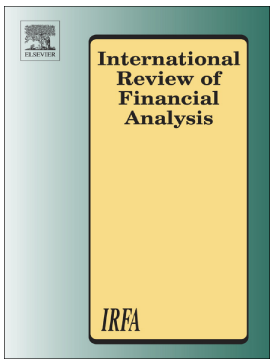

ESG scores and debt costs: Exploring indebtedness, agency costs, and financial system impact

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ESG SCORES AND DEBT COSTS: EXPLORING INDEBTEDNESS, AGENCY COSTS, AND FINANCIAL SYSTEM IMPACT

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Abstract

This paper provides evidence that conventional risk measures (Merton Distance to Default, Altman Z-Score, Z-Score and Volatility) fail to capture all the relevant information to assess borrower risk. Moreover, the paper shows that the additional information contained in ESG scores has a negative relationship with the cost of debt, and this relationship is economically significant. In addition, companies whose sustainability generates major concerns (i.e., the most indebted companies and those with the highest agency costs) benefit the most from ESG performance. Finally, the paper provides evidence that the return on companies' ESG efforts in terms of the cost of debt is higher in countries with bank-based financial systems, where long-term relationships between lenders and borrowers prevail, than in countries with market-based financial systems.

Keywords: cost of debt; ESG; risk metrics; default risk; stakeholder orientation

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Abstract

This paper provides evidence that conventional risk measures (Merton Distance to Default, Altman Z-Score, Z-Score and Volatility) fail to capture all the relevant information to assess borrower risk. Moreover, the paper shows that the additional information contained in ESG scores has a negative relationship with the cost of debt, and this relationship is economically significant. In addition, companies whose sustainability generates major concerns (i.e., the most indebted companies and those with the highest agency costs) benefit the most from ESG performance. Finally, the paper provides evidence that the return on companies' ESG efforts in terms of the cost of debt is higher in countries with bank-based financial systems, where long-term relationships between lenders and borrowers prevail, than in countries with market-based financial systems.

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1. INTRODUCTION

The ESG (Environmental, Social, and Governance) score measures a company's environmental impact, social responsibility, and quality of corporate governance. In recent years, several studies have examined the impact of ESG scores on various financial outcomes (for a deep review, see Gillan et al., 2021). Concerning the companies' stock market performance, for example, Shackleton et al. (2022) explore the dynamic relationship between a firm's environmental and social performance and its stock market returns, Nguyen et al. (2023) investigate the effect of corporate green activity on the stock price crash risk and Wang et al. (2024) show that ESG scores disagreement has a significant negative correlation with stock returns. Other studies show that ESG performance can increase the firm value (Albuquerque et al., 2019). Some papers address the relationship between ESG performance and the cost of capital, generally finding a negative relationship between them (Breuer et al., 2018). Others focus on the relationship between ESG and risk, addressing especially the systematic risk (Cerqueti et al., 2021, Zhang et al., 2023), the idiosyncratic volatility (Zhang et al., 2023), or topics like the relationship between ESG and economic policy uncertainty (Li et al., 2024). Additionally, some investigate the relationship between ESG practices and ownership structure, focusing on the implications of institutional ownership (Nofsinger et al., 2019; Chen et al., 2020). Others center on the consequences of ESG-guided investment. For example, Wang (2024) found that better ESG performance increases portfolio liquidity and weakens the investment funds performance-flow relationship. Finally, some connect ESG with decisions at the corporate finance level, like, for example, cash holdings (Chang et al., 2019).

However, the role of ESG in influencing default risk and the cost of debt has received only limited attention (Erragragui, 2018; Atif and Ali, 2021; Gillan et al., 2021). Some papers have found a negative relationship, suggesting that lenders perceive borrowers with higher ESG performance as less risky (e.g., Goss and Roberts, 2011; Ge and Liu, 2015; Polbennikov et al., 2016; Crifo et al., 2017; Zerbib, 2019; Jang et al., 2020; Apergis et al., 2022; Gao et al., 2022;

Agnese and Giacomini, 2023; Kong, 2023). However, certain studies have found no significant relationship (e.g., Menz, 2010; Hoepner et al., 2016; Erragragui, 2018; Gigante and Manglaviti, 2022) or the impact depends on the level of ESG investment (Ye and Zhang, 2011). Finally, others have revealed a positive relationship between ESG performance and the cost of debt (Magnanelli and Izzo, 2017). Thus, the evidence is mixed.

Some potential mechanisms have been proposed to explain the relationship between ESG scores and the cost of debt. One is the direct channel. Better ESG performance corresponds to lower default risk (e.g., Jang et al., 2020). Others are indirect channels. The ESG performance of a firm can interact with growth opportunities, influence the expected cash flows and, finally, impact the cost of debt (e.g., Luo and Bhattacharya, 2006). Companies with higher ESG scores may be better positioned to manage ESG risks, such as climate change and labor challenges, which can lead to improved financial performance and lower default risk. This can deliver lower borrowing costs and improved access to credit (e.g., Atif and Ali, 2021).

In the perspective that relates ESG directly to the cost of debt, the ESG score would measure – or, at least, have relevant information on – the risk of default and would be information that justifies a negative relationship between the ESG scores and the cost of debt. However, it is possible that ESG scores provide lenders with information not captured by traditional financial metrics (Clarkson et al., 2011). The perception of lower risk, not measured by conventional risk measures, can translate into lower borrowing costs for companies with higher ESG scores. The ESG score reduces information asymmetry (Jang et al., 2020). Thus, in this perspective, the ESG score is complementary information rather than a substitute for conventional credit risk measures. In this scenario, the ESG scores provide a full picture of what is happening inside companies. It is said to capture valuable risks that did not exist in the past and are not captured by other metrics.

The World Economic Forum (WEF) has drawn attention to environmental risks that have increased in importance significantly in recent years (World Economic Forum, 2023). In

contrast, classic economic risks are no longer major concerns. According to the WEF's 2023 Global Risk Report, six out of ten (including the first four) global risks ranked by severity over the next ten years are environmental risks. However, none of the traditional economic risks is in the top 10 major risks, either over a two-year or a ten-year horizon. Indeed, financial regulators are paying increased attention to the topic (Kalfaoglou, 2021). Consequently, it is natural, to ensure their legitimacy (Eliwa et al., 2021), that lenders (mainly banks and other regulated institutions) attach importance to ESG-related risks not captured by conventional financial risk measures. Thus, one of the main reasons for ESG's impact on the cost of debt is that it measures additional risks and injects new and forward-looking insights into the investment process not considered by classic financial tools.

This research aims to comprehensively evaluate the impact of ESG scores on the cost of debt. The investigation delves into potential mechanisms explaining the ESG scores and cost of debt relationship, considering both direct and indirect channels. The research assesses whether ESG scores provide information beyond traditional financial metrics (Altman Z-score, Z-score, Merton Distance to Default, and Volatility), aiming to determine whether they complement or substitute information for conventional risk measures. The study explores potential asymmetry in the effects of ESG scores on the cost of debt, focusing on whether highly indebted firms derive more significant benefits from higher ESG scores compared to those with lower levels of indebtedness. Furthermore, it analyzes how agency costs interact with ESG performance, investigating whether companies with higher agency costs experience a different impact of ESG scores on their cost of debt compared to those with lower agency costs. Lastly, the research examines the moderating effect of the type of financial system on the relationship between ESG scores and the cost of debt, considering distinctions between bank- and market-based systems. Overall, this study aims to comprehensively understand the multifaceted dynamics between ESG scores and the cost of debt in the corporate landscape. More specifically, the paper aims to answer the following research questions:

What is the nature and strength of the relationship between ESG scores and the cost of debt for non-financial firms? To what extent do ESG scores provide additional information beyond traditional financial metrics in influencing the cost of debt?

Is there an asymmetrical impact of ESG scores on the cost of debt, particularly in highly indebted firms?

How do agency costs interact with the influence of ESG scores on the cost of debt?

Does the type of financial system (bank-based vs. market-based) moderate the relationship between ESG scores and the cost of debt?

Effectively, this paper conjectures that, if ESG data provide reliable information on the firms' sustainability beyond the information captured by conventional risk measures, this information will be more relevant in some instances than others. In particular, it examines whether the ESG effect is moderated by the firm's debt level and its agency costs. Higher debt and higher leverage generally mean higher levels of risk captured by conventional risk metrics. Therefore, with high debt and leverage, companies are already required to pay more for credit. However, the conventional metrics may not entirely capture the companies' sustainability – that is, they do not capture the full picture. Even economically viable, heavily indebted organizations could find it challenging to generate enough cash flow to pay off all or a significant portion of their debt. Creditors need information about their long-term sustainability beyond conventional risk indicators based on accounting or capital market information. Therefore, the ESG scores are likely to have a more significant impact on highly indebted firms. However, no research has looked into the possible asymmetry of the ESG effect. This study seeks to shed some light on this issue.

For agency costs, a similar reasoning applies. Managers can invest in risky projects to benefit shareholders at the expense of creditors (Jensen and Meckling, 1976) or desist from investing in projects that benefit debtholders (Myers, 1977). Furthermore, managers can use free

cash flow on unprofitable projects or increase their own utility (Jensen, 1986). Therefore, agency costs negatively impact the cost of debt (Chui et al., 2016). This paper hypothesises that, as with the most indebted companies, those with the highest agency costs benefit most from good ESG performance. This idea finds support not only in the assumption that the sustainability of firms with higher agency costs gives rise to greater concern for creditors, but also in the expected behavior of managers. Indeed, bankruptcy puts the image of managers and firms at risk (Chui et al., 2016). The better the social reputation of firms, the more they are exposed to society and the more managers have at risk. This can lead them to moderate their risk-generating behaviors.

Finally, this paper explores the potential moderating effect of the type of financial system. Companies with higher ESG scores are more likely to have better stakeholder relationships (Hoepner et al., 2016). Such companies are more likely to access cheaper financing because lenders are more willing to lend to companies with a good reputation and strong stakeholder relationships (Clarkson et al., 2011). It can be argued that banks are the most important stakeholders in firms and that they will not want to be perceived as facilitators of harmful ESG practices (Eliwa et al., 2021). This can lead to improved access to credit and more favorable loan terms in contexts where banks and firms have long-term relationships, compared with cases where the relationships are at arm's length.

The relationship between banks and their stakeholders can vary. Banks and stakeholders, who include companies and individual customers, build long-term relationships through bank-based systems. These relationships are based on trust and rely on the bank's reputation and ability to deliver high-quality services (e.g., Marques and Alves, 2021; Moutinho et al., 2022). In market-based systems, the relationships between banks and their stakeholders are more transactional. Banks provide underwriting, advisory services, and securities trading, focusing more on specific transactions than long-term relationships (e.g., Marques and Alves, 2021; Moutinho et al., 2022). Therefore, if the transmission mechanism of the ESG score is the relationship with lenders, a greater impact can be expected in bank-based systems (e.g., some

European countries) than in market-based financial systems (which is the paradigm in the US but also in Brazil and some European countries). This paper provides evidence of this impact.

This paper uses a dataset of 768 non-financial firms headquartered in 21 countries (19 European, Brazil and the US) from 2013 to 2022. The inclusion of these distinct geographic locations allows us to explore different institutional contexts and realities. This diversity enhances the robustness and generalizability of the results and aids in assessing the applicability of hypotheses in various institutional and regulatory contexts. Moreover, these countries have different levels of stakeholder orientation. According to Dhaliwal et al. (2014), European countries are predominantly stakeholder-oriented, whereas the USA and Brazil are shareholder-oriented. Including companies from these diverse regions, this study is able to assess the proposed hypotheses in varied institutional and regulatory contexts, as well as in countries with different stakeholder orientations. This method improves the robustness and generalizability of the findings and provides a more thorough grasp of the topic studied.

This paper has several theoretical contributions. First, it contributes to advancing ESG-Debt knowledge by expanding understanding of the relationship between ESG scores and debt cost. It clarifies mixed evidence, addresses conflicting findings on the ESG-debt relationship, and offers insights into the nuanced dynamics that drive varying associations. The paper also evaluates whether ESG scores offer unique information beyond traditional metrics, contributing to the ongoing debate on whether ESG is a complement or substitute for conventional risk measures. The paper also enhances theoretical understanding by exploring both direct and indirect channels through which ESG influences debt costs, shedding light on the underlying mechanisms of this relationship. It examines asymmetry in the impact of ESG on debt costs, particularly focusing on highly indebted firms, providing a nuanced perspective on how ESG effects may vary. Additionally, it advances theoretical understanding by proposing and exploring the interaction between agency costs and ESG performance in shaping the cost of debt. Finally, the paper investigates the moderating effect of financial system types on the ESG-debt

relationship, adding a layer of complexity to the understanding of how institutional characteristics matter.

This paper provides practical insights for risk management practitioners, offering a nuanced understanding of how ESG scores go beyond traditional metrics in assessing default risk. It aids lenders in making more informed decisions by incorporating ESG-related risks into lending considerations, extending beyond conventional financial risk measures. The paper also guides companies in strategic planning, emphasizing the potential impact of ESG on debt costs and promoting sustainability practices for improved financial performance. Notably, it highlights the significance of ESG considerations for heavily indebted firms. Additionally, policymakers and financial regulators can benefit from insights emphasizing the relevance of considering ESG-related risks not captured by conventional measures and how factors like debt levels, agency costs, and financial system types moderate their impact.

The paper is organized as follows. The following section contains the literature review and the formulation of the hypotheses. The subsequent section presents the methodology and the database. Section four presents and discusses the results. The last section presents the study's conclusions.

2. HYPOTHESIS DEVELOPMENT

The ESG score is a measure of a company's performance in the areas of environmental, social, and governance. According to Khan et al. (2016) and Cohen (2023), among others, ESG scores comprehensively assess a company's sustainability practices, enabling investors to make informed decisions. The scores synthesize various data sources, including company disclosures, news articles, and third-party databases. Furthermore, the ESG scores are dynamic, reflecting changes in the company's practices over time.

The literature is extensive on ESG in corporate finance (for a review, see Gillan et al., 2021). Several studies have examined the impact of ESG practices on companies' performance and cost of capital (e.g., Chava, 2014; Flammer, 2015; Ng and Rezaee, 2015; Breuer et al., 2018). However, contradictory results prevail, and more research is needed (Erragragui, 2018; Atif and Ali, 2021; Gillan et al., 2021). In this field, some literature, albeit relatively scarce, has explored the link between ESG scores and debt financing. This literature rests on two main pillars. First, the impact that the ESG score has on the cost of debt. Second, the mechanisms through which the ESG score relates to the cost of debt. The following paragraphs aim to develop a literature review of these two dimensions to sustain the hypothesis.

2.1 Information content in ESG and the cost of debt

In recent years, several studies have examined the impact of ESG performance on various financial outcomes, including the cost of debt. Some studies found that companies with higher ESG scores have lower borrowing costs than companies with lower ESG scores. For example, using a dataset of US banking loans, Goss and Roberts (2011) report that borrowers with high social responsibility concerns pay between 7 and 18 basis points more than others who are more responsible. Similarly, Apergis et al. (2022) found that higher ESG scores were associated with lower bond spreads. Moreover, Chava (2014) revealed that the cost of capital (equity and debt) is

higher for firms with low environmental performance. Similarly, Oikonomou et al. (2014) and Polbennikov et al. (2016) found that corporate bonds with high composite ESG scores have slightly lower spreads. Zerbib (2019) noted that green bonds are issued at a negative premium. The negative relationship between ESG scores and bond spreads also applies to sovereign borrowing (Crifo et al., 2017). In another approach, Gao et al. (2022) uncovered evidence that the cost of debt is significantly reduced in Chinese corporations that benefit from a positive media ESG spotlight.

