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Sustainability Performance and the Cost of Capital

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Abstract: This study examines the association between firms' environmental, social, and governance (ESG) performance and the cost of capital for the largest European firms listed on the STOXX Euro 600 in a large panel from 2002 to 2018. We find that ESG is priced by both debt and equity markets, although in different directions. While better ESG performance is associated with a lower cost of equity, the relationship is positive regarding the cost of debt. We also account for industry idiosyncrasies. The relationship with the cost of equity is penalized for firms lagging in ESG performance compared with industry peers, and the industry median corporate sustainability performance score is around optimal to balance the cost of equity and cost of debt. We also find that ESG is not influential in shaping firms' cost of capital in periods of financial and sovereign crises. Overall, in the same research setting, we find that the channels of firms' cost of capital composition behave differently in response to changes in sustainability performance.

Keywords: corporate and social responsibility; cost of capital; cost of debt; cost of equity; ESG

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1. Introduction

The recent surge in the environmental, social, and governance (ESG) factors has highlighted many unanswered questions in the financial market world (Starks 2021). Shareholders and creditors may price ESG performance of firms depending on their incentives and objectives, which may be in the form of higher and less volatile cash flows, and also on the perceived risk of firms (Gillan et al. 2021; Gonçalves et al. 2021; Liang and Renneboog 2020). However, there is no consensus on the association between sustainability performance and the cost of equity and cost of debt. Most empirical research points to negative relationships between sustainability performance and cost of equity (Sharfman and Fernando 2008; El Ghoul et al. 2011, 2018) and cost of debt (Goss and Roberts 2011; Oikonomou et al. 2014; Du et al. 2017). Contrarily, other studies find a positive relationship between both variables (Magnanelli and Izzo 2017; Menz 2010) or an inconclusive one (Salama et al. 2011; Humphrey et al. 2012; Gregory et al. 2014). We argue that debtholders and equity holders are not exposed to the same risks; therefore, their response to sustainability practices is unlikely to be aligned.

Furthermore, an increasing body of literature shows that other factors have an impact on the association between the cost of capital and sustainability performance, such as industry membership (Reverte 2012; Gregory et al. 2016; El Ghoul et al. 2018) and country-level factors such as stakeholder orientation, financial transparency, and governance (Dhaliwal et al. 2014; Gupta 2018). This study aims to fill precisely this gap in the literature. The concept evolved from corporate social responsibility to ESG, later to sustainability performance, and more recently to impact performance, although these designations are used in this study interchangeably. We therefore employ an analysis of the association between the two channels of the firms' cost of capital and sustainability performance in a European context, thus looking at both the cost of equity and cost of debt responses to sustainability performance in the same research setting.

To study the association between sustainability performance and cost of capital, two samples are considered, following data availability. The sample to study the cost of debt consists of 388 unique firms in a sample of 4383 firm-year observations, while the sample to study the cost of equity comprises 4276 firm-year observations of 413 unique firms. All firms are constituents of the STOXX Europe 600, and these firms belong to 17 countries of the European Union, in a large period between 2002 and 2018. This study employs an ex ante cost of equity measure, using the abnormal growth models of Ohlson and Juettner-Nauroth (2005), as implemented by Gode and Mohanram (2003) and Easton (2004). The cost of debt model follows La Rosa et al. (2018). Sustainability performance was measured through the environmental, social, and governance (ESG) combined score provided by the Refinitiv Eikon database. We take a step further and disentangle the three components to assess effects grounded in competing literature streams.

The results from this study point to a statistically significant positive relationship between a firm's cost of debt and sustainability performance, suggesting that lenders perceive sustainability activities as a waste of a firms' resources, in line with overinvestment theory. This finding is consistent with those from Sharfman and Fernando (2008), Menz (2010) and Magnanelli and Izzo (2017). Regarding the cost of equity, results show a negative relationship with corporate sustainability, in line with Sharfman and Fernando (2008) and El Ghoul et al. (2011, 2018). This suggests equity markets perceive sustainable investments as a source of value, possibly through risk-mitigation arguments.

After segmenting the sample into firms below and above the industry median corporate sustainability performance, the results show that lenders penalize firms for their efforts to be industry leaders in sustainability, while not finding evidence that they reward those investing less than their peers. An inverse association is found regarding how equity markets perceive sustainable practices. Results show that investors penalize firms who are laggers in sustainability with higher required equity premiums, while no significant association is found for the group of leaders. This suggests that the industry median corporate sustainability performance score is optimal, as investors penalize below industry performance and lenders penalize above industry performance. This also accords with Ye and Zhang (2011) and Bae et al. (2018), who work around optimal levels of sustainability practices.

The results are robust for alternative measures of corporate and social performance, cost of debt and equity, as well as alternative models that explore the association between cost of capital and corporate and social performance. An additional test explores if the relationship is robust during different economic conditions. The results show that the relationship is only statistically significant during a period of stability, in line with La Rosa et al. (2018) and El Ghoul et al. (2018), implying that sustainability is not value-relevant to capital markets during periods of crises.

This study offers important contributions to the literature. First, it provides evidence on pricing corporate sustainability performance by the capital markets. Other studies failed to look at both components of the cost of capital (equity and debt) in the same setting. The results point to divergent positioning by lenders and investors, forcing socially responsible managers to weight the cost of each source of capital when allocating firm resources. We therefore add to the literature focusing on sustainability and the cost of equity (El Ghoul et al. 2011; Hong and Kacperczyk 2009; Sharfman and Fernando 2008; Bauer and Hann 2010; Schneider 2011; Chen and Gao 2012; Smith 1994; Boutin-Dufresne and Savaria 2004; Kim et al. 2014; Krüger 2015) and cost of debt (Thompson 1998; Coulson and Monks 1999; Thompson and Cowton 2004; Cogan 2008; Weber 2012; Attig et al. 2013). Second, we examine how capital markets perceive leaders and laggers in sustainability within an industry to account for its idiosyncrasies. Not all industries respond to the same sustainability drivers, while most literature has not accounted for these differences (Goss and Roberts 2011; Jo and Harjoto 2012). Being a lagger and investing in sustainability is rewarded by equity holders, while leaders appear to be penalized by debtholders. Overall, positioning corporate sustainability around the industry median appears to drive value the most. Third, we also add to the literature that worked around external shocks

(El Ghoul et al. 2018; Lins et al. 2015) and find that sustainability performance in periods of crisis is not priced for both equity holders and debtholders.

The remaining part of the paper proceeds as follows: Section 2 provides a literature review, where the models and definitions of cost of equity, cost of debt, and corporate sustainability performance are presented, and testable hypotheses are developed. Section 3 presents the subsamples and methodologies used. Section 4 discusses the findings. Finally, Section 5 presents the conclusions, limitations, and future research avenues.

2. Literature Review and Hypotheses Development

Companies face increasing pressure from shareholders and other stakeholders to redesign their operations sustainably (Madime and Gonçalves 2022). This includes rethinking sources of financing such as the issuance of green bonds, tapping into loans with ESG-related constraints, and deciding which projects to invest in and how to allocate sustainably. Additionally, firms have been trying to measure how sustainability issues affect their businesses, while other firms have made their business evaluate firms' socially responsible performance through ratings. This paper explores both dimensions, focusing on how sustainability ratings might affect the financial performance of a firm, particularly by measuring its impact on the cost of debt and equity capital.

Corporate and social responsibility is a subject related to a panoply of concepts such as corporate and social performance, corporate governance, corporate citizenship, and corporate sustainability. All have the underlying aim of addressing the parallel obligations that firms have, other than financial considerations (Parmar et al. 2010). McWilliams and Siegel (2001, p. 117) defined these as "actions that appear to further some social good, beyond the firm's interests and that which is required by law". More recently, the environmental, social, and governance (ESG) concept has emerged, capturing most sustainability-related activities a firm might pursue (Starks 2009).

One of the first papers studying the relationship between sustainability and cost of capital was by Sharfman and Fernando (2008). Drawing on risk mitigation theory, the authors hypothesized that improved environmental risk management should lower a firm's cost of debt and equity, and they found mixed results. While the cost of equity decreases with better environmental risk management, an increase in the cost of debt is observed. The authors infer that the increasing cost of debt might reside in the perception of environmental risk management activities as a waste of firm's resources by the debt markets. Another possible explanation presented by the authors involves the possible lack of control for the effects of increasing leverage and improved environmental risk management on the cost of debt.

2.1. Cost of Equity and Sustainability

El Ghoul et al. (2011) argue for a negative relationship between corporate and environmental responsibility and cost of equity driven by both risk mitigation theory and an investor base perspective. The risk mitigation argument states that responsible firms present lower risk profiles in the eyes of investors, and, thus, will benefit from a lower cost of capital. In this view, there is a lower probability of adverse events happening to responsible firms, and, in case they occur, sustainability can act as a cushion to mitigate such effects.

Risk mitigation builds on the stakeholder theory framework, in which the business is seen as a net of relationships between stakeholders. Executives manage these relationships to maximize and distribute stakeholder value (Parmar et al. 2010). Sustainability can be seen as a way to improve these relationships by reducing the probability of negative events such as costly lawsuits and clean-ups from environmental damage, unsafe product recalls, strikes from dis-satisfied employees, and brand and reputation erosion from scandals (Godfrey 2005).

Furthermore, empirical studies find that firms operating in "sin" businesses such as tobacco, gambling, and alcohol face higher uncertain future claims and litigation risks than comparable firms in other industries (El Ghoul et al. 2011; Hong and Kacperczyk 2009). Consistently, studies have shown that firms exposed to carbon risk carry increased uncertainty around regulatory, physical, and business hazards (Sharfman and Fernando 2008; Bauer and Hann 2010; Schneider 2011; Chen and Gao 2012). Such events greatly impact the firms' perceived image, which can materially worsen their overall risk profile and profitability (Smith 1994; Boutin-Dufresne and Savaria 2004; Kim et al. 2014; Krüger 2015). Since sustainability might act as an "insurance" against negative events, firms with high sustainability scores should display lower idiosyncratic risk. Therefore, findings must be viewed within the context of each industry and not be generalized.

A good record of sustainability performance enables firms to build moral capital, i.e., goodwill among stakeholders, which can act as a risk-management tool (Godfrey 2005). Testing the effect of 178 negative regulatory and legal actions taken upon firms in 11 years, Godfrey et al. (2009) found that firms engaged in sustainability activities aimed at society benefited from the "insurance quality" of moral capital, while such activities directed at the firms' trading partners had no such effect. The relevance of sustainability issues and regulation on the topic has also motivated rebrandings in terms of financial instruments, especially for investment funds (El Ghoul and Karoui 2021).

Heinkel et al. (2001) introduced a theoretical framework through which the sustainability performance and cost of capital relationship is explored based on categorizing risk-averse investors into green and neutral, and firms into green, polluting, and reformed. In building portfolios, neutral investors are indifferent to a firm's ethical behavior, while green investors only invest in firms that meet their ethical criteria. According to the framework, with lower demand for their stocks, polluting firms have a smaller investor base, finding risk harder to diversify. This lack of demand and risk-sharing ability leads to a decrease in the polluting firms' share price as well as to a higher cost of equity capital (Merton 1987). Heinkel et al. (2001) have demonstrated that at least 25% of investors need to be green to prompt polluting firms to change their behavior and invest in greener technologies. Hong and Kacperczyk (2009) provide evidence that U.S. institutions with greater social-norm constraints hold fewer sin stocks in their portfolio than less norm-constrained institutions, as the latter are less exposed to news and analysts' coverage. El Ghoul et al. (2011) have concluded that better sustainability performers exhibit lower cost of equity and that firms in the nuclear power and tobacco industry display a significantly higher cost of equity capital among U.S. sin stocks. Chava (2014) provides further evidence that investors require higher returns on stocks excluded by environmental screens related to chemical hazards, emissions, and climate change concerns when compared with firms without such concerns. According to Chava (2014), sin firms see lower demands for their stock from institutional investors and a lower bank participation rate in their loan syndicate.

