

# **Environmental Performance and Cost of Debt: Evidence from FTSE 100**

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March 2024

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## **Abstract**

Within the developing concept of sustainable finance, this paper investigates the complex relationship between environmental performance and the cost of financing for corporations listed on the FTSE 100. This study makes a valuable contribution to the existing body of knowledge by examining the varying effects of various aspects of environmental performance on debt financing. Using a comprehensive dataset spanning 17 years, we use ordinary least squares (OLS) regression models to evaluate the impact of environmental performance, emission performance, resource usage performance, and environmental innovation on the debt cost. The empirical findings highlight a notable inverse correlation between the environmental pillars and the cost of debt, suggesting that increased commitment to environmental, emissions, and resource management is accompanied by decreased borrowing costs. Nevertheless, there is no statistically significant association between the cost of debt and environmental innovation performance, indicating a complex relationship that requires further studies. The inclusion of robustness tests, such as a comparison study conducted before and after the Paris Agreement, offers a more comprehensive understanding of the changes in the value of environmental credentials across time. The presence of disparities between the data provided by Bloomberg and LSEG introduces an additional dimension to our inquiry, shedding light on the impact of contrasting approaches used by ESG rating agencies on financial analysis. Additionally, it sheds insight on the wider financial consequences associated with sustainable business practices.

**Keywords:** Cost of Debt; Environmental Performance; Emission; Environmental Enovation; Resource Use.

## 1. Introduction

Since The New York Times published a seminal piece by Milton Friedman in 1970, the question of whether corporations should maximise shareholder wealth or stakeholder welfare has been the subject of discussion ([Friedman, 1970](#)). Does environmental, social, and governance (ESG) certification by a third-party matter, and more importantly, does it offer value to the firm? The growing number of companies covered by third-party ESG rating providers demonstrates that capital providers value these ratings ([Wong et al., 2021](#)). A rising number of companies have incorporated global warming measures into their fundamental policies, recognising that becoming green may save money via, among other variables, greater energy efficiency and waste management ([Cadez, Czerny and Letmathe, 2019](#)).

In recent years, there has been an increasing desire from enterprises' stakeholders, such as consumers, workers, communities, governments, and shareholders, to implement social and environmental policies ([Ahmed, Eliwa and Power, 2019](#)). Given the growing awareness of environmental preservation, the question of whether a company may gain from adopting environmentally friendly practices is a subject of ongoing discussion ([Horváthová, 2010; Gupta, 2018](#)).

In accordance with some of the models, [Gillan, Koch and Starks \(2021\)](#) refer to high ESG businesses as "green" and poor ESG businesses as "brown" while explaining these theoretical models. Additionally, more extensive quantifiable environmental disclosures of particular pollution measures and incidents are strongly correlated with strong economic performance and good environmental performance([Al-Tuwaijri et al., 2004](#)). Given a sufficient number of investors desiring green investments in the economy, i.e. the investor base, the majority of models predict that green enterprises will have reduced capital costs ([Gillan, Koch and Starks, 2021](#)).

This better perception should, in turn, encourage the financial market to be prepared to take lower risk premiums on shares or allow the business to acquire larger leverage levels, which may result in a cheaper cost of capital overall ([Sharfman and Fernando, 2008](#)). The government, the public, and other stakeholders have expressed significant concern regarding the environmental performance of severely polluting enterprises, as it serves as an essential element and institutional guarantee for such enterprises to attain environmental sustainability (Sun et al.,2023).

In our current day, Environmental, Social, and Governance (ESG) factors have gained increased significance, particularly in relation to the Environmental pillar. Investors, regulators, policymakers, citizens, and investees have become increasingly concerned about the risks associated with environmental and climate factors. As a result, there has been a growing use of E scores/ratings in investment analyses and decisions. E scores are influenced by the accessibility and accuracy of the data reported by companies, with a primary emphasis on greenhouse gas emissions and resource utilization, such as water management and waste management (Apergis et al.,2022). In fact, many aspects of enterprises' Environmental Performance (EP) deserve more study. First, rarely is known about the mechanism through which enhanced EP leads to increased financial performance. In other words, the issue of which channels improve the financial success of businesses remains unclear. [Sharfman and Fernando \(2008\)](#) contend that enterprises might decrease their perceived risk by enhancing their EP, hence lowering their cost of capital which is an external route that may impact financial performance. Second, most studies see the EP as a sub-dimension of corporate social responsibility (CSR), and as a result, they do not emphasise the pillars of EP ([El Ghouli et al., 2011](#); [Cheng et al., 2014](#); [Naseem et al., 2020](#)). [Bouslah et al. \(2013\)](#) suggest that examining the effects of EP on the cost of equity (COE)by decomposing its pillars (such as resource

reduction, emission performance, and environmental product innovation) would shed more light on the relationship, as not all pillars may be equally relevant.

Debt financing from banks remains a significant option, even for major publicly traded corporations (Houston and James ,1996).The adoption of environmentally responsible lending policies by a substantial proportion of lenders may influence the cost of capital for the borrowing firm and, via this channel, may potentially affect the environmental policies of borrowers(Chava,2010; Heinkel et al.,2001). In line with the rationales put forth for equity risk, credit risk ought to be impacted by the manner in which robust corporate social responsibility (CSR) initiatives serve to safeguard companies' earnings from abrupt shifts in consumer preferences or regulatory actions resulting from environmental or societal emergencies (Albuquerque et al.,2019). Lenders may also expose themselves to a risk to their reputations if they provide financing for environmentally detrimental initiatives. Lenders might be marginally impacted by the negative publicity and societal perceptions that are progressively scrutinising the polluting corporations(Chava ,2010).

The importance of environmental performance in the debt market is becoming increasingly evident, as firms with strong environmental practices often enjoy more favorable debt financing terms. Empirical studies have shown that proactive environmental management is associated with reduced credit risk, which can lead to better loan conditions offered by lenders (Bauer & Hann, 2010). Moreover, the financial benefits of environmental stewardship are highlighted by findings that link robust carbon disclosure and lower emission levels with a decreased cost of debt (Kleimeier & Viehs, 2018). This underscores the critical role that environmental performance plays in mitigating financial risks and enhancing a firm's appeal to creditors. Additionally, the presence of environmental externalities has been found to correlate with an increased cost of capital, further emphasizing the financial imperative for firms to engage in

environmentally responsible behaviors to secure competitive financing (Chava, 2014). These insights collectively reinforce the growing significance of environmental considerations in shaping financing strategies within the debt market, illustrating the necessity for firms to prioritize environmental performance not only as a commitment to sustainability but also as a strategic financial decision.

Recent empirical research underscores the significant impact of environmental performance on financing within the debt market. Flammer (2021) provides compelling evidence that the issuance of corporate green bonds is associated with a lower cost of debt, signaling the financial markets' endorsement of firms' environmental commitments. Similarly, Tang and Zhang (2020) explore the financial implications of green bonds, demonstrating their positive effect on shareholder value, which suggests broader benefits of environmental initiatives for corporate financing strategies. Furthermore, Bachelet, Becchetti, and Manfredonia (2019) delve into the green bonds market, highlighting how issuer environmental performance and third-party verification contribute to the observed green bond premium, reinforcing the value of credible environmental practices in debt financing. These studies collectively indicate a growing recognition of environmental sustainability as a critical factor in shaping favorable debt financing conditions, emphasizing the strategic financial importance of integrating environmental considerations into corporate decision-making processes.

Debt providers such as banks and lenders can mitigate information asymmetry by evaluating hard data contained in a company's annual reports. Additionally, they can base their lending decisions on soft data. Fundamentally, the disclosure of environmental information by corporations is considered a significant form of soft data. We hypothesise, as a logical

consequence, that financiers would commend an organization's environmentally sustainable practises and consequently levy reduced interest rates on said organisations (Du et al.,2017).

In light of the significant role that banks play in capital allocation and oversight of the firm's operations, it is critical to comprehend whether lending decisions take into account the environmental profile of the organization. To the best of my knowledge, this is the first paper that analyzes how the environmental performance of a firm and its pillars impact the cost of its debt financing. The paper conducts an examination of the extent to which banks are committed to environmental sustainability and explores the possible consequences of incorporating corporate environmental performance factors into lending decisions. The study's primary objective is to evaluate enterprises' EP's influence on cost of debt in the FTSE 100. The second objective is to investigate the influence of each EP pillar on the cost of debt.

We contribute to the literature on the financial market responses to corporate environmental news. The paper conducts an examination of the extent to which banks are committed to environmental sustainability and explores the possible consequences of incorporating corporate environmental performance factors into lending decisions. First, our study broadens the literature on financial market responses to corporate environmental news by providing a comprehensive examination of the lending landscape's commitment to environmental sustainability. Extending our analysis beyond traditional banking institutions, we include a variety of lenders such as bond issuers (Flammer, 2021), institutional investors (Berg, Koelbel, & Rigobon, 2020), and alternative financing platforms, thereby encompassing the wider spectrum of financial entities offering debt financing. This approach allows us to explore the multifaceted consequences of incorporating corporate environmental performance factors into lending decisions across different types of lending institutions (Hachenberg & Schiereck, 2018; Goss & Roberts, 2011). Furthermore, we delve into the valuation impact of environmental sustainability, as evidenced by the critical analysis provided by Cornell and Damodaran (2020),

highlighting the growing integration of ESG considerations into the financial decision-making processes across various sectors. By doing so, we shed light on the pervasive influence of environmental sustainability considerations not only within the banking sector but also across the broader financial ecosystem, underscoring the universal significance of environmental factors in shaping lending practices and investment decisions.