The impact can vary according to the borrower's characteristics. Jang et al. (2020) found that companies with higher ESG scores have lower borrowing costs, especially small companies with higher information asymmetry. Overall, these studies suggest that ESG disclosure contributes to reducing borrowing costs and enhancing the creditworthiness of companies. Furthermore, investors may be willing to accept lower returns from companies with strong ESG practices because of the lower risk of adverse ESG events and the potential for long-term financial outperformance. However, Ng and Rezaee (2015) conclude that environmental and governance aspects of ESG contribute to reducing borrowing costs, but the same does not apply to the social dimension. Additionally, Ye and Zhang (2011), using data from corporate philanthropy by Chinese corporations, show that expenditures beyond the optimal point tend to increase rather than reduce the cost of debt. Therefore, according to this paper, the relationship between ESG performance and the cost of debt depends on the level of ESG investment.

Moreover, other studies have found no significant relationship between ESG scores and the cost of debt. For example, Hoepner et al. (2016), using data from 28 jurisdictions, found that the country's sustainability score is associated with a decrease in the cost of debt of bank loans but, at the firm level, ESG scores did not impact such costs. Similarly, Erragragui (2018) found that only a few constituents of ESG scores matter in 'creditors' perception of company' risk in the US market and, in particular, environmental concerns increase the cost of debt while governance concerns have no impact. Additionally, Menz (2010) found that ESG performance does not

impact the pricing of corporate bonds. Moreover, Gigante and Manglaviti (2022) concluded that no significant relationship exists between ESG scores and the cost of debt in the European market. Finally, there is evidence of a positive relationship between ESG performance and the cost of debt. Magnanelli and Izzo (2017), using a dataset of 332 firms from different continents, found that higher ESG scores are associated with a higher cost of debt.

In summary, some literature supports the relevance of the ESG score in explaining the cost of debt, arguing that companies with higher ESG scores tend to have lower borrowing costs. However, other studies have found mixed results, highlighting the need for further research to fully understand the relationship between ESG scores and the cost of debt.

Moreover, from a theoretical perspective, there are reasons to expect firms with higher ESG scores to have lower borrowing costs. Either a higher ESG score corresponds to lower credit risk, given the greater sustainability and better business governance, or a higher ESG score translates into a better long-term relationship with stakeholders, including lenders. In effect, a firm can use its resources, including the intangible assets of reputation and social capital, to increase its financial performance and risk management (Atif and Alif, 2021). ESG is a strategic resource that firms utilize to enhance their reputation, improve cash flows, attract investors, and mitigate risks (Teece et al., 1997). By achieving a high ESG score, firms demonstrate their commitment to sustainable practices, stakeholder engagement, and long-term value creation, potentially reducing default risk. For instance, ESG performance has been linked to brand value and customer happiness, consumer loyalty, and increasing sales and profitability (Brown and Dacin, 1997; Luo and Bhattacharya, 2006, Bardos et al., 2020). Others contend that ESG increases productivity (Shrivastava, 1995) and performance due to product differentiation (Albuquerque et al., 2019). Therefore, high scores can be an indicator of higher future cash flows.

Furthermore, Cho et al. (2013) found that sharing ESG data helps reduce knowledge asymmetry, which fosters investor loyalty and trust. In times of crisis, Garel and Petit-Romec

(2021) found that firms with responsible environmental strategies experienced better stock returns during the COVID-19 crash. However, Bae et al. (2021) found no evidence that corporate social responsibility scores affect stock returns during the same period.

Finally, firms with high ESG performance benefit from having a broader spectrum of potential investors and from having policies that favour investing in green securities. The first case includes all socially responsible investment funds, for which companies with better environmental, social, and governance performance are more attractive (Peng et al., 2023). The second case includes policies such as the Green Quantitative Easing of ECB, a monetary programme consisting of buying green bonds issued by companies responding to climate issues instead of buying assets (Aloui et al., 2023).

Therefore, giving due consideration to all the above (risk mitigation, long-term performance, investor preferences, regulatory and market trends arguments), the first part of the first hypothesis is as follows:

H1: The level of the ESG score provides relevant information to explain the cost of debt. Specifically:

a) *Ceteris paribus*, the higher the ESG score, the lower the cost of debt.

Figure 1 aims to clarify the logic of the hypotheses. In this context, this hypothesis means that the sum of the A and B effects is non-null, and the sign of this sum is negative.

Having ESG score content that explains the cost of debt, another question arises. Is such content a substitute for traditional credit risk measures, or is it complementary information that provides additional relevance and contributes to reducing information asymmetry? In many countries, ESG information is voluntarily disclosed (Dhaliwal et al., 2014). Therefore, it is unlikely that information on ESG performance provides much incremental information. In this sense, if relevant, it would act as a substitute rather than a complement. However, the ESG score can capture non-financial risks, such as environmental and social impacts, governance practices,

and ethical considerations. It is also true, as mentioned earlier, that new and non-financial risks concern firms, creditors, and regulators. It is likewise true that banks are increasingly forced to consider these risks and weigh their clients' environmental and social performance in the balance (Eliwa et al., 2021; Kalfaoglou, 2021). Hence, these other forces point to the relevance of the ESG score's information content and its function as a complement to traditional financial information.

A holistic view of a company's performance and risk profile beyond traditional financial metrics is increasingly encouraged (Palmieri et al., 2023). While financial risk measures focus on monetary aspects, ESG factors encompass non-financial dimensions, offering a more comprehensive risk assessment. ESG factors often capture elements related to a company's long-term sustainability, ethical practices, and social responsibility. Traditional financial risk measures may primarily measure sustainability for the debt maturity period, and the integration of ESG data enhances the evaluation of a firm's overall resilience and adaptability for more extended periods.

Additionally, ESG information reflects how a company is perceived by stakeholders, including customers, employees, and the wider community. Poor ESG performance can lead to reputational damage and stakeholder disapproval, aspects not fully captured by financial risk measures (Hong and Liskovich, 2015). Therefore, ESG information adds valuable insights into the potential reputation, including regulatory and legal risks. Finally, ESG scores may be an additional layer of information that traditional financial metrics might not fully capture, which is valuable for a growing investor base that invests considering ESG practices (Peng et al., 2023).

The few empirical studies that have looked into this matter have had mixed results. Atif and Ali (2021) conclude that ESG information is positively related to the Merton Distance to Default (Merton DD) and negatively related to credit default swap (CDS) spreads, indicating its character as substitute information. Palmieri et al. (2023) show that improvements in environmental scores reduce the probability of default. In the same vein, Ge and Liu (2015)

present evidence that ESG performance is associated with lower yield spreads, but credit ratings absorb some of the effects. Jiraporn et al. (2014) found that ESG leads to more favorable bond ratings. Moreover, Hübel and Scholz (2020) discovered that portfolios with pronounced ESG risk exposures exhibit substantially higher risks. According to Dhaliwal et al. (2014), corporate social and financial disclosures are substitutes for each other in lowering the cost of equity capital. Finally, Cheung (2016) contends that firms with high corporate social responsibility scores tend to have low (idiosyncratic and systematic) risk. In contrast, Stellner et al. (2015), using credit ratings and zero-volatility spreads as risk measures, located only weak evidence that superior corporate social performance results in systematically reduced credit risk.

Other studies have shown that the ESG score provides additional information beyond traditional risk measures, such as credit scores and financial ratios. In this context, Jang et al. (2020) showed that ESG information complements credit ratings, especially in small companies. Hong and Liskovich (2015) argue that it is an insurance against 'firms' legal risk. Cho et al. (2013) also conclude that corporate social responsibility scores reduce information asymmetry. Consequently, ESG factors in the risk assessment process can lead to more informed lending decisions and lower company borrowing costs.

Therefore, the second part of the first hypothesis is the following:

H1: The level of the ESG score provides relevant information to explain the cost of debt. Specifically:

b) The information content in the ESG's score is a complement to rather than a substitute for the information content provided in traditional financial risk measures.

In Figure 1, this hypothesis means that, in absolute terms, the effect of relationship A is, in absolute value, greater than the effect resulting from relationship B.

2.2 Moderating Effects of the Level of Debt and Agency Costs

Conventional risk metrics fundamentally measure economic and financial risk. However, there is now awareness of other threats and the relevance of risks not previously recognized. As the World Economic Forum (2023, p. 6) points out, "*the world is facing a set of risks that feel both wholly new and eerily familiar*". It is significant that, according to this entity, none of the top ten global risks ranked by severity over the short and long term is economic or financial. It is hard to believe that banks and other creditors are not sensitive to this reality. Indeed, financial regulators are particularly attentive to this and exercise their regulatory power and influence (Kalfaoglou, 2021). On its website, the ECB clearly states that climate change poses risks to the economy and the financial sector and that "*we are firmly committed to doing our part to address climate change, within our mandate*" (European Central Bank, 2023).

Lenders incorporate companies' ESG information into their lending decisions to assess at least two types of risk: reputational risk and credit risk (Weber et al., 2010). Reputational risk is the risk of perceiving the lender as a financial enabler of harmful ESG practices. It predominantly affects credit institutions and other financial institutions. Credit risk is the risk of losing the principal amount of the loan plus any mediation costs that the lending institution has to bear. Concerning reputational risk, financial institutions avoid being associated with entities with low ESG performance. In this sense, the ESG score should be helpful information for all borrowing companies, regardless of their level of indebtedness. Public knowledge that a bank finances a company with poor ESG practices causes reputational damage, whatever its credit risk. Assuming that the probability of such financing becoming publicly known is the same for all companies, the impact of the ESG on the cost of debt would not be expected to depend on the level of company indebtedness. The level of debt would not be a moderating variable, and the benefit extracted by firms per unit of ESG score would not depend on whether firms have too much or too little debt. However, consider a situation where there is a higher probability of loan relationships becoming known if firms go bankrupt or need restructuring. Here, lenders, for reputational reasons (Weber et al., 2010), will tend to value the ESG score more when firms are

highly indebted. A banking loan provided to a non-failing company with a lower ESG score probably will never be known by the public. However, a loan provided to a failing company with a lower ESG score will probably be noticed, and the reputational damage will materialize. In this line, Galletta et al. (2023) provide evidence supporting the importance of ESG drivers on banks' reputation and operational risk management.

Conventional measures are aimed at capturing credit risk fully. At least, this should be the case with those who incorporate perspectives into their calculations on the company's future cash flows, such as the Altman Z-score and the Merton DD, insofar as both use the company's market capitalization as input. Nevertheless, ESG can provide reliable information on firms' sustainability and their competitive advantage beyond the information captured by conventional risk measures. The idea of the full picture (holistic view of a company's risk profile) once again applies (Palmieri et al., 2023). A company with better ESG performance can use its improved long-term relationship with its stakeholders and critical constituents to generate a comparative advantage and improve its long-term financial performance (Hoepner et al., 2016). Such a company will be better prepared to deal with adverse situations (Brown and Dacin, 1997; Luo and Bhattacharya, 2006; Atif and Ali, 2021). Although not fully captured by conventional risk measures, this information is still valuable for those who have to price credit. However, this information is not necessarily of equal benefit to all firms. This paper hypothesizes that this information is of greater relevance to more indebted companies and those with higher agency costs.

Once higher debt and higher leverage mean higher levels of risk captured by the conventional risk metrics, the gross effect of higher indebtedness is captured and priced throughout the traditional metrics. If a company has a low level of debt and, therefore, is a low-risk borrower according to conventional measures, the remaining concerns of the lender would be negligible. However, if a firm has a high level of debt, despite their risk according to traditional measures, the lenders will naturally pay more attention to additional information. The

lenders will be most concerned about the sustainability of these companies. For all companies, the creditors are concerned about the timely fulfilment of the debt service. However, for low-indebted companies, there are potentially two ways to repay the outstanding capital: payment with the cash flows accruing from the company's operations; debt roll-over, where the company takes on new debt to repay the old debt. The highly indebted companies, even those that are economically sustainable, may struggle to generate sufficient cash flow to repay all or even a large part of their debt. Therefore, they will most likely need to finance debt repayment (at least partially) by taking on new debt. Information on their long-term sustainability – going beyond traditional risk measures based on accounting or capital market information – can be crucial for them. Hence, as mentioned previously, the impact of ESG on the cost of debt is expected to be of particular significance statistically and economically in the case of the most indebted companies. Therefore, the ESG effect will tend to have a more significant impact on more indebted companies.

Finally, another correlation mechanism between ESG scores and debt costs may result from the credibility that these scores give to the company's confidence in generating high cash flows in the future. Signalling theory suggests that more indebted companies have higher debt levels because they are more confident about the future than others. However, for these signals to materialise in lower debt costs, they need to be credible. The ESG performance can help confer such credibility. High ESG scores signal management's commitment to reducing negative business risks by adopting sound corporate environment, social, and governance policies (Li et al., 2023). Thus, the return of high ESG scores, in terms of lowering the cost of debt, may be higher for those with high debt levels than those with low levels of indebtedness.

For all the above reasons, the second hypothesis of the paper is as follows:

> **H2:** The information content in the ESG score is especially relevant to companies with a higher level of debt, who benefit more extensively from higher scores.

In Figure 1, this hypothesis is equivalent to saying that for companies with higher debt levels, the route is C (more robust) and not D (less impactful).

Regarding agency costs, many authors see ESG efforts as a waste of resources. They contend that managerial agency issues frequently reveal themselves through ESG activities (Benabou and Tirole, 2010; Masulis and Reza, 2015). According to others, managers involved in ESG activities waste time and lose focus on their core responsibilities (Jensen, 2001). The agency perspective would have it that ESG activities are generally not in the interest of shareholders. However, agency costs exist not only in the relationship between managers and shareholders but can affect a wide range of stakeholders (Hill and Jones, 1992). In effect, managers can choose not to invest in projects that help debtors (Myers, 1977) or invest in hazardous ventures that benefit shareholders at the expense of creditors (Jensen and Meckling, 1976). Moreover, managers can invest free cash flow in unsuccessful ventures or boost their utility (Jensen, 1986). As a result, agency expenses may be detrimental to creditors' interests and raise the cost of borrowing (Chui et al., 2016). According to this view, ESG efforts and agency costs would be positively correlated, and both would contribute to an increase in the cost of debt.

However, another view exists. While agency issues may influence some corporate policies related to ESG issues, others may result from good governance and positive stakeholder relations consistent with value maximization. Or, even more radically, ESG performance is positively related to firm value and is negatively associated with firms' risk and agency costs (Hill and Jones, 1992; Ferrell et al., 2016; Rossi and Harjoto, 2020). In this sense, there is nothing to prevent a company from having good ESG performance, which materializes in lower debt costs, while having agency costs that contribute to lower efficiency and higher cost of financing.