Still on the risk-mitigation effect of adopting sustainable practices, Boubaker et al. (2020) shed light on the fact that firms that are engaged in greater corporate social responsibility enjoy a reduced financial-distress risk, which is embedded directly into the social component of the ESG score. Yet, the risk reduction may be of higher magnitude in controversial industry sectors (Jo and Na 2012). The benefits of sustainable corporate practices are also beneficial in improving resilience in uncertain times, such as during the COVID-19 pandemic (Boubaker et al. 2022).

In contrast, some authors find little to no evidence for the negative relationship between corporate sustainability performance and the cost of equity. While estimating the cost of equity in green and toxic portfolios, Gregory et al. (2014) claim that although the market associates sustainability strengths with improved financial performance, the effect derives mainly from a greater expectation of future growth rather than from the cost of equity capital. Ahmed et al. (2021) argue that investor preference for ESG may enhance its utility, albeit not at the cost of performance. Moreover, several studies are inconclusive: Gregory et al. (2016) show industry-specific results. In the UK, Salama et al. (2011) report an economically meaningless negative relationship between systematic financial risk and environmental performance, while Humphrey et al. (2012) find no impact of different levels of corporate sustainability performance on the risk-adjusted performance. Some authors even suggest an optimal level of corporate sustainability performance. Stemming from the overinvestment theory, Bartkus et al. (2002) suggest that managers may overinvest in philanthropy beyond an optimal level for their self-interests, at the shareholders' expense.

Several studies suggest that the business cycle might play a part in this relationship. A study by El Ghoul et al. (2018) points out that during noncrisis periods, corporate environmental responsibility can help reduce the probability and costs of adverse events such as environmental scandals, while during the global financial crisis of 2008, the financial distress and bankruptcy costs had a higher priority than decreasing the probability of such events. This finding is consistent with that of Lins et al. (2015), who report that high-sustainability firms exhibited higher stock returns than low-sustainability firms during the 2008–2009 financial crisis.

Taken together, while most empirical research favors a negative relationship between corporate sustainability performance and cost of equity, a relatively small body of literature finds little or no support for it. This inconsistency may be due to other variables that play a role in the relationship, such as the type of measure used to assess corporate sustainability performance, industry membership, the choice of sample, and other cultural and institutional factors that impact the context of the firm (Schoenmaker et al. 2018).

2.2. Cost of Debt and Sustainability

Proponents of sustainability defend a negative relationship between it and the cost of debt, arguing that responsible firms are perceived as less risky by lenders and thus should obtain better financing conditions. On the other hand, opponents of sustainability argue that such activities represent a waste of limited and finite resources, and firms that pursue such activities destroy value, suggesting a positive relationship between both variables.

The main driver of the cost of debt is a firm's default risk. A similar argument applies to bad corporate and social behavior, as creditors also bear reputational risk derived from their clients' actions and may require borrowers to mitigate such sustainability-related risks.

As specialized risk appraisers, lenders are incentivized to incorporate sustainability measures in their risk-assessment models. Prior research reports that lenders increasingly incorporate environmental and carbon issues into their lending decisions (Thompson 1998; Coulson and Monks 1999; Thompson and Cowton 2004; Cogan 2008; Weber 2012). Attig et al. (2013) suggest that more socially responsible firms exhibit higher credit ratings, consistent with the idea that these firms have a lower risk. Consequently, firms with higher credit quality should obtain better borrowing conditions and a lower loan spread (Coulson and Monks 1999; Soppe 2004). This relationship seems to hold in the United States, both with private lenders and the public debt markets, with factors such as geography having a larger impact than the widely studied industry effect on the relationship (Erragragui 2018; Ge and Liu 2015; Jiraporn et al. 2014). Similar results are found in European firms. A recent study by La Rosa et al. (2018) reports a negative relationship between a firm's corporate sustainability performance and cost of debt in a sample of firms included in the S&P Europe 350 index from 2005 to 2012. The authors further conclude that improved corporate sustainability performance is associated with higher credit ratings. Similarly, Oikonomou et al. (2014) find that good corporate sustainability performance is rewarded with a lower cost of debt, while a bad performance penalizes it. ESG disclosure connects with ESG rating disagreement from bondholders (Christensen et al. 2022), and market reaction is also likely with adverse ESG disclosure (Wong and Zhang 2022).

Overall, there is support for a negative relationship between corporate sustainability performance and the cost of debt based on risk mitigation theory. The risk reduction is further corroborated by the research on the association between credit ratings and corporate sustainability performance. Some papers quantified this reduction of the cost of debt: Jung et al. (2018) showed that Australian firms with higher carbon risk and lower risk awareness paid 38 to 62 basis points more on their loans than more aware firms. Goss and Roberts (2011), in a study using a large sample of U.S. firms over 15 years, found that firms exhibiting sustainability concerns are penalized with an increase of 7 to 18 basis points on their bank loans. Interestingly, the authors found that credit providers penalize low-quality borrowers that engage in sustainability activities but are indifferent to high-quality borrowers that engage in similar activities.

This view is commonly called delegated philanthropy. Investors, customers, and employees are willing to give up personal benefits such as purchasing power to improve social well-being, for example, by paying higher prices for more-sustainable products and demanding firms adopt more-sustainable practices (Bénabou and Tirole 2010). Managers are thus pressured to invest beyond what is financially optimal.

Overinvestment theory, an alternative to risk mitigation theory, draws its support from agency theory (Jo and Harjoto 2012). The view is that discretionary investments in socially and environmentally responsible activities pose a costly deviation from the optimal use of scarce resources (Goss and Roberts 2011; Leins 2020).

Some argue that managers overinvest in philanthropy and sustainability to improve their image, as good behavior benefits the managers' reputations at the shareholders' cost (Barnea and Rubin 2010). Friedman (1962) first argued that corporations' pursuit of philanthropic activities is inefficient and should be left to individual shareholders, reflecting information asymmetry and agency problems between managers and shareholders (Boatsman and Gupta 1996; Jensen 2000). Either way, lenders that perceive these activities as resource-wasteful will require higher returns. Following Goss and Roberts (2011), both types of excess spending will be considered under the overinvestment hypothesis, proposing that firms with better sustainability scores have higher levels of cost of capital. Accordingly, the overinvestment hypothesis posits that a firm's sustainability engagement is a diversion of corporate resources and thus makes the firm more vulnerable to credit screening by lenders, resulting in a higher cost of capital.

Menz (2010) was the first paper focusing solely on the relationship between the cost of debt and corporate sustainability performance. Menz (2010) analyzed the relationship between 498 Euro corporate bonds spreads and RobecoSAM CSR scores, observed over 38 months. Following a similar risk-mitigation argument to Sharfman and Fernando (2008), Menz (2010) hypothesized a negative relationship between sustainability scores and firms' credit spreads. However, the study found a weak positive relationship between both variables. The author concluded that it is possible that the credit ratings used in the model already account for sustainability issues and that an additional noncertified sustainability rating does not improve the explanatory power of sustainability to bondholders.

Additionally, agency conflicts regarding the difficulty of simultaneous shareholders' and bondholders' value creation could help explain the results. In Suto and Takehara (2017), the authors study the relationship between corporate sustainability performance and cost of debt, finding a positive link between both variables in the period spanning from 2008 to 2013. The relationship is significant only for the 2008 to 2010 period, indicating that during the financial crisis, lenders saw sustainability spending as a risk to the firm's future, pricing this risk through the cost of debt.

The research conducted until now has focused on the linear relationship between the cost of capital and corporate sustainability performance. Focusing on the cost of debt side, Ye and Zhang (2011) and Bae et al. (2018) have examined the existence of a nonlinear relationship between the cost of debt and corporate sustainability performance, finding a "U-shaped" association between both variables that points to an optimal level of corporate sustainability performance.

Ye and Zhang (2011) are the first researchers to document a U-shaped relationship between both variables. The authors base their hypothesis on risk mitigation theory, examining whether better corporate sustainability performance—measured as the ratio of donations to charity over sales—reduces the cost of debt in a sample of Chinese firms. The authors document a negative relationship between both variables. With higher charity contributions, the relationship turns into a positive one.

Bae et al. (2018) found the same type of relationship with a wide sample of 5810 syndicated bank loans issued by U.S. firms from 1991–2008. The authors conclude that sustainability strengths decrease loan spreads at a decreasing rate, while sustainability concerns increase cost of debt at a decreasing rate. When controlling for business cycles, the authors find that during the technology crisis (2000–2002) and the global financial crisis (2008), firms with sustainability strengths saw lower spreads on their loans. Furthermore, the nonlinearity effect remained significant during these periods, which indicates that the relationship is not sensitive to different periods. The nonlinearity effect of sustainability on the cost of debt suggests that lenders perceive corporate sustainability performance as a form of risk reduction, up until a certain level. After reaching the optimal point, creditors view sustainability investments as ineffective and costly uses of a firm's resources.

As previously noted, the literature on the association between cost of capital and corporate sustainability performance so far provides mixed results. Although some studies find no support for a relationship between both variables, literature reviews such as that conducted by Schoenmaker et al. (2018) have shown that most studies find a negative one. Accordingly, as markets seem to price corporate sustainability performance, an association between corporate sustainability performance and cost of capital is expected:

Hypothesis 1a (H1a). *There is an association between corporate sustainability performance and the cost of debt.*

Hypothesis 1b (H1b). *There is an association between corporate sustainability performance and the cost of equity.*

From the cost of equity point of view, risk mitigation, moral capital, and the investor base frameworks point to a decrease in equity premiums derived from better corporate sustainability performance (Heinkel et al. 2001; Godfrey 2005). Other studies find no support for the relationship or even suggest a positive one (Bartkus et al. 2002). McWilliams and Siegel (2001) and Godfrey (2005) advanced the idea of an optimal level of sustainability investment concerning the cost of equity, while Ye and Zhang (2011) and Bae et al. (2018) provide support for such an optimal level on the cost of debt side in the American and Asian contexts. These studies suggest that the risk mitigation and overinvestment theories play a role in pricing corporate and social investments, echoing how lenders and investors perceive firms as under- or overinvesting in sustainability. In this sense, the following hypotheses are advanced:

Hypothesis 2a (H2a). *The association between cost of debt and corporate sustainability performance changes as firms under- or overinvest in sustainability.*

Hypothesis 2b (H2b). *The association between cost of equity and corporate sustainability performance changes as firms under- or overinvest in sustainability.*

As business cycles greatly influence how firms allocate their capital, corporate and social investments may vary according to economic growth and crisis periods. Accordingly, lenders and investors might perceive sustainability investments differently during such periods.

