# Impact of ESG performance and carbon emissions on cost of debt – A study of the Nordic markets

Master's Thesis 30 credits
Programme: Master's Programme in Accounting and Financial Management
Specialisation: Financial Management / Management and Control

Department of Business Studies
Uppsala University
Spring Semester of 2023

Date of Submission: 2023-05-30

**Filip Larsson**
**Henrik Larsson**

**Supervisor: Joachim Landström**

# Abstract

The study examines the link between the Environmental, Social and Governance (ESG) performance of a company and its cost of debt, measured as credit spreads between corresponding corporate and risk-free government bonds, in Nordic countries between 2020 and 2022. No previous studies look at ESG effects on bond spreads in the Nordic markets, although their stakeholder-oriented nature could make them attentive to ESG issues. Additionally, public and regulatory attention to carbon dioxide suggests a value for companies in decreasing emissions. In line with previous studies on ESG top-level and individual pillar performance, Refinitiv ESG scores are used as proxies for ESG performance in the two initial regressions, and an additional regression is run where a measure of carbon intensity is substituted for environmental pillar performance. Although there is a risk of reverse causality inherent in this field, the findings in this study indicate that ESG top-level performance reduces cost of debt, while carbon intensity increases it. Notably, social pillar scores and carbon intensity, but not environmental pillar scores, have significant effects on spreads.

Keywords: ESG performance, carbon intensity, cost of debt, spreads, Refinitiv, ESG scores, CSR, sustainability, Nordics

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# 1. Introduction

With the effects of the climate crisis being felt more acutely worldwide, and more governments and companies committing to emissions targets than ever before, the interest in so-called Environmental, Social, and Governance (ESG) concerns has arguably become more relevant than ever. In the context of business studies, there is a question of whether companies addressing ESG concerns can benefit financially. This thesis examines the potential impact of ESG performance on their cost of debt, a key financial metric for businesses. The relationship between ESG performance and cost of debt is examined in the Nordics, due to the possible impact from the stakeholder-oriented nature of these markets (Eliwa et al., 2021; Poulsen et al., 2010). The thesis takes the practice of Eliwa et al. (2021) in using ESG scores provided by data provider Refinitiv as proxies for ESG performance, and adapts it by, in line with Borisova et al. (2015), applying the market-based cost of debt measure of corporate bond yields less the risk-free rate. Furthermore, it follows research by Erragragui (2018) on individual E, S, G pillar performance and Palea and Drogo (2020) on carbon emissions to look at their respective impact on cost of debt. Based on these arguments, this thesis investigates the question of whether ESG performance affects Nordic companies' cost of debt.

Previous research by El Ghoul et al. (2011) and Chen et al. (2023) show a negative relationship between cost of equity and ESG performance, which suggests that ESG performance is considered when investors price risk. Although Auer and Schuhmacher (2016) find that selecting stocks based on the rival Morningstar ESG score does not produce better risk-adjusted returns than the market, Soh Young In et al. (2017) find abnormal returns for portfolios of carbon-efficient firms with good governance. If ESG aspects affect the assessment of riskiness in equities, there could also be a relationship between ESG aspects and debt investments. Looking at the cost of debt specifically, there are studies seeking to isolate ESG performance as an indicator of financing cost. The aforementioned study of European firms by Eliwa et al. (2021) finds a company's cost of debt to be lower when there is better ESG performance and related reporting. Since the data in Eliwa et al. (2021) was collected, it can be noted that new disclosure regulations have been implemented within the EU (European Union, 2019), highlighting the need for a study that includes more recent observations. Furthermore, while Eliwa et al. (2021) make the connection with ESG effects, they rely on accounting data for cost of debt as opposed to timelier, market-based measures such as bond spreads. The latter is the method used by Borisova et al. (2015), as well as Qiu and Yu (2009), when looking at the effects of corporate control measures – commonly used as a governance metric. Impact from ESG scores on market-based cost of debt are investigated in the U.S. market by Apergis et al. (2022), who find higher scores to result in lower cost of debt for companies within the S&P 500 index.

Other research provides evidence pointing in the opposite direction. Sharfman and Fernando (2008) find a significant positive relationship in the S&P500 between environmental risk management and cost of debt. Moreover, a 2022 study of the European Stoxx600 index sees firms with higher ESG score exhibiting a higher cost of debt (Gonçalves et al., 2022). This is contrasted by the cost of equity, which is found to be lower for the same companies.

Some studies look at the impact of specific ESG metrics, finding cost of debt to also be higher for high emitters of CO2 (Jung et al., 2018; Palea & Drogo, 2020). There is some debate about the measurement accuracy of ESG scores (Berg et al., 2022), and some researchers, like Pedersen et al. (2021), exchange the E in ESG for carbon emissions. Palea and Drogo (2020) find a higher cost of debt for European firms with high CO2 emissions per unit of revenue with differences in the relationship before and after the 2015 Paris Agreement. This indicates that new studies are needed, to account for a continuously changing discussion, region-specific risk perceptions, and recent carbon-related regulations like the European Emission Trading System (Albers, 2009; European Union, 2019).

Knowledge about the ESG-to-cost of debt relationship could allow executives to increase leverage (Sharfman & Fernando, 2008). Increased leverage has benefits like tax offsets and can increase value for non-distressed firms (Korteweg, 2010). Borrowing costs are more likely to have an immediate impact on company operations than a shift in share price. Any knowledge helping lower the cost of debt could therefore be highly beneficial for companies. Nevertheless, most studies in the field examining links between ESG performance and cost of capital focus on the cost of equity. While it is clearer that high ESG performance leads to a lower cost of equity, effects in debt capital markets are more unclear with fewer studies and conflicting findings (Eliwa et al., 2021). Poor ESG performance increasingly is a ground for exclusion by institutional equity investors, while the importance of ESG aspects to debt investors still needs further investigation (Hoepner & Schopol, 2018). Eliwa et al. (2021) suggest that country-level perceptions of ESG concerns have a moderating effect on the cost of capital, especially in stakeholder-oriented countries. With Poulsen et al. (2010) finding the business environment in the Nordic countries to be stakeholder-focused, a study of Nordic markets is motivated. Stellner et al. (2015) furthermore show effects of ESG performance on cost of debt to be dependent on the relative performance of a company to that of its geographical region. The absence of previous studies on ESG company performance in the Nordic bond market therefore creates an interesting research gap.

# 2. Theory

This section begins by examining previous research on company debt financing and risk assessment. These subjects are then connected to the risk assessment of ESG, and we give an overview of relevant literature in the area. Two opposing theories regarding the risk of ESG aspects are presented: the overinvestment view and the risk-mitigating view. Introducing ESG scores, the three different E, S, and G pillars are first presented separately, and then together as the aggregated ESG performance. We elaborate on the environmental pillar by presenting a theoretical background regarding the impact of the less qualitative measure carbon emissions on cost of debt.