Therefore, some literature sees the ESG score as not being a mere manifestation of agency costs. Several studies point to the fact that better ESG performance corresponds to lower

financing costs (e.g., Goss and Roberts, 2011) and better relations with consumers that are reflected in brand value, customer happiness, and consumer loyalty. In consequence, this leads to increased sales and profitability (Brown and Dacin, 1997; Luo and Bhattacharya, 2006, Bardos et al., 2020), enhanced potential to increase productivity (Shrivastava,1995) and follow product differentiation strategies (Albuquerque et al., 2019). Hence, in this other view, there is nothing to prevent the ESG score from reducing the cost of debt, while agency costs influence it positively. In this case, the question is whether there is any interaction effect between the two variables. Do agency costs moderate the impact of the ESG on the cost of debt? For the following reasons, this paper hypothesizes that the interaction of the ESG score with agency costs decreases the cost of debt.

When a company takes excessive risks due to agency problems, the likelihood of long-term bankruptcy increases. Consequently, its managers' public image is put at risk. Managers concerned about their public image and security tend to adopt financial policies that minimize their firms' bankruptcy risk (Chui et al., 2016). Thus, the better this public image is, the more managers have to lose if the firm goes bankrupt. Companies with higher ESG scores are companies with a better image (i.e., higher social capital) among their stakeholders and the general public (Hoepner et al., 2016). Hence, they have the most to lose in case of bankruptcy (Chui et al., 2016). They will, therefore, be more concerned about external costs in the event of bankruptcy. In firms with good social capital, the managers are more concerned with maintaining employment and the welfare of employees, and with the relationship with consumers and suppliers. The bankruptcy of the firm jeopardizes all the benefits. Hence, although the information asymmetry that managers benefit from allows them to impose agency costs on shareholders and creditors, managers tend to be more cautious when the firm's relations with its stakeholders are more harmonious.

Additionally, better ESG performance will likely mitigate investor concerns about inefficiencies arising from agency costs. Indeed, the higher the agency costs, the less efficient the

use of company assets tends to be. Some tend to be used for comfort and maximizing the welfare of managers. However, better ESG performance can counterbalance this effect because it indicates that companies will have more efficient governance control mechanisms in place and will pay greater attention to using resources sustainably and with social responsibility. Additionally, a high score can enhance credibility by indicating a commitment from management to mitigate business risks through adopting robust ESG policies (Li et al., 2023). All this will help to mitigate the fears of investors, including lenders, concerning agency costs and, thus, minimize their effect on financing costs.

Therefore, the third hypothesis of the paper is as follows:

> **H3:** The information content of the ESG score is of particular relevance to companies with a higher level of agency, who benefit more extensively from higher scores.

In Figure 1, this hypothesis is equivalent to saying that for companies with higher agency costs, the route is C (more robust) and not D (less impactful).

2.3 Moderating Effects of Financial System

One of the possible transmission mechanisms from ESG scores to the cost of debt is the long-term relationship with stakeholders. Companies that maintain excellent long-term relationships with stakeholders benefit from better dealings (Cornell and Shapiro, 1987; McGuire et al., 1988), and they secure greater support from these stakeholders in a crisis (Godfrey, 2005). ESG reputation exercises an insurance-like effect in adverse situations (Godfrey, 2005; Godfrey et al., 2009; Shiu and Yang, 2017). Thus, firms that are more stakeholder-oriented will tend to have better long-term relationships with their suppliers, customers, and creditors than firms that are more shareholder-oriented. While the orientation of each firm may change over time and may be distinct from other firms in its country (Alves, 2022), the legal environment and institutional environment in which firms operate, including the

financial system, will influence their orientation. Thus, the institutional environment, and therefore the country, may matter.

With less proximity to companies than in bank-based systems, creditors in market-based financial systems tend to base their decisions predominantly on conventional financial indicators, giving less importance to non-financial information and taking a less holistic view of the company. In this sense, creditors are expected to value information on ESG issues more highly in financial systems where long-term relationships, and the relationship lending, predominate (Ergungor, 2008). In these contexts, non-financial, frequently qualitative, is considered in the decision-making process related to the cost of debt (Moutinho et al., 2022), and high scores pay off because borrowers need to build a good reputation to reduce the cost of borrowing (Ergungor, 2008).

Evidence shows that debt costs vary according to the type of financial system and the inherent information asymmetry between borrowers and lenders (Carey and Nini, 2007; Moutinho et al., 2022). In particular, there is less information asymmetry in countries with bank-based financial systems due to the long-term relationship between banks and their corporate clients (Marques and Alves, 2021; Moutinho et al., 2022). Depending on the type of financial system, the relationship between banks and their stakeholders may differ. In bank-based systems, banks have a long-term connection with their stakeholders, which includes businesses and individual clients. The interaction between banks and their stakeholders is more transactional in market-based systems. Therefore, if the relationships with lenders serve as the ESG score's transmission mechanism, it is reasonable to assume that these relationships will have a more significant impact in bank-based financial systems (such as those in some European nations), where businesses rely more on bank loans than those in market-based financial systems (which include the US, Brazil, and some European countries). It, therefore, encompasses companies from countries with typically bank-based financial systems and from countries with a market-based financial system. Thus, the fourth hypothesis is as follows:

H4: The more market-oriented the financial system, the lower the benefit of ESG performance in terms of the cost of debt.

In Figure 1, this hypothesis is equivalent to saying that in a market-oriented financial system, the route is D (less impactful) and not C (more robust impact).

3. METHOD AND DATA

3.1 Sample and Data

This sample includes 768 listed companies, covering the period from 2013 to 2022.[1] The companies were selected on the basis of membership in the S&P 500 Index, the S&P Europe 350 Index, and the Bovespa Index. Financial companies were eliminated. The final sample comprises 403 US companies, 294 European companies, and 71 Brazilian companies from 10 sectors. The number of countries represented is 21. This results in an unbalanced panel with a maximum of 6,988 firm-year observations.

The sample includes companies from different institutional environments. It should be noted that, in the US, firms are predominantly shareholder-oriented and principal-agent problems predominate, whereas, in Brazil and Europe, principal-principal issues prevail. However, European countries are mainly stakeholder-oriented, whilst Brazilian firms are shareholder-oriented. La Porta et al. (1999) show that dispersed ownership is rare in Europe, whereas it predominates in the US. Rogers et al. (2008) proved that ownership concentration prevails in Brazil. Additionally, Dhaliwal et al. (2014)'s measure of shareholder orientation points to a solid orientation for shareholders in the US (-1.55) and in Brazil (-1.92). However, most European countries show a solid orientation for stakeholders – *e.g.*, Austria, 1.25; Belgium, 1.29; Denmark, 2.95; Finland, 1.89; France, 1.12; Germany, 0.81; Netherlands, 1.52; Sweden, 2.90; UK, 0.47. Finally, it should be noted that the sample covers geographical areas where most assets are dedicated to sustainable investment. The market share of regions included in terms of total assets allocated to sustainable investment is over 93% of the total (OECD, 2000).

Furthermore, the sample is diversified in terms of the sectors of activity. It comprises ten industries, using the TRBC Economic Sector Name: Healthcare; Technology; Consumer

[1] In 2012, the percentage of listed companies with an ESG score was only around 5% in the US and the EU and just over 3% in the rest of the world. It was from 2015 that this percentage began to rise significantly, reaching 25 per cent in the US in 2019 (OECD, 2020). Therefore, extending the analysis to before 2013 probably would not provide any additional relevant information.

Cyclicals; Academic and Educational Services; Industrials; Utilities; Energy; Real Estate; Basic Materials; and Consumer Non-Cyclicals.

This study, in line with Bae et al. (2021) and Garel and Petit-Romec (2021), among others, uses ESG scores from the Refinitiv ESG database (formerly Thomson 'Reuters' ASSET4). It also uses Datastream for the remaining financial data. Finally, the World Bank Financial Development and Structure Data provide the sources to build 'countries' financial development, structure indicators, and consumer price indicators. The raw data were winsorized at the 1% and 99% levels.

3.2 Univariate and multivariate analysis

The univariate analyses constitute a preliminary investigation with the aim of ascertaining to what extent there is differentiation of the (marginal and average) cost of debt as a function of the ESG score and the extent to which the ESG score is confounded by traditional risk variables.

The central methodology consists of multivariate regression analysis. The dependent variable is the Marginal Cost of Debt (CoD). The marginal cost captures the effect of changes in the ESG score on the cost of debt more quickly than the average cost. CoD is the cost to the company of issuing new debt, calculated by Refinitiv, adding the weighted cost of short-term debt and the weighted cost of long-term debt based on the 1-year and 10-year points of an appropriate credit curve. It is the debt component of the WACC (Weighted Average Cost of Debt), as computed by Refinitiv.

There are several ways to compute the cost of debt. One is the marginal cost of debt (e.g., Caragnano et al., 2020; Kordsachia, 2021); another is the average cost of debt (e.g., Chui et al., 2016; Eliwa et al., 2021; Kong, 2023); a third is the yield of bonds (Crifo et al., 2017; Apergis et al.; 2022); and a fourth is a spread (e.g., Goss and Roberts, 2011). The third applies exclusively to firms with securitized debt and only computes the cost of debt to the maturities of issued

bonds. The average cost of debt – the ratio of current interest payments to total debt – reflects the creditor conditions of the firm at the time of borrowing and not the current conditions. Hence, it takes time to reflect ESG scores or, for example, changes in the capital structure.

On the contrary, the marginal cost, as calculated by Refinitiv, reflects the current financing conditions of the company and is, therefore, likely to immediately incorporate changes in the ESG score. Indeed, determining the appropriate credit curve for a company encompasses various risk factors, including company-specific information, credit ratings, and the current economic environment. Moreover, it is the firm's marginal real cost. It is also an after-tax cost of debt (Kordsachia, 2021) and is, therefore, more appropriate for comparing financing costs between firms in different countries. For these reasons, the dependent variable of the regressions is the marginal cost of debt. However, some univariate analyses use the average cost of debt, and some robustness tests also use this as the dependent variable.

The main variable of interest is the ESG score. The study contemplates two variants. One set of initial regressions uses the ESG scores without adjustment. An additional set of regressions uses orthogonalized ESG variables – that is to say, variables that retain the component of the ESG score that is not explained by any or some of the traditional risk measures.

The set of explanatory variables includes one or more traditional risk measures: Altman Z-Score, the Z-Score, Merton Distance to Default and Volatility.

In addition, the control variables include the SIZE (log of total assets), the INTANGIBLES (i.e., intangible assets/total assets), and the ROA (return on assets). As referenced earlier, the literature suggests that size (negatively), intangibles (positively), and ROA (negatively) can impact a company's cost of debt (see, among others, Chui et al., 2016; Atif & Ali, 2021).

Finally, there are fixed effects. The period (year) fixed effects to control for the decrease in the global level of interest rates due to the monetary policies adopted by the central banks.

Given the ratio between the number of observations and coefficients to estimate substantial decreases, cross-section fixed effects were not included to avoid overfitting, in violation of the rule of thumb, the "one in ten rule". However, the regressions include industry and region-fixed effects. This was prompted by certain studies that provide evidence that the cost of debt can vary geographically (Carey and Nini, 2007; Moutinho et al., 2022) and according to the industry (Valta, 2012).

Therefore, the baseline model is the following:

$$CoD_{i,t} = \alpha + \beta_1 ESG_{i,t} + \sum_{j=1}^{4} \beta_{2j} RISK_{j,i,t} + \beta_3 SIZE_{i,t} + \beta_4 INTANGIBLES_{i,t} + \beta_5 ROA_{i,t} + \mu_t + v_i + w_i + \varepsilon_{i,t}$$

where, in addition to the variables already identified, $RISK_{j,i,t}$ stands the risk measure j (j=1,..,4) for the company i in the year t, and the term μ_t denotes the unobserved time-specific effect, whereas v_i and w_i stand for the industry and region effects, and $\varepsilon_{i,t}$ is a random disturbance.

All regressions use robust standard errors. Propensity Score Match and IV 2LS regressions are applied in the robustness checks.

3.3 The orthogonalization of the variable ESG

A two-step methodology was applied to orthogonalize ESG variables. In the first step, the ESG variable was the dependent variable in a regression that had, depending on the case, one or more traditional risk measures as explanatory variables. In the second step, the residuals of the first regression were the component of the ESG variable not explained by the traditional risk measure (i.e., the orthogonalized ESG variable).

To calculate the orthogonalized ORT_ALL variable, all four traditional risk measures were used as regressors. Only the relevant traditional risk measure was included as a regressor in the first-step regression for the remaining orthogonalized variables. The Altman score was

employed to calculate ORT_ALT, the Z-score, to obtain ORT_Z, the Merton Distance to Default to get ORT_Merton DD, and Volatility to obtain ORT_VOL.

The second step's regressions differ from the baseline regression in section 4.2 because an orthogonalized variable replaces the ESG.

3.4 The traditional measures of risk

There are several measures of financial risk, some of which aim to capture the risk of a debtor's bankruptcy. This paper uses four risk measures: the Altman Z-Score, the Z-Score, the Merton Distance to Default, and Volatility.

Altman Z-score

The Altman Z-score model is a widely used approach to assess the risk of corporate bankruptcy (Altman,1968). Over the last 50 years, many studies have investigated the performance of the Altman score in predicting corporate bankruptcy. The original paper has more than 23,700 citations, according to Google Scholar. Even today, the model is widely used to measure the risk of default (Pandey et al., 2023). The original formula of the Altman score was applied in this study.

However, some researchers have identified limitations of the Altman score model. For instance, some studies have suggested that introducing predictive variables that can be extracted from the maturity schedule of a firm's long-term debt enhances bankruptcy prediction (e.g., Philosophov et al., 2008). Therefore, other measures are applied.

The Z-score

The Z-score derived by Boyd and Runkle (1993) also measures bankruptcy risk. Default occurs when firm j's losses in year t exceed its equity. Then, assuming that the return on assets

(ROA) or π_{jt}/TA_{jt}, is normally distributed around the mean μ_j, and standard deviation σ_j, the Z-score corresponds to the number of standard deviations of the ROA that the firm is from bankruptcy. It is calculated as follows:

$$Z_{jt} = \frac{\left(\frac{E_{jt}}{TA_{jt}}\right) + \pi_{jt}/TA_{jt}}{\sigma_j}$$

The higher the Z-score, the lower the probability of bankruptcy. The Z has been widely used as a measure of default risk, especially for financial institutions (see, among others, Marques and Alves, 2021; Alves et al., 2023) but also for non-financial institutions (see, among others, Hale and Santos, 2008).

Merton Distance to Default

The Merton DD, developed by Merton (1974), is computed as the number of standard deviations between the expected asset value at maturity date T and the liability threshold:

$$Merton\ DD = \frac{\ln\left(\frac{A}{L}\right) + \left(r - {\sigma_A^2}/{2}\right)T}{\sigma_A\sqrt{T}}$$

where *A* represents the market value of the assets, *L* represents liabilities, *r* is the risk-free interest rate, *T* is the maturity of the liability, and σ_A is the volatility of the assets.

The Merton approach was applied to solve for (A, σA), a 2-by-2 system of nonlinear equations. The first equation is the Black and Scholes formula. The second relates the unobservable volatility of asset σ_A to the given equity volatility σ_E:

$$\sigma_E = \frac{A}{E}N(d_1)\sigma_A.$$

The level of debt used to compute Merton DD was, following Bharath and Shumway (2008), the face value of short-term debt plus one-half of the face value of long-term debt.

The Merton DD model has been widely applied. Altman (1984) found that the Merton DD model reliably predicts default events. Subsequent studies have confirmed the predictive power of the Merton DD model.