Hypothesis 3a (H3a). *Sustainability practices are perceived differently by lenders during periods of crisis.*

Hypothesis 3b (H3b). *Sustainability practices are perceived differently by investors during periods of crisis.*

3. Sample and Methodology

3.1. Sample Construction

Our sample is composed of the largest European firms that are constituents of the STOXX Europe 600 index from 2002 to 2018. Firms in the financial sector were excluded because their capital market decisions are greatly constrained by industry-specific regulation, which is fundamentally different from the nonfinancial sector (Pittman and Fortin 2004). These firms should be analyzed autonomously as in other studies (Aracil et al. 2021). Furthermore, firms with unavailable ESG scores or insufficient data to compute the cost of capital metrics are also excluded from the sample. Two different samples exclude firm-year observations with negative shareholder equity value, as these represent firms in financial distress and thus, their financing sources and conditions have different characteristics from those this study targets. Observations at 1% and 99% percentiles for each variable are excluded.

3.2. ESG Score

ESG scores are aggregated based on the 10 category weights and calculated based on the Refinitiv magnitude matrix. Refinitiv computes an ESG controversies score, which discounts the ESG performance score based on negative media stories captured from global media sources. During the year, if a firm is involved in a scandal or related to a negative event (e.g., lawsuits, ongoing legislation disputes, or fines), its ESG controversies score is penalized. Impacts related to developments linked to the negative event may still be reflected in the subsequent year's score. The controversies score also controls for market capitalization bias resulting from more media attention being given to larger firms than smaller firms.

A combined ESG score is computed based on these two scores, as the weighted average of the ESG scores and ESG controversies score per fiscal period when firms are involved in ESG controversies, with recent controversies reflected in the latest completed period. The ESG combined score equals the ESG score when firms are not involved in ESG controversies. This research employs the combined ESG score (Comb_ESG) as a measure of a firm's corporate and social performance.

3.3. Cost of Debt

3.3.1. Cost of Debt Measuring and Sample

The ratio between a firm's interest expense to total interest-bearing debt outstanding has been used in the literature to study the relationship between the cost of debt and corporate and social performance (Ye and Zhang 2011; Magnanelli and Izzo 2017; La Rosa et al. 2018).

The sample for the cost of debt consists of 388 firms belonging to 17 countries in the European Union and 12 industry sectors, totaling 4383 firm-year observations. Appendix B presents the sample composition by country and by industry.

3.3.2. Methodology

To test hypotheses H1a to H3a, three different models are adopted that aim to investigate any association between cost of debt and corporate sustainability performance, while controlling for firm-specific characteristics and year, industry, and country effects. Following La Rosa et al. (2018), Equation (2) seeks to test H1a:

$$\begin{aligned} Cost\ of\ Debt_{i,t} &= \beta_0 + \beta_1 Comb\_ESG_{i,t} + \beta_2 Size_{i,t} + \beta_3 Lev_{i,t} + \beta_4 IntCov_{i,t} + \beta_5 TobinQ_{i,t} + \beta_6 Beta_{i,t} \\ &+ \beta_7 Perf_{i,t} + \beta_8 Liq_{i,t} + \beta_9 Tang_{i,t} + \beta_{10} AssetG_{i,t} + \beta_{11} OCF_{i,t} + \beta_{12} Year_t + \beta_{13} Ind_i \\ &+ \beta_{14} Country_i + \varepsilon_{i,t} \end{aligned} \quad (1)$$

where i denotes each firm and t the corresponding year. The measure of sustainability performance (Comb_ESG) serves as the first independent variable and is computed as described in Section 3.2. Firm control variables are defined as follows:

Firm's size (Size): Computed as the natural logarithm of a firm's market value of equity, in thousands of euros. Studies suggest that the impact of negative events in a firm's cash flows tends to be lower for larger firms, decreasing its default risk. Additionally, larger firms can provide more collateral than smaller firms, thus being viewed as less risky by lenders (Diamond 1989; Goss and Roberts 2011). Firm size is also relevant in an ESG context (Drempetic et al. 2020). A negative association is predicted between Size and cost of debt.

Leverage (Lev): Computed as the ratio between total debt and the market value of equity. The leverage ratio is positively correlated with cost of debt, based on the argument that default risk increases with leverage (Goss and Roberts 2011). On the other hand, higher leverage ratios might also be associated with higher creditworthiness, resulting in a lower cost of debt (Ye and Zhang 2011). Thus, it is difficult to predict the relationship between both variables.

Interest coverage ratio (IntCov): Computed as the sum of income before extraordinary items and interest expenses, divided by interest expenses. A higher interest coverage ratio indicates that the firm can generate sufficient resources to meet its debt obligations, reducing debt costs (Álvarez-Botas and González 2021). A negative sign is expected on IntCov.

Tobin Q ratio (TobinQ): Measured as the sum of the market value of equity and total debt, divided by total assets (Alareeni and Hamdan 2020). A low Tobin Q ratio (between 0 and 1) usually represents an undervalued stock, while a Tobin Q ratio higher than 1 implies that the stock is overvalued. It is analogous to the market-to-book ratio, which has been used as a control for risk, market mispricing, and a proxy for growth opportunities (Goss and Roberts 2011). Based on prior research, a negative association between the TobinQ and cost of debt is expected.

Beta: The market beta is estimated by regressing daily stock returns on the STOXX Europe 600 index (considered the European market proxy in this study) over the previous 5 years. Prior research suggests an adverse effect of a firm's systematic risk on its creditworthiness and default probability and thus, on its cost of debt. (Attig et al. 2013). A positive sign is expected for Beta.

Other typical control measures have been included: a measure of performance (Perf), computed as income before extraordinary items divided by sales; the ratio of current assets to current liabilities as a proxy for a firm's liquidity (Liq); a measure of asset tangibility (Tang), computed as the ratio between property plant and equipment and total assets; the yearly relative variation of total assets (AssetG); and Operating Cash Flow (OCF), as the ratio between operating cash flow and total assets. All control variables should exhibit a negative association with the cost of debt (Goss and Roberts 2011; Ye and Zhang 2011; La Rosa et al. 2018).

Finally, industry membership is controlled for with dummy variables, on the basis of different industries' perceived risk levels for lenders. Regarding countries, applicability and readability of ESG data may be more volatile in countries that exhibit high unstable environments (Park and Jang 2021), which is not the case in our sample. All variables are described in Appendix B with the respective computation formula.

Under- and overinvestments in sustainability are measured by the variable IndDev, employed in Equation (2). IndDev measures corporate sustainability performance deviations from the industry median. Firms belonging to the same industry are subject to equivalent regulations and have similar access to sources of capital and investment opportunities. Furthermore, social and financial performances are only meaningful when compared with firms operating in equivalent economic conditions. Thus, it makes sense for lenders and investors to categorize sustainability investments as excessive or insufficient based on the industry corporate sustainability performance median level.

$$\begin{aligned} Cost\ of\ Debt_{i,t} = & \beta_0 + \beta_1 Comb\_ESG_{i,t} + \beta_2 IndDev_{i,t} + \beta_3 Size_{i,t} + \beta_4 Lev_{i,t} \\ & + \beta_5 IntCov_{i,t} + \beta_6 TobinQ_{i,t} + \beta_7 Beta_{i,t} + \beta_8 Perf_{i,t} \\ & + \beta_9 Liq_{i,t} + \beta_{10} Tang_{i,t} + \beta_{11} AssetG_{i,t} + \beta_{12} OCF_{i,t} + \beta_{13} Year_t \\ & + \beta_{14} Ind_i + \beta_{15} Country_i + \varepsilon_{i,t} \end{aligned} \quad (2)$$

Finally, Equation (3) aims to further explore this deviation; namely, it tests if the magnitude of the deviation affects the relationship. SqrDev is added to the model, computed as the square of IndDev. Squaring the corporate sustainability performance deviation from the industry median allows for controlling for firms with extremely low and high investments in sustainability.

$$\begin{aligned} Cost\ of\ Debt_{i,t} &= \beta_0 + \beta_1 Comb_{ESG\,i,t} + \beta_2 IndDev_{i,t} + \beta_3 SqrDev_{i,t} + \beta_4 Size_{i,t} \\ &+ \beta_5 Lev_{i,t} + \beta_6 Perf_{i,t} + \beta_7 IntCov_{i,t} + \beta_8 Liq_{i,t} + \beta_9 Tang_{i,t} \\ &+ \beta_{10} AssetG_{i,t} + \beta_{11} Beta_{i,t} + \beta_{12} TobinQ_{i,t} + \beta_{13} OCF_{i,t} + \beta_{14} Year_t \\ &+ \beta_{15} Ind_i + \beta_{16} Country_i + \varepsilon_{i,t} \end{aligned} \quad (3)$$

3.4. Cost of Equity

3.4.1. Cost of Equity Measuring and Sample

There are two main types of study designs used to study the relationship between sustainability and cost of equity premium: the first one consists of estimating the cost of equity with an asset pricing model sorted on a measure of corporate and social performance. In the second method, an implied cost of equity is regressed on a measure of environmental performance and control variables (Schoenmaker et al. 2018). Concerning the first method, both the standard single-factor model and the Fama and French (1993) three-factor model have been shown to provide poor proxies for the cost of equity (Fama and French 1997). Additional concerns have been raised over conventional proxies for realized returns by Elton (1999), calling for alternative methods. On the other hand, an implied cost of equity approach has been argued to be particularly useful because it attempts to isolate the cost of equity effects from growth and cash flow effects (Hail and Leuz 2006; Hail and Leuz 2009; Chen et al. 2009). Furthermore, evidence presented by Pástor et al. (2008) supports the notion that a class of implied cost of capital models reasonably captures the time-variation in expected returns. Based on the previous exposure, we followed the second strand of research and estimated the ex ante cost of equity implied in current stock prices and analyst forecasts. Analysts help, in fact, to shape information asymmetry (Naqvi et al. 2021).

Botosan and Plumlee (2005) argue that the proxies should be evaluated based on their relationship with known risk factors such as market risk, leverage, information risk, firm size, and growth. In opposition, Monahan and Easton (2010) defend that the appropriate criterion should be realized returns. Regarding the proxies, the most commonly used models to estimate cost of equity in the literature are the Claus and Thomas (2001) model—CT, the Gebhardt et al. (2001) model—GLS, the Ohlson and Juettner-Nauroth (2005) model—OJ, and the Easton (2004) model—ES. After assessing the performance of five models, including the GLS, OJ, and the PEG model, Botosan and Plumlee (2005) concluded that the PEG model proposed by Easton (2004) and the target price model proposed in Botosan and Plumlee (2002) were the superior ones. Thus, the most recent models, the Ohlson and Juettner-Nauroth (2005) and Easton (2004) models, were selected. Both have the benefit of being parsimonious.

Furthermore, the Ohlson and Juettner-Nauroth (2005) measure is highly correlated with the Claus and Thomas (2001) measure, with a correlation coefficient of 0.945 (Hail and Leuz 2006). As both OJ (KOJ) and ES (KES) measures can be a noisy proxy for the underlying "true" cost of equity capital, the average of the aforementioned two measures is used as the final proxy for implied cost of equity, to the extent that as the noise represents random errors, the averaging methodology should potentially remove a fraction of that noise. Appendix A provides a brief explanation of both models.

Following the common methodology in the literature, the ten-year German Treasury bond yield is subtracted from each model's estimated cost of equity, yielding the risk premium. The final sample includes sample firms with the valid cost of equity measures under both models as well as sufficient data on ESG and control variables.

The sample for the cost of equity consists of 413 firms belonging to 17 countries in the European Union and 12 industry sectors, totaling 4276 firm-year observations. Appendix B presents the sample composition by country and by industry.