### *2.1. Debt Financing*

A key aspect when looking at the potential impact of ESG metrics on company financing costs is to look at how a company funds itself. When seeking to minimize the cost of debt, a company must choose between different sources of funding, principally bond issuance or bank loans. Previous research finds that, when possible, i.e., when a company is in a better financial condition, they tend to prefer funding via the open market (Morellec et al., 2015). This finding somewhat contradicts some older research pointing to companies with the lowest credit ratings being among the most likely to issue bonds at an early stage (Hale & Santos, 2008).

### *2.2. Risk assessment and ESG*

De Fiore and Uhlig (2011) find that when public information on credit metrics is scarce, as is often the case with smaller companies, banks are better than markets at assessing the risk of lending. Banks giving out bank loans might prioritize financial returns and that the lender does not default, while caring less about customer pressures. In the public equity market, private investors that do not have a public image or customers to worry about, might care less about holding stocks that are in opposition to what the public deems ethical (Colonnello et al, 2019; Hong & Kacperczyk, 2009).

Agnese and Giacomini (2023) find that institutions such as banks could themselves obtain benefits from high ESG scores. Since bond investors tend to be institutions (ECB, 2022), and there is evidence of institutions wanting to adhere to pressures from ESG-prioritizing customers (Weber et al., 2014) there might be visible effects on the cost of debt of low ESG score companies from the general trend of institutions excluding companies with a low ESG performance. There is some evidence that banks indeed incorporate environmental risks in credit management to avoid financial risk (Weber, 2012). Moreover, market analysts find similar indications of ESG performance being beneficial for bond issuers in the market for green bonds, which have been shown to trade at a premium (Klevan, 2016). Additionally, research on ESG as a risk-mitigating factor has become more widespread because of both related reputational and financial risks (Kölbel et al., 2017; Landi et al., 2022). Atif and Ali (2021) specifically find ESG disclosure to affect default risk, of particular interest to both management and debt investors as default risk is the key driver in credit spreads. Landi et al. (2022) conclude that ESG performance scores provide added information to investors and significantly impacts their systematic risk assessment of companies.

### *2.2.1. Risk assessment of ESG aspects in related fields - sin stocks and green bonds*

A related field when talking about risk assessment and ESG, is the research regarding equity investments in companies regarded as ‘sin stocks’. Sin stock companies are, according to Hong and Kacperczyk (2009), companies that have core operations in gambling, alcohol or tobacco. In the context of ESG, being a sin stock company can be seen as comparable to having a poor social score (Pedersen et al, 2021). Hong and Kacperczyk (2009) argue that sin stocks are underpriced due to lower institutional ownership. Due to this underpricing, being a sin company is in a few studies associated with better relative firm financials and better risk-adjusted returns for equity investors (Pedersen et al, 2021; Perez Liston & Soydemir, 2010). There is limited research regarding investing in sin stock companies’ debt, however one study by Fabozzi et al. (2019) finds lower bond spreads for sin companies, which suggests that debt investors perceive risk to be lower in companies with low social scores.

When considering how debt investors perceive the risk of ESG aspects, the existing research regarding green bonds is also relevant to address. Some research shows that financing through green bonds could reduce companies’ cost of capital (Zerbib, 2019), indicating that debt investors could be willing to trade off financial returns for societal benefits (Flammer, 2021). Flammer (2021), however, observes no difference in the cost of capital for companies issuing green bonds and suggests that financial returns are of leading importance for green bond investors as well. The indirect relationship between the cost of debt from conventional bonds and companies’ ESG performance, as opposed to the direct relationship of green bond financing to specific ESG initiatives, could generate different findings.

*2.3. Risk-mitigating view*

Maaloul et al. (2021) suggest that, through a mediating effect of improved corporate reputation, cost of debt is lower for companies with higher ESG performance scores. Future reputational damage due to environmental concerns could lead to a loss of customers, and decreased income streams that will affect a firm's ability to repay their debt. Lins et al. (2017) find that firms with high Corporate Social Responsibility (CSR), measured using the MSCI ESG score, have better sales margins, profitability, and better ability to raise debt during periods of crisis than firms with low CSR. Lins et al. (2017) believe this is because social capital is built through CSR activities resulting in stakeholders and investors helping out firms deemed more trustworthy in times of crisis. These results indicate that in periods of distress, firms with high ESG performance have a higher likelihood to survive the crisis and should thereby be perceived as less risky. Moreover, Godfrey et al. (2009) find that firms engaging in CSR-activities directed at secondary stakeholders, provide insurance-like effects to firm value in the face of negative corporate events. Sun and Cui (2014) argue that corporate social responsibility is a risk-managing activity and finds an associated reduction in default risk. Eliwa et al. (2021) as well as Apergis et al. (2022) argue that a higher ESG score has risk-mitigating properties and should lower cost of debt.

*2.4. Overinvestment view*

The alternative view is based on assumptions that companies have limited resources, and discretionary spending on activities that are not value-maximizing is at least partially an agency problem. This is commonly referred to as the overinvestment view (Goss & Roberts, 2011). Masulis and Reza (2015) present evidence that executives indeed spend on philanthropic ventures with personal interests in mind, which in turn reduces firm value. Krueger et al. (2020) find that institutional investors still consider financial and operational risks to be of higher importance than ESG risks. Moreover, considering reasoning from Di Giuli and Kostovetsky (2014), who argue that ESG performance reduces company performance, there should be a higher cost of debt due to higher default risk when wasting money on undertakings that do not help the company repay their debt. This view is supported by the findings of Goss and Roberts (2011), but the results are only significant for low-quality borrowers, whereas regarding high-quality borrowers, lending institutions do not care about discretionary ESG initiatives. An additional finding by Stellner et al. (2015) and building on the theory about whether ESG investments are resources spent wisely (Goss & Roberts, 2011), is that there is only a reduction in yield for companies if their ESG performance is in line with that of their home country. The empirical results of Sharfman and Fernando (2008), and Gonçalves et al. (2022)

among others find a positive relationship between ESG performance and the cost of debt, supporting the overinvestment view. ESG initiatives could be a waste of resources and lower the ability of companies to meet their debt repayment obligations. Given this ambiguity about the impact of ESG initiatives on cost of debt, it is useful to look at previous research on the individual pillars contributing to ESG performance.

### *2.5. ESG performance as individual pillars*

In this subsection, we introduce the three components that constitute ESG performance: the social pillar, governance pillar, and environmental pillar, by reviewing the existing literature in the field.

#### *2.5.1. Social Pillar*

Previous research has been conducted in the area of sovereign debt. Capelle-Blancard et al. (2019) show a marked decline in sovereign debt yields for countries which score better on ESG metrics, as compiled by rating agencies and asset managers. Notably, they find social and governance factors to have a markedly greater impact than environmental ones, with studies finding firms making social considerations having higher credit scores (Attig et al., 2013) and lower Credit Default Swap (CDS) spreads (Drago et al., 2019). La Rosa et al. (2018) find the Refinitiv social pillar score to have a negative relationship to cost of debt, however without accounting for any effects from the Environmental and Governance pillar Score. Conversely, Fabozzi et al. (2019) find lower credit spreads for bonds if the company belongs to a sin industry, which is sometimes used as a proxy for the S in ESG (see Pedersen et al., 2021).

