, and governance; GMM = generalized method of moments; ICR = interest coverage ratio; IPCA = Índice Nacional de Preços ao Consumidor Amplo; SELIC = Sistema Especial de Liquidação e Custódia.

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

**Source:** Elaborated by the authors.

## **5. SECTORAL HETEROGENEITY ANALYSIS**

We split the sample into two subsamples: firms in sectors with high environmental liabilities (energy, mining, agribusiness, and construction) and firms in all other sectors, and re-estimated the regressions for each group (Table 5). The results indicate that, as expected, ESG effects are stronger in liability-intensive sectors.

**Table 5***Results of panel regression models for ln of CoD – Fixed effects, segmented by intensive and non-intensive in environmental liabilities sectors*

Variable	Model 6	Model 7	Model 8	Model 9
	Intensive in environmental liabilities	Non-intensive in environmental liabilities	Intensive in environmental liabilities	Non-intensive in environmental liabilities
ESG score (dummy)	-0.155** (0.075)	-0.047 (0.115)		
Ln(ESG)			-0.169** (0.076)	-0.066* (0.030)
Liquidity	-0.073 (0.396)	-0.090 (0.230)	-2.030*** (0.630)	-0.859 (0.587)
Operating profit	0.297 (0.489)	0.082 (0.309)	2.298 (1.516)	0.306 (1.451)
Equity ratio	-0.493*** (0.091)	-0.130** (0.061)	-0.202 (0.14)	-0.036 (0.087)
Asset turnover	0.042 (0.204)	-0.106 (0.159)	-0.235 (0.149)	-0.199 (0.386)
Size	0.531*** (0.148)	0.506*** (0.107)	0.349** (0.159)	0.355* (0.192)
Leverage	-0.356 (0.524)	-0.420 (0.343)	-0.271 (0.654)	-1.406*** (0.492)
Market-to-book	0.107 (0.228)	0.174 (0.118)	0.512 (0.504)	0.156 (0.399)
Volatility	-0.365*** (0.127)	-0.138* (0.073)	0.414*** (0.143)	0.363** (0.199)
SELIC	2.379** (0.997)	2.269*** (0.678)	-1.299 (1.584)	-1.619 (1.174)
IPCA	-0.486 (1.003)	-1.201* (0.649)	1.754 (1.195)	-1.679* (1.514)

CDS.10	-0.001 (0.001)	0.001 (0.001)	-0.010 (0.011)	0.003 (0.009)
ICR	0.002** (0.001)	0.001 (0.001)	0.006 (0.013)	0.017* (0.009)
Intercept	-0.559 (1.558)	-4.126*** (0.977)	-1.941 (3.017)	-0.499 (2.777)
Firm fixed effect	Yes	Yes	Yes	Yes
R <sup>2</sup>	0.14	0.10	0.16	0.11
n	277	371	277	371
Hausman test	45.33***	38.82***	42.25***	39.46***

**Notes:** Robust standard errors in parentheses. Dependent variable:  $\ln(\text{CoD})$ .

CDS.10 = 10-year credit default swap; CoD = cost of debt; ESG = environmental, social, and governance; ICR = interest coverage ratio; IPCA = Índice Nacional de Preços ao Consumidor Amplo; SELIC = Sistema Especial de Liquidação e Custódia.

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

**Source:** Elaborated by the authors.

As shown in Model 6, firms operating in sectors characterized by high environmental liabilities and exposure to controversies exhibit a lower CoD compared to their counterparts without ESG coverage. The coefficient for the ESG coverage dummy indicates that, on average, the existence of an ESG rating is associated with a reduction in borrowing costs, highlighting the role of ESG disclosure as a credible signal of lower risk and managerial quality in sectors subject to intense scrutiny from regulators, investors, and society. This result is consistent with the notion that in industries where environmental and social externalities are material, creditors place greater emphasis on sustainability indicators as part of their credit risk assessment (Chava, 2014; Eccles et al., 2014).