3.4.2. Methodology

Regarding firm-specific control variables, we follow El Ghoul et al. (2011) and use size, leverage, the book-to-market ratio, the market beta, a long-term growth rate, and earnings forecast dispersion, as well as year, industry, and country effects. To examine H1b, the following base model is employed:

$$\begin{aligned} Cost\ of\ Equity_{i,t} &= \beta_0 + \beta_1 Comb\_ESG_{i,t} + \beta_2 Beta_{i,t} + \beta_3 Size_{i,t} + \beta_4 Lev_{i,t} + \beta_5 BTM_{i,t} \\ &+ \beta_6 LTG_{i,t} + \beta_7 Disp_{i,t} + \beta_8 Year_t + \beta_9 Ind_i + \beta_{10} Country_i + \varepsilon_{i,t} \end{aligned} \quad (4)$$

The adaptations made to Equation (5) are analogous to those discussed in Section 3.3.2. Equations (7) and (8) are used for H2b and H3b:

$$\begin{aligned} Cost\ of\ Equity_{i,t} &= \beta_0 + \beta_1 Comb\_ESG_{i,t} + \beta_2 IndDev_{i,t} + \beta_3 Beta_{i,t} + \beta_4 Size_{i,t} \\ &+ \beta_5 Lev_{i,t} + \beta_6 BTM_{i,t} + \beta_7 LTG_{i,t} + \beta_8 Disp_{i,t} + \beta_9 Year_t + \beta_{10} Ind_i \\ &+ \beta_{11} Country_i + \varepsilon_{i,t} \end{aligned} \quad (5)$$

$$\begin{aligned} Cost\ of\ Equity_{i,t} &= \beta_0 + \beta_1 Comb\_ESG_{i,t} \\ &+ \beta_2 IndDev_{i,t} + \beta_3 SqrDev_{i,t} + \beta_4 Beta_{i,t} + \beta_5 Size_{i,t} + \beta_6 Lev_{i,t} \\ &+ \beta_7 BTM_{i,t} + \beta_8 LTG_{i,t} + \beta_9 Disp_{i,t} + \beta_{10} Year_t + \beta_{11} Ind_i \\ &+ \beta_{12} Country_t + \varepsilon_{i,t} \end{aligned} \quad (6)$$

where i denotes each firm and t the corresponding year. The measure of sustainability performance (Comb_ESG) serves as the first independent variable and is computed as described in Section 3.2. Firm control variables are defined as follows:

Beta: According to the Capital Asset Pricing Model (CAPM), Beta should be positively associated with the cost of equity. The market beta is estimated by regressing daily stock returns on the STOXX600 index (considered the European market proxy) over the previous 5 years. As such, a positive coefficient is expected.

Firm Size (Size): Computed as the natural logarithm of total assets, in thousands of euros. Fama and French (1993) suggest that the cost of equity is negatively related to a firm's size, while Hail and Leuz (2006) provide evidence of this relationship using an implied cost of equity. A negative coefficient is expected regarding Size.

Leverage (Lev): Computed as the ratio between total debt and the market value of equity. Modigliani and Miller (1958) have shown that a higher leverage ratio increases the cost of equity when considering no taxes or transaction costs. Furthermore, higher subsequent stock returns are earned by higher-leveraged firms (Fama and French 1993). Thus, a positive association is expected.

Book-to-market ratio (BTM): Computed as the ratio between book value and market value of equity. Fama and French (1993) suggest a positive relationship between the book-to-market ratio and implied cost of equity, as higher book-to-market firms are expected to earn higher ex post returns than firms with low BTM. Furthermore, the book-to-market ratio is a proxy for a firm's growth opportunities (La Porta et al. 2002). Recent studies such as those conducted by Gebhardt et al. (2001), Gode and Mohanram (2003), and Hail and Leuz (2006) have provided support for a positive association; thus, a positive sign is expected.

Long-term growth rate (LTG): The consensus five-year growth rate, available in I/B/E/S. Although it might be challenging to predict how long-term growth alone affects the implied cost of equity, Gode and Mohanram (2003) propose a positive association between both variables. The authors argue that high-growth firms tend to be perceived as risky by the market because of the significant impact any misestimation of growth has on prices, i.e., a higher probability of negative returns for high-growth firms. Thus, a positive association is expected.

Forecast dispersion (Disp): Provided by I/B/E/S, it is computed as the coefficient of variation of a 1-year-ahead earnings forecast. Disp is expected to be positively associated with the implied cost of equity, as earnings volatility can be regarded as a source of risk in firm valuations (Madden 1999) and likely captures cash flow risk.

In addition to firm-specific controls, year, industry, and country controls are included in all regressions. Fama and French (1997) find substantial variation in factor loadings across industries, while Hope (2003) shows that analyst forecast accuracy varies significantly across countries.

4. Results

4.1. Cost of Debt

4.1.1. Descriptive Statistics and Correlations

Table 1 reports descriptive statistics for all variables in the cost of debt model. The average cost of debt for a European firm is 4.83%, while on average, firms exhibit a leverage ratio of 0.2447, a liquidity ratio of 1.4498, and a performance of 7.77%. Regarding sustainability measures, the average combined ESG score stands at 53.5015, which indicates that firms are still halfway through their full sustainability potential.

Table 1. Cost of debt model descriptive statistics.

	N	Mean	Std. Dev.	Quartile 1	Median	Quartile 3
Cost of Debt	4383	0.048	0.032	0.031	0.044	0.058
Comb_ESG	4383	53.502	18.604	40.550	54.580	67.840
Beta	4383	0.908	0.331	0.677	0.901	1.120
Size	4383	15.985	1.212	15.160	15.890	16.780
TobinQ	4383	1.440	1.372	0.802	1.149	1.735
Liq	4383	1.450	0.764	0.989	1.287	1.693
Lev	4383	0.245	0.116	0.156	0.237	0.329
AssetG	4383	0.088	0.352	−0.015	0.043	0.118
Tang	4383	0.265	0.197	0.107	0.218	0.389
Perf	4383	0.078	0.091	0.033	0.067	0.116
IntCov	4383	15.022	55.300	3.329	6.307	13.062
CashFlow	4383	0.102	0.074	0.064	0.092	0.126

Appendix B presents the Pearson correlation matrix. A statistically significant negative correlation (−0.119) is found between the cost of debt and Comb_ESG. Overall, there is a statistically significant correlation between independent variables. The correlations between Size and Comb_ESG, with a coefficient of 0.401, and OCF and TobinQ, with a coefficient of 0.730 (p-value < 0.01), are relatively high. The variance inflation factors (VIFs) were computed for all variables to test for potential multicollinearity. As the VIF statistics for each independent variable are only slightly above 1.0, multicollinearity is not a major concern, and all variables are kept in the model.

4.1.2. Results for the Cost of Debt

Table 2 reports the main results from the regressions estimated using the pooled Ordinary Least Squares method. In all models, the cost of debt serves as the dependent variable. Several sustainability metrics are included as explanatory variables, and every model specification includes ten firm-specific control variables and year, industry, and country effects.

Table 2. Cost of debt regression results.

Variables	(1)	(2)	(3)
Comb_ESG	0.000132 ***	−0.000235 *	−0.000238 **
	(4.66)	(−1.95)	(−1.97)
IndDev		0.000376 ***	0.000376 ***
		(3.14)	(3.14)
SqrDev			−0.00000115
			(−0.97)
Beta	0.00625 ***	0.00700 ***	0.00697 ***
	(3.93)	(4.36)	(4.34)
Size	−0.00315 ***	−0.00318 ***	−0.00319 ***
	(−7.09)	(−7.17)	(−7.20)
TobinQ	−0.00121 **	−0.00111 **	−0.00111 **
	(−2.39)	(−2.18)	(−2.19)
Liq	0.00255 ***	0.00263 ***	0.00263 ***
	(3.99)	(4.11)	(4.11)
Lev	−0.0807 ***	−0.0807 ***	−0.0807 ***
	(−20.28)	(−20.30)	(−20.28)
AssetG	−0.00712 ***	−0.00713 ***	−0.00714 ***
	(−5.91)	(−5.92)	(−5.93)
Tang	−0.0101 ***	−0.00989 ***	−0.00981 ***
	(−3.74)	(−3.66)	(−3.63)
Perf	−0.00123	−0.00111	−0.000874
	(−0.23)	(−0.21)	(−0.17)
IntCov	−0.0000800 ***	−0.0000802 ***	−0.0000804 ***
	(−9.73)	(−9.76)	(−9.78)
CashFlow	0.0287 ***	0.0275 ***	0.0276 ***
	(3.17)	(3.04)	(3.05)
Intercept	0.132 ***	0.147 ***	0.147 ***
	(16.55)	(15.96)	(15.98)
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Country	Yes	Yes	Yes
Observations	4383	4383	4383
Adj. R-Squared	0.272	0.273	0.273
F-Test	31.25	30.93	30.39

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. (1), (2), and (3)—Pooled OLS. t-statistics are presented in parentheses. All variables are defined in Appendix B.

Regarding the association between the explanatory variable Comb_ESG and the cost of debt, Model (1) shows a positive and statistically significant coefficient at the 1% level. This suggests that firms showing better corporate and social performance pay higher interest rates on debt. This finding is consistent with that of Sharfman and Fernando (2008), Menz (2010), and Magnanelli and Izzo (2017), implying that lenders perceive sustainability investments as a waste of a firm's resources. As Comb_ESG is significant in all models, at least at the 10% level, there is support for a relationship between corporate sustainability performance and cost of debt, validating H1a.

Model (2) further explores the corporate sustainability performance–cost of debt relationship concerning deviations from the industry median. Interestingly, adding this variable to the model turns the coefficient on Comb_ESG negative and significant at the 10% level, while IndDev shows a positive sign, statistically significant at the 1% level. As deviations are measured in negative (corporate sustainability performance < industry median) and positive (corporate sustainability performance > industry median) terms, this result indicates that firms underinvesting in corporate sustainability performance pay lower interests on debt (i.e., a negative IndDev measure times a positive coefficient), while firms with ESG scores above industry medians are penalized. These results are consistent with Ye and Zhang (2011) and Bae et al. (2018), suggesting that the relationship between the cost of debt and corporate sustainability performance changes based on whether firms are under- or overinvesting in sustainability. Although this points to the acceptance of H1b, these results are further explored in Section 4.3 to better examine this association.

Model (3) results show that the magnitude of the corporate sustainability performance deviation is not significant for the relationship between the cost of debt and corporate sustainability performance. Here, the significance level of Comb_ESG coefficient increases to 5%. When considering individual ESG scores and deviation from industry peers, the magnitude of the deviation does not impact the relationship between the cost of debt and corporate sustainability performance.

Regarding control variables, most display the predicted signs. Beta is positive and significant at the 1% level across all models, indicating that cost of debt increases with higher systematic risk. Size is negative and statistically significant (p-value < 0.01) in all models, as predicted by previous works in the literature (Goss and Roberts 2011; Sharfman and Fernando 2008). Regarding variable TobinQ, there is a negative and statistically significant relationship between this and the cost of debt in all models (p-value < 0.05). Lev is negatively associated with the cost of debt at a 1% significance level, supportive of the argument that those who are more creditworthy can take on more leverage. The variables AssetG, Tang, and IntCov show the predicted negative association with the cost of debt across all models, with a significance level of 1%. As such, firms with more tangible assets (guarantees), higher interest coverage ratios, as well as positive asset growth, display a lower cost of debt. Perf also shows a negative coefficient, although not statistically significant. Variables Liq and CashFlow do not have the expected negative relation with the cost of debt, although they are statistically significant (p < 0.01) and in line with La Rosa et al. (2018).