Volatility

Volatility is a commonly used risk measure in finance, particularly in investments. The literature supports the hypothesis that firms with high corporate social responsibility scores tend to have low (idiosyncratic and systematic) risk (Cheung, 2016). In the case of this paper, it was calculated using 5-year historical data, where available.

3.5 The type of financial system

This paper uses the methodology proposed by Demirgüç-Kunt and Maksimovic (2002), Beck and Levine (2002), and Levine (2002) to measure the type of financial system. Therefore, the ' 'country's financial structure indicator (FINSYS) is the first principal component resulting from the aggregation of three indicators: structure-activity, structure-size, and structure-efficiency. The data is sourced from the World Bank Financial Structure Database.

The structure-activity indicator measures the relative level of capital market activity. It is the logarithm of the ratio between (1) the total value of transactions in domestic securities on national stock exchanges divided by GDP and (2) the value of bank credit granted to the private sector divided by GDP. The Structure-Size indicator measures the relative size of the capital market compared to the banks. It is the logarithm of the ratio between (1) the value of the market capitalization of national shares admitted to trading on national stock exchanges and GDP and (2) the value of bank credit granted to the private sector divided by GDP. Finally, the structure-efficiency indicator is the logarithm of the product between (1) the total value of transactions in national securities on national stock exchanges divided by GDP and (2) the overhead costs ratio

(i.e. the operating costs of the banking system divided by the total assets of the banking system).The higher the value of the FINSYS, the closer the country is to the prototypical market-based financial system. This paper's values range from -1.362 (France) to 1.894 (US).

3.6 Agency costs

The inverse of the asset utilization ratio is a common proxy for agency costs in the finance and accounting literature (Ang et al., 2000; Chui et al., 2016). It indicates how efficient the firm is at generating revenues from total assets. If managers intentionally allocate capital to acquire assets for non-profit maximizing purposes, or if their behavior reduces asset utilization efficiency, agency costs are most likely present, and the asset-to-sales ratio will increase. Therefore, the asset-to-sales ratio measures the propensity for agency activities to be present (Chui et al., 2016). However, asset utilization depends on the type of activity. Hence, although the regressions control for industry, the difference between each firm's asset-to-sales ratio and its industry's historical average (named AS) was used as a measure of agency cost. In other words, the agency costs are measured as the difference between each firm's asset-to-sales ratio (total assets divided by total revenue) each year and the average asset-to-sales ratio of firms in the same sector for the ten years of the sample.

4. RESULTS AND DISCUSSION

4.1 Descriptive Statistics

Table 1 presents the essential descriptive statistics (Panel 1) and the Pearson's correlation coefficients between the main variables of the study (Panel 2). Two points stand out. First, there is a negative correlation between ESG scores and CoD (-0.16). Second, the relationship between GES scores and financial risk depends on the risk measure. The higher the value of the ESG score, the lower the risk, measured by Merton DD or Volatility. The Altman score correlation (-0.20) indicates the opposite. The Z-score, with a low correlation level (-0.05), aligns with the Altman score.

– Table 1 –

As regards the correlation of the CoD with traditional risk measures, the signs are as expected in all cases (higher risk corresponds to higher cost of debt and vice versa). The absolute value is, however, small in the case of Merton DD.

Therefore, Table 1 suggests that hypotheses H1a) will be accepted. It will enable us to foresee that a higher (lower) ESG score must correspond to a lower (higher) CoD. The low correlation levels between the ESG score and the risk measures, plus the exchanged signs in the case of Altman and Z-scores, also indicate that the information content of the ESG, if relevant, will be a complement to rather than a substitute for the risk measures.

4.2 Test of H1a) and H1b)

4.2.1 Univariate Tests

Table 2 shows that higher ESG scores correspond to a lower cost of debt, whether this is calculated on the basis of the average or the marginal cost of debt. In the construction of Table 2,

the observations were sorted and divided into quartiles according to the ESG scores. The column Q4-Q1 reports the difference between the cost of debt means for the quartiles with higher ESG scores (Q4) and lower ESG scores (Q1). In all situations, the null hypothesis that the mean values for Q1 and Q4 are equal is rejected in favor of the alternative hypothesis that the cost of debt is higher for observations in quartile Q1. Analyzing by regions, the average cost of debt is lower for firms with higher ESG scores in all subsamples. However, the difference is much narrower in the US than in Europe or Brazil.

- Table 2 –

This first, straightforward exercise shows that a higher ESG score is associated with a lower (average or marginal) cost of debt. The Q4-Q1 difference in the US is narrower compared to Europe or Brazil, and several factors can contribute to this. First, higher interest rates in Brazil result in elevated risk spreads. Second, the disparity in average ESG scores between Q4 and Q1 quartiles is smaller in the US (33.5) compared to Europe (38.4) and Brazil (48.5). Therefore, the cost of debt can reflect differences in ESG performance among companies in distinct sub-samples. Third, the impact of ESG scores in the US may be diminished due to the market-oriented nature of its financial system and, therefore, the absence of long-term stakeholder-type relationships among banks and firms.

However, it may be that the difference in the cost of debt in quartiles Q1 and Q4 of the ESG score merely reflects the difference in financial risk corresponding to the observations in each of these quartiles.

Table 3 shows that this is implausible. In this table, the observations were again sorted by ESG scores. It reports the average values for each quartile of various risk measures and the difference in mean values for quartiles Q4 (higher ESG scores) and Q1 (lower ESG scores). The relationship between ESG scores and the financial risk level again depends on the risk measure used. This result aligns with Atif and Ali's (2021) findings that ESG information positively

relates to Merton DD. They are also consistent with Cheung's (2016) conclusion that firms with high scores tend to have low risk. The same conclusion (high score, low risk) is reached by measuring risk by volatility. However, using measures strictly or mainly based on accounting information, the conclusion is the opposite. Companies with higher ESG scores are more indebted (higher debt-to-asset ratio) and are closer to bankruptcy (lower Altman and Z-scores) than companies with lower ESG scores. Again, this is true for the entire sample and each regional subsample. The exception is the Altman score in the Brazilian subsample, where a high ESG score corresponds to lower credit risk.

- Table 3 –

Table 4 also helps to support hypothesis h1b). This table shows that traditional risk measures explain very little of the variance in ESG scores. The first column of each panel of this table ("Explanatory Power of Each Risk Measure Alone (%)") reports the R-square of regressions in which the dependent variable is the ESG score, and the explanatory variable is the respective risk measure. The explanatory power of each risk measure is minimal. Panel 1 (Full Sample) shows that the risk measure with the highest explanatory power is the Altman score, which only explains 4.32% of the total variance of the ESG scores. The added explanatory power of each risk measure is also reduced. All risk measures explain only 10.35% of the variance in the ESG variable. This table, therefore, makes it clear that the information contained in the ESG score and the risk measures do not overlap. It seems that, if the ESG score is relevant in explaining the cost of debt, it is because it contains relevant information beyond traditional risk measures.

- Table 4 –

In sum, Table 1 and Table 2 provide a first contribution to support hypothesis H1a), showing a negative association between higher ESG scores and the cost of debt. Table 3 and Table 4 contribute to supporting hypothesis H1b). Table 3 clarifies that, if lenders see companies

with higher ESG scores as having lower risk, this is not because these companies have, in effect, a lower risk as quantified by conventional measures. On the contrary, using risk measures based on accounting and financial information (Altman score, Z-Score, and debt-to-assets ratio), higher ESG scores are associated with higher economic or financial risk. Table 4 shows that the traditional risk measures have little capacity to explain the ESG scores. The ESG score is not a substitute for traditional risk measures. Therefore, contrary to others who found that ESG and financial information are substitutes (e.g., Dhaliwal et al., 2014), Tables 3 and 4 indicate that, if ESG scores contribute to explaining the cost of debt, it is because they have information content beyond that captured by conventional risk measures.

4.2.2 Panel Regressions

This section presents panel regressions with robust errors and fixed effects. The dependent variable is the cost of debt approximated by the marginal cost. The independent variables are the ESG score, the traditional risk measures, and additional control variables. The remaining variables are Size (log of total assets), Intangibles (intangible assets over total assets), and ROA (return on assets). The effects applied include industry effects, period effects, and region effects.

Table 5 reports the results. These make it clear that the higher the ESG score, the lower the cost of debt. All the regressions show a negative and statistically significant coefficient for the ESG variable.

- Table 5 -

This table clarifies that this effect does not disappear in the presence of any or all risk measures. In all cases, the coefficient of the ESG variable is negative and statistically significant. Except for Merton DD in regression 2 (coefficient not statistically significant), all traditional risk

measures show the expected signs and statistical significance. For all of them, more risk corresponds to a higher cost of debt, and less risk corresponds to a lower cost of debt.

In sum, the regressions reported in Table 5 support hypothesis H1a). These results are in line with the literature suggesting that lenders perceive borrowers with higher ESG performance as less risky (e.g., Goss and Roberts, 2011; Crifo et al., 2017; Apergis et al., 2022; Agnese and Giacomini, 2023; Kong, 2023). Moreover, they align with the papers that found that ESG complements credit risk measures (e.g., Jang et al., 2020), at least for all risk measures other than Merton DD.

4.2.3 Orthogonalization of ESG variable

In order to eliminate doubts as to whether the ESG score contains relevant information complementary to the information contained in traditional risk measures, the variable was orthogonalized. A two-step regression method was applied (see section 3.3). Table 6 reports second-step regressions. All regressions include the control variables of Size, Intangibles, and ROA, as well as period, region, and industry fixed effects.

- Table 6 -

The information contained in the ESG score, after removing the part explained by traditional risk measures, is relevant information to explain the cost of debt. Panel 1 makes clear that a higher value of the orthogonalized ESG variable corresponds to a lower cost of debt. This result, therefore, supports acceptance of hypothesis H1 and, more particularly, hypothesis H1b). In fact, not only are the coefficients of the orthogonalized ESG variables negative and statistically significant, but the coefficients of the traditional risk variables also remain significant and with the expected signs (i.e., signs indicating that higher financial risk corresponds to higher cost and vice versa). The only exception is the Merton DD variable, which

is not statistically significant in the first regression. This result indicates that the Merton DD has reduced explanatory power when other traditional risk measures are considered. However, regression five shows that Merton DD is influential when used as the sole measure of financial risk.

Panel 2 reports the regressions for regional subsamples. The coefficients of ORT_ALL are all negative and significant. Although not reported, regressions similar to regressions (2) to (4) calculated for each region also show negative and statistically significant coefficients for each of the risk measures. However, the Merton DD coefficient is only significant for the US, indicating that creditors probably rely more on other measures in other countries.

Note that the coefficient for the US subsample is much lower. For Europe, it is two times the American. For Brazil, the proportion is 5.1. This means that, for each additional point of the ESG score, US firms, in absolute value, see their debt costs decrease less than European firms. This is more impressive when one considers that CoD is, on average, higher in the US than in Europe. It is about twice as high for Brazilian firms as for US firms. Therefore, in relative terms, the impact is more pronounced in Europe and Brazil than in the US.

In sum, the results indicate that ESG scores have relevant information content and that the higher the score, the lower the cost of debt. This is true for both more shareholder-oriented and more stakeholder-oriented regions. However, in line with Chui et al. (2016) and Eliwa et al. (2021), the effect seems less pronounced in the US, a country characterized by a predominance of agency relationships and shareholder orientation.

4.2.4 Economic significance

Statistical significance may not be accompanied by economic significance. The impact of the ESG on the cost of debt may not be material. Following Marques and Alves (2021), the

estimated coefficient for the variable was multiplied by the standard deviation to get an idea of the economic impact. This measures the impact of variation in one standard deviation in the variable on the cost of debt. Figure 2 shows the results.

- Figure 2 -

An increase of one standard deviation in the ESG score (18.8 points) means a decrease, on average, of ten basis points in the cost of debt. If the information contained in all the traditional risk measures is removed, the saving by one standard deviation (16.8 points) is around 9.0 basis points. The ORT_ALT (9.0), ORT_Z (9.2), and ORT_Merton DD (9.0) variables have a similar impact. Finally, the ORT_VOL variable saves 7.0 basis points for each standard deviation. These results align with the findings of Goss and Roberts (2011). They conclude that the premium paid by borrowers with high social responsibility concerns is between 7 and 18 basis points.

Note that the economic impact is, of course, less than that of some traditional risk variables, but not all. The impact of a standard deviation in the ESG score is equivalent to: i) 32% of the impact of a standard deviation of the Altman score; ii) 64% of the impact of a standard deviation of the Z-score; and iii) 55% of the impact of a standard deviation of volatility. However, it is higher than the impact of the Merton DD.

It, therefore, indicates that ESG ratios contain statistically and economically relevant information to explain the cost of debt. This information is a complement to and not a substitute for the information contained in traditional risk measures. Moreover, it is evident that a higher ESG score corresponds to a lower cost of debt.

4.3 Test of H2

The sample was divided by quartiles, alternatively as a function of the absolute dollar

amount of long-term debt (LTD) and the debt-to-equity ratio (DtoA). In a subsequent step, the regressions were run using only the observations in each quartile. As explained above, the expectation is that the ESG score is especially relevant and negatively impacts the cost of debt in the case of more indebted firms.

Therefore, the expectation is a negative coefficient for the ESG variable orthogonalized to the highest debt quartiles (Q4). The expected coefficient for the lowest indebtedness levels (Q1) is no longer negative and statistically significant, given that the ESG complementary information will be less relevant there. However, if it is negative and significant for Q1, the coefficient value will be smaller in absolute value than for Q4.

- Table 7 -

Table 7 confirms expectations. All orthogonalized ESG variables show statistically negative coefficients in Q4, either when using LTD (Panel 1.A) or the debt-to-assets variable (Panel 2.A). This means that, for long-term debt levels above USD 10.6 billion and debt-to-assets levels above 39.8%, respectively, the ESG score is relevant information, and a better score corresponds to a lower cost of debt. However, this is not true for long-term debt levels below USD 1.4 billion or debt-ot-asset levels below 18.5%. In the first case (Panel 1.B), the coefficients are insignificant, indicating the absence of relevant information content. The coefficients are significant but positive in the second case (Panel 2.B).

This means that the level of debt, absolute or relative, has a moderate effect on the impact of ESG information on the cost of debt. Having a high ESG score seems especially relevant as a means to reduce the cost of debt in the most indebted firms. In these companies, creditors seem to attribute greater relevance to these scores as a source of information on the company's sustainability. This seems credible because, for these companies, most questions have been asked about their sustainability, particularly their capacity to roll over debt in the medium and long term.

Table 8 confirms this moderating effect, given that, in all cases, the coefficient of the interaction of ESG information with the debt level is negative and statistically significant. Firms with higher debt levels benefit more by having higher scores than less indebted firms. In Panel 1, the DEBT is the long-term debt in USD. In Panel 2, the DEBT is the debt-to-assets ratio (DtoA). In both cases, the moderating effect is evident.

- Table 8 -

4.4 Test of H3

Table 8 shows that, as expected, agency costs increase the cost of financing. The AS variable has a positive impact on the cost of debt. However, it also leads to the acceptance of hypothesis H3. Indeed, whether the orthogonalized ESG variable interacts with AS (Panel 1) or with a dummy (Panel 2), the product of this interaction has a negative coefficient. This dummy takes the value of one if the firm has an asset-to-sales ratio above the average of its sector, and zero otherwise. Hence, the conclusion is that a higher ESG performance tends to reduce the increase in the cost of debt arising from higher agency costs, or that firms with higher agency costs take greater advantage of the beneficial effect of ESG performance.