#### *2.5.2. Governance Pillar*

Jeanneret (2018) finds the risk of sovereign debt to be negatively related to what is categorized as ‘government effectiveness’. Similar examination of governance metrics in companies however shows no impact on the cost of debt (Erragragui, 2018). Conversely, Akdogu and Alp (2016) look specifically at shareholder protection as a governance metric and find a negative correlation with cost of debt. Their view builds on work by Bhojraj and Sengupta (2003) that companies with governance mechanisms in place to mitigate agency conflicts experience lower yields. Borisova et al. (2015) find, using credit spreads as the proxy, that government ownership, which has been shown to be associated with worse overall corporate governance (Borisova et al., 2012), is also linked to a higher cost of debt.

### *2.5.3. Environmental Pillar*

Schneider (2011) finds risks for US companies in the chemical and pulp industry not being able to meet future credit payments if they have high toxic waste emissions, since future cleanup and compliance costs could be large enough to put the company into default. Considering Nordic companies, the Swedish-Swiss firm ABB had its credit rating drop from above investment grade to below due to asbestos contamination and the litigation claims that followed (Menz, 2010). Moreover, in a survey of institutional investors, Krueger et al. (2020) address three risks related to climate change: physical, technological, and regulatory. Physical risks consider direct damage due to climate change like droughts and extreme weather. Technological risks consider risks related to companies being outcompeted by more climate-friendly innovations, such as companies building electric cars outcompeting builders of combustion engine cars. Most institutional investors perceive that the main risks considered right now related to climate change are linked to regulations, which have already begun to be introduced. There is no consensus of whether environmental risk management leads to a lower cost of debt. Erragragui (2018) finds a negative relationship to cost of debt when environmental management is good, as indicated by a high Sustainalytics score, however findings of Sharfman and Fernando (2008) point in the opposite direction.

## *2.6. Aggregated ESG performance*

An increasing number of studies attempts to isolate the impacts of the different pillars of ESG. Due to the differences in impact of the respective pillars in the previous research outlined above, we believe that there is value in looking at the effects of the pillars individually. While the empirical results for what pillar is most influential are conflicting (Apergis et al., 2022), there are results indicating that there are stronger effects on cost of capital from the environmental pillar of ESG, especially due to the regulatory risks (Ng & Rezaee, 2015). This can be contrasted with Capelle-Blancard et al. (2018) finding sovereign yields to be most affected by social and governance scores, and Bannier et al. (2022) finding low social scores impacting the CDS spreads of European, but not U.S. firms. Apergis et al. (2022) find a lowering effect on credit spreads in the US, from all pillars of ESG, with the strongest effects from the social pillar. Additionally, there is evidence that ownership structure (specifically, government ownership), a key component of governance scores, impacts cost of debt.

These findings in particular are relevant since, ceteris paribus, one factor of governance affects cost of debt negatively while public ownership is presumed by the authors to incentivize prioritizing other environmental or social goals (Borisova et al., 2015). This makes it difficult to hypothesize which, if any, ESG component will have an outsized impact on cost of debt. However, previous research strongly suggests that there should be some kind of relationship between ESG performance and cost of debt. Thus, our first hypothesis is that:

*H1: ESG performance impacts a firm's cost of debt*

### *2.7. Avoiding ESG score confusion – carbon intensity as proxy for environmental performance*

Although there is no clear consensus about how the E, S and G pillar impact cost of debt, there are other measures that make up parts of the aggregate score which are subject to previous research. In particular, carbon emissions are proposed as one such measure. In their suggested future research, Matsumura et al. (2014), who find a decreasing market cap for companies increasing their carbon emissions, suggest a deeper investigation of effects of carbon emissions on components of market value. Regulatory risks for European companies due to regulation of carbon emissions in particular are exemplified well by the airline industry (Apergis et al., 2022), and further by the European Emission Trading System, or EU ETS (Albers, 2009). Chapple et al. (2013) find a lowering of market valuation for Australian companies affected by an introduced trading scheme if carbon emissions are high. While emission rights in Europe are currently free, 15% of the emission rights in the airline industry are allocated in auctions (Cui et al., 2016). Exceeding your emission limit can increase operational costs by necessitating the purchasing of rights from other companies. Moreover, the need for European companies to deal with these costs could further lower competitive advantage against non-EU companies since, at least in the airline industry, the carbon cost is likely to be passed on to the customer (Albers, 2009). The EU has recently passed new laws to begin charging money for emission rights (Reuters, 2022). It is likely that pressure from regulators will continue to rise and this uncertainty regarding future cashflows should affect a firm's operational risk. Apergis et al. (2022) argue that regulatory risks are poorly accounted for in environmental pillar score metrics. However, we believe that a carbon emission metric incorporates this risk better. Carbon emissions already being subject to regulations and taxes, could to some degree merge a company's climate risk with its operational risk, with the latter being of higher importance to institutional investors (Krueger et al., 2020).

Relating emissions to cost of debt, there are studies of $CO_2$ emissions and their effect on cost of debt (Palea and Drogo, 2020). This research builds on previous findings about company environmental performance affecting bank lending decisions (Thompson & Cowton, 2004). Furthermore, studies indicate a rise in cost of debt for companies in Australia specifically correlated with high scope 1 $CO_2$ emissions (Jung et al., 2018), with companies failing to voluntarily disclose their emissions being categorized as high emitters. Palea and Drogo (2020) also find cost of debt to be higher for firms with a higher $CO_2$-emission-to-revenue ratio, or carbon intensity, with even greater effects after the Paris Agreement in 2015. As governments move towards mandatory disclosure for $CO_2$, investor awareness of such figures should increase. Pedersen et al. (2021) find a lower $CO_2$-emission-to-sales ratio to be associated with higher institutional ownership. Thus, if investors value $CO_2$ emissions as important for assessing risk, then the increase in the availability of data should also lead to an impact on cost of debt, leading to the hypothesis:

*H2: Carbon intensity increases a firm's cost of debt*

Overall, the literature suggests that there is an impact of ESG performance on cost of debt. However, there are two main views of how company riskiness, and thus cost of debt, is affected by ESG performance. Firstly, there is the risk-mitigation view, which argues that ESG considerations have risk-mitigating properties and can reduce the cost of debt. Secondly, there is the overinvestment view, arguing that initiatives to improve ESG performance could be considered a waste of resources, and will not contribute to companies being able to meet their debt obligations. Furthermore, although previous research suggests that ESG performance will have an impact on cost of debt, it is inconclusive about the isolated impact of the constituent parts of ESG, i.e., the Environmental, Social, and Governance aspects. However, there is more consensus in previous research regarding the cost of debt impact of a more granular measure of environmental performance, carbon intensity. The risks surrounding regulations are believed to have an especially important role in why carbon intensity may impact cost of debt.