4.2. Cost of Equity

4.2.1. Descriptive Statistics and Correlations

Table 3 presents the descriptive statistics regarding all variables in the cost of equity model. The average implied cost of equity premium estimate for a European firm is 8.55%, with the Easton model producing a higher mean estimate than the OJ model (8.68% and 8.43%, respectively), which is in line with El Ghoul et al. (2011). Like the cost of debt model results, European firms show an average ESG score of 54.3284. Regarding control variables, the average firm size is close to $e^{(15.9496)}$, with an average book-to-market ratio of 0.4685 and a leverage level of 39.74%. On average, firms exhibit a Beta of 0.8945.

Table 3. Cost of equity model descriptive statistics.

	N	Mean	Std. Dev.	Quartile 1	Median	Quartile 3
KES	4276	0.087	0.038	0.063	0.080	0.103
KOJ	4276	0.084	0.041	0.061	0.076	0.098
Cost of Equity	4276	0.086	0.036	0.063	0.078	0.100
Comb_ESG	4276	54.328	18.176	41.980	55.340	68.180
Beta	4276	0.895	0.322	0.676	0.885	1.096
Size	4276	15.950	1.433	14.969	15.931	17.003
BTM	4276	0.469	0.331	0.240	0.377	0.622
Lev	4276	0.397	0.561	0.105	0.237	0.478
Disp	4276	0.108	0.594	0.033	0.057	0.100
LTG	4276	0.110	0.114	0.057	0.092	0.135

Appendix B presents the Pearson correlation matrix. A statistically significant positive correlation (0.0553) is found between the average implied cost of equity and the combined ESG score. Overall, there is a statistically significant correlation between independent variables. The correlation between Lev and BTM, with a coefficient of 0.533 (p-value < 0.01), is relatively high. Once again, the variance inflation factors (VIFs) were computed for all variables and all results are low (<2), which indicates that potential multicollinearity is not a major concern, and all variables are kept in the model.

4.2.2. Results for the Cost of Equity

Table 4 reports the main results from the cost of equity–corporate sustainability performance regressions estimated using the pooled Ordinary Least Squares method. In all models, the dependent variable is the average implied cost of equity. Several sustainability metrics are included as explanatory variables, and all model specifications include six firm-specific control variables, as well as year, industry, and country effects.

Table 4. Cost of equity regression results.

	(1)	(2)	(3)
Comb_ESG	−0.000141 ***	−0.000551 ***	−0.000548 ***
	(−4.71)	(−4.47)	(−4.45)
IndDev		0.000425 ***	0.000424 ***
		(3.43)	(3.43)
SqrDev			0.000000884
			(0.70)
Beta	0.00895 ***	0.00988 ***	0.00990 ***
	(5.09)	(5.56)	(5.57)
Size	0.00232 ***	0.00221 ***	0.00221 ***
	(5.48)	(5.21)	(5.20)
BTM	0.0285 ***	0.0283 ***	0.0282 ***
	(16.10)	(15.99)	(15.95)
Lev	0.00894 ***	0.00903 ***	0.00905 ***
	(8.97)	(9.08)	(9.10)
Disp	0.00652 ***	0.00653 ***	0.00654 ***
	(8.74)	(8.76)	(8.77)
LTG	0.0749 ***	0.0746 ***	0.0746 ***
	(18.81)	(18.74)	(18.75)
Intercept	0.0313 ***	0.0489 ***	0.0488 ***
	(4.16)	(5.38)	(5.36)
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Country	Yes	Yes	Yes
Observations	4276	4276	4276
Adj. R-Squared	0.374	0.376	0.376
F-Test	51.16	50.53	49.58

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. (1), (2), and (3)—Pooled OLS. t-statistics are presented in parentheses.

Model (1) examines the association between corporate and social performance and the implied cost of equity. Regarding the Comb_ESG variable, a negative and statistically significant coefficient (p-value < 0.01) is reported across all models. This result is in line with the majority of research conducted on the cost of equity and sustainability relationship (Sharfman and Fernando 2008; El Ghoul et al. 2011, 2018), suggesting that investors reward firms that are more socially responsible with a lower cost of equity capital. As an association between corporate sustainability performance and cost of equity is found across all models, there is support for the notion that investors' prices are included in a firm's corporate and social responsibility. Thus, H1b is validated.

Once again, Model (2) employs IndDev to explore the corporate sustainability performance–cost of equity relationship considering deviations from the industry median. Comb_ESG is still negative and significant at the 1% level. IndDev shows a positive coefficient, statistically significant at the 1% level. From this result, it can be inferred that negative deviations from the industry median (negative IndDev) are seen as beneficial by investors, who require lower equity premiums. On the other hand, when a firm's corporate sustainability performance is above the industry median level, its implied cost of equity increases. This means that investing in corporate and social responsibility up until a level equal to industry peers is seen as valuable by investors, while overinvesting in sustainability is seen as a waste of resources. The results are further explored in Section 4.3 in order to better examine this association.

Model (3) results report a positive but not statistically significant coefficient on SqrDev. The model emphasizes under- and overinvestments by squaring the deviation from the industry mean. Although the coefficient is positive, one cannot conclude that more considerable deviations impact the corporate sustainability performance–cost of equity relationship, as the *p*-value is higher than 0.10.

Regarding firm-specific control variables, a positive and statistically significant coefficient is reported for all variables across the three models at the 1% significance level. Furthermore, all control variables exhibit the expected sign, except for Size. Interestingly, Size exhibits a positive and statistically significant coefficient at the 1% level, contrary to the consistent negative association found in the literature (El Ghoul et al. 2011), implying that bigger firms tend to pay higher equity premiums. However, this positive association might have to do with sample selection, as we restricted the sample to firms that are constituents of the STOXX600, thus all large in size, so that no true differentiation between large and small firms can be made.

The control variable Beta shows a positive and statistically significant coefficient at the 1% level in all specified models. This finding is consistent with that of Hail and Leuz (2006) and El Ghoul et al. (2011). The book-to-market ratio (BTM) variable yields a positive coefficient, statistically significant at the 1% level across all models, indicating that investors require higher equity premiums for firms with lower growth opportunities. The control variable Lev's coefficient is in the correct direction and significant at $p < 0.01$. Results are in line with previous studies by Gode and Mohanram (2003), Hail and Leuz (2006), and El Ghoul et al. (2011).

All variables are defined in Appendix B. Both analyst-forecast variables, the 1-year-ahead EPS forecast dispersion (Disp) and the consensus long-term growth forecast (LTG), are in line with previous studies (El Ghoul et al. 2011) and have a statistically significantly (*p*-value < 0.01) effect on the implied cost of equity across the three models. As such, the results imply that the market requires higher equity premiums for riskier, higher growth, more-leveraged firms, and those displaying more dispersed analyst forecasts.

4.3. Underinvestment and Overinvestment Group Samples

To further explore the implications related to firms under- and overinvesting in sustainability, each sample was partitioned into underinvestment (ESG < industry median) and overinvestment (ESG $\geq$ industry median) subsamples, while using IndDev as the explanatory variable. For the underinvestment subsample, negative IndDev values were converted to absolute ones; thus, a higher IndDev value represents higher negative deviations from the industry median (lower scores). For parsimony, only IndDev coefficients are reported in Table 5, although both models contain the complete set of control variables and year, industry, and country indicators, which present the expected signs at the standard significance levels.

Panel A. reports a statistically insignificant negative relationship between IndDev and cost of debt for firms in the underinvestment group, and a positive statistically significant IndDev for the overinvestment group (*p*-value < 0.01). The results indicate that negative divergences from the industry median are not priced-in by lenders, while firms with above industry median scores are penalized with higher interest rates. It also suggests that the positive coefficient on IndDev found in Model (2) of Table 2 is only significant for those firms overinvesting in sustainability. These results further support the conclusion of Jung et al. (2018), which suggests that lenders perceive a firm's carbon risk differently regarding high- and low-emitting industries.

Table 5. Additional analyses.

Variables	Panel A. Cost of Debt Model		Panel B. Cost of Equity Model	
	Underinvestment Sample	**Overinvestment Sample**	**Underinvestment Sample**	**Overinvestment Sample**
IndDev	−0.0000873 (−1.27)	0.000164 *** (2.64)	0.000144 ** (2.10)	−0.0000360 (−0.51)
Firm-controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes
adj. R^2	0.253	0.299	0.414	0.364
N	2010	2303	1950	2254
F-test	13.62	19.49	27.96	26.32

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. t-statistics are presented in parentheses. All variables used in Panel A and Panel B models are presented in Appendix B.

Alternatively, Panel B results show a positive relationship between the cost of equity and IndDev for the underinvestment subsample, significant at the 5% level, and a statistically insignificant negative coefficient for the overinvestment group. This suggests that negative divergences from the industry median translate into higher required equity premiums. From a different perspective, this also suggests that sustainability investments are rewarded up until an industry-standard level for firms lagging in corporate sustainability performance.

These results are interesting, with a possible explanation deriving from the contrasting resources-allocation approaches between investors and lenders. While lenders are only interested in those firms wasting resources beyond some optimal level, investors are worried about whether firms present corporate sustainability performance below their peers—supporting the overinvestment and risk mitigation theories, respectively. Thus, as the association between corporate sustainability performance seems to change based on whether firms are considered underinvestors or overinvestors, Hypotheses 2a and 2b are validated.

4.4. Robustness and Additional Tests

4.4.1. Alternative Measurement

There is no consensus in the literature on the best proxies for corporate sustainability performance, cost of equity, and cost of debt measures. As such, different dependent and explanatory variables are employed to test the robustness of previous results.

Regarding the cost of debt–corporate sustainability performance relationship, we follow Álvarez-Botas and González (2021) and subtract the industry median value from cost of debt, resulting in a cost of debt "premium" as an alternative measure. The re-estimated models in Appendix B Model (1) show a positive Comb_ESG coefficient (p-value < 0.01) in line with previous findings. This further supports the notion that lenders penalize corporate sustainability performance. Models (2) and (3) report a negative Comb_ESG coefficient but without statistical significance. These results are not surprising, considering that the industry-adjusted ESG score (IndDev) reports a positive and highly statistically significant coefficient (p-value < 0.01), possibly shadowing any explanatory power a firm's ESG score might have on the cost of debt measure, which is also adjusted to the industry median. Once again, the variable SqrDev shows no impact on the relationship.

Following El Ghoul et al. (2011), the models in Table 5 are re-estimated by replacing the dependent variable cost of equity with the individual cost of equity premiums from the Easton (KES) and Ohlson and Juettner-Nauroth (KOJ) models, as well as the earnings-to-price (KEP) ratio, as described in Appendix A. The EP ratio is a special case of the Easton (2004) model, which assumes no abnormal earnings growth. The results are reported in

Appendix B. Across all models, a negative Comb_ESG coefficient is found, statistically significant at the 1% level, confirming previous conclusions that corporate sustainability performance helps decrease the cost of equity. The variable IndDev loads a positive and statistically significant coefficient at the 1% level in the Panel A and Panel B models, and a 5% significance level in models from Panel C. SqrDev shows no statistical significance in any model, which is in line with previous results.