- Table 9 -

Note that the fact that the ORT (in its different specifications) and AS variables have different signals, with the former contributing to a reduction in the cost of debt and the latter to an increase in it, can also be interpreted as a sign that investors do not see ESG efforts as a waste of resources. Therefore, these results are more consistent with the view of Hill and Jones (1992), Ferrell et al. (2016), and Rossi and Harjoto (2020), that see ESG as positively related to firm value and negatively associated with firms' risk and agency costs than with the view of others (Benabou and Tirole, 2010; Masulis and Reza, 2015) that see ESG as a manifestation of agency costs.

4.5 Test of H4

Finally, this section tests the hypothesis that the type of financial system moderates the impact of the ESG score. The idea is that the negative effect on debt in countries with market-based financial systems is smaller than in countries with bank-based financial systems. The rationale behind such a hypothesis, as explained previously, is that when long-term relationships with banks prevail, and the information asymmetry is correspondingly lower, the price of credit tends to be lower. Better relationships with stakeholders, including lenders, help firms to access cheaper financing because lenders are more willing to lend to companies with a good reputation and strong stakeholder relationships.

- Table 10 -

Table 10 shows that the type of financial system moderates the impact of ESG performance on the CoD. The higher the variable FINSYS – that is, the financial system is more market-oriented – the lower the (negative) impact of the orthogonalized variables of ESG. Therefore, the H4 is accepted.

4.6 Tests of Robustness and Endogeneity Bias

The relationship between the ESG score and the cost of debt can be affected by endogeneity, either through omitted variables or reverse causality. It is impossible to include as regressors all the variables that may affect the cost of debt. Thus, omitted variables – namely, unobservable variables – may simultaneously affect both ESG performance and the cost of debt. For example, factors not taken into account, such as sector-specific characteristics that vary over time or macroeconomic conditions that may also change over time and from country to country, which affect ESG performance, default risk and the cost of debt, can lead to biased estimates of

the true relationship between ESG scores and the cost of debt. Second, the direction between the ESG score and debtor risk and, consequently, the cost of debt may be bidirectional (Bénabou and Tirole, 2010). For example, abundant literature suggests that a company's governance structure is endogenously determined (Hermalin and Weisbach, 2001), as is its ownership and capital structure (Demsetz and Villalonga, 2001). Li et al. (2023) show that ESG composite scores and long-term debt have a nonlinear relationship; therefore, ESG activities can potentially increase debt capital and influence the cost of debt. Bouslah et al. (2013) also document a bidirectional causality between corporate social performance and company risk. Thus, ESG scores and default risk may be determined simultaneously. Furthermore, it is also possible that the cost of debt determines the ESG behaviour of companies. Companies with lower debt costs have more resources available for other purposes, namely for more sustainable environmental practices and greater social responsibility. Additionally, ESG could reflect managerial agency problems, and, in this case, the causality is in the opposite direction; lower debt costs facilitate better financial performance and lead to higher ESG scores. Finally, as the cost of debt for green investing is lower, a company can invest more in a way that helps improve its sustainability and social responsibility performance. For all these reasons, we can not exclude the hypothesis that there is a simultaneous relationship between ESG scores and the cost of debt.

Therefore, the possibility of endogeneity needs to be addressed. Here, three methodologies are applied: i) lagged independent variables; ii) the instrumental variable approach – that is, the two-stage least squares (2SLS); iii) propensity matching scores (PSM). Lagged explanatory variables are commonly used to alleviate the endogenous problems caused by missing variables or reverse causality in studies investigating ESG scores' impact on the cost of debt (*vg*, Atif and Ali, 2021; Palmieri et al., 2023; Kong, 2023).

The same can be said of the instrumental variables approach (*vg*, Benlemlih and Bitar, 2018; Atif and Ali, 2021; Kong, 2023). This method aims to eliminate the endogenous component of an independent variable in the regression model by introducing an instrumental

variable. While applicable to various sources of endogeneity, identifying a suitable instrumental variable can pose a significant challenge. The chosen variable must be correlated with the variables under consideration but not with the disturbance terms. If the instrumental variables selected fail to meet these conditions, the outcomes of the instrumental variable regression may be deemed invalid. Furthermore, despite being widely used, 2LS regression is a non-linear estimation method, which may not be efficient enough compared to the least squares method and may introduce additional variance, leading to instability in the estimation results.

Finally, PSM is suitable for correcting endogeneity from omitted variables (Zhang et al., 2022). This is because omitted variables might influence the distribution of groups (i.e., the firms with high and low ESG score) in the sample, whereas PSM uses propensity scores to simulate randomly matched groups (Zhang et al., 2022). Under this method, firms-years with higher ESG are matched with lower firms-years ESG, without significant difference in other dimensions. PSM was chosen over other propensity score methods because, according to Austin (2011), score matching eliminates a greater proportion of systematic differences in baseline characteristics of the individuals than other approaches, including the inverse probability of treatment weighting method.

4.6.1 Lagged Variables

To mitigate the problem of possible reverse causality, following Atif and Ali (2021) and Kong (2023), among others, the orthogonalized ESG variables were lagged for one or two years. The results are presented in Table 11 and confirm the negative impact of the information content of the ESG score, not captured by conventional risk measures, on the cost of debt. Moreover, Table 11 shows the moderating effect of the debt level. Companies with higher debt amounts or debt-to-assets ratios benefit the most. The moderating effect of the type of financial system was also confirmed, but the significance level is only 10%. Finally, the moderating effect of the

agency cost is again evident. Therefore, further investigations are needed to verify whether it is the case that the more the financial system is bank-oriented, the greater the benefit in terms of the cost of debt.

- Table 11 -

4.6.2 Instrumental Variable Approach

Table 12 shows the IV 2LS estimations. In these regressions, the variable ORT_ALL is the endogenous regressor. In Panel 1, the instrument is the industry median ESG. As with Benlemlih and Bitar (2018), Atif and Ali (2021), and Kong (2023), the median industry ESG (ESG IND) is the mean score for all industry firms in a specific year. Following Atif and Ali (2021), the industry mean was calculated excluding the firm's score for the same year. The idea is that a firm's score should be correlated with its peers' values in a given industry but not correlated with the credit risk or cost of debt capital of those firms. Effectively, some industries have higher scores than others (Borghesi et al., 2014). The instruments proved to be strong. The F statistics of the first-step regressions largely surpass the thumb rule of 10, and Cragg-Donald's Wald F statistics are greater than Stock-Yogo critical values (10% level).

In Panel 2, in addition to ESG IND, as with Benlemlih and Bitar (2018) and Kong (2023), the company's initial ESG score (ESG INI) is used as an instrument. Again, the idea is that a firm's initial score should be correlated with subsequent values for the same entity but not correlated with the firm's credit risk or cost of debt capital in the following years. The instruments proved to be strong (the F statistics of the first step regressions again surpass the thumb rule) and exogenous (J-statistics do not reject the null hypothesis that the overidentifying restrictions are valid).

The findings confirm that the ESG score's informational component negatively impacts the cost of debt. Moreover, they support the moderating role of absolute and relative levels of indebtedness. The moderating impact of the type of financial system is also supported. Lastly,

the moderating effect of agency costs is confirmed.

- Table 12 -

4.6.3 PSM Approach

The third way to eliminate endogeneity bias is a two-step PSM approach – see, among others, Benlemlih and Bitar (2018) and Atif and Ali (2021). First, firm-years with higher ESG scores were matched with lower ESG scores. This step aims to obtain a sample where the firms differ in the ESG scores but no other independent variables. Second, multivariate regressions were estimated for the matched sample.

In the first step, a dummy ESG High takes a value of one for the firms in which, in each specific year, the ESG score is above the sample median, and zero otherwise. Table 13 presents the logit regressions pre-match and post-match. Regression two in Panel 1 shows that, in effect, firms differ in the ESG scores after matching but do not differ significantly in other dimensions.

The regressions of the second step are presented in Panel 2. The conclusions remain. Therefore, the PSM approach supports the inference obtained with the baseline regressions.

4.6.4 Additional Robustness Tests

In an additional robustness test, instead of the marginal cost of debt (CoD), the dependent variable is the average cost of debt. The average cost is the interest paid each year divided by the average amount owed that year. Given that the average cost is nominal, in another additional robustness test, the dependent variable was the average cost minus the inflation rate. The inflation rates were computed from the consumer price indexes from the World Development Indicators.

The results (not reported) hold in the two robustness tests, confirming both the negative effect of ESG performance on the cost of debt, the (negative) moderating effect of the level of

debt, and the (positive) moderating effect of more market-based financial systems.

Additionally, the interaction effect of agency costs and the orthogonalized ESG score remains, using different criteria to build a dummy. Namely, they remain when a dummy identifies the observations with a level of AS above the median or when it only identifies the observations of the higher quarter of AS values.

Furthermore, if firm fixed effects are used instead of industry and region effects, the negative effect of the ESG score (with or without orthogonalisation) on the cost of debt remains. However, using firm fixed effects, the ratio between the number of observations and coefficients to estimate substantial decreases, increasing the risk of overfitting.

Finally, the conclusions remain using additional control variables, namely total liability to total assets, current assets to total assets, sales to total assets and Tobin Q. Tobin's Q was calculated, as in Atif and Ali (2021), adding market capitalisation to total liability and dividing by total assets.

5. CONCLUSIONS

This paper has several contributions. First, it contributes significantly to understanding the relationship between ESG scores and the cost of debt, helping to unravel the intricate relationship between ESG scores, credit risk and the cost of debt.

In fact, the paper shows that companies with higher ESG scores tend to have lower debt costs, even when considering traditional risk measures. Therefore, in line with others, this study helps to support the thesis that firms with better ESG performance tend to benefit from lower debt costs.

Moreover, the paper shows that the relationship between ESG scores and financial risk depends on the measure of risk used. When volatility or the Merton DD are used as risk

measures, higher ESG scores are associated with lower risk. However, when risk measures based on accounting information are used, companies with higher ESG scores have higher financial risk, such as a greater likelihood of bankruptcy, according to the Altman score or the Z-score. Therefore, the ESG score does not serve as a substitute for economic and financial risk measures.

The traditional risk measures have limited explanatory power for ESG scores. The ESG score provides additional information beyond traditional risk measures. After removing that part of the ESG variable explained by conventional risk measures, the remaining information contained in ESG scores is relevant in explaining the cost of debt. Higher values of the orthogonalized ESG variable correspond to lower costs of debt. In other words, the study shows that the ESG has relevant information content to explain the cost of debt, which is complementary to traditional risk measures' information content.

The economic impact of ESG scores on the cost of debt is statistically and economically significant. An increase of one standard deviation in the ESG score results in an average decrease of 9 basis points in the cost of debt.

In summary, the findings indicate that higher ESG scores are associated with lower debt costs, suggesting that ESG factors provide additional information beyond traditional risk measures in explaining the cost of debt. Furthermore, the relevance of the ESG score is particularly significant for companies with higher debt levels, whether these are measured using the absolute amount of the long-term debt or the debt-to-asset ratio.

Second, the paper also contributes to uncovering significant moderating effects in the relationship between ESG scores and the cost of debt. Effectively, the impact of ESG scores on the cost of debt is moderate by the level of long-term debt and by the debt-to-asset ratio. Having a high ESG score is more effective in reducing the cost of debt for highly indebted firms than for firms with lower debt levels. This result shows that the relevance of the information content in the ESG score is not identical for all companies.

Additionally, the findings indicate that agency costs raise the cost of debt. However, increased ESG performance tends to lower the increase in debt cost caused by increased agency expenses. In other words, enterprises with higher agency costs benefit more from the positive effect of ESG performance. This must occur because managers of firms with high ESG performance have more to lose than others regarding their public image in case of bankruptcy. The results obtained – with ESG performance contributing to a reduction in debt costs and agency charges contributing to an increase – might also be read as a signal that lenders do not regard ESG activities as a waste of corporate resources.

Third, the paper shows the variability of the impact of ESG scores across regions and financial systems. In fact, not only does it show that the impact is lower in the US than in other regions, but it also highlights that the type of financial system moderates the impact of the ESG score. The negative impact of the ESG score on debt is smaller in countries with market-based financial systems compared to countries with bank-based financial systems. Bank-oriented financial systems benefit more from the ESG score regarding lower debt costs. This supports the hypothesis that ESG performance is more valuable in areas where long-term bank-firm relationships tend to predominate.

Fourth, different methodologies were used to address endogeneity concerns, such as lagged variables, the instrumental variable approach (2SLS), and propensity matching scores (PSM). These approaches confirm the negative impact of the ESG score on the cost of debt and support the moderating effects of debt level and financial system type.

In this context, it is important to recognise that it is of the utmost importance to carefully choose instrumental variables that meet the criteria of correlation with the explained variables, avoiding correlation with disturbance terms. Failure to fulfil these conditions can invalidate the results of regression with instrumental variables. In addition, it should be emphasised that two-stage least squares regression, being a non-linear estimation method, may not be efficient compared to the traditional least squares method. Furthermore, the use of 2LS regression can

introduce additional variance, potentially resulting in instability in the estimation results.

Overall, the findings suggest that the ESG score provides relevant information for evaluating the cost of debt, particularly in highly indebted firms. The impact of the ESG score varies based on the level of debt, regional differences, and the type of financial system.

Such findings offer practical insights for risk management, financial decision-making and ESG investments. It provides a nuanced understanding of how ESG scores can inform assessments of default risk beyond the traditional risk metrics. It helps lenders to make better-informed decisions on incorporating ESG-related risks into lending decisions, considering information beyond traditional financial risk measures. Additionally, it assists companies in strategic planning by highlighting the potential impact of ESG on debt costs, encouraging a focus on sustainability practices that can positively influence financial performance. In particular, this paper has implications for heavily indebted firms by suggesting that ESG considerations may be particularly important for them. Finally, it offers insights for policymakers and financial regulators, emphasizing the relevance of considering ESG-related risks not captured by conventional financial risk measures but also showing that factors like debt levels, agency costs, and the type of financial system where the firms get the funding moderate its impact. Regulators and supervisors can adopt several policy measures to address ESG-related risks that conventional financial risk measures might not fully capture. First, regulators can develop ESG-based macroprudential policies complementary to traditional risk management frameworks. Second, regulators can promote innovation in the forward-looking modelling, which is essential to accurately capture the impact of ESG risks not captured by traditional measures. Third, supervisors can promote collecting and utilizing granular data related to ESG factors. This data can enhance risk assessment. Finally, regulators may promote a holistic approach combining macroprudential policies, disclosure requirements, and risk assessment integration, essential for moderating ESG-related risks' impact on the financial system.

This study's sample includes firms from various countries with different types of financial

systems and stakeholder orientations. This variety increases the robustness and generalizability of the findings and aids in assessing how well the hypotheses apply in different institutional and regulatory contexts. However, it covers companies from only 21 countries, which is a limitation to a vigorous generalization of its conclusions. In addition, agency costs are measured by a dummy, which, although used in the literature, is still an indirect and proxy measure. Finally, it should be noted that this document uses ESG scores from Refinitiv. It is therefore important to recognise that, although this metric is commonly used, there is no single, agreed-upon way of measuring a company's ESG performance.