# 3. Method

In this chapter, we first introduce the regression models used for the main tests and explain how we retrieve or construct the variables used in the model. Secondly, we go deeper into the theory and choice of the specific measurements of ESG performance, carbon intensity, and cost of debt. Thirdly, we give an empirical background to the choice of control variables. Lastly, we explain the scope of the sample and motivate any relevant exclusions or inclusions.

## *3.1. Regression Model*

In this study, regression analysis is used to answer the research question of whether ESG performance impacts cost of debt. To assess the cost of debt, we use spreads between corporate bonds and matched government bonds as the dependent variable. There are three main analyses, seen in the result section Table 4, where ESG Performance in the model is exchanged firstly for the top-level ESG score, secondly for the ESG pillars separately, and thirdly for the carbon intensity, social pillar score, and governance pillar score. Moreover, we use control variables regarding firm financial performance that have a well-documented effect on cost of debt, control variables for bond characteristics that affect the spread, and dummy variables for year fixed effects and industry fixed effects.

To control for autocorrelation and heteroscedasticity, the linear regressions in this study produce Newey-West Robust Standard Errors. The number of lags chosen is the integer below $T^{1/4}$, where T is the number of time periods in the sample, in line with the suggestions of Greene (2003, p. 200). In this sample, there are three years of observations, which means $3^{1/4} \approx 1$ lag is suggested.

The variables used in the main models assessing the impact of ESG performance on cost of debt are the following:

$$Spread_{i,t} = \alpha + \beta_1 ESG\ Performance_{i,t} + \beta_2 Size_{i,t} + \beta_3 Profitability_{i,t} + \beta_4 Leverage_{i,t} + \beta_5 Interest\ Coverage_{i,t} + \beta_6 EBITDA/Debt_{i,t} + \beta_7 Maturity(days)_{i,t} + \beta_8 Is\ fixed_{i,t} + \beta_9 Is\ callable_{i,t} + \beta_{10} IndustryFixedEffect_{i,t} + \beta_{11} YearFixedEffect_{i,t} + \varepsilon_{i,t}$$

The variables used in the regression model are all retrieved from Refinitiv Eikon. The specific names of the Refinitiv formulas used to retrieve the variables can be found below. To mitigate endogeneity and seasonality effects in the observations, spreads are retrieved on the third Wednesday of November in 2020, 2021, and 2022, for a complete explanation see chapter 3.8. The financial and ESG data used is from the latest full financial year at that time.

*Spread* is the proxy for cost of debt, calculated as the yield to maturity on an issued corporate bond ('TR.BIDYIELD') less the yield of a treasury bond matched by remaining time to maturity (further explanation in chapter 3.6.)

*ESG Performance* in model one is the top-level ESG score ('TR.TRESGScore')

*ESG Performance* in model two is the Environmental pillar score ('TR.EnvironmentPillarScore'), the Social pillar score ('TR.SocialPillarScore'), and the Governance pillar score ('TR.GovernancePillarScore')

*ESG Performance* in model three is the Carbon Intensity calculated as total CO2 emission equivalents in tons ('TR.CO2EmissionTotal') divided by million euro in revenue ('TR.Revenue'), the Social pillar score ('TR.SocialPillarScore'), and the Governance pillar score ('TR.GovernancePillarScore')

*Size* is the natural logarithm of total assets (TR.TotalAssetsActual)

*Profitability* is the net income before extraordinary items ('TR.NetIncomeBeforeExtraItems') of the firm divided by its total assets (TR.TotalAssetsActual)

*Leverage* is the total short- and long-term liabilities ('TR.TotalLiabilities') of the firm divided by its total assets (TR.TotalAssetsActual)

*Interest Coverage* is the operating profit ('TR.OperatingIncome') of the firm divided by its interest expenses ('TR.InterestExpense')

*EBITDA/Debt* is the firm's Earnings Before Interest, Taxes, Depreciation, and Amortization (EBITDA) ('TR.F.EBITDA') divided by its total short- and long-term liabilities ('TR.TotalLiabilities')

*Maturity (days)* is the natural logarithm of the time to maturity of the bond in days, calculated as the maturity date as shown in Refinitiv less the date of measurement

*Is fixed* is a dummy variable constructed based on bond coupon type where fixed rates are coded as 1 and variable rates are coded as 0 ('TR.FiCouponTypeDescription')

*Is callable* is a dummy variable based on whether the bond has a call option where callable bonds are coded as 1 and non-callable bonds are coded as 0 ('TR.FiIsCallable')

*Convexity* is used as a variable in the robustness tests, and is the bond sensitivity to interest rate change ('TR.CONVEXITY')

### *3.2. ESG performance measurement*

Even though this study primarily seeks to identify if the bond market recognizes ESG scores or not, a discussion about ESG measurement is warranted. The way to objectively measure if a company has a negative impact on society and the world is cumbersome. Firstly, there is the field of research that refers to companies or whole industries as sin companies or sin stocks (Hong & Kacperczyk, 2009; Fabozzi et al. 2018). Secondly, a branch of researchers (see for example Agnese & Giacomini, 2023; Goss & Roberts, 2011; El Ghoul et al., 2011) instead use ESG scores constructed by data providers such as KLD Research & Analytics (now MSCI), Morningstar Sustainalytics, Bloomberg, or Refinitiv. These data providers attempt to score companies based on whether they disclose information about their Environmental, Social, and Governance impact or not, and what their respective performance in these areas are. Notably, ESG scores from different data providers can yield varying results for the same companies. Nevertheless, such scores are widely accepted and used by the financial industries as proxies of ESG performance (Berg et al., 2022). The choice of only one source in this study is down to the availability of data and Refinitiv ESG score's widespread use in earlier literature (Drago et al., 2018; Eliwa et al., 2021; La Rosa et al., 2018). This remains relevant since, as highlighted by previous research, investor focus on the ESG ratings from the leading data providers has been linked to inflows from investors to ESG conscious portfolios and securities (Berg et al., 2022; Hartzmark & Sussman, 2019). Thirdly, some researchers create their own definitions, such as using carbon emissions for the E, level of accounting accruals for the G, or look at very specific aspects of ESG (Pedersen et al., 2021).

### *3.3. Refinitiv ESG score*

In this study, to test H1, the Refinitiv ESG score is used as a proxy for ESG performance. According to Stellner et al. (2015), the Refinitiv ESG score is second in quality only to MSCI and has a reputation as one of the most highly regarded and trustable sources for ESG data. Refinitiv covers 85% of the global market cap and bases the score on publicly available company-reported data. 186 data points considered relevant by Refinitiv are aggregated into Environmental, Social, and Governance pillar scores on a scale of 0 to 100, and lastly into one final overarching ESG score

(Refinitiv, 2022). The Refinitiv score scale is useful in a study of the relationship between independent and dependent variables, since it helps mitigate the effects of kurtosis and skewness inherent in the sample (La Rosa et al., 2018). Firstly, the environmental pillar score is based on data points regarding environmental product innovation, emissions, and resource use. Secondly, the social pillar score is based on data about workforce, human rights, community, and product responsibility. Lastly, the governance pillar score consists of observations regarding management, shareholders, and CSR strategy (Refinitiv, 2022).