Second, our research makes a significant leap forward in the literature by conducting a nuanced analysis of the impact of environmental performance (EP) on the cost of debt within FTSE 100 companies, an area that recent studies have begun to explore but not in the depth our work provides. Unlike existing literature that broadly addresses CSR disclosures and their financial implications (Dhaliwal et al., 2011; Clarkson et al., 2013; Plumlee et al., 2015), our study carves a unique niche by dissecting EP into its constituent elements—resource use efficiency, environmental innovation, and emission control. This granular approach not only aligns with but also extends beyond the calls for detailed environmental evaluations in corporate finance research, as underscored by recent findings from Jung, Herbohn, and Clarkson (2020), who highlight the critical link between carbon risk awareness and the cost of debt financing. Furthermore, our exploration into the distinct impacts of these EP components on debt financing costs responds to the evolving landscape of financial decision-making influenced by environmental sustainability, as evidenced by Wang and Lucey's (2020) investigation into green bonds within the EU. By adopting this detailed perspective, inspired by but distinctly advanced from the broader analyses (e.g., Trumpp & Guenther, 2017), our research not only adheres to but innovatively expands upon the recommendations for comprehensive environmental evaluations. Consequently, our work distinctly contributes to the literature by offering a pioneering analysis that quantifies the nuanced impacts of specific EP activities on the cost of debt, providing invaluable insights into how each environmental performance pillar directly affects financial outcomes.

Through the identification of precise environmental measures that yield the greatest reduction in a company's cost of debt, this research offers more precise recommendations for environmental policies and strategies at the corporate level. Our empirical findings makes a substantial contribution to the dialogue surrounding sustainable finance by providing valuable perspectives on particular ecological procedures that yield advantages for an organization's financial performance and the environment (Flammer, 2013; Ioannou and Serafeim, 2012). In conclusion, this study makes a valuable contribution to the domain of sustainable finance through the provision of an exhaustive and nuanced examination of the correlation between different aspects of environmental performance and the cost of debt. This study contributes to the expanding body of research on the intersection of corporate finance and environmental responsibility by offering novel perspectives that deepen our comprehension of the financial advantages associated with responsible environmental behaviour (Chava, 2014; Goss & Roberts, 2011).

In our study, we investigate the impact of environmental performance and its components—emission performance, environmental innovation, and resource use—on the cost of debt within FTSE 100 companies, drawing on a 17-year dataset from Refinitive DataStream. Our methodological approach employs a series of ordinary least squares (OLS) regression models to test our hypotheses. The findings reveal a significant and negative association for most environmental activities with the cost of debt, indicating that enhanced environmental practices are linked to lower financing costs. However, environmental innovation stands as an exception, not showing a significant impact, highlighting the intricate dynamics between different aspects of environmental performance and their financial implications.

The remainder of the paper is structured as follows. In the next section, we provide a literature review, the theoretical framework and develop our hypotheses; section three states the research gap and section four describes the methodology used to test our hypothesis. Section

five describes the sample selection process and discusses the empirical findings. In section six, we present our conclusion.

## **2. Theoretical framework and Literature Review**

This research often uses the following theories to explain the probable relationship between ESG and the cost of debt. Agency, Signaling, Stakeholder and traditional finance theories are examples.

Agency difficulties are caused primarily by the separation of ownership and management ([Jensen and Meckling, 2019](#)). Agency costs are incurred when management conduct results in monetary loss for shareholders ([Ness and Mirza, 1991](#)). Businesses may use CSR tactics to mitigate the conflict of interest between management and interested parties ([El Ghouli et al., 2011](#)). Better access to capital may be linked to decreased agency costs owing to more stakeholder participation and less informational asymmetry([Cheng, Ioannoy and Serafeim, 2014](#)).

In the manner of the signaling theory, it is used to explain the relationship between Corporate Social and Environmental Performance (CSEP) and the cost of equity in the second line of inquiry ([Morris, 1987](#)). It is based on the notion that organizations that perform well are incentivised to differentiate themselves from those that do poorly ([Craven and Marston, 1999](#)). [Gray \(2005\)](#) suggests that organizations engaged in CSEP are mainly concerned with signaling the quality of their management in this context.

Based on stakeholder theory, which states that a firm's objective is to produce shareholder value while preserving the interests of all stakeholders ([Freeman, 2010](#); [Jensen, 2001](#)), I additionally examine the differential impacts of non-financial ESG sustainability performance on the cost of equity. According to [Ng and Rezaee \(2015\)](#), most surveyed institutional investors want more sustainability information, and investors continue to place a high value on a

company's sustainability performance. Firms wish to present transparent views of their corporate responsibility procedures and activities to all stakeholders. Over the course of more than two decades, corporate disclosure of environmental, social, and governance (ESG) factors has evolved in several ways ([Alareeni and Hamdan, 2020](#)). In order to gain greater access to financing sources (including debt), managers would provide funds providers (including credit providers) with explanations and justifications regarding the social and environmental impacts of their activities. Therefore, enterprises that provide comprehensive disclosures regarding environmental and social matters are more likely to satisfy the demands of credit providers, earn their endorsement, and secure improved access to sources of debt financing (Hamrouni et al.,2012). Shareholder theory states that the primary objective of a business is to optimise corporate value.

Certain proponents of shareholder theory contend that corporate social responsibility (CSR) initiatives deplete business resources that should be directed towards profit generation. Therefore, they anticipate a negative correlation between the pursuit of maximising shareholder wealth and engaging in corporate social responsibility (CSR) initiatives (Friedman,2016). In contrast, the stakeholder theory argues that corporations should go beyond the interests of shareholders and consider the interests of a broader group of stakeholders. (Freeman, 2010). In his research, (Jones,1995) expands upon stakeholder theory by asserting that corporate social responsibility (CSR) is crucial for companies to acquire the resources they need and gain support from stakeholders.

According to traditional finance theory, a manager's sole responsibility is to maximise shareholder value. In fact, Milton Friedman, winner of the Nobel Peace Prize, famously argued in an article titled "The Social Responsibility of Business Is to Increase Profits" that managers, acting as agents and not principals, should not spend company resources on "social" initiatives because they reduce shareholder value. Today, forty years later, corporations are under enormous

pressure to enhance their corporate social performance (CSP) and incorporate environmental, social, and governance (ESG) aspects into their business activities. Managers must thus decide whether to invest in CSP using company funds. The crucial issue for them is whether this spending would provide future advantages for the company, so increasing its value, or if it will be a waste of the company's resources, thereby decreasing its value ([Humphrey, Lee and Shen, 2012](#)).

Empirically, the current literature provides conflicting evidence on the effect of ESG and the environmental performance on the cost of capital.

## **2.1. Firms' ESG attributes and cost of capital**

It has been widely shown in the previous literature that ESG has a negative relationship with the cost of capital. [Temiz \(2022\)](#) seeks to examine the impact of environmental performance (EP) and its pillars on the cost of debt and equity (Cost of Capital) in an emerging market context. [Temiz's \(2022\)](#) findings indicate that the collective EP of enterprises reduces the cost of both debt and equity. All of the EP pillars have a negative influence on the cost of debt, but only emission performance has a major negative impact on the cost of equity which demonstrates that the emission performance of enterprises mostly determines the impacts of EP on equity cost ([Temiz, 2022](#)). Based on an analysis of 230 Australian listed corporations between 2004 and 2016, the researchers found that firms that commit to greater levels of corporate social responsibility (CSR) have a negative impact on both the cost of equity (COE) and the cost of debt (COD). This implies that disclosing CSR activities decreases the cost of financing for these firms" (Bhuiyan and Nguyen, 2020).

Furthermore, using a wide cross-section of companies, [Cheng, Loannou and Serafeim \(2014\)](#) conclude that corporations with greater CSR performance are much less constrained by capital restrictions. As stated in [Wong et al. \(2021\)](#), ESG certification reduces a company's cost

of capital, whereas Tobin's Q considerably rises, according to empirical evidence of Malaysian businesses. An empirical analysis of [Sharfman and Fernando \(2008\)](#) on 267 US companies demonstrates that enhanced environmental risk management correlates with a reduced cost of capital. If increased environmental risk management leads to reductions in the weighted average cost of capital in one period, this reduced cost of capital will result in enhanced economic performance in subsequent periods ([Sharfman and Fernando, 2008](#)).

The cost of capital (both equity and debt) is greater for enterprises with poor environmental characteristics; Unlike prior findings, few investigations demonstrate a positive or non-significant association between ESG and Cost of capital ([Chava, 2014](#)). Even though greenhouse gas emissions are not officially regulated, investors seem to take climate change concerns into account, as seen by the much higher cost of equity and loan financing for companies with climate change problems; however, equity and loan capital costs are not often cheaper for enterprises with environmental strengths ([Chava, 2014](#)). Moreover, the study provides evidence that enterprises with environmental issues have a lower proportion of institutional ownership, and those fewer institutions keep their shares ([Chava, 2014](#)).