In what concerns future research directions, this study highlights the need to understand better what ESG indices effectively measure, given that their impact on the cost of debt is a complement rather than a substitute for credit risk. Based on the assumption that ESG scores provide relevant information to give a full picture of a company's sustainability, it is important to understand the channels through which ESG performance is transmitted to the cost of debt and which variables have a moderating effect on such transmission. One of these possible channels is the legal protection of creditors in the event of bankruptcy. The impact of the ESG score is probably more significant in countries where creditors feel less protected by the law and have to rely more on the company's sustainability, responsibility and good governance.

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Table 1 – Descriptive Statistics and Correlation Coefficients

	ESG	CoD	Altman	Z_Score	Merton DD	Volatility	Assets	ROA	Intangibles
Panel 1 - Descriptive Statistics									
Average	62.54	2.50	3.99	20.23	8.15	34.19	30 000 676 287	6.57	0.10
SD	18.76	1.63	4.30	20.02	11.11	11.63	47 519 255 566	7.04	0.11
Max	96.06	31.45	28.67	122.51	71.20	73.91	283 262 500 336	31.24	0.55
Min	1.13	-0.26	0.26	-4.35	-2.49	16.01	212 951 948	-15.94	0.00
n	7092	7027	6681	7092	7082	7082	7092	7092	6850
Panel 2 - Correlation Coefficients									
ESG	1.00	-0.16	-0.20	-0.05	0.11	-0.24	0.31	-0.07	-0.03
CoD		1.00	-0.20	-0.13	-0.02	0.21	-0.04	-0.13	0.06
Altman			1.00	0.01	-0.17	0.14	-0.18	0.53	-0.14
Z_Score				1.00	0.02	-0.31	-0.03	0.02	0.01
Merton DD					1.00	-0.22	0.28	-0.30	-0.05
Volatility						1.00	-0.17	-0.06	-0.11
Assets							1.00	-0.12	0.04
ROA								1.00	-0.09
Intangibles									1.00

Obs.: This table reports the summary statistics and Pearson's correlation coefficients for the key variables for the period 2013 to 2022. The names and acronyms identify the following variables: ESG (ESG Score), CoD (Marginal Cost of Debt), Altman score (Altman), accounting-based Z score (Z-Score), volatility of stock returns (Volatility), Merton distance to default (Merton DD), the total assets (Assets), the return of assets (ROA) and intangibles over total assets (Intangibles).

Table 2 - Cost of Debt by Quartiles of ESG Score

	Q1	Q2	Q3	Q4	Q4-Q1	t	p-value
				Panel 1 - Full Sample			
Average Cost of Debt	4.06%	3.95%	3.75%	3.19%	-0.87%	-8.44	0.00
	3.76%	*3.76%*	*3.76%*	*3.76%*			
	1843	1783	1723	1743			
Marginal Cost of Debt	2.85%	2.60%	2.37%	2.20%	-0.65%	-11.72	0.00
	1.83%	*1.70%*	*1.43%*	*1.45%*			
	1798	1746	1743	1740			
				Panel 2 - US			
Average Cost of Debt	3.57%	3.61%	3.67%	3.32%	-0.25%	-2.20	0.01
	3.07%	*3.07%*	*3.07%*	*3.07%*			
	954	954	953	954			
				Panel 3 - EU			
Average Cost of Debt	3.82%	3.41%	3.28%	2.90%	-0.92%	-4.99	0.00
	4.31%	*2.97%*	*2.51%*	*2.19%*			
	687	686	686	687			
				Panel 4 - Brazil			
Average Cost of Debt	7.67%	7.80%	6.68%	6.42%	-1.25%	-2.64	0.00
	4.62%	*4.62%*	*4.62%*	*4.62%*			
	133	133	132	133			

Obs.: This table reports the (average and marginal) debt cost by ESG score quartiles. First, the observations were sorted by ESG score, dividing them into quartiles. Then for each quartile were calculated the means cost of debt variable. Finally, for each cost of debt variable, it was calculated the difference in means between Quartile 1 (lowest ESG scores) and Quartile 4 (highest ESG scores) and the t-statistic and p-value for the null hypothesis of equality of means.

Table 3 – Risk Measures by Quartiles of ESG Score

	Q1	Q2	Q3	Q4	Q4-Q1	t	p-value	Q1	Q2	Q3	Q4	Q4-Q1	t	p-value
	Panel 1 - Full Sample							Panel 3 - EU						
Debt-to- Assets	0.29	0.31	0.31	0.31	0.02	2.21	0.01	0.23	0.27	0.29	0.30	0.08	5.68	0.00
	0.26	*0.20*	*0.17*	*0.27*				*0.17*	*0.16*	*0.29*	*0.30*			
	1773	1773	1773	1772				687	686	686	687			
Altman	4.79	3.79	3.25	2.88	-1.92	-12.85	0.00	5.16	3.55	2.76	2.37	-2.79	-13.02	0.00
	5.71	*3.82*	*3.30*	*2.63*				*5.32*	*3.80*	*2.44*	*1.79*			
	1671	1670	1670	1670				649	648	648	648			
Z-Score	21.46	22.21	20.31	18.47	-2.99	-4.42	0.00	24.83	21.99	20.54	20.27	-4.55	-4.20	0.00
	23.49	*21.74*	*18.67*	*16.06*				*22.93*	*17.31*	*15.80*	*16.80*			
	1773	1773	1773	1773				687	686	686	687			
Volatility	0.37	0.34	0.32	0.31	-0.06	-17.07	0.00	0.31	0.29	0.29	0.28	-0.03	-6.86	0.00
	0.13	*0.11*	*0.10*	*0.09*				*0.10*	*0.09*	*0.08*	*0.08*			
	1770	1771	1770	1771				686	686	686	686			
Merton DD	6.59	7.67	8.65	10.13	3.54	9.04	0.00	9.13	10.95	11.69	13.02	3.89	5.54	0.00
	11.57	*10.22*	*10.59*	*11.75*				*13.23*	*12.73*	*12.14*	*12.79*			
	1770	1771	1770	1771				686	686	686	686			
	Panel 2 - USA							Panel 4 - Brazil						
Debt-to- Assets	0.31	0.31	0.33	0.34	0.03	2.49	0.01	0.30	0.42	0.39	0.36	0.05	2.82	0.00
	0.29	*0.23*	*0.18*	*0.19*				*0.17*	*0.24*	*0.20*	*0.14*			
	954	954	953	954				133	132	132	133			
Altman	4.99	4.09	3.56	3.63	-1.36	-5.86	0.00	13.59	11.24	20.20	15.94	2.34	1.08	0.14
	6.20	*4.06*	*3.33*	*3.58*				*18.32*	*15.25*	*22.88*	*17.13*			
	890	*890*	*890*	*890*				132	132	132	132			
Z-Score	21.90	21.92	22.08	17.18	-4.72	-4.96	0.00	12.46	12.99	13.33	12.23	-0.23	-0.22	0.41
	23.97	*24.02*	*22.38*	*16.98*				*8.70*	*13.11*	*11.94*	*8.01*			
	954	954	953	954				133	133	132	133			
Volatility	0.37	0.36	0.34	0.33	-0.04	-7.68	0.00	0.43	0.44	0.38	0.40	-0.03	-1.99	0.02
	0.13	*0.11*	*0.10*	*0.10*				*0.16*	*0.13*	*0.10*	*0.12*			
	953	953	953	953				132	131	132	131			
Merton DD	4.58	5.22	5.92	5.01	0.42	1.44	0.08	13.59	11.24	20.20	15.94	2.34	1.08	0.14
	7.62	*6.16*	*6.27*	*4.88*				*18.32*	*15.25*	*22.88*	*17.13*			
	953	953	953	953				132	131	132	131			

Obs.: This table reports the average risk metrics by ESG score quartiles. First, the observations were sorted by ESG score, dividing them into quartiles. Then for each quartile were calculated the means of the risk measures. Finally, the difference in means between Quartile 1 (lowest ESG scores) and Quartile 4 (highest ESG scores) was calculated for each risk measure, and the t-statistic and p-value for the null hypothesis of equality of means. The names and acronyms identify the following variables: Total debt at the end of the year divided by the total assets (Debt-to-Assets), Altman score (Altman), accounting-based Z score (Z-Score), volatility of stock returns (Volatility), and Merton distance to default (Merton DD).

Table 4 - The Proportion of the ESG Score Explained by Risk Measures

	Explanatory Power of Each Risk Measure Alone (%)	Increase in Explanatory Power Due to the Addition of Each Risk Measure to All Others (%)	Explanatory Power of Each Risk Measure Alone (%)	Increase in Explanatory Power Due to the Addition of Each Risk Measure to All Others (%)
	Panel 1 - Full Sample		Panel 3 - EU	
Debt-to-Assets	0.26	0.07	2.42	0.12
Altman	4.32	2.47	8.16	4.34
Z-Score	0.20	1.54	0.82	1.07
Volatility	5.30	5.37	1.54	0.83
Merton DD	1.31	0.10	1.66	0.03
All Risk Measures		10.35		10.03
	Panel 2 - US		Panel 4 - Brazil	
Debt-to-Assets	0.75	0.01	1.64	1.41
Altman	3.04	2.02	2.36	0.75
Z-Score	0.40	2.15	0.08	0.71
Volatility	2.85	3.72	1.93	1.34
Merton DD	0.25	0.08	0.32	0.01
All Risk Measures		7.53		5.84

Obs.: This table reports the proportion of the ESG Score explained by each risk measure alone and when added to other metrics. The column «Explanatory Power of Each Risk Measure Alone (%)» reports the proportion of the ESG score explained by each risk measure. That is, the R^2 of a regression where the ESG score is the dependent variable, and the risk measure is the single independent variable. The column «Increase in Explanatory Power Due to the Addition of Each Factor to All Others (%)» reports the difference between the R^2 of the regression where all risk measures are explanatory variables, less the R^2 of the regression where all risk measures except the correspondent risk measure are explanatory variables. Variable names are abbreviated in the following way: total debt at the end of the year divided by the total assets (Debt-to-Assets), Altman score (Altman), accounting-based Z score (Z-Score), volatility of stock returns (Volatility), and Merton distance to default (Merton DD).

Table 5 – Impact on Marginal Cost of Debt

	[1]		[2]		[3]		[4]		[5]		[6]	
C	3.680	***	4.100	***	5.143	***	3.867	***	2.387	***	3.626	***
	13.109		*12.951*		*17.249*		*13.841*		*7.857*		*12.370*	
ESG	-0.005	***	-0.005	***	-0.005	***	-0.005	***	-0.004	***	-0.005	***
	-4.926		*-5.727*		*-5.557*		*-5.700*		*-4.323*		*-4.958*	
Z-SCORE			-0.082	***	-0.074	***						
			-15.110		*-13.429*							
ALTMAN			-0.007	***			-0.008	***				
			-11.212				*-12.853*					
VOLATILITY			0.018	***					0.016	***		
			10.368						*9.595*			
MERTON DD			0.000								-0.001	
			0.197								*-0.628*	
SIZE	-0.002		-0.038	***	-0.057	***	-0.005		0.025	*	0.001	
	-0.175		*-2.699*		*-4.251*		*-0.410*		*1.940*		*0.082*	
INTANGIBLES	0.861	***	0.767	***	0.588	***	0.862	***	1.053	***	0.855	***
	6.731		*6.138*		*4.577*		*6.786*		*8.387*		*6.660*	
ROA	-0.033	***	-0.006	**	-0.014	***	-0.032	***	-0.029	***	-0.034	***
	-13.708		*-2.276*		*-4.954*		*-13.603*		*-12.431*		*-13.490*	
Industry fixed	Yes		Yes		Yes		Yes		Yes		Yes	
Period fixed	Yes		Yes		Yes		Yes		Yes		Yes	
Region fixed	Yes		Yes		Yes		Yes		Yes		Yes	
N	6988		6553		6988		6850		6978		6978	
R2	0.494		0.536		0.511		0.505		0.503		0.494	
R2 Adj	0.492		0.534		0.509		0.503		0.502		0.492	

Obs.: This table reports the baseline regressions. The dependent variable is the marginal cost of debt. Numbers in italic are the t-statistics based on the robust standard errors. Variable names are abbreviated in the following way: ESG Score (ESG), Altman Score (ALTMAN), accounting-based Z score (Z-SCORE), volatility of stock returns (VOLATILITY), Merton Distance to Default (Merton DD), log of total assets (SIZE), Intangibles assets over total assets (INTANGIBLES), and return on assets (ROA). The symbols ***, ** and *, respectively, show statistical significance at 1%, 5% and 10%, for one-sided tests.

Table 6 – Impact of Orthogonalized Content of ESG Score on Marginal Cost of Debt

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
	Panel 1 - All Sample					Panel 2 - Regional Subamples		
						US	EU	Brazil
ORT_ALL	-0.005 ***					-0.003 **	-0.006 ***	-0.013 ***
	-5.386					*-2.110*	*-3.158*	*-4.852*
ORT_ALT		-0.005 ***						
		-5.538						
ORT_Z			-0.005 ***					
			-5.846					
ORT_VOL				-0.004 ***				
				-4.382				
ORT_MDD					-0.005 ***			
					-5.327			
ALTMAM	-0.078 ***	-0.070 ***				-0.093 ***	-0.053 ***	-0.004
	-14.840	*-13.125*				*-13.752*	*-6.311*	*-0.125*
Z-SCORE	-0.006 ***		-0.008 ***			-0.007 ***	-0.007 ***	-0.027 ***
	-10.558		*-12.833*			*-6.888*	*-6.245*	*-5.356*
VOLATILITY	0.019 ***			0.018 ***		0.017 ***	0.020 ***	0.021 ***
	11.643			*10.604*		*7.386*	*6.195*	*4.117*
MERTON DD	0.000				-0.002 *	-0.006 *	-0.001	0.004
	0.145				*-1.390*	*-1.627*	*-0.610*	*1.085*
N	6553	6563	6988	6978	6978	3453	2573	527
R-squared	0.538	0.513	0.506	0.586	0.495	0.518	0.388	0.606
Adj. R-squared	0.536	0.511	0.504	0.584	0.493	0.514	0.382	0.587

Obs.: This table reports the regressions using the ESG orthogonalized variables instead of the ESG scores as a metric of ESG performance. The dependent variable is the marginal cost of debt. Numbers in italic are the t-statistics based on the robust standard errors. Variable names are abbreviated in the following way: ESG Score (ESG), Altman Score (ALTMAN), accounting-based Z score (Z-SCORE), volatility of stock returns (VOLATILITY), Merton Distance to Default (MERTON DD), Orthogonalized Content of ESG Score not captured by all risk measures (ORT_ALL); Orthogonalized Content of ESG Score not captured by the Altman Score (ORT_ALT); Orthogonalized Content of ESG Score not captured by the Z Score (ORT_Z); Orthogonalized Content of ESG Score not captured by the Volatility (ORT_VOL); Orthogonalized Content of ESG Score not captured by the Merton Distance to Default (ORT_MERTON DD). In all regressions, a constant and the control variables log of total assets (SIZE), intangibles assets over total assets (INTANGIBLES), and return on assets (ROA), as well as industry fixed, period fixed and region fixed effects, were included. The symbols ***, ** and *, respectively, show statistical significance at 1%, 5% and 10%, for one-sided tests.