*3.4. Carbon emission measurement*

For testing H2, we introduce a CO2 emissions measure. The emission measure in this study is measured as total CO2 equivalents, in line with previous research (Jung et al., 2018). The data is retrieved from Refinitiv. Their methodology for the Total CO2 equivalent emissions measure is described as follows:

*"Total Carbon dioxide and CO2 equivalents emission in tons. Greenhouse gases considered relevant as CO2 equivalents are methane (CH4), nitrous oxide (N20), hydrofluorocarbons (HFCS), perflourinated compound (PFCS), sulfur hexaflouride (SF6), nitrogen triflouride (NF3). Refinitiv follows the greenhouse gas protocol for all their emission classifications by type."*

In this study, substituting the Refinitiv environmental score for carbon emissions also serves as a sensitivity check for the environmental pillar. In some studies, such as Pedersen et al. (2021), carbon emissions to sales is the entire proxy for the E in ESG. As outlined in the theory section, we propose carbon emissions to be an important factor in assessing credit risk due to the regulation and investor scrutiny of such emissions. The Refinitiv environmental pillar score is only weighted 35% towards the emission score, and that measure is in turn not solely based on actual carbon emissions. Furthermore, emissions make up just 15% of the top-level ESG score (Refinitiv, 2022).

As the measure of total CO2 emissions, this study uses both so-called Scope 1 and Scope 2 emissions, as is defined as emissions produced or directly controlled by the company (EPA, 2022). Including Scope 2 emissions is done to provide a more accurate description of the carbon emissions of companies who outsource certain production. Outsourcing will reduce the Scope 1 emissions but can still be considered fully relatable to the observed company since they are in control of their supplier contracts.

In this study, $CO_2$ emissions are measured as total $CO_2$ equivalent emissions divided by million euros in revenue. In previous studies, such as Matsumura et al. (2014), the measurement of $CO_2$ emissions is simply $CO_2$ emissions totaled in tons. We choose to study $CO_2$ emissions as a share of revenue, since if firms' potential to make future profit is threatened by possible costs due to regulations or litigation fees, linking $CO_2$ emissions to the accounting-based measure revenue helps to control for size differences between companies (Jung et al., 2018). This metric is often referred to as either carbon intensity or carbon efficiency and is a widely used measure by practitioners as well as in previous research (Gazheli et al., 2016; Pedersen et al., 2021; S&P Dow Jones Indices, 2020; Palea & Drogo, 2020; Wang & Wang, 2020).

Since $CO_2$ reporting is often not assured, some question its credibility. If the reporting is not credible, the data will not be valued by the markets (Matsumura et al., 2014). However, firms in the European Union are exposed to regulation when it comes to disclosure of carbon emissions (Rezaee et al., 2023), and the cost of reporting false $CO_2$ data is likely damaging for the firm, both in terms of general reporting credibility and the potential litigation for untruthful reporting in the future. Thus, voluntary $CO_2$ reporting could still be assumed to be rather credible (Matsumura et al., 2014).

### *3.5. Cost of debt*

The existing literature presents a few different methods for assessing the cost of debt of a company. A discussion of the different ways is outlined in this subsection, ultimately leading up to the decision for the cost of debt measurement in this study.

#### *3.5.1. Accounting-based cost of debt*

Recent studies in the field, such as Eliwa et al. (2021), Gonçalves et al. (2022), Erragragui (2018) and La Rosa et al. (2018) use accounting-based cost of debt as their proxy for cost of debt, calculated as interest expenses divided by total debt in book values. The first two argue, with support from a meta-analytic study by Orlitzky et al. (2003), that studies seeking to isolate impacts of ESG metrics on financial performance have more success in finding significant relationships using accounting-based measures of cost of debt. However, perceptions of how ESG is valued by creditors are likely to have changed in the last two decades since Orlitzky et al. (2003).

### *3.5.2. Ratings-based cost of debt*

Credit ratings are used as a proxy for cost of debt in some studies (Rosa et al., 2018). However, it is possible that ESG metrics are already incorporated into the credit rating and therefore this is not a great proxy for cost of debt (Gonçalves et al., 2022). Additionally, the availability of ratings is considerably lower for the Nordic markets and would in this study necessitate substantially decreasing the sample size.

### *3.5.3. Market-based cost of debt*

There are very few studies, only Apergis et al. (2022) on the S&P500 to our knowledge, that use market-based cost of debt figures when measuring the impact of ESG scores. Because market-based data is timelier and prices in investor reactions and interest rate changes, our thesis contributes to knowledge on ESG effects by conducting a market-based cost of debt study on ESG performance. Moreover, it is the first study, to our knowledge, doing this specifically in the Nordic debt markets.

## *3.6. Credit spreads*

We argue that a market-based measure of cost of debt should also be used in the ESG field of research, even though current studies in this field have not used it to a great extent. Estimating the cost of debt through the credit spread, meaning the yield to maturity of outstanding corporate bonds less a corresponding risk-free asset, is a widely used approach in the accounting and finance research community (see Menz, 2010; Qiu & Yu, 2009; Borisova et al. 2015). However, this approach can also have limitations due to few companies having long-term straight bonds that are frequently traded (Damodaran, 2021), which could create a sampling bias. Moreover, there is an issue with term-structure effects and if not specifically accounted for, this method implicitly assumes that the yield curve is flat (Stellner et al., 2015). Thus, like Borisova et al. (2015) we introduce control variables in our regressions such as the time to maturity to account for this effect.

Data of issued corporate bonds is retrieved from Refinitiv Eikon. Like Borisova et al. (2015) and Qui and Yu (2009), we calculate the credit spread of the corporate bond as the difference between its yield to maturity and the yield of a benchmark government bond of the same domicile and the same maturity, matched through linear interpolation using statistical software. In essence, this means that for bonds with a remaining time to maturity that does not correspond to an observation among the available issued government bonds, we use the method described by Borisova et al. (2015) of linearly interpolating a yield curve between the known yields and using the corresponding data point in terms of time to maturity. If the days to maturity of the corporate bond exceed the days to maturity of the longest-maturity government bond of that domicile, the corporate bond is still matched with that government bond. If the corporate bond has fewer days to maturity than the shortest-maturity government bond of that domicile it is still matched with that government bond. The domicile of the corporate bond is the domicile displayed in the Refinitiv corporate bond prices application.

### *3.7. Control variables*

We control for firm variables that have well-documented effects on cost of debt. All figures are translated into Euros in Refinitiv before being extracted to make the financial performance metrics of the Nordic firms comparable.