Empirical results indicate that climate vulnerability raises the cost of debt both directly and indirectly by limiting access to financing; however, the results find insufficient evidence that climate vulnerability influences equity costs ([Kling et al., 2021](#)). Investors and managers are able to adopt a corporate social performance investment or business plan without incurring a high financial cost (or gain) in terms of risk or return, according to the empirical evidence of UK firms ([Humphrey, Lee and Shen, 2012](#)). Additionally, [Shad et al. \(2020\)](#) clarify that environmental sustainability reporting decreases just the cost of debt for Malaysian oil and gas businesses but not the cost of equity.

Nevertheless, created in 2006 in the United States, the B Lab certification of for-profit companies with social and environmental purposes has evolved as a prominent signalling mechanism in recent years ([Silva et al., 2022](#)). Surprisingly, B Corporation certification does not result in financial benefits or stability, as the equity ratio falls and becomes more volatile after certification. The results offer a bleak picture of minimal economic rewards and diminishing engagement of equity holders as a result of B Corporation accreditation ([Patel and Dahlin, 2022](#)). [Patel and Dahlin \(2022\)](#) indicate that different events may impact the equity ratio. Certification and modifications required to fulfil certification standards may be expensive and result in a loss of property and equity diminution. Certificates may also provide access to "green bonds," allowing for debt growth, which can affect the equity ratio.

## **2.2. Firms' ESG attributes and cost of debt.**

In the context of the debt market, companies with higher transparency in disclosing ESG information have easier access to the debt market ([Ramio et al., 2021](#)). Empirical evidence from France reveals that the total CSR disclosure score negatively influences the cost of debt as a combination of ESG disclosure scores (i.e. lowers the cost of debt) ([Hamrouni, Uyar and Boussaada, 2019](#)). Bannier et al. (2022) analyse the environmental and social pillars by examining data from 2003 to 2018. They find that environmental factors alone lower various indicators of credit risk for U.S. companies, whereas both environmental and social factors have this effect on European companies. Additionally, they discover that credit ratings fail to accurately represent the credit-risk mitigating impacts of corporate social responsibility. Furthermore, Barth et al. (2022) examine the influence of environmental, social, and governance (ESG) factors on credit default swap (CDS) credit spreads in financial markets. They discover a decrease in credit spreads for companies that possess favourable ESG ratings.

Likewise, using a dataset consisting of 18,950 observations of firm-year pairs from 41 different countries covering the years 2008 to 2015, we have discovered a noteworthy and statistically significant negative relationship between the overall environmental, social, and governance (ESG) performance of enterprises and their cost of debt (COD) (Houqe, Ahmed, and Richardson, 2020). However, corporate social responsibility (CSR) spending is negatively correlated with overall leverage but positively associated with long-term leverage at the 25th and 50th percentiles, and it shows a significant positive correlation with long-term debt but no significant correlation with short-term or overall debt (Oware and Mallikarjunappa, 2021).

#### *2.2.1. Firms' environmental performance attributes and the cost of debt.*

Combining insights from various studies, a comprehensive understanding emerges of the relationship between environmental performance and the cost of debt. Sharfman and Fernando (2008) argued that enhanced environmental risk management translates into financial benefits for firms, such as reduced cost of equity capital and a shift towards debt financing. Furthermore, Bauer and Hann (2010) highlighted that environmental strengths are linked with lower cost of debt, whereas environmental concerns correlate with higher costs and lower credit ratings. This indicates the financial market's nuanced response to different levels of environmental performance. As a result of the prudent lending approach taken with companies that face substantial environmental risks, Ginglinger and Moreau (2023) demonstrated that increased climate risk decreases firm leverage.

The financial implications of environmental stewardship are underscored by the discovery by Seltzer et al. (2022) that inadequate environmental performance, as measured by increased carbon footprints, generally leads to diminished credit ratings and elevated bond yield spreads. Moreover, Chava (2010) presented empirical evidence indicating that environmental concerns have an impact on the interest rates charged by banks to companies, resulting in increased costs. Environmental considerations are incorporated into corporate lending decisions

by UK banks, according to Thompson and Cowton (2004), indicating a paradigm shift in conventional credit risk assessment approaches.

Yoo (2021) adapted these results to an international framework, demonstrating that credit ratings are substantially influenced by environmental responsibility information in South Korea. Offering empirical evidence of the financial benefits of environmentally friendly practises, Du et al. (2017) determined through content analysis that improved environmental performance is associated with a substantial reduction in the cost of debt. Furthermore, Sun et al. (2023) discovered that long-term financial debt is more favourable for firms with superior carbon emission performance, indicating that financial rewards are being extended to companies that make environmental investments.

In evaluating the effect of carbon-neutral lending on credit risk in the Eurozone, Umar et al. (2021) found a negative association with default risk, which supports the promotion of carbon-neutral initiatives. From 2010 to 2017, Pizzutilo et al. (2020) examined the correlation between the carbon emissions of EuroStoxx 600 companies and the cost of debt financing. They discovered substantial support for the hypothesis that the cost of debt financing is positively correlated with the intensity of carbon emissions.

In responding to the literature on financial market responses to corporate environmental actions, this study carves out a distinct niche by meticulously examining the discrete components of environmental performance—resource use efficiency, environmental innovation, and emission control—within the FTSE 100 companies. Unlike the broader analyses provided by existing studies (El Ghouli et al., 2011; Clarkson et al., 2013; Plumlee et al., 2015), which primarily focus on CSR disclosures and their aggregate impact on financial metrics, our research delves into the specific elements of EP and their direct association with the cost of debt. This granular approach not only fulfills the recommendation by Clarkson et al. (2011) for more

comprehensive environmental evaluations but also pioneers in linking these distinct EP components with financial outcomes, particularly in the context of debt financing.

Moreover, our focus on the cost of debt, as opposed to the cost of equity, addresses an underexplored area in the literature. While studies like El Ghouli et al. (2011; 2018) and Ahmed, Eliwa, and Power (2019) shed light on the relationship between CSR and the cost of equity, emphasizing the beneficial impact of higher CSR rankings and environmental practices on equity financing costs, there remains a gap in understanding how these environmental practices influence debt financing costs. Our research aims to fill this gap, particularly within the UK market, where the financial landscape and regulatory environment offer a unique context for evaluating the implications of EP on the cost of debt. The UK's commitment to environmental sustainability, coupled with its advanced financial markets, makes it an ideal setting to explore these dynamics.

A comprehensive set of empirical studies (Sun et al., 2023; Chiesa, McEwen, and Barua, 2021; Temiz, 2022; Bauer and Hann, 2010; Sharfman and Fernando, 2008) substantiates the hypothesis that a negative association exists between debt service costs and environmental performance. It is substantiated by Sun et al. (2023) that enhanced environmental performance substantially reduces the financing costs of corporations. Similarly, Chiesa, McEwen, and Barua (2021) establish a relationship between such performance and decreased debt financing costs, as indicated by coupon rates that are shorter across a range of debt maturities. Temiz (2022) expands upon this notion by illustrating that in developing economies, firms exhibiting superior environmental performance experience reduced debt and equity costs. Bauer and Hann (2010) contribute to this discourse by demonstrating an association between proactive environmental management practices and reduced debt financing costs. Sharfman and Fernando (2008) support this notion, emphasising that improved environmental risk management results in a decrease in the cost of capital, which is driven by investors' diminished risk perceptions. Collectively, these

studies substantiate the claim that environmental stewardship confers financial benefits, specifically with regard to borrowing costs. These analyses lead us to formulate our main hypothesis as follows:

**H1: There is a negative association between environmental performance and the cost of debt.**

The study by Jung, Herbohn, and Clarkson (2020) underscores the financial benefits of emission control. By demonstrating a negative association between carbon risk awareness and the cost of debt, it highlights how effective emission management can lead to favorable financial conditions due to perceived lower risks by lenders. A collection of studies has been conducted to establish a positive association between elevated carbon emissions and heightened borrowing costs in diverse settings. In their study, Kleimeier and Viehs (2018) observe a positive correlation between elevated carbon emissions and increased loan spreads, indicating a clear connection between emissions levels and the borrowing expenses incurred by enterprises. Palea and Drogo (2020) support this conclusion, demonstrating that throughout the Eurozone, particularly after the Paris Agreement, there is an association between carbon emissions and an increased cost of debt. This trend remains constant across several geographical regions. Pizzutilo et al. (2020) find a strong positive relationship between carbon intensity and the cost of debt, providing more evidence that greater emissions result in higher borrowing costs. This trend is supported by the research conducted by Maaloul (2018), which demonstrates that greenhouse gas (GHG) emissions have a positive impact on the cost of loans for Canadian enterprises. This highlights the importance of lenders taking emissions into account when making lending choices. The findings of Caragnano et al. (2020) contribute to the existing body of evidence by demonstrating that European firms exhibit a positive correlation between emissions intensity and the cost of debt financing. This correlation is observed across various studies and regions, indicating that a higher intensity of carbon emissions is linked to an increased cost of debt financing. These studies together contradict the basic idea, demonstrating a strong positive correlation between emissions performance and borrowing costs. Based on this anticipation, the subsequent hypotheses are developed:

**H2: There is a negative association between Emission performance and the cost of debt.**

Flammer (2021) discusses the role of environmental innovation in enhancing operational efficiencies and market positioning, which can contribute to lower financing costs. Firms engaged in innovative environmental practices are often viewed as lower risk, making them more attractive to investors and lenders. Romano et al. (2023) and Benkraiem et al. (2023) notably observe that healthcare enterprises that participate in environmental innovation discover a decrease in the cost of financing. This drop is attributed to the enhanced perception of risk and

increased financial appeal resulting from the adoption of sustainable practices. In their recent study, Chen et al. (2022) examine the potential hindrances to corporate green innovation caused by external financial pressures, such as local government debt. However, they also propose that surmounting these obstacles might result in advantageous financing circumstances. Alberini et al. (2021) expand upon this story by providing evidence that companies engaged in environmental innovation have advantages such as reduced borrowing cost, improved reputation, and a more favourable risk profile. Collectively, these studies provide a coherent rationale for the significance of environmental innovation in mitigating the costs associated with debt, underscoring the favourable financial consequences of sustainable business approaches. Therefore, the following hypothesis is developed and tested:

**H3: There is a negative association between Environmental innovation performance and the cost of debt.**

Wang and Lucey (2020) examine the impact of efficient resource management on financial outcomes. Their findings suggest that efficient resource use not only reduces operational costs but also aligns with investor expectations for sustainable growth, positively influencing the cost of debt. The findings of Fonseka et al. (2019) in the Chinese energy market, Sylvia and Siregar (2021) in ASEAN countries, and El Ghouli et al. (2018) in global manufacturing sectors collectively demonstrate a consistent pattern: the impact of sustainability and efficient resource management on financing costs is substantial. The research conducted by Fonseka et al. demonstrates that companies who prioritise environmental transparency and embrace cleaner energy sources have advantages such as reduced loan costs. This indicates a positive correlation between the efficiency of resource management and financial performance. Sylvia and Siregar support this notion, since they observe that implementing complete sustainability standards results in advantageous loan rates, underscoring the financial sector's recognition of the need of sustainable and effective resource utilisation. In a similar vein, the analysis conducted by El

Ghoul et al. across various nations demonstrates that a robust dedication to environmental responsibility, as evidenced by improved resource utilisation, is associated with decreased costs of equity financing. This finding further emphasises the favourable financial consequences of sustainable practices on broader financing dimensions, potentially encompassing the cost of debt. The following hypothesis is therefore formulated and examined:

**H4: There is a negative association between Resource use performance and the cost of debt.**

### **3. Research Gap**

Based on reviewing previous literature on the relationship between ESG and the cost of capital, researchers Widley examine the entire ESG impact on COE. Nevertheless, the nature of the role of environmental performance and its pillars on the implied cost of debt is still an open question. Therefore, to the best of my knowledge, this paper will provide an extension of the previous work. I filled this gap in the knowledge by analysing the relationship between FTSE 100' environmental performance and the cost of debt financing.

Hence, the intended study will concentrate on analysing the overall environmental performance by breaking it down into its fundamental components and investigating how each component affects the cost of debt. This technique is anticipated to provide a more lucid comprehension of the specific factors of environmental performance that have the most impact on defining the financial leverage and lending conditions for enterprises in various sectors and geographic locations.

This comprehensive research gap, based on a variety of studies, emphasises the need for a thorough and distinct examination of the connection between certain elements of environmental performance and the financial burden of debt, providing a useful addition to the area.

## **4. Research Methodology**

### **4.1. Sample selection**

To investigate the relation between EP and the CoD, the data used in the study to proxy firms' environmental and financial information is obtained from LSEG, which is widely used in academic studies (Ferrell et al., 2016; Dyck et al., 2019; Stellner et al., 2015a, 2015b; Ghoul et al., 2017; Drempetic et al., 2020; Liang and Renneboog, 2017; Cheng et al., 2014). LSEG (Refinitiv DataStream) is a leading data provider with global coverage. It evaluates the firms' environmental, social and governance (ESG) performances and provides performance scores for each related category. These dimensions are environmental (resource use, emissions, and innovation), social (workforce, human rights, community, and product responsibility) and governance (management, shareholders, and CSR strategy). They are considered a comprehensive evaluation of the company's sustainability impact and conduct based on the reported data in the public domain, and Refinitiv ESG controversy score ([Refinitiv, 2022](#)).

The firms included in FTSE 100 are our initial sample, and we examine 17 years from 2006 to 2022, totalling 1360 firm-year observations. The FTSE 100, representing the largest 100 companies by market capitalization on the London Stock Exchange, accounts for approximately 78% of its market capitalization, making it an exemplary sample for financial research. Furthermore, the FTSE 100 serves as a critical benchmark for the UK stock market, offering insights that are applicable to a wide range of stakeholders, including investors and policymakers, and enhances the international relevance of the research findings. ([see sample table](#)).

### **4.2. Variables**

#### *4.2.1. Cost of Debt Estimates*

The cost of debt refers to the total interest payments made by a corporation on its external debt. Various metrics have been suggested for determining the cost of debt. Nevertheless, there is a lack of agreement over the best appropriate metric. The cost of debt is determined by three primary measures: credit rating, yield spread, and interest rate method. The literature has used the ratio of a firm's interest expense to its total interest-bearing debt outstanding to examine the correlation between the cost of debt and corporate and social performance (Pittman et al. 2004; Ye and Zhang 2011; Magnanelli and Izzo 2017; La Rosa et al. 2018; Gonçalves et al. 2022).

#### *4.2.2. Environmental performance measurement*

In line with previous research ([Garcia et al., 2017](#); [Sassen et al., 2016](#); [Xue et al., 2020](#); [Temiz, 2022](#)), the environmental performance data of companies are gathered from the LSEG(Refinitive DataStream), which offers EP data with various scopes. The database gives scores ranging from 0 to 100 for each company. Low ratings indicate weak environmental performance, while high scores indicate outstanding environmental performance ([Refinitiv, 2022](#)). In addition, the definitions of each environmental variable are provided in [appendix 1](#).

#### *4.2.3. Control variables*

Variables I use as controls range into a few broad categories: firm characteristics, firm environment performances, and cost of debt. Consistent with past research, we included several control variables in our regression model to consider other effects on COD (Houqe et al., 2020; La Rosa et al., 2018; Gonçalves et al., 2022; Eliwa et al., 2021; Sun et al., 2023), such as leverage, return on assets (ROA), interest coverage, performance and Beta. ([see appendix 1](#)).

We anticipate discovering a positive relationship between leverage and the cost of debt. Enterprises with a lower level of leverage are anticipated to exhibit stronger solvency and lower

interest rates compared to enterprises with a greater level of leverage. Return on assets (ROA) is calculated by dividing the net income before exceptional items by the total assets. A negative correlation is anticipated between Return on Assets (ROA) and the cost of debt. Companies that have a high return on assets (ROA) are in a more favourable financial situation and often get loans at reduced interest rates.

Interest coverage is calculated by dividing the entire operational revenue by the total interest expenditure. Interest coverage is a metric that assesses a company's ability to meet its interest obligations. Firms having a greater rate of interest coverage are likely to have a lower cost of debt. The aim of our study is to assess the influence of environmental performance on the cost of debt, while excluding the influence of financial performance. In accordance with prior research, we included a control variable (Performance) into our model. Performance is defined as the ratio of Income before Extraordinary Items at time  $t$  to Sales at time  $t$ . As per the Capital Asset Pricing Model (CAPM), there should be a positive correlation between (Beta) and the cost of debt. The market beta is calculated by doing a study of regression, where the daily stock returns are regressed to the FTSE 100 index. Therefore, it is anticipated that there will be a positive coefficient. In addition to firm-specific controls and year controls are included in all regressions.

#### **4.3. Model specifications**

I apply the following set of ordinary least squares (OLS) regression models to test my hypotheses:

$$\text{COD} = \beta_0 + \beta_1 \text{Enviromental\_Performance} + \text{Firm-level controls} + \text{Year FE} + \text{Industry FE} + \varepsilon \quad (1)$$

$$\text{COD} = \beta_0 + \beta_1 \text{Emission} + \text{Firm-level controls} + \text{Year FE} + \text{Industry FE} + \varepsilon \quad (2)$$

$$\text{COD} = \beta_0 + \beta_1 \text{Enviromental\_Innovation} + \text{Firm-level controls} + \text{Year FE} + \text{Industry FE} + \varepsilon \quad (3)$$

$$\text{COD} = \beta_0 + \beta_1 \text{Resource\_Use} + \text{Firm-level controls} + \text{Year FE} + \text{Industry FE} + \varepsilon \quad (4)$$

The company's time effect and industry effect are denoted by + Year FE and Industry FE, respectively. To control time trends and industry distinctions, this paper controls these effects in the regression analysis.