By contrast, in Model 7, which includes firms from sectors with lower environmental exposure, the estimated coefficient remains negative but is not statistically significant, suggesting that ESG coverage alone does not materially influence credit conditions in less sensitive industries. This pattern underscores the idea that ESG information is more value-relevant for creditors when firms operate in environments where environmental and regulatory risks have direct financial implications.

When the binary ESG coverage variable is replaced by the continuous ESG score, the results remain robust. In Model 8, the coefficient on  $\ln(\text{ESG})$  is negative and statistically significant, reinforcing the finding that higher-quality ESG performance translates into lower debt costs in high-liability sectors. The economic magnitude of this effect is noteworthy: the elasticity of the CoD with respect to ESG score is approximately three times larger in these sectors than in non-liability-intensive ones (Model 9). This difference suggests that creditors differentiate sharply between firms' sustainability profiles when environmental risks are financially material, while in less exposed sectors, the market response remains weaker and less consistent.

Overall, these findings highlight that the credit market rewards ESG transparency and performance asymmetrically across industries, with stronger effects observed where environmental and social risks are more salient. The results lend further support to signaling and stakeholder theories (Freeman, 1984; Spence, 1973), indicating that robust ESG disclosure and performance serve as effective mechanisms to reduce information asymmetry, enhance credibility with lenders, and ultimately lower the cost of external financing, particularly in sectors facing greater environmental scrutiny and potential liability.

## 6. LIMITATIONS

Although the results obtained offer relevant insights into the relationship between ESG practices and the CoD, it is essential to recognize the limitations of the study, which may influence the interpretation of the results and pave the way for future research. First, there is a limitation in the method used to calculate the CoD. Although widely accepted, the metric based on the ratio between financial expenses and interest-bearing liabilities does not consider important elements, such as the debt maturity structure or specific credit spreads. This simplification may lead to an underestimation or overestimation of the actual costs faced by companies. Alternatively, using market spreads as a proxy for the cost of financing could provide a more detailed view that is directly related to the risk perceived by creditors. This approach would allow for better capturing the nuances of the CoD, especially in relation to the perception of long-term risks.

The lack of standardization in ESG scores (Berg et al., 2022) compromises their readability as a measure of the quality of ESG practices. Using a single provider can introduce bias. Standardization would benefit creditors and companies, facilitating

assessments and attracting investors. In Brazil, the mandatory adoption of IFRS S1 and S2 by the CVM could mitigate this inconsistency in the future.

Another point to highlight is the limitation of the database used. The sample was restricted to publicly traded companies in Brazil, which are generally larger and better structured compared to privately held or smaller companies. This limitation excludes a significant portion of the market, especially small and medium-sized companies that face specific difficulties both in terms of access to capital and in implementing ESG practices.

Finally, although the study sought to reduce endogeneity using lagged variables and GMM, it is still plausible that companies with higher debt costs face financial constraints that limit their ability to invest in ESG practices (Zhang et al., 2022). This reverse causality can create a vicious cycle, where less sustainable companies face higher financing costs and have fewer resources to become sustainable.

Another point of attention concerns the temporal dynamics of the relationship between ESG performance and the CoD. The effects of changes in ESG practices may take longer to be reflected in firms' credit conditions, especially in long-term financing operations.

Additionally, institutional characteristics of the Brazilian credit market impose limitations on the interpretation of the results. The analysis does not distinguish between bank- and market-based debt, which may respond differently to ESG-related information, nor does it explicitly account for the role of public and development banks, such as BNDES. Moreover, the sample is restricted to publicly traded firms with ESG coverage, which may introduce selection and survivorship biases. These features should be considered when generalizing the findings and point to avenues for future research.