Table 7 – Regressions on Extreme Quartiles of Debt and Debt to Asset Ratios (Panel 1)

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
	Panel 1.A - Q4 Total Long Term Debt in USD (High)					Panel 1.B - Q1 Total Long Term Debt in USD (Low)				
ORT_ALL	-0.005 ***					0.001				
	-2.515					*0.456*				
ORT_ALT		-0.009 ***					-0.000			
		-4.601					-0.095			
ORT_Z			-0.009 ***					0.002		
			-5.010					*0.848*		
ORT_VOL				-0.006 ***					0.002	
				-3.318					*0.855*	
ORT_MERTON DD					-0.009 ***					0.002
					-5.146					*0.986*
ALTMAM	-0.129 ***	-0.116 ***				-0.058 ***	-0.055 ***			
	-5.573	*-4.854*				*-9.592*	*-9.131*			
Z-SCORE	-0.005 ***		-0.007 ***			-0.001		-0.003 *		
	-5.651		*-6.458*			*-0.496*		*-1.548*		
VOLATILITY	0.033 ***			0.033 ***		0.007 ***			0.002	
	10.425			*9.851*		*2.419*			*0.720*	
MERTON DD	-0.002				-0.002	0.011 ***				0.009 **
	-0.854				*-0.680*	*2.363*				*2.078*
N	1629	1629	1752	1746	1746	1667	1667	1712	1712	1712
R-squared	0.630	0.593	0.586	0.601	0.577	0.442	0.437	0.409	0.409	0.410
Adj. R-squared	0.624	0.586	0.580	0.595	0.571	0.433	0.428	0.401	0.400	0.402

Table 7 – Regressions on Extreme Quartiles of Debt and Debt to Asset Ratios (Panel 2)

	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]
	Panel 2.A - Q4 Debt-to-Assets Ratio (High)					Panel 2.B - Q1 Debt-to-Assets Ratio (Low)				
ORT_ALL	-0.013 ***					0.006 ***				
	-6.629					*2.775*				
ORT_ALT		-0.014 ***					0.005 ***			
		-7.585					2.592			
ORT_Z			-0.015 ***					0.006 ***		
			-8.073					*3.127*		
ORT_VOL				-0.013 ***					0.006 ***	
				-6.729					*3.119*	
ORT_MERTON DD					-0.015 ***					0.005 ***
					-7.982					*2.878*
ALTMAM	-0.168 ***	-0.159 ***				-0.054 ***	-0.052 ***			
	-8.647	*-7.888*				*-8.525*	*-8.243*			
Z-SCORE	-0.010 ***		-0.007 *			-0.006 ***		-0.009 ***		
	-7.873		*-5.439*			*-3.104*		*-4.422*		
VOLATILITY	0.025 ***			0.024 ***		0.008 **			0.007 **	
	9.234			*9.008*		*2.259*			*2.059*	
MERTON DD	0.006 **				-0.003	-0.001				-0.001
	1.935				*-0.982*	*-0.166*				*-0.348*
N	1628	1628	1797	1788	1788	1667	1667	1735	1735	1735
R-squared	0.638	0.597	0.568	0.579	0.560	0.421	0.411	0.401	0.397	0.394
Adj. R-squared	0.632	0.591	0.562	0.573	0.554	0.411	0.403	0.392	0.388	0.385

Obs.: This table reports the regressions on extreme quartiles of debt and debt to asset ratios. The dependent variable is the marginal cost of debt. Panel 1 shows regressions performed using the highest (lowest) quartile in total long-term debt (respectively, Panel 1.A and Panel 1.B). Panel 2 shows regressions performed using the highest (lowest) quartile in debt to asset ratio (respectively, Panel 2.A and Panel 2.B). Numbers in italic are the t-statistics based on the robust standard errors. Variable names are abbreviated in the following way: Orthogonalized Content of ESG Score not captured by all risk measures (ORT_ALL); Orthogonalized Content of ESG Score not captured by the Altman Score (ORT_ALT); Orthogonalized Content of ESG Score not captured by the Z Score (ORT_Z); Orthogonalized Content of ESG Score not captured by the Volatility (ORT_VOL); Orthogonalized Content of ESG Score not captured by the Merton Distance to Default (ORT_MERTON DD), Altman Score (ALTMAN), accounting-based Z score (Z-SCORE), volatility of stock returns (VOLATILITY), Merton Distance to Default (MERTON DD). In all regressions, the control variables log of total assets (SIZE), intangibles assets over total assets (INTANGIBLES), and return on assets (ROA), as well as industry fixed, period fixed and region fixed effects, were included. The symbols ***, ** and *, respectively, show statistical significance at 1%, 5% and 10%, for one-sided tests.

Table 8 – Moderating Effect of the Level of Debt

	[1]	[2]	[3]	[4]	[5]	[4]	[7]	[8]	[9]	[10]
	Panel 1. Long-Term Debt					Panel 2. Debt to Assets Ratio				
ORT_ALL	0.003 ***					0.007 ***				
	3.130					*4.114*				
ORT_ALL*DEBT	-0.003 ***					-0.039 ***				
	-3.397					*-8.223*				
ORT_ALT		0.005 ***					0.006 ***			
		4.298					*3.561*			
ORT_ALT*DEBT		-0.003 ***					-0.040 ***			
		-3.192					*-8.801*			
ORT_Z			0.003 ***					0.007 ***		
			2.885					*4.625*		
ORT_Z*DEBT			-0.002 ***					-0.044 ***		
			-3.455					*-10.495*		
ORT_VOL				0.001					0.009 ***	
				0.758					*5.623*	
ORT_VOL*DEBT				-0.002 ***					-0.041 ***	
				-3.241					*-9.482*	
ORT_MDD					0.002 ***					0.007 ***
					2.359					*4.823*
ORT_MDD*DEBT					-0.002 ***					-0.044 ***
					-3.409					*-10.431*
DEBT	0.011 ***	0.011 ***	0.011 ***	0.011 ***	0.010 ***	1.749 ***	1.716 ***	1.636 ***	1.713	1.673 ***
	6.168	*6.023*	*6.196*	*6.370*	*6.259*	*20.515*	*20.372*	*19.757*	*20.604*	*20.304*
N	6514	6524	6948	6948	6948	6552	6562	6987	6977	6987
R-squared	0.589	0.536	0.538	0.535	0.518	0.543	0.545	0.549	0.545	0.548
Adj. R-squared	0.542	0.534	0.536	0.534	0.516	0.541	0.544	0.547	0.543	0.547

Obs.: This table reports the regressions, including the interaction of the level of debt (DEBT) with the orthogonalized variable as an explanatory variable. The dependent variable is the marginal cost of debt. In Panel 1, the variable DEBT is the long-term total debt in billions of USD (LTD). In Panel 2, the variable DEBT is the debt-to-asset ratio. Numbers in italic are the t-statistics based on the robust standard errors (DtoA). Other variable names are abbreviated in the following way: Orthogonalized Content of ESG Score not captured by all risk measures (ORT_ALL); Orthogonalized Content of ESG Score not captured by the Altman Score (ORT_ALT); Orthogonalized Content of ESG Score not captured by the Z Score (ORT_Z); Orthogonalized Content of ESG Score not captured by the Volatility (ORT_VOL); Orthogonalized Content of ESG Score not captured by the Merton Distance to Default (ORT_Merton DD), Altman Score (ALTMAN), accounting-based Z score (Z-SCORE), volatility of stock returns (VOLATILITY), Merton Distance to Default (Merton DD). In all regressions, a constant and the control variables log of total assets (SIZE), intangibles assets over total assets (INTANGIBLES), and return on assets (ROA), as well as industry fixed, period fixed and region fixed effects, were included. The symbols ***, ** and *, respectively, show statistical significance at 1%, 5% and 10%, for one-sided tests.

Table 9 – Moderating Effect of the Agency Costs

	[1]	[1]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
	Panel 1 - Continuously Variable Agency Costs (AS)					Panel 2 - Dummy Variable Agency Costs				
ORT_ALL	-0.005 ***					-0.003 **				
	-4.897					*-2.261*				
ORT_ALL*[AS or Dummy]	-0.001 ***					-0.006 ***				
	-2.988					*-3.344*				
ORT_ALT		-0.005 ***					-0.002 ***			
		-5.258					*-2.375*			
ORT_ALT*[AS or Dummy]		-0.001 ***					-0.007 ***			
		-2.988					*-4.451*			
ORT_Z			-0.005 ***					-0.003 ***		
			-5.378					*-2.687*		
ORT_Z*[AS or Dummy]			-0.001 **					-0.006 ***		
			-2.038					*-3.307*		
ORT_VOL				-0.004 ***					-0.002 **	
				-3.840					*-1.736*	
ORT_VOL*[AS or Dummy]				-0.001 *					-0.004 ***	
				-1.630					*-2.526*	
ORT_MDD					-0.005 ***					-0.003 ***
					-5.002					*-2.549*
ORT_MDD*[AS or Dummy]					-0.001 **					-0.003 ***
					-2.067					*-2.549*
AS	0.023 **	0.009	0.023 **	0.022 ***	0.013 *	0.025 ***	0.012 *	0.024 ***	0.022 ***	0.015 *
	2.278	*0.862*	*2.558*	*2.458*	*1.441*	*2.597*	*1.292*	*2.728*	*2.565*	*1.639*
N	6428	6438	6862	6852	6852	6428	6438	6862	6852	6852
R-squared	0.538	0.512	0.508	0.506	0.496	0.539	0.513	0.509	0.507	0.496
Adj. R-squared	0.536	0.510	0.506	0.504	0.494	0.537	0.511	0.507	0.505	0.494

Obs.: This table reports the regressions, including the interaction of a proxy for agency costs with the orthogonalized variable as an explanatory variable. The dependent variable is the marginal cost of debt. In Panel 1, the variable proxy for agency costs is AS (the difference between each firm's asset-to-sales ratio and its industry's historical average). In Panel 2, the proxy for agency costs is a dummy that takes the value one if the firm has an asset-to-sales ratio above the average of its sector and zero otherwise. Numbers in italic are the t-statistics based on the robust standard errors. Other variable names are abbreviated in the following way: Orthogonalized Content of ESG Score not captured by all risk measures (ORT_ALL); Orthogonalized Content of ESG Score not captured by the Altman Score (ORT_ALT); Orthogonalized Content of ESG Score not captured by the Z Score (ORT_Z); Orthogonalized Content of ESG Score not captured by the Volatility (ORT_VOL); Orthogonalized Content of ESG Score not captured by the Merton Distance to Default (ORT_Merton DD). In all regressions, a constant and the following control variables: the difference between each firm's asset-to-sales ratio and its industry's historical average (AS), Altman Score (ALTMAN), accounting-based Z score (Z-SCORE), volatility of stock returns (VOLATILITY), Merton Distance to Default (Merton DD), log of total assets (SIZE), intangibles assets over total assets (INTANGIBLES), and return on assets (ROA), as well as industry fixed, period fixed and region fixed effects, where included. The symbols ***, ** and *, respectively, show statistical significance at 1%, 5% and 10%, for one-sided tests.

Table 10 – Moderating Effect of the Type of Financial System

	[1]		[1]		[3]		[4]		[5]	
ORT_ALL	-0.012	***								
	-5.439									
ORT_ALL*FINSYS	0.004	**								
	1.882									
ORT_ALT			-0.012	***						
			-5.432							
ORT_ALT*FINSYS			0.003	**						
			1.982							
ORT_Z					-0.010	***				
					-4.912					
ORT_Z*FINSYS					0.003	***				
					2.675					
ORT_VOL							-0.008	***		
							-3.839			
ORT_VOL*FINSYS							0.003	***		
							2.742			
ORT_MDD									-0.010	***
									-4.648	
ORT_MDD*FINSYS									2.731	***
									2.583	
FINSYS	0.130	***	0.256	***	0.103	**	0.099	**	0.104	**
	2.559		*2.685*		*2.081*		*1.980*		*2.085*	
N	6553		6563		6988		6978		6978	
R-squared	0.539		0.517		0.515		0.517		0.511	
Adj. R-squared	0.537		0.515		0.513		0.515		0.509	

Obs.: This table reports the regressions dedicated to analyzing the moderating effect of the type of financial system. The dependent variable is the marginal cost of debt. Variable names are abbreviated in the following way: Orthogonalized Content of ESG Score not captured by all risk measures (ORT_ALL); Orthogonalized Content of ESG Score not captured by the Altman Score (ORT_ALT); Orthogonalized Content of ESG Score not captured by the Z Score (ORT_Z); Orthogonalized Content of ESG Score not captured by the Volatility (ORT_VOL); Orthogonalized Content of ESG Score not captured by the Merton Distance to Default (ORT_Merton DD); AS is the difference between each firm's asset-to-sales ratio and its industry's historical average; FINSYS is the country's financial structure indicator. In all regressions, the control variables log of total assets (SIZE), intangibles assets over total assets (INTANGIBLES), and return on assets (ROA), Altman Score (ALTMAN), accounting-based Z score (Z-SCORE), volatility of stock returns (VOLATILITY), Merton Distance to Default (Merton DD), and the variable multiplied with ORT_ALL (D_to_A, LT DEBT, FINSYS or AS, depending on the case), as well as industry fixed and period fixed effects, were included. The symbols ***, ** and *, respectively, show statistical significance at 1%, 5% and 10%, for one-sided tests.

Table 11 – Impact on Marginal Cost of Debt by Lagged ESG Variables

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
	Panel 1 - Lag 1					Panel 2 - Lag 2				
ORT_ALL	-0.005 ***	-0.006 ***	-0.004 **	-0.007 **	-0.005 **	-0.005 ***	-0.004 ***	-0.005 **	-0.008 **	-0.005 **
	-4.902	*-3.343*	*-3.562*	*-4.112*	*-4.597*	*-4.564*	*-2.477*	*-3.784*	*-3.882*	*-4.156*
ORT_ALL*D_to_A		-0.040 ***					-0.037 ***			
		-8.184					*-8.055*			
ORT_ALL*LT DEBT			-0.000 **					-0.000 *		
			-1.795					*-1.609*		
ORT_ALL*FINSYS				0.001 *					0.002 *	
				1.371					*1.828*	
ORT_ALL*AS					-0.001 ***					-0.001 **
					-2.376					*-2.343*
ALTMAM	-0.060 ***	-0.057 ***	-0.076 **	-0.080 **	-0.077 **	-0.071 ***	-0.064 ***	-0.086 **	-0.091 **	-0.087 **
	-9.227	*-9.266*	*-13.001*	*-17.810*	*-15.037*	*-9.884*	*-9.162*	*-12.756*	*-15.470*	*-15.456*
Z-SCORE	-0.005 ***	-0.005 ***	-0.007 **	-0.007 **	-0.006 **	-0.006 ***	-0.005 ***	-0.007 **	-0.008 **	-0.007 **
	-6.126	*-6.120*	*-8.319*	*-8.681*	*-9.930*	*-5.964*	*-5.899*	*-7.941*	*-8.302*	*-9.535*
VOLATILITY	0.019 ***	0.019 ***	0.019 **	0.018 **	0.019 **	0.019 ***	0.019 ***	0.020 **	0.018 **	0.019 **
	10.516	*10.005*	*10.061*	*11.689*	*10.680*	*9.721*	*9.364*	*9.379*	*8.956*	*10.047*
MERTON DD	0.002	0.002	-0.001	-0.002	-0.001	0.001	0.002	-0.001	-0.002	-0.001
	0.795	*1.065*	*-0.438*	*-1.004*	*-0.380*	*0.470*	*0.915*	*-0.414*	*-0.868*	*-0.396*
N	5959	5959	5959	5959	5959	5342	5342	5342	5342	5342
R-squared	0.455	0.440	0.468	0.437	0.438	0.425	0.425	0.456	0.425	0.425
Adj. R-squared	0.452	0.437	0.465	0.434	0.435	0.422	0.422	0.453	0.422	0.422

Obs.: This table reports the regressions using lagged ESG orthogonalized variables. The dependent variable is the marginal cost of debt (CoD). The variable ORT_ALL lagged one year in Panel 1 and two years in Panel 2. Numbers in italic are the t-statistics based on the robust standard errors. The variable names are abbreviated in the following way: Orthogonalized Content of ESG Score not captured by all risk measures (ORT_ALL); D_to_A is the ratio debt-to-assets; LT DEBT is the dollar amount of long-term debt; AS is the difference between each firm's asset-to-sales ratio and its industry's historical average; FINSYS is the country's financial structure indicator; Altman Score (ALTMAN); accounting-based Z score (Z-SCORE); volatility of stock returns (VOLATILITY); and Merton Distance to Default (Merton DD). In all regressions, a constant and the control variables log of total assets (SIZE), intangibles assets over total assets (INTANGIBLES), return on assets (ROA), and the variable multiplied with ORT_ALL (D_to_A, LT DEBT, FINSYS or AS, depending on the case), as well as industry fixed, period fixed and region fixed effects, were included. The symbols ***, ** and *, respectively, show statistical significance at 1%, 5% and 10%, for one-sided tests.