Firms with a larger size are usually more mature and have a better ability to meet credit obligations (Erragragui, 2018). The variable for firm size is calculated as the natural logarithm of total assets. Credit rating institutes often highly value companies' ratio of EBITDA to total debt as a core ratio for assessing risk of default (S&P, 2013). Therefore, due to having omitted credit rating as a control variable, we use this core ratio in our model. Highly leveraged firms are presumed to have a higher cost of debt as so-called 'bankruptcy costs' likely increase with high leverage (Bradley et al., 1984: Eliwa et al., 2021; Sun & Cui, 2014). Leverage is in this study calculated as total debt divided by total assets. Interest coverage is also used by credit rating institutes for assessing creditworthiness and in related previous studies as a control variable (Apergis et al., 2022; S&P, 2013). We calculate interest coverage as the operating profit divided by interest expense. Profitable firms are expected to be more likely to have the resources to meet credit obligations. Like Eliwa et al. (2021) we estimate profitability as the net income before extraordinary items deflated by total assets.

*3.7.1. Bond characteristics*

Moreover, like Borisova et al. (2015) we control for the bond characteristics days to maturity and in the robustness tests also its convexity. A bond with many days left to maturity is expected to have a higher yield as it is more exposed to duration risk. Similarly, bonds with high convexity are expected to also experience higher yields. Previous studies also use credit ratings as a control variable (see Qui & Yu, 2008), but the Nordic bonds are often lacking a credit rating, and this is therefore excluded as a variable in this study to not further limit the sample size.

*3.7.2. Bond categories*

Borisova et al. (2015) include only fixed coupon-type bonds in their study. However, in this study bonds with a floating rate are included due to being a large part of the Nordic bond market. Using the classification of different coupon types from Eikon, the bonds are divided into two categories to form a dummy variable; fixed and not fixed.[1] In line with Borisova et al. (2015) and Fabozzi et al. (2019) we also control for whether the bond is callable. A bond being callable is expected to increase the spread of the bond to compensate for the risk of the issuer exercising the call option and refinancing if the interest rate is lower (Qui & Yu, 2008).

*3.7.3. Year fixed effects and industry fixed effects*

Dummy variables that classify companies according to the 13 Refinitiv Business Classification (TRBC) economic sectors are included to control for industry-fixed effects, in similarity with Eliwa et al. (2021). Moreover, dummies for year-fixed effects are included in line with Borisova et al. (2015) and Fabozzi et al. (2019), to account for macro-level effects on the bond market.

*3.8. Data and sample*

Poulsen et al. (2010) argue Nordic countries to be stakeholder-focused in general. Moreover, Stellner et al. (2015) and Eliwa et al. (2021) argue that geography-specific settings are important when investigating the impact of ESG metrics on other variables. Consequently, this study is limited to

[1]Using Refinitiv definitions, coupons classified as fixed are Plain Vanilla Coupon, Zero Coupon, Zero then Fixed. Coupons classified as not fixed are Discount, Fixed Margin over Index, Step Up / Step Down, Other / Complex Floating Rate, Fixed Resettable, Pay at Maturity Floater, Fixed then Floating.

Nordic corporate bonds where the issuer is of Norwegian, Danish, Finnish, or Swedish domicile. Icelandic companies are omitted due to not having enough observations. Focusing on the effects of sustainability in the Nordic countries, we follow previous research that includes data from non-EU member Norway (Somoza, 2023). Furthermore, Norway uses the same regulations and accounting standards as EU members (Eliwa et al., 2021).

Bonds issued by companies that do not have an ESG score or have missing values in any of the firm variables for the year of observation in Refinitiv Eikon are excluded from the study. In keeping with other ESG and cost of debt studies (La Rosa et al., 2018; Mansi et al., 2011; Eliwa et al., 2021), we exclude companies in the financial sector and their issued bonds as well as government-linked issuers due to the different roles of debt financing in contrast to non-financial companies. Regarding sector weights, they are likely to differ from those of the broader market, as represented by equity indices. This is because not all companies seek financing via the bond market, and capital-intensive businesses have greater need for external funding. Most notably for this sample, the share of real-estate companies will likely be overweighted compared to their market capitalization (MSCI, 2023; Nordic Trustee, 2020). The specific sector proportions in the sample can be seen in Table 1.

In line with Borisova et al. (2015) the bond data is gathered from the third Wednesday in November every respective year, meaning November 18 2020, November 17 2021, and November 16 2022, which means end-of-year and beginning-of-year effects are avoided, as well as beginning-of-week effects and end-of-week effects. Moreover, we get a time lag to reduce endogeneity problems. By choosing these dates, we ensure that ESG data from sustainability reports have been published for the year in consideration and can potentially be incorporated into the pricing of the bonds. The financial performance control variables are retrieved from Refinitiv as the latest full-year financial data for every respective year. The time-period is motivated by findings from Palea and Drogo (2020), indicating that the environment regarding how cost of debt is priced has changed after the 2015 Paris Agreement. Moreover, new regulations regarding sustainability are continuously being presented (European Union, 2019; Reuters, 2022). This motivates as recent a sample as possible to capture how ESG performance is currently assessed by creditors, while still including more than one year to ensure that the effects are not year-specific, and that the sample is sufficiently large. At the time of conducting the study, all the data required to accurately assess 2023 is not available in full, which means that the year is excluded in the study.

The sample for the primary analysis of ESG scores and their impact on cost of debt consists of 1,268 corporate bonds issued by 120 different companies. All the continuous variables are winsorized at the 1% and 99% levels. In the sample where the environmental pillar score is exchanged for total CO2 equivalent emissions to million in revenue, there are 1,112 bonds issued by 91 unique companies. The difference in the samples could to some extent affect the findings. To make the sample as large as possible, we include bonds with floating rates in the primary analysis, since they are a large part of the Nordic bond market (see Table 2), while controlling for whether the bond has a fixed or floating rate coupon using a dummy variable. Moreover, we do not necessitate $CO_2$ emission data to be available for the main analysis of ESG scores since it would unnecessarily limit the sample size.

### *3.9. Robustness tests*

To make the results more reliable and less sensitive to sample differences, we perform robustness tests where bonds with a floating rate are excluded from the sample, while also adding a control for bond convexity in line with Borisova et al. (2015) to further control for term-structure effects. In model 8 the regression for the effects of the different ESG pillars is performed with the sample used in model 3, where $CO_2$ data is required to be available, to see if the primary results hold.

### *3.10. Omitted variables*

Findings by Cicchiello et al. (2022), building on work by Christensen et al. (2021), support the idea of increasing regulation of ESG reporting influencing the behavior of affected companies. As such standardization of reporting has been carried out extensively within the European Union, this study chooses to omit level of ESG disclosure as a variable despite it being present in previous research in the field (see Eliwa et al., 2021).

# 4. Results

In this chapter, the sample observations are first described in terms of year, nationality, and industry, as well as with descriptive statistics and variable correlations. Secondly, the main tests are presented to explore how ESG score, individual pillar scores, and carbon intensity impact cost of debt. Lastly, robustness tests are performed to ensure the reliability of the main tests. All regressions produce heteroscedasticity and autocorrelation consistent standard errors.