The combined ESG score (Comb_ESG) employed in previous models is discounted when firms are involved in ESG controversies. To better understand the direct effect of sustainability on the relationship, we use the ESG score (ESG) provided by Refinitiv, which is unaffected by controversies. Furthermore, both IndDev and SqrDev are recalculated using the unaffected ESG score. Appendix B presents the results, omitting firm-specific control variables results, which all display coefficient results similar to previous results from Table 2. Regarding the cost of debt–corporate sustainability performance relationship, Model (1) in Panel A shows a positive and statistically significant relationship between ESG and cost of debt, which is in line with previous findings. In Models (2) and (3), ESG becomes statistically insignificant, suggesting scores adjusted for controversies affecting firms help better explain the cost of debt–corporate sustainability performance relationship, implying that lenders price such events in their activities. In Models (2) and (3), IndDev shows a positive coefficient (p-value < 0.05), while SqrDev is not significant.

Regarding the results from Panel B, ESG is negative across all models at the standard significant levels. IndDev shows a positive sign (p-value 0.05) in Models (2) and (3), while SqrDev is not significant. These results are in line with those reported in Table 4. Although results are generally robust, the higher adjusted R^2 scores and lower statistical significance levels reported in Tables 2 and 4 suggest that the combined ESG score is more adequate when measuring the relationship between the cost of capital and corporate sustainability performance, enhancing the impact of controversies in the relationships.

Appendix B reports results from Tables 2 and 4, where models are re-estimated using the industry average ESG score to compute variables IndDev and SqrDev. Once again, firm-specific control variables are omitted, as their coefficients present equivalent signs at statistically significant levels to those from Tables 2 and 4. The variables Comb_ESG, AvgIndDev, and AvgSqrDev present equal signs and statistically significant levels to the results in Tables 2 and 4. Overall, the results are robust for the various alternative measures and models used to access the association between the cost of capital and corporate sustainability performance.

Finally, we disentangled the ESG score in its components. This is only an additional analysis, as Refinitiv has not disclosed these components for several firm-year observations, especially for older observations. Therefore, we looked at the three pillars of sustainability performance, although this standalone approach may not comprehensively capture the entire sustainability ecosystem of firms. Because in the primary analysis we found that the deviations in the score are more relevant to driving the cost of debt down, in columns 1 to 3 of Table A11, we included the square of each ESG pillar as a proxy for changes. Additionally, in the primary analysis, we considered that the sustainability performance levels are more relevant to explaining the cost of equity; therefore, we included the corresponding ESG pillars in columns 4 to 6 of Table A11. The results are in line with previous findings. Each pillar contributes to reducing the cost of capital. While the cost of debt is affected by changes in the sustainability performance, the cost of equity is affected by the raw score.

Our sample is composed of firms belonging to 17 different countries in Europe, although the United Kingdom comprises about 25.6% (26.6%) of the sample for the cost of debt (equity). Therefore, we performed an additional analysis by considering observations exclusively from firms headquartered in the United Kingdom and also by excluding these observations. The tables from these analyses are not formally reported for parsimony. Our results hold similar to the primary analysis in this robustness test.

4.4.2. Results for the Robustness Tests

In this section, the results from Table 5 are tested using the alternative measures for corporate sustainability performance, cost of debt, and cost of capital, as described in Section 4.4.1. Negative deviations (for the underinvestment subsamples) are measured in absolute terms. Appendix B reports results from examining the cost of debt–corporate sustainability performance relationship regarding sustainability under- and overinvestment groups, i.e., firms with lower-than-industry median and higher-than-industry median corporate sustainability performance scores, respectively. Model (1) reports a statistically insignificant negative IndDev, suggesting that when firms exhibit lower-than-average ESG scores (sustainability investment), lenders do not price such activities. On the contrary, IndDev is positive and statistically significant (p-value < 0.05) for firms with higher-than-industry median corporate sustainability performance, implying that lenders penalize sustainability industry leaders with higher debt costs.

Appendix B reports the re-estimated models from Table 4 using the Easton (KES), Ohlson and Juettner-Nauroth (KOJ), and Earnings-to-price ratio (KEP) measures as alternative cost of equity measures. The underinvestment subsamples show that IndDev is positive across all models and statistically significant at the 1% and 5% levels for KES and KEP measures, respectively, although not significant for the KOJ measure. This confirms previous findings that the lower the corporate sustainability performance of a firm compared with peers, the higher the cost of equity. It also means that investing in sustainability is rewarded until the industry median level. Regarding the overinvestment subsample, IndDev is not statistically significant for every alternative cost of equity measure.

Overall, previous findings are robust when considering alternative dependent variables. There is a reinforcement of the idea that debt markets penalize industry leaders in sustainability, once again alluding to the proposition that lenders penalize the pursuit of corporate responsibility beyond a "sufficient" level. While firms are not rewarded for lower corporate sustainability performance concerning industry peers, they are disincentivized from being more responsible than necessary. On the other hand, results suggest that firms with low corporate sustainability performance that improve their score are rewarded by the equity markets, while there is no meaningful relationship between corporate sustainability performance and cost of equity for industry leaders.

4.5. Impact of Crises

This section examines whether periods of crisis affect the relationship between corporate sustainability performance and the cost of capital. Bae et al. (2018) affirm that firms pay significantly higher loan spreads during crisis periods, while El Ghoul et al. (2018) suggest that corporate environmental responsibility becomes ir-relevant. The Models in Tables 2 and 4 are re-estimated after partitioning both the cost of debt and cost of equity samples into two periods: crisis periods, considering years from 2008 to 2012 (financial and sovereign debt crisis)[1], and stability periods (2002–2007 and 2012–2018). For parsimony, Table 6 omits the results regarding control variables, as most coefficients exhibit the predicted signs at the standard statistical significance levels. For parsimony, SqrDev is not included in the analysis, as previous findings find no effect on the relationship between cost of capital and corporate sustainability performance.

Table 6. Analysis of the impact of crisis periods.

	Panel A. Cost of Debt Model		Panel B. Cost of Equity Model	
Variables	**Crisis**	**Stability**	**Crisis**	**Stability**
Comb_ESG	0.000163	−0.000380 ***	0.0000872	−0.000599 ***
	(0.53)	(−2.78)	(0.22)	(−4.68)
IndDev	0.0000276	0.000487 ***	−0.000303	0.000514 ***
	(0.09)	(3.59)	(−0.75)	(4.01)
Firm-controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes
adj. R^2	0.227	0.293	0.328	0.404
N	1356	3027	1111	3165
F-Test	10.23	26.11	14.86	46.59
p-value	0.0000	0.0000	0.0000	0.0000

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. t-statistics are presented in parentheses.

Panel A presents the results regarding the cost of debt–corporate sustainability performance relationship, where both coefficients on Comb_ESG and IndDev are positive but statistically insignificant during crisis periods. During stability periods, Panel A reports a negative and statistically significant coefficient on Comb_ESG (p < 0,01) and a positive one on IndDev (at the 1% level). Panel B exhibits equivalent results for the cost of equity sample, with both coefficients on Comb_ESG and IndDev showing statistically insignificant coefficients during crisis periods. For the stability subsample, a negative and a statistically significant coefficient for Comb_ESG is found (p < 0,01), while IndDev is positive and significant at the 1% level.

These results align with studies such as those by La Rosa et al. (2018) and El Ghoul et al. (2018). They find no statistically significant relationship between corporate sustainability performance and cost of debt, or corporate sustainability performance and cost of equity during periods of crisis, respectively. Both studies explain that during periods of crisis, firms prioritize avoiding financial distress and bankruptcy and maintaining profitability. The positive effects sustainability might have on the cost of capital, by reducing the probability of negative events or increasing moral capital, become secondary in such circumstances. Furthermore, El Ghoul et al. (2018) point to investor short-termism during crisis periods, who emphasize short-term financial performance over long-term sustainability performance.

5. Conclusions

The main objective of this study was to analyze the association between corporate and social performance and the cost of equity and debt for firms belonging to the STOXX600. Two samples were used, based on different data availability. The first is a sample for the cost of equity that covers 388 of the firms that are included in the STOXX600. The second is a sample of 413 unique firms from the same stock index. The period under analysis goes from 2002 to 2018.

In line with Sharfman and Fernando (2008), Menz (2010), and Magnanelli and Izzo (2017), the current study suggests a positive relationship between corporate and social performance and the cost of debt, i.e., more socially responsible firms are penalized by lenders through an increase in interest rates of about 1.32 b.p. in a 10% change on ESG score. On the other hand, this study points to a negative relationship between corporate and social performance and the cost of equity, which is in line with Sharfman and Fernando (2008) and El Ghoul et al. (2011, 2018). This suggests that investors reward firms displaying higher corporate and social performance with lower required equity premiums of about 1.42 b.p. on a 10% increase in ESG score.

When comparing corporate sustainability performance with industry peers, the results point to an optimal level of sustainability investment. In the first analysis regarding both relationships, lenders and investors seem to penalize firms who overinvest in sustainability (corporate sustainability performance above industry-standard) and reward those who underinvest in sustainability (below industry-standard corporate sustainability performance). A 10% deviation from industry median impacts both cost of debt and cost of capital by about 4 b.p. Robustness tests suggest that lenders are only sensitive to firms who overinvest in sustainability, while investors are sensitive only to firms who underinvest in sustainability. Furthermore, the results indicate that the magnitude of the deviation from the optimal level does not have an additional impact on the relationships.

The study results are robust for alternative measures of corporate and social performance, cost of debt and cost of equity, and alternative models employing these alternative measures to test under- and overinvestment theories regarding debt and equity markets.

However, previous research suggests that the impact of sustainability on the cost of capital varies depending on the economic cycle, with mixed results (El Ghoul et al. 2018; La Rosa et al. 2018; Suto and Takehara 2017). This study finds that during periods of financial crisis, sustainability and the degree of under- and overinvestment in sustainability activities become ir-relevant to lenders and investors.

This study is innovative and important for several reasons, offering practical implications for managers and policymakers. First, it is the first study analyzing both the cost of equity–corporate sustainability performance and the relationship between the cost of debt and corporate sustainability performance in a European context that focuses on analyzing the optimal level of corporate sustainability performance concerning firms in the same industry. Other studies fail to look at both components of the cost of capital in the same setting.

It also provides evidence on the pricing of corporate sustainability performance by the capital markets, helping to shed some light onto the mixed results advanced by the literature. It further supports the growing importance of considering sustainability as value-relevant when defining a business strategy, as its impact on cost of capital urges managers to think beyond just financial measures. Moreover, the results point to divergent positioning by lenders and investors regarding sustainability. While lenders seem to perceive sustainability investments as a waste of resources, investors perceive them as mitigators of risk. This forces socially responsible managers to weight the cost of each source of capital when allocating firm resources. This study further examines how capital markets perceive sustainability leaders and laggers within an industry. Investors seem to reward corporate sustainability performance laggers who invest in sustainability up to the industry corporate sustainability performance median, while lenders penalize overinvestments (i.e., leaders with corporate sustainability performance above the industry median). Moreover, the deviation's magnitude seems ir-relevant when already controlling for corporate sustainability performance and industry positioning. This study finds no evidence that sustainability has a meaningful impact on the cost of capital during periods of a financial crisis.

Finally, environmental and social issues such as climate change have been behind major political policies aiming toward a more sustainable future. One such example is the Paris Agreement, adopted by nearly every nation in 2015, to achieve climate neutrality before the end of the century. In order to make finance flows consistent with the long-term climate goals, policymakers who champion such actions must also understand how the capital markets price sustainable activities and regulate accordingly.