## 7. CONCLUSIONS

This study investigated the relationship between ESG practices and the CoD in publicly traded Brazilian companies. Using data from companies listed on B3 from 2014 to 2023 and Refinitiv Eikon scores, the results corroborated that the existence of ESG scores, as well as the level of the score, is associated with reduced debt costs. Therefore, even in emerging countries, where regulatory governance and legal protection may not be as robust as in more developed economies, ESG practices can serve as risk mitigators and substitutes for weaker legal environments.

This effect is most notable in the governance dimension, which showed a significant reduction in CoD, highlighting its effectiveness in mitigating agency costs and strengthening creditor confidence. The environmental and social components had differentiated impacts, with the environmental component showing a marginally significant relationship with CoD and the social component showing no statistical significance.

This suggests that, in the Brazilian context, there is still an evolving assessment of how environmental and social practices affect the risk perceived by creditors. Nevertheless, the recent initiative of the CVM to mandate the adoption of IFRS S1 and S2 for listed companies is expected to have a positive effect by standardizing the ESG taxonomy and enhancing the transparency, consistency, and comparability of sustainability-related disclosures. Such regulatory advances may strengthen investors' and creditors' ability to assess firms' exposure to environmental and social risks, ultimately improving the integration of ESG factors into credit risk evaluation. This expectation is consistent with the findings of Ferreira et al. (2025), who show that, following the mandatory adoption of IFRS, the explanatory power of accounting

information for credit ratings assigned by rating agencies increased, with this association being significantly stronger in emerging economies than in developed ones.

Furthermore, the control variables indicate that larger and more leveraged firms access credit at lower costs, while profitability had a less consistent impact on CoD. These results highlight the complexity of financial management and the need to consider a detailed and sector-specific context in the analysis of ESG and the CoD.

In practical terms, the results emphasize the importance of governance as a priority factor for companies seeking to reduce financing costs. They also highlight the need for regulatory initiatives that promote the standardization and reliability of ESG data, which can facilitate the integration of these practices into financial risk assessment and investment decision-making.

This study contributes significantly to the literature by exploring the relationship between ESG and the CoD in an emerging market, offering valuable insights into the strategic role of ESG practices in strengthening companies' financial sustainability. Integrating these practices into the core of corporate strategies not only benefits risk management but also enhances long-term financial stability and performance.

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## **AUTHOR CONTRIBUTIONS**

### **Adriana Bruscato Bortoluzzo**

Conceptualization: lead;  
Data curation: lead;  
Formal analysis: lead;  
Investigation: equal;  
Methodology: lead;  
Project administration: lead;  
Software: equal;  
Supervision: lead;  
Validation: lead;  
Visualization: equal;  
Writing – original draft: equal;  
Writing – review and editing: lead.

### **Andrea Maria Accioly Fonseca Minardi**

Conceptualization: supporting;  
Methodology: supporting;  
Project administration: supporting;  
Supervision: lead;  
Writing – original draft: supporting;  
Writing – review and editing: lead.

### **Vinicius Francisco Samartin Botzelli**

Conceptualization: supporting;  
Data curation: supporting;  
Formal analysis: equal;  
Investigation: supporting;  
Methodology: supporting;  
Project administration: supporting;  
Software: supporting;  
Validation: supporting;  
Visualization: equal;  
Writing – original draft: supporting;  
Writing – review and editing: supporting.

## **CONFLICT OF INTEREST**

The authors declare that there is no conflict of interest.

## **DATA AVAILABILITY STATEMENT**

The dataset supporting the results of this study is not publicly available.

## **GENERATIVE AI DISCLOSURE**

The authors declare that generative artificial intelligence was used in the following stages of the production of this manuscript:

- Text refinement: ChatGPT
- Translation: ChatGPT

The author(s) declare(s) that, regardless of the use of the tools mentioned above, all generated content was supervised, verified, and critically validated by humans. The author(s) assume(s) full and exclusive responsibility for the accuracy of the data, integrity of mathematical/statistical formulas, originality of the text, and the conclusions presented in the published article.

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