## *4.1. Description of sample*

**Table 1: Distribution of the sample by year, nationality, and industry**

| *Panel A: Spread observations grouped by year* | | | | |
|---|---|---|---|---|
| | ESG Score Sample | | CO2 Emissions Sample | |
| Year | N | Proportion | N | Proportion |
| 2020 | 348 | 27.4% | 319 | 28.7% |
| 2021 | 453 | 35.7% | 394 | 35.4% |
| 2022 | 467 | 36.8% | 399 | 35.9% |
| Total | 1,268 | 100% | 1,112 | 100% |
| *Panel B: Spread observations grouped by nationality* | | | | |
| | ESG Score Sample | | CO2 Emissions Sample | |
| Nationality | N | Proportion | N | Proportion |
| Denmark | 64 | 5% | 59 | 5.3% |
| Finland | 159 | 12.5% | 154 | 13.8% |
| Norway | 406 | 32% | 380 | 34.2% |
| Sweden | 639 | 50.4% | 519 | 46.7% |
| Total | 1,268 | 100% | 1,112 | 100% |

**Table 1: Distribution of the sample by year, nationality, and industry (continued)**

*Panel C: Spread observations grouped by industry*

| | ESG Score Sample | | CO2 Emissions Sample | |
|---|---|---|---|---|
| TRBC Economic Sector | N | Proportion | N | Proportion |
| Real Estate | 317 | 25% | 235 | 21.1% |
| Industrials | 183 | 14.4% | 170 | 15.3% |
| Technology | 182 | 14.4% | 157 | 14.1% |
| Energy | 180 | 14.2% | 166 | 14.9% |
| Basic Materials | 173 | 13.6% | 171 | 15.4% |
| Consumer Cyclicals | 118 | 9.4% | 108 | 9.7% |
| Consumer Non-Cyclicals | 66 | 5.2% | 64 | 5.8% |
| Utilities | 28 | 2.2% | 28 | 2.5% |
| Healthcare | 21 | 1.7% | 13 | 1.2% |
| Total | 1,268 | 100% | 1,112 | 100% |

This table presents the two samples, one when only using ESG scores, where 1,268 bonds are used, and another where carbon intensity is included, and 1,112 bonds remain after observations with missing values are cleaned from the dataset. The bond spreads are observed in the three years 2020-2022, in four countries, across nine TRBC economic sectors. Panel A shows the years the bond spreads are observed. Panel B includes observation counts by the nation of the bond (domicile of the bond as displayed in the Refinitiv corporate bond prices application). Panel C displays the bonds by issuing company industry (retrieved from Refinitiv as 'TR.TRBCEconomicSector').

The sample has more observations in the year 2021 than in 2020, and even more observations in 2022. This is likely explained by Refinitiv having increased their coverage of ESG Scores every year, and because more and more companies are publishing sustainability reports from which the ESG Scores are created (Refinitiv, 2022). There is however not a total overlap between companies for which Refinitiv has ESG scores and CO2 data, causing the CO2 sample to contain 156 fewer observations, which could affect the results. Although there could be some differences between the samples, this study prioritizes having as many observations as possible due to the already limited scope of the universe. Because of this, the regressions using ESG scores retain those companies that do not have reported CO2 data.

As expected, sector weights differ somewhat from broad, market cap-based equity indices which contain many of the same companies. As sectors such as real estate have been overrepresented in the Nordic bond market for several years, the sample can nevertheless be deemed an accurate representation of the investable universe for a bond investor, as well as the existing market a company may issue bonds in (MSCI, 2023; Nordic Trustee, 2020).

It can be noted that most observations in the sample are in the Swedish market and that observations in Denmark are relatively fewer at around a 5% share, likely due to many companies with ESG scores in Denmark not having outstanding bonds in the observed time-period.

*4.2. Descriptive statistics*

**Table 2: Descriptive overview of the binary and continuous variables**

*Panel A: Binary variables*

| | ESG Score Sample | | | CO2 Emissions Sample | | |
|---|---|---|---|---|---|---|
| Variable | Count | Yes | No | Count | Yes | No |
| Fixed | 1,268 | 849 | 419 | 1,112 | 797 | 315 |
| Callable | 1,268 | 483 | 785 | 1,112 | 420 | 692 |

*Panel B: Continuous variables*

ESG Score Sample

| Variable | Count | Mean | Std. Dev. | 25th perc. | 50th perc. | 75th perc. |
|---|---|---|---|---|---|---|
| Spread | 1,268 | 1.84 | 1.85 | 0.75 | 1.43 | 2.45 |
| ESG Score | 1,268 | 69.03 | 16.03 | 61.64 | 72.01 | 80.45 |
| Env Score | 1,268 | 67.02 | 19.09 | 56.83 | 71.69 | 81.43 |
| Soc Score | 1,268 | 70.48 | 17.32 | 62.69 | 76.01 | 82.88 |
| Gov Score | 1,268 | 68.28 | 20.03 | 55.02 | 72.98 | 84.15 |
| Leverage | 1,268 | 0.59 | 0.14 | 0.50 | 0.58 | 0.68 |
| Size | 1,268 | 23.07 | 1.18 | 22.32 | 23.08 | 23.63 |
| EBITDA/Debt | 1,268 | 0.19 | 0.12 | 0.07 | 0.18 | 0.26 |
| Interest Coverage | 1,268 | 14.20 | 18.75 | 4.43 | 9.36 | 18.71 |
| Profitability | 1,268 | 0.04 | 0.05 | 0.03 | 0.05 | 0.07 |
| Maturity (days) | 1,268 | 7.33 | 0.54 | 6.97 | 7.30 | 7.69 |

CO2 Emissions Sample

| Variable | Count | Mean | Std. Dev. | 25th perc. | 50th perc. | 75th perc. |
|---|---|---|---|---|---|---|
| Spread | 1,112 | 1.61 | 1.56 | 0.66 | 1.35 | 2.24 |
| Carbon Intensity | 1,112 | 224.97 | 391.25 | 17.34 | 54.68 | 265.50 |
| Soc Score | 1,112 | 73.46 | 14.89 | 67.29 | 77.52 | 83.70 |
| Gov Score | 1,112 | 72.85 | 16.19 | 61.92 | 76.42 | 86.07 |
| Leverage | 1,112 | 0.59 | 0.14 | 0.49 | 0.57 | 0.68 |
| Size | 1,112 | 23.20 | 1.13 | 22.48 | 23.14 | 23.83 |

**Table 2: Descriptive overview of the binary and continuous variables (continued)**

| Variable | Count | Mean | Std. Dev. | 25th perc. | 50th perc. | 75th perc. |
|---|---|---|---|---|---|---|
| EBITDA/Debt | 1,112 | 0.20 | 0.12 | 0.09 | 0.20 | 0.26 |
| Interest Coverage | 1,112 | 13.97 | 22.03 | 5.04 | 9.41 | 19.02 |
| Profitability | 1,112 | 0.04 | 0.05 | 0.03 | 0.05 | 0.07 |
| Maturity (days) | 1,112 | 7.36 | 0.55 | 6.97 | 7.35 | 7.76 |

Panel A describes the distribution of the binary variables in the sample. Panel B describes the continuous variables in the two samples with the mean, standard deviation, 25th percentile, 50th percentile, and 75th percentile of the observations. All continuous variables are winsorized at the 1% and 99% level. Spread, measured in percentages, is the difference between the yield to maturity and a matched through linear interpolation yield of a benchmark government bond of the same domicile and the same maturity. ESG Score is the ESG score from Refinitiv. Env Score is the environmental pillar score from Refinitiv. Soc Score is the social pillar score from Refinitiv. Gov Score is the governance pillar score from Refinitiv. Carbon Intensity is the total CO2 emission equivalents in tons divided by million euros in revenue. Profitability is the net income before extraordinary items of the firm divided by its total assets. Leverage is the total debt of the firm divided by total assets. Size is the natural logarithm of total assets. Interest Coverage is the operating profit of the firm divided by its interest expenses. EBITDA/Debt is the firm's EBITDA divided by its total short- and long-term liabilities. Maturity (days) is the natural logarithm of the time to maturity in days.