## 5. Descriptive statistics and empirical findings

### 5.1.Descriptive Statistics

Table 2: Panel A presents descriptive statistics derived from 1175 observations for a variety of financial and environmental variables among FTSE 100 companies from 2006 to 2022. The variable known as the Cost of Debt exhibits a wide range, fluctuating between 0.005 and 0.46, with an average value of 0.049. This range suggests that the corporations in question employ a variety of financial strategies. The Environmental Score fluctuates considerably, ranging from 0 to 97.12, before stabilising at an average of 59.968. This value highlights the significant variations in environmental involvement. In the same manner, the Emission Score ranges from zero to 99.71, which is virtually ideal, with an average of 67.299, reflecting varying degrees of effectiveness in managing emissions. The substantial variation in Environmental Innovation scores—from zero to 98.21—with an average of 34.007—illustrates the breadth of sustainability practice innovation. This diversity is reflected in the Resource Use scores, which range from 0 to 99.82 and indicate how various businesses manage their resources. The substantial range of leverage values, which span from 0.001 to 16.235, suggests the existence of variations in financial leveraging. The dramatic range of performance values from -5.915 to 6.778 illustrates the company's performance highs and lows. Both Interest Coverage (-102.867) and Return on Assets (ROA) (2.531) exhibit fluctuations, reflecting the volatile nature of the financial health. Beta values ranging from 2.73 to 0.22 indicate stocks with varying degrees of market volatility;

in total, they portray a complex and varied picture of the financial performance and business practices of these industry titans.

Table 2: Panel B displays the average values of the variables, categorised by year, for a selected group of FTSE 100 businesses throughout the fiscal years 2006 to 2022. The analysis specifically emphasises financial and environmental measures. The cost of debt has seen a steady decline, decreasing from 0.064 in 2006 to 0.039 in 2022, indicating a continuous reduction in the expenses associated with financing. The Environment Score has consistently risen from 38.741 in 2006 to 70.575 in 2022, indicating enhanced environmental management. Similarly, the Emission Score has increased from 49.736 in 2006 to 80.366 in 2022, indicating improved emissions control. The field of Environmental Innovation has experienced substantial expansion, with a beginning value of 4.638 in 2006 and a subsequent increase to 41.695 in 2022. This trend signifies an increasing focus on adopting creative approaches to enhance environmental performance. The Resource Use scores have seen significant improvement, increasing from 50.241 in 2006 to 79.134 in 2022. This upward trend indicates a shift towards a more effective utilisation of resources. These patterns indicate the continuous enhancements in environmental performance and a reduction in finance expenses, indicating a favourable transition towards sustainability in business practices among these prominent companies.

Table 3, titled "Pairwise Correction Matrix," presents the pairwise correlations among several financial and environmental factors, emphasising their correlation coefficients, significance levels, and p-values. The correlation analysis reveals that there is a strong negative relationship between Cost of Debt and many environmental factors. Specifically, there is a substantial negative correlation between Cost of Debt and Environment Score (-0.164,  $p < 0.000$ ), Emission Score (-0.152,  $p < 0.000$ ), Environmental Innovation (-0.079,  $p < 0.007$ ), and Resource Use (-0.149,  $p < 0.000$ ). This indicates that as environmental performance improves, the costs associated with debt decrease. The Environment Score and Emission Score have a substantial positive

correlation (0.849,  $p < 0.000$ ), suggesting that greater scores in one variable are often associated with higher scores in the other. There are positive relationships between the Environment Score and both Environmental Innovation (0.594,  $p < 0.000$ ) and Resource Use (0.872,  $p < 0.000$ ). Leverage demonstrates negligible and statistically inconsequential associations with the majority of variables, indicating its considerable autonomy. It is worth mentioning that the Return on Assets (ROA) is positively affected by a larger Interest Coverage (0.734,  $p < 0.000$ ) and adversely affected by a higher Leverage (-0.215,  $p < 0.000$ ). This demonstrates the interaction between financial health measures. Finally, there is a notable and positive association between Beta and Cost of Debt (0.165,  $p < 0.000$ ), suggesting that when debt costs increase, there is a larger level of market risk. This matrix provides a clear representation of the intricate relationships between several important business factors. The significance levels are shown by asterisks, which indicate the strength of the evidence (\*\*  $p < 0.01$ , \*  $p < 0.05$ , \*  $p < 0.1$ ).

## 5.2. Empirical findings

We start our regression analysis by examining the association between the environmental performance and the cost of debt in the context of FTSE 100, testing our first hypothesis. Panel A of Table 4 The empirical analysis of the association between environmental performance and the cost of debt, as revealed in Table 4, not only demonstrates a significant negative correlation but also reveals the robustness of this relationship. The regression model yields an Adj. R<sup>2</sup> of 0.36 and 0.35 for the two models, indicating that a substantial proportion of the variability in the cost of debt is explained by the included variables, particularly the environmental score. This strong explanatory power underscores the material impact of environmental performance on financial metrics.

Furthermore, the inclusion of a lagged environmental score variable (Environment\_Score\_l) in the second model, with a coefficient of -0.00020 (significant at the 5% level), provides evidence of the enduring impact of past environmental performance on current financial conditions. This lagged variable approach is crucial in financial studies as it accounts for the time-delayed effect of environmental actions on financial outcomes, suggesting that the benefits of environmental stewardship extend beyond the immediate fiscal year.

The findings resonate with the broader literature, where studies by Shad et al. (2020) and Sharfman and Fernando (2008) highlight the long-term financial benefits of sustainable practices. Similarly, Gonçalves, Dias, and Barros (2022) emphasize the sustained influence of sustainability on the cost of capital, aligning with the observed lag effect in this study. The research by Houqe, Ahmed, and Richardson (2020) also complements these results by discussing how ESG performance, including past environmental initiatives, significantly influences a firm's financial leverage and credit risk.

In summary, the analysis not only confirms the negative association between environmental performance and the cost of debt but also indicates the lasting impact of environmental initiatives. This supports the hypothesis that environmental stewardship, viewed through the lens of both current and past performance, is a critical factor in determining a company's financial health, particularly its borrowing costs.

The second hypothesis (H2: There is a negative association between Emission performance and the cost of debt) is explored in Table 5 of the empirical results. The findings show a negative correlation between Emission Score and Cost of Debt, with a coefficient of -0.0001 (significant at the 10% level). This suggests that improved emission performance is associated with a lower cost of debt, albeit with a weaker significance compared to the environmental score. The table also includes additional variables like Leverage, Performance, Interest Coverage Ratio, ROA, and Beta, which are controlled for in the analysis. The inclusion of a lagged emission score variable (Emission\_Score\_l) in the second model, though not significant, suggests an attempt to capture the potential delayed impact of emission performance on financial outcomes.

These results are consistent with findings in the literature. For instance, Shad et al. (2020) and Sharfman and Fernando (2008) note the positive impact of sustainability practices, including emission control, on reducing the cost of debt and equity. This aligns with the observed negative association between emission performance and the cost of debt in the study. Furthermore, Gonçalves, Dias, and Barros (2022) discuss the broader influence of sustainability performance on the cost of capital, supporting the idea that enhanced emission performance can lead to more favorable financial conditions. Additionally, Du et al. (2017) found that lenders regard corporate environmental performance, particularly in emission reduction, positively, which could influence financial decisions such as lending rates. This reinforces the findings from the

empirical analysis, indicating a tangible financial benefit associated with better emission performance.

Overall, the regression analysis with an Adj. R<sup>2</sup> of 0.36 and 0.35 for the two models respectively, and the inclusion of a lagged variable, provide a comprehensive understanding of the impact of emission performance on the cost of debt. The results support the hypothesis and align with the broader literature, emphasizing the growing importance of emission control in financial decision-making and risk assessment.

The third hypothesis (H3: There is a negative association between Environmental Innovation performance and the cost of debt) is investigated in Table 6 of the empirical results. The findings indicate a slightly negative but not statistically significant relationship between Environmental Innovation and the cost of debt, as evidenced by a coefficient of -0.000041 with a t-statistic of -0.95. This suggests that while there is a trend towards a negative association, it is not strong enough to be conclusive. Additionally, the inclusion of a lagged variable (Environmental\_Innovation t-1) with a coefficient of -0.000044 and a t-statistic of -1.14 further explores the potential delayed impact of environmental innovation on the cost of debt, although this too is not statistically significant.

These results align with the broader literature, which often posits a positive impact of environmental innovation on financial performance. For instance, studies by Shad et al. (2020) and Silva et al. (2022) highlight the benefits of sustainability reporting and environmental innovation on financial metrics, including the cost of debt and equity. However, the empirical findings suggest that this relationship may not be as straightforward or consistently observable across different contexts and measurement approaches. This is in line with the nuanced understanding of environmental innovation's impact on financial performance discussed by Gonçalves, Dias, and Barros (2022) and Houqe, Ahmed, and Richardson (2020), who note the

varying degrees of influence that environmental and sustainability factors can have on a firm's financial outcomes, including its borrowing costs.

In summary, the empirical analysis provides an insight into the complex and not always directly observable relationship between environmental innovation and the cost of debt. While there is a trend indicative of a negative association, the results are not conclusive, suggesting the need for further research and a more nuanced understanding of the ways in which environmental innovation influences financial outcomes.