Table 12 – Impact on Marginal Cost of Debt – Instrumental Variable Approach

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
	Panel 1 - Instruments Exactly Identified					Panel 2- Instruments Overidentified				
ORT_ALL	-0.006 ***	0.069 ***	0.022 ***	-0.154 ***	-0.013	-0.009 ***	-0.002	0.027 **	-0.015 ***	-0.007 ***
	-5.593	*4.683*	*4.173*	*-3.373*	*-0.859*	*-4.404*	*-0.433*	*2.257*	*-2.768*	*-3.330*
ORT_ALL*D_to_A		-0.173 ***					-0.026 ***			
		-5.254					*-2.403*			
ORT_ALL*LT DEBT			-0.000 ***					-0.000 ***		
			-4.421					*-8.641*		
ORT_ALL*FINSYS				0.120 ***	-0.001 **				0.005 **	
				3.744	*-1.932*				*1.679*	
ORT_ALL*AS										-0.001 ***
										-2.589
ALTMAM	-0.044 ***	-0.088 ***	-0.108 ***	-0.083 ***	-0.076 ***	-0.074 ***	-0.072 ***	-0.076 ***	-0.074 ***	-0.077 ***
	-9.082	*-11.356*	*-17.168*	*-4.553*	*-12.569*	*-13.137*	*-16.655*	*-8.641*	*-12.747*	*-14.435*
Z-SCORE	-0.004 ***	-0.004 ***	-0.006 ***	-0.000	-0.006 ***	-0.007 ***	-0.007 ***	-0.004 **	-0.007 **	-0.006 **
	-4.986	*-3.772*	*-5.902*	*-0.098*	*-8.587*	*-9.481*	*-8.871*	*-2.951*	*-8.373*	*-10.391*
VOLATILITY	0.020 ***	0.014 ***	0.018 ***	0.021 ***	0.021 ***	0.020 ***	0.019 ***	0.013 ***	0.021 ***	0.020 ***
	13.149	4.985	*8.544*	*3.737*	*8.308*	*11.019*	*12.191*	*4.755*	*11.778*	*11.815*
MERTON DD	0.004 ***	0.015 ***	0.011 ***	-0.001	-0.002	-0.002	-0.001	-0.002 *	-0.001	-0.001
	2.681	*7.233*	*5.634*	*-0.218*	*-0.481*	*-0.955*	*0.355*	*-1.390*	*-0.670*	*-0.312*
N	6553	6552	6552	6552	6553	6553	6552	6552	6552	6553
F statistics	169.44	128.94	108.49	249.4698	246.6479	247.86	250.56	234.71	243.3995	247.4972
Cragg-Donald/J - Statistic	33.5	120.32	376.06	23.29	229.21	0.28	0.38	0.13	0.31	0.72

Obs.: This table reports the regressions using IV 2SLS. The dependent variable is the marginal cost of debt (CoD). Panel 1 uses the median industry ESG score (ESG IND) as an additional instrument. Panel 2, in addition to ESG IND, uses each firm's initial (ESG INI) score as an additional instrument. Numbers in italic are the t-statistics based on the robust standard errors. The variable names are abbreviated in the following way: Orthogonalized Content of ESG Score not captured by all risk measures (ORT_ALL); D_to_A is the ratio debt-to-assets; LT DEBT is the dollar amount of long-term debt; AS is the difference between each firm's asset-to-sales ratio and its industry's historical average; FINSYS is the country's financial structure indicator; Altman Score (ALTMAN); accounting-based Z score (Z-SCORE); volatility of stock returns (VOLATILITY); and Merton Distance to Default (Merton DD). In all regressions, a constant and the control variables log of total assets (SIZE), intangibles assets over total assets (INTANGIBLES), and return on assets (ROA), and the variable multiplied with ORT_ALL (D_to_A, LT DEBT, FINSYS or AS, depending on the case),

as well as industry fixed, period fixed and region fixed effects, were included. The line Cragg-Donald/J - Statistic reports the Cragg-Donald Statistic in Panel 1 and the J - Statistic in Panel 2. The symbols ***, ** and * show statistical significance at 1%, 5% and 10%, respectively.

Table 13 – Impact on Marginal Cost of Debt – Propensity Score Match Approach

	[1]		[2]		[3]		[4]		[5]		[6]	
Panel 1 - Pre-Match and Post-Match Diagnostic Test				Panel 2 - Multivariate Regression								
	Pre-Match		Post-Match									
						**		**		**		**
				ORT_ALL	-0.005	*	0.011	*	-0.011	*	-0.005	*
					-5.187		*6.076*		*-4.709*		*-5.025*	
				ORT_ALL*D_to_A			-0.054	**				
SIZE	0.045	*	0.034									
	1.869		*1.412*				*-10.627*					
				ORT_ALL*FINSYS					0.004	**		
INTANGIBLES	0.000		0.000									
	0.288		0.415						*2.600*			
ROA	-0.005		-0.005	ORT_ALL*AS							-0.001	**
	-1.193		*-1.366*								*-2.093*	
						**		**		**		**
ALTMAM	0.000		0.000	ALTMAM	-0.077	*	-0.074	*	-0.082	*	-0.078	*
	0.381		*0.368*		*-13.771*		*-13.933*		*-14.238*		*-17.048*	
						**		**		**		**
Z-SCORE	0.001		0.002	Z-SCORE	-0.007	*	-0.007	*	-0.007	*	-0.007	*
	0.656		*0.943*		*-9.050*		*-8.516*		*-8.616*		*-8.805*	
						**		**		**		**
VOLATILITY	0.005	*	0.002	VOLATILITY	0.019	*	0.017	*	0.019	*	0.019	*
	1.945		*0.984*		*10.470*		*9.776*		*10.258*		*12.286*	
MERTON DD	-0.003		0.002	MERTON DD	-0.001		0.000		-0.002		-0.002	
	-1.095		*0.682*		*-0.541*		*0.093*		*-0.975*		*-1.164*	
N	6860		5712	N	5712		5711		5711		5712	
McFadden R-squared	0.001		0.001	R-squared	0.537		0.551		0.544		0.537	
				Adj. R-squared	0.534		0.549		0.542		0.534	

Obs.: This table presents the regression results using the propensity score matching approach. Panel 1 reports the pre-match propensity score regression (column [1]) and post-match diagnostic regression (column [2]). The dependent variable is HIGH_ESG, a variable set to 1 if the ESG score exceeds the median and 0 otherwise. Panel 2 reports multivariate regressions using the observations that HIGH_ESG equals one and the correspondent matched observations as a sample. The dependent variable is the marginal cost of debt. Numbers in italic are the t-statistics based on the robust standard errors. The variable names are abbreviated in the following way: Orthogonalized Content of ESG Score not captured by all risk measures (ORT_ALL); D_to_A is the ratio debt-to-assets; AS is the difference between each firm's asset-to-sales ratio and its industry's historical average; FINSYS is the country's financial structure indicator; Altman Score (ALTMAN), accounting-based Z score (Z-SCORE), volatility of stock returns (VOLATILITY), Merton Distance to Default (Merton DD). In all regressions, a constant and the control variables log of total assets (SIZE), intangibles assets over total assets (INTANGIBLES), and return on assets (ROA), and the variable multiplied with ORT_ALL (D_to_A, LT DEBT, FINSYS or AS, depending on the case), as well as industry fixed, period fixed and region fixed effects, were included. The symbols ***, ** and * show statistical significance at 1%, 5% and 10%, respectively.

Figure 1 - The relationships mapped in this figure come from the literature review. The codes assigned to each relationship (A, B, C, D) are identified in the main text.

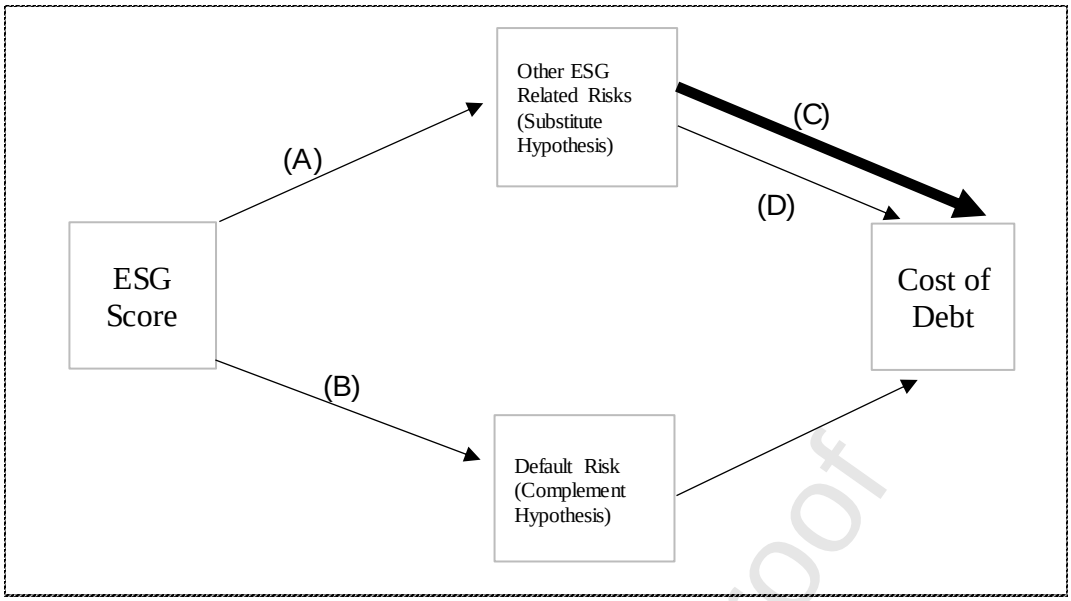
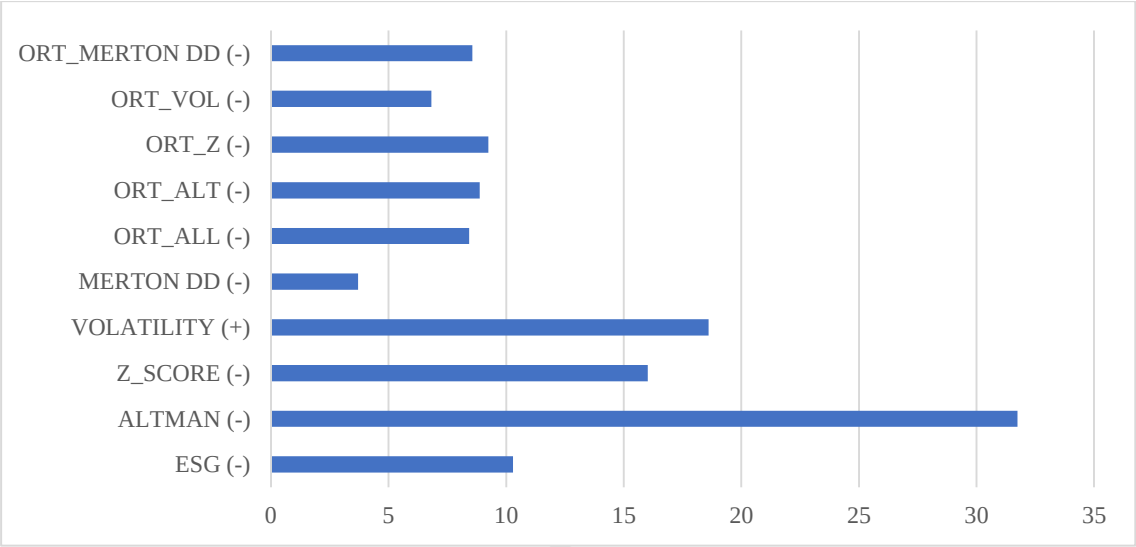


Figure 2 - Absolute between effects on marginal cost of debt of a one (between) standard deviation change of the ESG Scores or Risk measures. Variable names are abbreviated in the following way: ESG Score (ESG), Altman Score (ALTMAN), accounting-based Z score (Z_SCORE), volatility of stock returns (VOLTALITY), Merton Distance to Default (Merton DD), Orthogonalized Content of ESG Score not captured by all risk measures (ORT_ALL); Orthogonalized Content of ESG Score not captured by the Altman Score (ORT_ALT); Orthogonalized Content of ESG Score not captured by the Z Score (ORT_Z); Orthogonalized Content of ESG Score not captured by the Volatility (ORT_VOL); Orthogonalized Content of ESG Score not captured by the Merton Distance to Default (ORT_Merton DD). The coefficients were estimated in regressions, including as control variables log of total assets (SIZE), intangibles assets over total assets (INTANGIBLES), and return on assets (ROA), as well as industry fixed, period fixed and region fixed effects.



Highlights

- This research aims to comprehensively evaluate the impact of ESG scores on the cost of debt. The investigation delves into potential mechanisms explaining the ESG scores and cost of debt relationship, considering both direct and indirect channels.

- The research assesses whether ESG scores provide information beyond traditional financial metrics, aiming to determine whether they complement or substitute information for conventional risk measures.

- The study explores potential asymmetry in the effects of ESG scores on the cost of debt, focusing on whether highly indebted firms derive more significant benefits from higher ESG scores compared to those with lower levels of indebtedness.

- Furthermore, it analyzes how agency costs interact with ESG performance, investigating whether companies with higher agency costs experience a different impact of ESG scores on their cost of debt compared to those with lower agency costs.

- Lastly, the research examines the moderating effect of the type of financial system on the relationship between ESG scores and the cost of debt, considering distinctions between bank- and market-based systems.

- Overall, this study aims to comprehensively understand the multifaceted dynamics between ESG scores and the cost of debt in the corporate landscape.