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Appendix A. Implied Cost of Equity Capital Models

Common variables:

P_t = stock price measured in June of each year;
$eps_{t+\tau}$ = forecasted earnings per share for year $t+\tau$;
dps_{t+1} = expected dividend per share.

Model (1): Ohlson and Juettner-Nauroth model (2005, OJ)

This model is a generalization of the Gordon constant growth model. It relates the current price (P_t) to estimated one-year-ahead earnings per share (eps_{t+1}), two-year-ahead earnings per share (eps_{t+2}), forecasted dividends per share (dps_{t+1}), and an assumed perpetual growth rate gamma (γ). The model requires positive 1-year-ahead and 2-year-ahead earnings forecasts in order to provide a positive root. The short-term growth $((eps_{t+2} - eps_{t+1})/eps_{t+1})$ is assumed to decay asymptotically to (γ), which is set to be equal to a long-term economic growth rate. The model defines a 1-year explicit forecast horizon, after which forecasted earnings grow at a near-term rate that decays to a perpetual rate. Following the Gode and Mohanram's (2003) implementation of the model, the near-term earnings growth rate (g_2) is the average of: (i) the percentage difference between 2-year-ahead and 1-year-ahead earnings forecasts, and (ii) the I/B/E/S long-term growth (LTG) forecast. The real perpetual growth rate is also set to 3%, corresponding to a long-term economic growth rate. The term $(\gamma - 1)$ is set to be equal to the risk-free rate minus 3%, where the risk-free rate is the yield on the 10-year German bond.

Because we perform a cross-sectional analysis, the choice of γ being equal to 3% does not affect the overall results, as it only affects the overall level of the risk premium and not the relative implied risk premia of different firms.

$$K_{OJ} = A + \sqrt{A^2 + \frac{eps_{t+1}}{P_t}(g_2 - (\gamma - 1))} \quad \text{(A1)}$$

where:

$$A = \frac{1}{2}\left((\gamma - 1) + \frac{dps_{t+1}}{P_t}\right) \quad \text{(A2)}$$

$$dps_{t+1} = dps_0 \quad \text{(A3)}$$

$$g_2 = \frac{STG + LTG}{2} \quad \text{(A4)}$$

$$STG = \frac{eps_{t+2} - eps_{t+1}}{eps_{t+1}} \quad \text{(A5)}$$

$$(\gamma - 1) = r_f - 0.03 \quad \text{(A6)}$$

Model (2): Easton (2004):

The Easton model is a special case of the abnormal earnings growth valuation model developed by Ohlson and Juettner-Nauroth (2005). It allows share price to be expressed in terms of 1-year-ahead (eps_{t+1}) and 2-years-ahead (eps_{t+2}) earnings per share forecasts, cost of equity (K_{ES}), and forthcoming dividends per share (dps_{t+1}) to derive a measure of abnormal earnings growth. The explicit forecast horizon is 2 years, after which the forecasted abnormal earnings are assumed to grow in perpetuity at a constant rate. This model requires a positive change in 1-year-ahead and 2-years-ahead earnings per share forecasts to yield a numerical solution. The valuation equation is given by:

$$P_t = \frac{eps_{t+2} - eps_{t+1} + (K_{ES} dps_{t+1})}{k_{ES}^2} \quad \text{(A7)}$$

where $dps_{t+1} = dps_t$

In this model, the implied cost of equity is the internal rate of return (IRR) that equates the stock price derived from the Easton model to the observed 30 June stock price, minus the yield on the 10-year Germany Treasury bond on 30 June.

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Model (3): Earnings–price (EP) ratio:

The Easton (2004) model particular case assumes zero abnormal earnings growth. The EP ratio is given by:

$$EP = \frac{eps_{t+1}}{P_t} \tag{A8}$$

Appendix B. Additional Tables

Table A1. Samples composition by country.

	Panel A. Cost of Debt	Panel B. Cost of Equity
Austria	82	56
Belgium	77	80
Denmark	169	171
Finland	178	134
France	675	697
Germany	497	529
Ireland	98	79
Italy	123	107
Luxembourg	41	30
Netherlands	242	205
Norway	124	101
Poland	22	13
Portugal	36	30
Spain	125	158
Sweden	384	352
Switzerland	389	395
United Kingdom	1121	1139
Total	4383	4276

Table A2. Samples composition by industry.

	Panel A. Cost of Debt	Panel B. Cost of Equity
Basic Materials	473	398
Consumer Cyclicals	21	24
Consumer Discretionary	821	814
Consumer Noncyclicals	23	24
Consumer Staples	463	462
Energy	202	164
Health Care	472	483
Industrials	1196	1072
Real Estate	17	156
Technology	209	250
Telecommunications	223	206
Utilities	263	223
Total	4383	4276

Table A3. Definition of cost of debt model variables.

Panel A. Dependent variables		
Cost of Debt	Interest expenses/total interest-bearing debt.	Francis et al. (2005); La Rosa et al. (2018)
Panel B. Explanatory variables		
Comb_ESG	ESG combined score obtained from Refinitiv database.	La Rosa et al. (2018)
Ind*Dev*	ESG combined score minus industry-year median value.	Author
SqrDev	Square of *IndDev* measure.	Author
Crisis	Crisis periods as defined by the European Commission.	European Business Cycle Indicators Technical Paper (11 October 2016)
Panel E. Control variables		
Beta	Estimated by regressing 5-year daily stock returns in year *t* on the STOXX600 index daily returns.	La Rosa et al. (2018)
Size	Natural logarithm of a firm's market $\text{value}_{\text{t-1.}}$	Ye and Zhang (2011); La Rosa et al. (2018)
TobinQ	(Market value + total debt)/total assets.	Bae et al. (2018); La Rosa et al. (2018)
Liq	Current assets/current liabilities.	La Rosa et al. (2018)
Lev	Total Debt/Total Asset.	Bae et al. (2018); Huang et al. (2017)
AssetG	$(\text{Total asset}_{\text{t}} - \text{total asset}_{\text{t-1}})/\text{total assets}_{\text{t-1.}}$	La Rosa et al. (2018)
Tang	Property plant and equipment/total assets.	Jung et al. (2018)
Perf	Income before extraordinary items/sales.	La Rosa et al. (2018)
IntCov	(Income before extraordinary items + interests)/interests.	La Rosa et al. (2018)
OCF	Operating cash flow/total assets.	Goss and Roberts (2011)
Ind	Industry dummy variable based on ICB industry classification.	
Year	Year dummy variable.	
Country	Country dummy variable	

Table A4. Definitions of cost of equity model variables.

Panel A. Dependent variables		
K_{OJ}	Implied cost of equity model derived from the Ohlson and Juettner-Nauroth (2005) model. Estimated in June of each year minus the 10-year German Treasury bond rate.	Ohlson and Juettner-Nauroth (2005)
K_{ES}	Implied cost of equity model derived from the Easton (2004) model. Estimated in June of each year minus the 10-year German Treasury bond rate.	Easton (2004)
Cost of Equity	Cost of Equity : average of r_{OJ} and r_{ES}. Both models are described in Appendix A.	Author

Table A4. *Cont.*

Panel B. Explanatory variables		
Comb_ESG	ESG combined score obtained from Refinitiv database.	
IndDev	ESG combined score—industry-year median value.	Author
SqrDev	Square of *IndDev* measure	Author
Crisis	Crisis periods as defined by the European Commission.	European Business Cycle Indicators Technical Paper (11 October 2016)
Panel D. Control variables		
Beta	Market beta estimated by regressing 5-year daily stock returns in year *t* on the STOXX600 index daily returns.	El Ghoul et al. (2011)
Size	Natural logarithm of total assets.	El Ghoul et al. (2011)
Lev	Ratio of total debt to the market value of equity.	El Ghoul et al. (2018)
BTM	Book to Market ratio computed as Book value of Equity/Market value of Equity.	Fama and French (1993), Hail and Leuz (2006)
LTG	Long-term growth forecast reported in December of year *t*, obtained from I/B/E/S.	El Ghoul et al. (2011)
Disp	Dispersion of analyst forecast: Computed as standard deviation of 1-year-ahead analyst forecasts of earnings per share divided by the mean 1-year-ahead analyst forecasts of earnings per share.	Gebhardt et al (2001)
Ind	Industry dummy variable based on ICB industry classification.	
Year	Year dummy variable.	
Country	Country dummy variable.	

Table A5. Cost of debt: robustness.

	(1)	**(2)**	**(3)**
Intercept	0.0677 ***	0.0797 ***	0.0800 ***
	(8.49)	(8.69)	(8.71)
Comb_ESG	0.000131 ***	−0.000178	−0.000180
	(4.60)	(−1.48)	(−1.50)
IndDev		0.000316 ***	0.000316 ***
		(2.64)	(2.64)
SqrDev			−0.000000972
			(−0.82)
Beta	0.00496 ***	0.00559 ***	0.00556 ***
	(3.13)	(3.49)	(3.47)
Size	−0.00295 ***	−0.00298 ***	−0.00299 ***
	(−6.67)	(−6.73)	(−6.75)
TobinQ	−0.000951 *	−0.000863 *	−0.000865 *
	(−1.88)	(−1.70)	(−1.71)
Liq	0.00255 ***	0.00261 ***	0.00262 ***
	(3.99)	(4.09)	(4.09)
Lev	−0.0797 ***	−0.0797 ***	−0.0797 ***

Table A5. *Cont.*

	(1)	(2)	(3)
	(−20.06)	(−20.08)	(−20.06)
AssetG	−0.00689 ***	−0.00690 ***	−0.00691 ***
	(−5.73)	(−5.74)	(−5.75)
Tang	−0.00999 ***	−0.00979 ***	−0.00972 ***
	(−3.70)	(−3.62)	(−3.60)
Perf	−0.00152	−0.00141	−0.00122
	(−0.29)	(−0.27)	(−0.23)
IntCov	−0.0000773 ***	−0.0000774 ***	−0.0000776 ***
	(−9.41)	(−9.44)	(−9.45)
OCF	0.0245 ***	0.0235 ***	0.0236 ***
	(2.71)	(2.60)	(2.61)
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Country	Yes	Yes	Yes
Adj. R^2	0.167	0.168	0.168
Observations	4383	4383	4383
F-test	17.27	17.10	16.81
p-value	0.0000	0.0000	0.0000

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. t-statistics are presented in parentheses. Variables: Comb_ESG, ESG combined score provided by Refinitiv; IndDev, Comb_ESG minus the industry median ESG score; SqrDev, square of IndDev; Beta, market beta; Size, natural logarithm of a firm's market value at t−1; TobinQ, summation of market value and total debt, divided by total assets; Liq, current assets divided by current liabilities; Lev, total debt divided by total assets; AssetG, yearly relative variation of total assets; Tang, property plant and equipment divided by total assets; Perf, income before extraordinary items divided by sales; IntCov, income before extraordinary items plus interests divided by interests; OCF, operating cash flow divided by total assets.

Table A6. Cost of equity: robustness.