The fourth hypothesis (H4: There is a negative association between Resource Use performance and the cost of debt) is explored in Table 7 of the empirical results. The analysis reveals a statistically significant negative association, with the coefficient for Resource Use being -0.00014 (significant at the 5% level). This suggests that improved resource use efficiency is correlated with a lower cost of debt. Additionally, the inclusion of a lagged variable (Resource\_Use  $t-1$ ) with a coefficient of -0.0002 (significant at the 5% level) indicates that past resource use efficiency also has a negative impact on the current cost of debt.

These findings are supported by the literature. Shad et al. (2020) and Sharfman and Fernando (2008) discuss the positive impact of sustainable practices, including efficient resource use, on the reduction of the cost of debt and equity. This aligns with the observed negative association between resource use efficiency and the cost of debt in the study. Moreover, Gonçalves, Dias, and Barros (2022) discuss the broader influence of sustainability performance on the cost of capital, supporting the idea that enhanced resource use efficiency can lead to more favorable financial conditions. Furthermore, Houqe, Ahmed, and Richardson (2020) indicate the significant impact of ESG factors, including resource use efficiency, on a firm's financial leverage and credit risk.

In summary, the regression analysis in Table 7, along with the Adj. R<sup>2</sup> of 0.36 for both models, suggests a robust and statistically significant relationship between resource use efficiency and the cost of debt. These results support the hypothesis and align with the broader literature, emphasizing the growing importance of efficient resource use in financial decision-making and risk assessment.

### **5.3. Robustness Checks and additional analyses**

Following this, we conduct a comprehensive evaluation of robustness checks along with additional analyses to support and enhance our understanding of the empirical evidence presented thus far. Recognising the intrinsic volatility of environmental performance and the resulting financial consequences over specified time periods, we have divided our analysis into two separate subsamples with great attention to detail. Sample 1, which comprises the initial subsample, pertains to the time span between 2006 and 2013, which is prior to the significant Paris Agreement on climate change. On the other hand, Sample 2 encompasses the period following the Paris Agreement, from 2014 to 2022. This enables a more comprehensive examination of the ways in which the worldwide pledge to tackle climate change as outlined in the agreement has impacted the correlation between environmental performance and the cost of debt in various economic and regulatory frameworks. The results of this bifurcated analysis are systematically presented in Table 8.

Furthermore, in order to strengthen the reliability of our empirical findings, we compare the dependent variable with the Weighted Average Cost of Capital (WACC) cost of debt after taxes, which is also obtained from Bloomberg, using the environmental disclosure score as the independent variable. The outcomes of this robustness check, employing Bloomberg data, are delineated in Table 9. The adherence to rigorous methodology not only enhances

the validity of our results but also precisely illustrates the interdependent connection between environmental disclosure and financial performance in the context of debt financing, focusing specifically on the paradigm-shifting effects of the Paris Agreement. The findings from the analysis displayed in Table 8 indicate that the environmental score and the cost of debt prior to the Paris Agreement exhibited a statistically significant inverse correlation ( $p < 0.1$ ). Although the correlation was weak and negative at the 10% level, the association and coefficient indicate that environmental performance has a marginally significant effect on debt cost reduction. The findings presented in this paper are consistent with those of Clarkson et al. (2008) and Dhaliwal et al. (2011). Furthermore, at the 1% level, a statistically significant positive correlation was observed between the size variable and the cost of debt. This suggests that larger organisations accrued greater debt expenses throughout this time frame, which is consistent with the results reported by Sharfman and Fernando (2008). The existence of additional consistent variables that impact the cost of debt is further supported by the constant term's significance at the 1% level, as outlined by Plumlee et al. (2015).

Nevertheless, since the signing of the Paris Agreement, the statistical significance that was previously identified between the environmental score and the cost of debt has vanished. This modification could indicate a potential alteration in the determinants of debt expenses, potentially attributable to unanticipated variables or more extensive market adaptations. Although this transition aligns with the timeframe of the Paris Agreement, attributing it exclusively to the agreement would require additional scrutiny. Significantly, there has been an elevated susceptibility of debt costs to market risk in the post-Paris Agreement era, as indicated by a 5% level of statistical significance in the positive correlation between beta and debt costs (Bauer and Hann, 2010). Furthermore, it is crucial to note that a significant

inverse correlation persists at a 1% significance level between the cost of debt and the interest coverage ratio. This further emphasises the paramount significance of financial health and profitability in assessing debt expenses in the aftermath of the Paris Agreement (Goss and Roberts, 2011).

A negative coefficient that does not reach statistical significance characterises the intricate association between environmental disclosure scores and the cost of debt, as stated in our analysis of Bloomberg data (Table 9). This result is consistent with the mediational function of corporate reputation and the direct financial benefits of ESG disclosure emphasised by Maaloul et al. (2023) and Raimo et al. (2021), respectively. The analysis indicates that there may be more to the indirect influence of environmental disclosures on financial metrics, such as the potential necessity to consider indirect channels via corporate reputation, rather than the anticipated direct impact of such disclosures on debt cost reduction.

The inconsistency between Bloomberg and LSEG data regarding the association between environmental scores and the cost of debt exemplifies the wider concern regarding disagreements among ESG rating agencies, which has been extensively examined in the works of Billio et al. (2021), Gibson Brandon, Krueger, and Schmidt (2021), and Lopez, Contreras, and Bendix (2020). The variation in approaches and emphasis between rating agencies highlights the intricate dynamics involved in incorporating environmental, social, and governance (ESG) considerations, including the cost of debt. Lopez et al. (2020) examine the ramifications of this disagreement for investors and corporations in particular, proposing that these discrepancies can have a substantial effect on the results of financial analysis. The subject of ESG rating disagreements underscores the utmost importance of being cognizant of the data source when conducting financial analysis related to ESG. It also implies that discrepancies in one's

conclusions may be attributable to the intrinsic incongruities that exist in the methods by which ESG performance is evaluated and disclosed across various platforms.

## **6. Conclusion**

Based on an empirical analysis conducted on a 17-year dataset obtained from LSEG (Refinitiv DataStream) for FTSE 100 businesses, this research paper makes a valuable contribution to the expanding field of research that explores the relationship between environmental performance and corporate finance. The results of our study support the hypothesis that reduced financing costs are linked to enhanced environmental practices, thus informing businesses of the financial necessity of adopting sustainable practices. This research contributes to the existing literature by examining the comprehensive influence of environmental performance on the cost of debt, while also analysing its specific elements, namely emission performance, environmental innovation, and the use of resources. The use of this comprehensive methodology allows a nuanced comprehension of the impact of certain environmental measures on a company's borrowing costs.

The results of our study align with other research, specifically the study conducted by Fonseka, Rajapakse, and Richardson (2019), which emphasised a detrimental association between the disclosure of environmental information and the cost of debt. Expanding upon this basis, our study enhances the comprehension of this association by including historical environmental scores, thereby demonstrating the long-lasting influence of previous environmental actions on present financial conditions.

What sets our method apart is the use of delayed emission ratings. This component offers a deeper understanding of the enduring financial effects of a company's emission

performance, expanding upon the time frame considered in previous research that have mostly concentrated on immediate ramifications. This perspective is crucial because it highlights the long-lasting impact of previous environmental activities on current and future financial well-being.

Furthermore, our study makes significant contributions to the existing body of research by analysing how financial markets react to news related to a company's environmental impact. The objective of our research is to investigate how various types of lenders, such as traditional banks, bond issuers, institutional investors, and alternative financing platforms, consider environmental performance variables while making financing decisions. Our thorough investigation of many lending institutions shows that there are diverse repercussions associated with the integration of environmental, social, and governance (ESG) issues into financial decision-making processes. This integration is backed by our critical analysis, which references the work of Cornell and Damodaran (2020). In addition, our research notably analyses the various elements of environmental performance (EP) - resource usage efficiency, environmental innovation, and emission control - in the context of FTSE 100 firms. This meticulous technique provides an intricate viewpoint that surpasses previous research that mostly focuses on CSR disclosures and their financial consequences in a general manner. Our research addresses the changing financial decision-making landscape driven by environmental sustainability by examining the specific effects of various EP components on the cost of debt.

Our empirical findings not only conform to, but also creatively extend, the guidelines for thorough environmental assessments. This research contributes significantly to the discussion on sustainable finance by providing precise recommendations for environmental

policies and strategies at the corporate level. It identifies the specific environmental measures that result in the largest reduction in a company's cost of debt.

Our study aligns with the results of Gonçalves Dias & Barros (2022) and offers a new opportunity for future studies to further investigate the relationship between innovative environmental practices and financial measures. Our analysis on resource usage efficiency and its financial consequences supports the conversation started by Sharfman & Fernando (2008), showing a strong negative effect on the cost of debt. This research highlights the significance of effective resource allocation in corporate financial plans and represents a notable contribution to academic conversations in sustainability and finance.

Our rigorous assessments indicate that the assessment of environmental performance in the financial market has changed, especially in relation to the impact of the Paris Agreement. A remarkable change has occurred with the disappearance of the formerly strong negative correlation between environmental ratings and the cost of debt after the Agreement. Moreover, the examination of Bloomberg and LSEG data serves to emphasise the matter of variations in ESG ratings, as emphasised by Billio et al. (2021), Gibson Brandon et al. (2021), and Lopez et al. (2020). This highlights the significance of the data source in the study of ESG financial performance. Our research ultimately builds upon and corroborates the existing body of literature, offering fresh perspectives on the financial advantages of environmental responsibility, the intricate financial ramifications of environmental innovation, and the intricate relationship between different aspects of environmental performance and the cost of debt.

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## Appendices:

### Appendix 1: Variables definition

| Variable | Definition |
|----------|------------|
|----------|------------|

|                              |                                                                                                                                                                                                                                                                    |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Dependent variable</b>    |                                                                                                                                                                                                                                                                    |
| CoD                          | The cost of debt calculated as the ratio of (Interest expenses/total interest-bearing debt).                                                                                                                                                                       |
| <b>Independent variables</b> |                                                                                                                                                                                                                                                                    |
| Environmental                | Refinitiv's Environment Pillar Score is the weighted average relative rating of a company based on the reported environmental information and the resulting three environmental category scores                                                                    |
| Emission                     | Emission category score measures a company's commitment and effectiveness towards reducing environmental emission in the production and operational processes                                                                                                      |
| Environmental Innovation     | Environmental innovation category score reflects a company's capacity to reduce the environmental costs and burdens for its customers, and thereby creating new market opportunities through new environmental technologies and processes or eco-designed products |
| Resource Use                 | Resource use category score reflects a company's performance and capacity to reduce the use of materials, energy or water, and to find more eco-efficient solutions by improving supply chain management.                                                          |
| <b>Control variables</b>     |                                                                                                                                                                                                                                                                    |
| LEV                          | Financial leverage, The ratio of total debt to market value of equity                                                                                                                                                                                              |
| ROA                          | Return on assets calculated as net income before extraordinary items deflated by total assets.                                                                                                                                                                     |
| Beta                         | Beta of individual stocks, systemic risk (Market Beta).                                                                                                                                                                                                            |
| Performance                  | Income before Extraordinary Items/Sales                                                                                                                                                                                                                            |
| Interest_coverage            | Interest coverage is calculated as total operating income deflated by total interest expense.                                                                                                                                                                      |

**Table 1: Sample Selection**

|                                                              |       |
|--------------------------------------------------------------|-------|
| FTSE 100                                                     | 100   |
| Firms in the financial industry                              | (20)  |
| Total Number of firms                                        | 80    |
| Total firm-year observations for the 17 years (2006 to 2022) | 1360  |
| Outliers                                                     | (11)  |
| Missing observations                                         | (174) |
| <b>Final Sample</b>                                          | 1175  |

**Table 2: Panel A- Descriptive Statistics**

| <b>Variables</b>         | <b>N</b> | <b>Mean</b> | <b>Median</b> | <b>SD</b> | <b>Min</b> | <b>Max</b> |
|--------------------------|----------|-------------|---------------|-----------|------------|------------|
| Cost Debt                | 1175     | .049        | 0.042         | .035      | .005       | .46        |
| Environment Score        | 1175     | 59.968      | 65.610        | 24.54     | 0          | 97.12      |
| Emission Score           | 1175     | 67.299      | 73.370        | 26.123    | 0          | 99.71      |
| Environmental Innovation | 1175     | 34.007      | 26.320        | 33.214    | 0          | 98.21      |
| Resource Use             | 1175     | 67.969      | 75.740        | 28.323    | 0          | 99.82      |
| Leverage                 | 1175     | .396        | 0.242         | .666      | .001       | 16.235     |
| Performance              | 1175     | .116        | 0.087         | .428      | -5.915     | 6.778      |
| Interest coverage        | 1175     | 15.549      | 6.038         | 50.279    | -102.867   | 878.493    |
| ROA                      | 1175     | .089        | 0.076         | .144      | -.356      | 2.531      |
| Beta                     | 1175     | 1.148       | 1.130         | .565      | .22        | 2.73       |

This table shows the mean, median, standard deviation, minimum, and maximum values for the variables for a sample of FTSE 100 over the fiscal years 2006 to 2022.

**Table 2: Panel B- Mean of the Variables by Year**

| <b>Years</b> | <b>Cost Debt</b> | <b>Environment Score</b> | <b>Emission Score</b> | <b>Environmental Innovation</b> | <b>Resource Use</b> | <b>Leverage</b> | <b>Performance</b> | <b>Interest coverage ratio</b> | <b>ROA</b> | <b>Beta</b> |
|--------------|------------------|--------------------------|-----------------------|---------------------------------|---------------------|-----------------|--------------------|--------------------------------|------------|-------------|
| 2006         | .064             | 38.741                   | 49.736                | 4.638                           | 50.241              | .26             | .156               | 9.597                          | .101       | 1.103       |
| 2007         | .069             | 48.841                   | 56.796                | 16.24                           | 61.088              | .303            | .124               | 8.709                          | .121       | 1.148       |
| 2008         | .054             | 54.853                   | 60.255                | 29.223                          | 64.497              | 1.014           | .012               | 7.55                           | .081       | 1.139       |
| 2009         | .057             | 55.616                   | 60.565                | 32.979                          | 64.482              | .579            | -.035              | 10.467                         | .069       | 1.143       |
| 2010         | .058             | 58.475                   | 65.697                | 33.984                          | 66.599              | .391            | .124               | 14.84                          | .09        | 1.152       |
| 2011         | .058             | 58.173                   | 63.023                | 34.289                          | 67.523              | .369            | .118               | 13.303                         | .089       | 1.17        |
| 2012         | .057             | 59.442                   | 64.418                | 35.657                          | 68.04               | .358            | .098               | 16.572                         | .084       | 1.173       |
| 2013         | .061             | 61.317                   | 66.208                | 36.436                          | 69.728              | .311            | .105               | 11.561                         | .074       | 1.164       |
| 2014         | .045             | 62.169                   | 67.885                | 38.3                            | 69.293              | .312            | .174               | 14.588                         | .091       | 1.154       |
| 2015         | .044             | 61.305                   | 68.004                | 37.349                          | 67.541              | .347            | .189               | 14.928                         | .083       | 1.143       |
| 2016         | .044             | 61.464                   | 68.038                | 36.732                          | 67.72               | .286            | .14                | 13.156                         | .073       | 1.138       |
| 2017         | .041             | 62.099                   | 70.713                | 36.168                          | 67.2                | .27             | .181               | 19.086                         | .094       | 1.152       |
| 2018         | .039             | 61.853                   | 70.315                | 35.078                          | 68.111              | .308            | .154               | 23.139                         | .111       | 1.16        |
| 2019         | .039             | 62.971                   | 72.193                | 38.044                          | 69.563              | .333            | .101               | 27                             | .101       | 1.147       |
| 2020         | .035             | 65.666                   | 74.348                | 39.621                          | 73.402              | .551            | .07                | 11.018                         | .058       | 1.153       |
| 2021         | .035             | 68.714                   | 78.098                | 42.487                          | 76.184              | .418            | .153               | 19.055                         | .084       | 1.153       |
| 2022         | .039             | 70.575                   | 80.366                | 41.695                          | 79.134              | .379            | .09                | 26.178                         | .111       | 1.107       |

This table shows the mean of the variables by the year for a sample of FTSE 100 over the fiscal years 2006 to 2022. See Appendix 1 for variable definition.

**Table 3: Pairwise Correlation Matrix**

| Variables                  | (1)                  | (2)                 | (3)                 | (4)                 | (5)               | (6)                  | (7)                 | (8)                 | (9)                 | (10)  |
|----------------------------|----------------------|---------------------|---------------------|---------------------|-------------------|----------------------|---------------------|---------------------|---------------------|-------|
| (1) Cost Debt              | 1.000                |                     |                     |                     |                   |                      |                     |                     |                     |       |
| (2) Enviroment_Score       | -0.164***<br>(0.000) | 1.000               |                     |                     |                   |                      |                     |                     |                     |       |
| (3) Emission_Score         | -0.152***<br>(0.000) | 0.849***<br>(0.000) | 1.000               |                     |                   |                      |                     |                     |                     |       |
| (4) Enviromental_Inovation | -0.079***<br>(0.007) | 0.594***<br>(0.000) | 0.300***<br>(0.000) | 1.000               |                   |                      |                     |                     |                     |       |
| (5) Resource_Use           | -0.149***<br>(0.000) | 0.872***<br>(0.000) | 0.740***<br>(0.000) | 0.328***<br>(0.000) | 1.000             |                      |                     |                     |                     |       |
| (6) Leverage               | 0.013<br>(0.668)     | 0.045<br>(0.125)    | 0.030<br>(0.302)    | 0.035<br>(0.236)    | 0.029<br>(0.315)  | 1.000                |                     |                     |                     |       |
| (7) Performance            | -0.004<br>(0.889)    | 0.054*<br>(0.062)   | 0.032<br>(0.269)    | 0.050*<br>(0.090)   | 0.051*<br>(0.078) | -0.137***<br>(0.000) | 1.000               |                     |                     |       |
| (8) Interest coverage      | -0.016<br>(0.578)    | -0.054*<br>(0.065)  | -0.003<br>(0.931)   | -0.046<br>(0.114)   | -0.005<br>(0.859) | -0.144***<br>(0.000) | 0.126***<br>(0.000) | 1.000               |                     |       |
| (9) ROA                    | 0.024<br>(0.405)     | -0.068**<br>(0.019) | -0.030<br>(0.302)   | -0.054*<br>(0.064)  | -0.025<br>(0.389) | -0.215***<br>(0.000) | 0.293***<br>(0.000) | 0.734***<br>(0.000) | 1.000               |       |
| (10) Beta                  | 0.165***<br>(0.000)  | 0.061**<br>(0.038)  | 0.042<br>(0.151)    | 0.016<br>(0.583)    | 0.023<br>(0.436)  | 0.116***<br>(0.000)  | -0.028<br>(0.336)   | 0.053*<br>(0.068)   | -0.059**<br>(0.042) | 1.000 |

This table shows Pairwise Correlations between the variables \*\*\* p<0.01, \*\* p<0.05, \* p<0.1 represent significance using a two-sided test. Numbers between parentheses represent p-values. See Appendix 1 for variable definitions.