Variables	Easton Model (2004)			Ohlson and Juettner-Nauroth Model (2005)			Earnings–Price Ratio		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intercept	0.0443 ***	0.0609 ***	0.0606 ***	0.0183 *	0.0369 ***	0.0369 ***	0.0291 ***	0.0401 ***	0.0400 ***
	(5.43)	(6.18)	(6.15)	(1.94)	(3.24)	(3.23)	(4.01)	(4.57)	(4.56)
Comb_ESG	−0.000147 ***	−0.000534 ***	−0.000529 ***	−0.000135 ***	−0.000568 ***	−0.000568 ***	−0.000107 ***	−0.000364 ***	−0.000362 ***
	(−4.53)	(−4.00)	(−3.97)	(−3.60)	(−3.68)	(−3.67)	(−3.70)	(−3.06)	(−3.05)
IndDev		0.000401 ***	0.000399 ***		0.000449 ***	0.000448 ***		0.000266 **	0.000266 **
		(2.99)	(2.98)		(2.89)	(2.89)		(2.23)	(2.23)
SqrDev			0.00000156			0.000000209			0.000000566
			(1.14)			(0.13)			(0.46)
Beta	0.0124 ***	0.0132 ***	0.0133 ***	0.00554 **	0.00652 ***	0.00653 ***	−0.00799 ***	−0.00741 ***	−0.00739 ***
	(6.50)	(6.88)	(6.90)	(2.52)	(2.93)	(2.93)	(−4.72)	(−4.32)	(−4.31)
Size	0.00176 ***	0.00165 ***	0.00165 ***	0.00289 ***	0.00277 ***	0.00277 ***	0.00442 ***	0.00435 ***	0.00435 ***
	(3.83)	(3.59)	(3.58)	(5.44)	(5.20)	(5.20)	(10.80)	(10.60)	(10.60)
BTM	0.0326 ***	0.0323 ***	0.0323 ***	0.0244 ***	0.0242 ***	0.0241 ***	0.0259 ***	0.0258 ***	0.0257 ***
	(17.01)	(16.90)	(16.85)	(11.00)	(10.89)	(10.88)	(15.19)	(15.10)	(15.08)
Lev	0.0106 ***	0.0107 ***	0.0107 ***	0.00730 ***	0.00740 ***	0.00741 ***	0.00397 ***	0.00403 ***	0.00404 ***
	(9.81)	(9.89)	(9.93)	(5.85)	(5.93)	(5.93)	(4.13)	(4.20)	(4.21)
Disp	0.00932 ***	0.00933 ***	0.00934 ***	0.00372 ***	0.00373 ***	0.00373 ***	−0.00594 ***	−0.00593 ***	−0.00593 ***
	(11.54)	(11.56)	(11.57)	(3.97)	(3.99)	(3.99)	(−8.25)	(−8.25)	(−8.24)
LTG	0.0496 ***	0.0493 ***	0.0494 ***	0.100 ***	0.0998 ***	0.0998 ***	−0.0388 ***	−0.0390 ***	−0.0390 ***
	(11.51)	(11.45)	(11.46)	(20.05)	(19.99)	(19.99)	(−10.12)	(−10.17)	(−10.17)
Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.363	0.364	0.364	0.268	0.270	0.269	0.325	0.326	0.326
Observations	4276	4276	4276	4276	4276	4276	4276	4276	4276
F-test	48.73	48.06	47.18	31.74	31.34	30.74	41.41	40.75	39.97
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. t-statistics are presented in parentheses. Variables: Comb_ESG, ESG combined score provided by Refinitiv; Beta, market beta; Size, natural logarithm of total assets; Lev, total debt to market value of equity ratio; BTM, book value to market value of equity ratio; LTG, long-term growth forecast; Disp, coefficient of variation of 1-year-ahead earnings forecast.

Table A7. Corporate sustainability performance measure robustness test.

Variables	Panel A. Cost of Debt			Panel B. Cost of Equity		
	(1)	(2)	(3)	(4)	(5)	(6)
ESG	0.000108 ***	−0.000166	−0.000175	−0.0000753 **	−0.000331 ***	−0.000322 ***
	(3.59)	(−1.39)	(−1.45)	(−2.36)	(−2.88)	(−2.80)
IndDev		0.000281 **	0.000281 **		0.000265 **	0.000266 **
		(2.36)	(2.36)		(2.32)	(2.32)
SqrDev			−0.000000838			0.000000962
			(−0.84)			(0.91)
Firm-controls	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.270	0.271	0.271	0.372	0.373	0.373
Observations	4383	4383	4383	4276	4276	4276
F-test	31.03	30.60	30.06	50.64	49.82	48.89
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. t-statistics are presented in parentheses. Variables: Comb_ESG, ESG combined score provided by Refinitiv; Beta, market beta; Size, natural logarithm of total assets; Lev, total debt to market value of equity ratio; BTM, book value to market value of equity ratio; LTG, long-term growth forecast; Disp, coefficient of variation of 1-year-ahead earnings forecast.

Table A8. Corporate sustainability performance measure robustness test.

Variables	Panel B. Cost of Debt Model		Panel A. Cost of Equity Model	
	(1)	(2)	(3)	(4)
Comb_ESG	−0.000251 *	−0.000252 *	−0.000561 ***	−0.000560 ***
	(−1.71)	(−1.72)	(−4.01)	(−4.01)
AvgIndDev	0.000395 ***	0.000393 ***	0.000438 ***	0.000440 ***
	(2.66)	(2.65)	(3.08)	(3.09)
AvgSqrDev		−0.000000736		0.000000509
		(−0.57)		(0.37)
Firm-controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes
Adj. R^2	0.273	0.272	0.376	0.375
Observations	4383	4383	4276	4276
F-Test	30.86	30.31	50.46	49.50
p-value	0.0000	0.0000	0.0000	0.0000

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. t-statistics are presented in parentheses. Variables: Comb_ESG, ESG combined score provided by Refinitiv; AvgIndDev, Comb_ESG minus the industry average ESG score; AvgSqrDev, square of AvgIndDev.

Table A9. Adjusted cost of debt for firms under- and overinvesting in sustainability.

	Underinvestment	Overinvestment
	(1)	(2)
Intercept	0.0761 ***	0.0692 ***
	(6.11)	(6.04)
IndDev	−0.0000873	0.000138 **
	(−1.27)	(2.30)
Beta	0.00628 **	0.00283
	(2.36)	(1.41)
Size	−0.00279 ***	−0.00312 ***
	(−4.09)	(−5.09)
TobinQ	−0.000582	−0.00165 *
	(−0.87)	(−1.75)
Liquidity	0.00173 *	0.00401 ***
	(1.82)	(4.27)
Lev	−0.0811 ***	−0.0808 ***
	(−12.74)	(−15.56)
AssetG	−0.00549 ***	−0.0110 ***
	(−3.49)	(−5.45)

Table A9. *Cont.*

	Underinvestment	Overinvestment
	(1)	(2)
Tang	−0.0163 ***	−0.00586 *
	(−3.68)	(−1.70)
Perf	0.0000680	−0.00230
	(0.01)	(−0.33)
IntCov	−0.000110 ***	−0.0000608 ***
	(−7.02)	(−6.49)
OCF	0.0216 *	0.0363 ***
	(1.73)	(2.64)
Year	Yes	Yes
Industry	Yes	Yes
Country	Yes	Yes
Adj. R^2	0.151	0.194
Observations	2010	2373
F-test	7.61	11.78
p-value	0.0000	0.0000

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. t-statistics are presented in parentheses. Variables: adjusted cost of debt ratio of interest expenses to total debt minus the industry median cost of debt; IndDev, Comb_ESG minus the industry median ESG score; Beta, market beta; Size, natural logarithm of a firm's market value at t − 1; TobinQ, summation of market value and total debt, divided by total assets; Liq, current assets divided by current liabilities; Lev, total debt divided by total assets; AssetG, yearly relative variation of total assets; Tang, property plant and equipment divided by total assets; Perf, income before extraordinary items divided by sales; IntCov, income before extraordinary items plus interests divided by interests; OCF, operating cash flow divided by total assets.

Table A10. Adjusted cost of equity for companies under- and overinvesting in corporate sustainability.

	KES Underinvestment	KOJ Underinvestment	KEP Underinvestment	KES Overinvestment	KOJ Overinvestment	KEP Overinvestment
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.0394 ***	0.0200	0.0297 ***	0.0324 **	0.00737	0.0245 **
	(3.35)	(1.48)	(3.15)	(2.54)	(0.49)	(1.98)
IndDev	0.000196 ***	0.0000915	0.000196 ***	−0.00000455	−0.0000675	−0.0000929
	(2.61)	(1.06)	(2.61)	(−0.06)	(−0.76)	(−1.27)
Beta	0.00851 ***	0.00434	−0.00451 *	0.0128 ***	0.00444	−0.0119 ***
	(2.73)	(1.21)	(−1.81)	(5.24)	(1.54)	(−4.99)
Size	0.00179 ***	0.00288 ***	0.00401 ***	0.00195 ***	0.00294 ***	0.00501 ***
	(2.74)	(3.84)	(7.66)	(2.85)	(3.64)	(7.52)
BTM	0.0348 ***	0.0237 ***	0.0228 ***	0.0272 ***	0.0220 ***	0.0279 ***
	(12.56)	(7.45)	(10.29)	(9.98)	(6.84)	(10.54)
Lev	0.0108 ***	0.00980 ***	0.00318 **	0.0113 ***	0.00616 ***	0.00311 **
	(6.13)	(4.84)	(2.25)	(8.13)	(3.77)	(2.31)
Disp	0.00762 ***	0.00322 ***	−0.00449 ***	0.0232 ***	0.00892 ***	−0.0158 ***
	(8.59)	(3.17)	(−6.32)	(10.33)	(3.37)	(−7.26)
LTG	0.0544 ***	0.0987 ***	−0.0370 ***	0.0411 ***	0.100 ***	−0.0434 ***
	(9.01)	(14.26)	(−7.65)	(6.53)	(13.53)	(−7.10)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.381	0.310	0.390	0.370	0.251	0.302
Observations	1950	1950	1950	2254	2254	2254
F-test	24.52	18.20	25.42	26.93	15.82	20.15
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively. t-statistics are presented in parentheses. Variables: KES, Easton model implied cost of equity premium; KOJ, Ohlson and Juettner-Nauroth model implied cost of equity premium; KEP, earnings–price ratio; IndDev, Comb_ESG minus the industry median ESG score; Beta, market beta; Size, natural logarithm of total assets; Lev, total debt to market value of equity ratio; BTM, book value to market value of equity ratio; LTG, long-term growth forecast; Disp, coefficient of variation of 1-year-ahead earnings forecast.

Table A11. Cost of debt and cost of equity for the ESG pillars.

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	Cost of Debt	**Cost of Debt**	**Cost of Debt**	**Cost of Equity**	**Cost of Equity**	**Cost of Equity**
Environmental	−0.02746 *** (−3.65)			−0.00804 *** (−2.99)		
Social		−0.02363 *** (−2.69)			−0.01039 *** (−3.43)	
Governance			−0.01729 ** (−2.02)			−0.00066 (−0.26)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2832	2832	2832	2874	2874	2874
Adj. R-Squared	0.256	0.251	0.248	0.384	0.385	0.382
F-Test	16.55	16.08	16.12	31.37	31.71	31.02

Note: *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Pooled OLS. In columns 1 to 3 we include the square of each ESG pillar as a proxy for deviation, while in columns 4 to 6 the corresponding ESG pillars are included. t-statistics are presented in parentheses.

Note

1 There is no clear consensus regarding the crisis period. We considered the period from 2008 to 2012, as defined in the European Business Cycle Indicators Technical Paper on 11 October 2016.

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