**Table 4: The Association between Cost of Debt and Environment Score**

| <b>Dependent Variable &gt;</b>  | <b>(1)<br/>Cost_Debt</b> | <b>(2)<br/>Cost_Debt</b> |
|---------------------------------|--------------------------|--------------------------|
| Environment Score               | -0.00021**<br>(-2.41)    |                          |
| Leverage                        | -0.002*<br>(-1.96)       | -0.002**<br>(-2.04)      |
| Performance                     | -0.003<br>(-1.38)        | -0.002<br>(-1.10)        |
| Interest coverage ratio         | -0.000046<br>(-1.21)     | -0.000048<br>(-1.25)     |
| ROA                             | 0.041**<br>(1.97)        | 0.036*<br>(1.79)         |
| Beta                            | -0.135***<br>(-7.21)     | -0.133***<br>(-5.53)     |
| Enviroment_Score <sub>t-1</sub> |                          | -0.00020**<br>(-2.01)    |
| _cons                           | 0.298***<br>(10.40)      | 0.295***<br>(8.19)       |
| Firm FE                         | Yes                      | Yes                      |
| Year FE                         | Yes                      | Yes                      |
| N                               | 1175                     | 1104                     |
| Adj. R <sup>2</sup>             | 0.36                     | 0.35                     |

The table shows the results of OLS regressions for the second model to test H2, with robust standard errors, year-fixed effects and firm-fixed effects, using two-tailed tests. Parameter estimates are reported first, followed by t-statistics in parenthesis. \*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$ . See Appendix 1 for variable definitions.

**Table 5: The Association between Cost of Debt and Emission Score**

| <b>Dependent Variable &gt;</b> | <b>(1)<br/>Cost_Debt</b> | <b>(2)<br/>Cost_Debt</b> |
|--------------------------------|--------------------------|--------------------------|
| Emission_Score                 | -0.0001*<br>(-1.93)      |                          |
| Leverage                       | -0.002*<br>(-1.96)       | -0.002*<br>(-1.86)       |
| Performance                    | -0.003<br>(-1.51)        | -0.002<br>(-1.21)        |
| Interestcoverageratio          | -0.000047<br>(-1.22)     | -0.00005<br>(-1.32)      |
| ROA                            | 0.042**<br>(2.03)        | 0.036*<br>(1.82)         |
| Beta                           | -0.156***<br>(-9.36)     | -0.167***<br>(-8.78)     |
| Emission_Score <sub>t-1</sub>  |                          | -0.00004<br>(-0.54)      |
| _cons                          | 0.332***<br>(12.65)      | 0.347***<br>(12.46)      |
| Firm FE                        | Yes                      | Yes                      |
| Year FE                        | Yes                      | Yes                      |
| N                              | 1175                     | 1104                     |
| Adj. R <sup>2</sup>            | 0.36                     | 0.35                     |

The table shows the results of OLS regressions for the second model to test H2, with robust standard errors, year-fixed effects and firm-fixed effects, using two-tailed tests. Parameter estimates are reported first, followed by t-statistics in parenthesis. \*\*\* $p < .01$ , \*\* $p < .05$ , \* $p < .1$ . See Appendix 1 for variable definitions.

**Table 6: The Association between Cost of Debt and Environmental Innovation**

| <b>Dependent Variable &gt;</b>         | <b>(1)<br/>Cost_Debt</b> | <b>(2)<br/>Cost_Debt</b> |
|----------------------------------------|--------------------------|--------------------------|
| Enviromental_Innovation                | -0.000041<br>(-0.95)     |                          |
| Leverage                               | -0.002*<br>(-1.75)       | -0.002*<br>(-1.87)       |
| Performance                            | -0.003<br>(-1.42)        | -0.002<br>(-1.09)        |
| Interest coverage ratio                | -0.000052<br>(-1.34)     | -0.000053<br>(-1.37)     |
| ROA                                    | 0.041**<br>(2.01)        | 0.036*<br>(1.81)         |
| Beta                                   | -0.175***<br>(-11.81)    | -0.176***<br>(-10.90)    |
| Enviromental_Innovation <sub>t-1</sub> |                          | -0.000044<br>(-1.14)     |
| _cons                                  | 0.354***<br>(14.57)      | 0.357***<br>(13.70)      |
| Firm FE                                | Yes                      | Yes                      |
| Year FE                                | Yes                      | Yes                      |
| N                                      | 1175                     | 1104                     |
| Adj. R <sup>2</sup>                    | 0.36                     | 0.35                     |

The table shows the results of OLS regressions for the second model to test H2, with robust standard errors, year-fixed effects and firm-fixed effects, using two-tailed tests. Parameter estimates are reported first, followed by t-statistics in parenthesis. \*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$ . See Appendix 1 for variable definitions.

**Table 7: The Association between Cost of Debt and Resource Use**

| <b>Dependent Variable &gt;</b> | <b>(1)<br/>Cost_Debt</b> | <b>(2)<br/>Cost_Debt</b> |
|--------------------------------|--------------------------|--------------------------|
| Resource_Use                   | -0.00014**<br>(-2.36)    |                          |
| Leverage                       | -0.002**<br>(-1.99)      | -0.002**<br>(-2.11)      |
| Performance                    | -0.003<br>(-1.44)        | -0.002<br>(-1.10)        |
| Interestcoverageratio          | -0.000046<br>(-1.17)     | -0.000045<br>(-1.17)     |
| ROA                            | 0.042**<br>(1.99)        | 0.036*<br>(1.79)         |
| Beta                           | -0.120***<br>(-4.87)     | -0.085**<br>(-2.24)      |
| Resource_Use <sub>t-1</sub>    |                          | -0.0002**<br>(-2.58)     |
| _cons                          | 0.274***<br>(7.53)       | 0.224***<br>(3.94)       |
| N                              | 1175                     | 1104                     |
| Adj. R <sup>2</sup>            | 0.36                     | 0.36                     |

The table shows the results of OLS regressions for the second model to test H2, with robust standard errors, year-fixed effects and firm-fixed effects, using two-tailed tests. Parameter estimates are reported first, followed by t-statistics in parenthesis. \*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$ . See Appendix 1 for variable definitions.

**Sub-sample (2006-2013) , (2014-2022)**

**Table 8. Regression results**

|                       | (1)       | (2)       |
|-----------------------|-----------|-----------|
|                       | Cost_Debt | Cost_Debt |
| Enviroment_Score      | -0.000*   | -0.000    |
|                       | (-1.70)   | (-0.42)   |
| Leverage              | 0.001     | 0.000     |
|                       | (0.64)    | (0.07)    |
| Performance           | -0.007    | 0.001     |
|                       | (-1.52)   | (0.74)    |
| Interestcoverageratio | 0.000     | -0.000*** |
|                       | (0.53)    | (-2.65)   |
| ROA                   | 0.063     | 0.000     |
|                       | (1.33)    | (0.04)    |
| Beta                  | -0.002    | 0.005**   |
|                       | (-1.25)   | (2.45)    |
| size                  | 0.013***  | -0.002    |
|                       | (3.04)    | (-1.49)   |
| _cons                 | 0.080***  | 0.085***  |
|                       | (3.18)    | (3.55)    |
| <i>N</i>              | 518       | 657       |
| Adj. R <sup>2</sup>   | 0.10      | 0.06      |

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**Table 9. The results from Bloomberg data**

|                       | (1)                |
|-----------------------|--------------------|
|                       | DebtB              |
| Environment_B         | -0.003<br>(-1.06)  |
| Leverage              | -0.003<br>(-0.03)  |
| Performance           | -0.086<br>(-0.67)  |
| Interestcoverageratio | -0.002*<br>(-1.81) |
| ROA                   | 1.349**<br>(2.37)  |
| Beta                  | 0.355***<br>(2.67) |
| size                  | 0.267***<br>(5.07) |
| _cons                 | -1.607*<br>(-1.94) |
| N                     | 1165               |
| Adj. R <sup>2</sup>   | 0.12               |

\* p<0.1, \*\* p<0.05, \*\*\* p<0.01