The distributions in Panel A for the two binary variables are not markedly different between the two samples. Notably, the share of floating-rate notes in the Nordic markets is quite high. Because of this, the study does not exclude them as done by Borisova et al. (2015), and instead applies a control variable for the coupon type.

ESG scores are plotted on a scale from 0 to 100. A method for measuring companies within an industry against each other, rather than against the whole universe of companies, is used for computing underlying environmental and social pillar scores. For governance scores, however, all companies are treated equally (Refinitiv, 2022). Notably, scores in this sample are clustered at around 75 points on the 100-point scale, in line with the findings about high stakeholder focus in the Nordics by Poulsen et al. (2010).

The observations of carbon intensity are notably less clustered around the mean, with a smaller median suggesting a few observed companies having comparatively much higher emissions, which could to some degree affect the findings in this study. Nevertheless, the sample remains an accurate reflection of the investable universe in the Nordic corporate bond market.

## Table 3: Correlation Matrices

*Panel A: ESG Score Sample*

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) | (20) | (21) | (22) | (23) | (24) | (25) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) Spread | | | | | | | | | | | | | | | | | | | | | | | | | |
| (2) ESG Score | -0.29 | | | | | | | | | | | | | | | | | | | | | | | | |
| (3) Env Score | -0.18 | 0.84 | | | | | | | | | | | | | | | | | | | | | | | |
| (4) Soc Score | -0.29 | 0.92 | 0.75 | | | | | | | | | | | | | | | | | | | | | | |
| (5) Gov Score | -0.27 | 0.79 | 0.45 | 0.58 | | | | | | | | | | | | | | | | | | | | | |
| (6) Leverage | 0.01 | -0.11 | -0.28 | -0.16 | 0.17 | | | | | | | | | | | | | | | | | | | | |
| (7) Size | -0.27 | 0.48 | 0.42 | 0.35 | 0.51 | 0.17 | | | | | | | | | | | | | | | | | | | |
| (8) EBITDA/Debt | -0.26 | 0.24 | 0.1 | 0.24 | 0.28 | -0.12 | 0.24 | | | | | | | | | | | | | | | | | | |
| (9) Interest Coverage | -0.08 | 0.1 | 0.14 | 0.17 | -0.04 | -0.28 | 0.04 | 0.39 | | | | | | | | | | | | | | | | | |
| (10) Profitability | 0.07 | 0 | 0.13 | 0 | -0.12 | -0.31 | -0.11 | 0.25 | 0.49 | | | | | | | | | | | | | | | | |
| (11) Maturity (days) | -0.14 | 0.21 | 0.17 | 0.14 | 0.22 | 0.06 | 0.37 | 0.13 | 0.01 | -0.06 | | | | | | | | | | | | | | | |
| (12) Is fixed | -0.13 | 0.25 | 0.19 | 0.19 | 0.27 | 0.1 | 0.41 | 0.22 | 0.04 | -0.08 | 0.33 | | | | | | | | | | | | | | |
| (13) Is callable | -0.02 | -0.12 | -0.19 | -0.15 | 0 | 0.21 | 0.02 | 0.09 | -0.06 | -0.02 | 0.14 | 0.31 | | | | | | | | | | | | | |
| (14) Basic Materials | -0.03 | 0.23 | 0.22 | 0.3 | 0.06 | -0.34 | -0.04 | 0.1 | 0.2 | 0 | 0.05 | 0.03 | 0 | | | | | | | | | | | | |
| (15) Consumer Cyclicals | -0.02 | 0.09 | 0.06 | 0.1 | 0.02 | 0.06 | -0.14 | 0.01 | 0.05 | 0 | -0.09 | -0.02 | -0.12 | -0.13 | | | | | | | | | | | |
| (16) Consumer Non-Cyclicals | -0.05 | -0.04 | -0.04 | -0.02 | -0.05 | -0.1 | -0.13 | 0.08 | 0.03 | 0.09 | -0.04 | -0.08 | 0 | -0.09 | -0.08 | | | | | | | | | | |
| (17) Energy | -0.15 | 0.08 | -0.01 | 0.02 | 0.26 | 0.4 | 0.49 | 0.26 | 0.02 | -0.27 | 0.2 | 0.19 | 0.11 | -0.16 | -0.13 | -0.1 | | | | | | | | | |
| (18) Healthcare | 0.06 | 0 | -0.07 | 0.03 | 0 | 0.03 | -0.15 | 0.06 | 0.02 | 0 | -0.05 | -0.05 | 0.04 | -0.05 | -0.04 | -0.03 | -0.05 | | | | | | | | |
| (19) Industrials | 0.02 | -0.04 | -0.07 | -0.01 | -0.03 | -0.07 | -0.14 | 0.26 | 0.05 | 0.13 | -0.09 | -0.02 | 0.02 | -0.16 | -0.13 | -0.1 | -0.17 | -0.05 | | | | | | | |
| (20) Real Estate | 0.25 | -0.25 | -0.01 | -0.28 | -0.31 | -0.12 | -0.15 | -0.64 | -0.19 | 0.19 | -0.15 | -0.24 | -0.15 | -0.23 | -0.18 | -0.14 | -0.23 | -0.07 | -0.24 | | | | | | |
| (21) Technology | -0.13 | -0.01 | -0.17 | -0.01 | 0.09 | 0.14 | 0.07 | 0.13 | -0.08 | -0.15 | 0.06 | 0.14 | 0.11 | -0.16 | -0.13 | -0.1 | -0.17 | -0.05 | -0.17 | -0.24 | | | | | |
| (22) Utilities | -0.01 | 0.04 | 0.11 | -0.08 | 0.05 | 0.05 | 0.13 | -0.09 | -0.03 | 0 | 0.18 | 0.08 | 0.1 | -0.06 | -0.05 | -0.04 | -0.06 | -0.02 | -0.06 | -0.09 | -0.06 | | | | |
| (23) 2020 | -0.17 | -0.04 | -0.04 | -0.01 | -0.06 | -0.02 | 0.04 | 0.04 | -0.01 | 0.03 | 0.16 | 0.03 | -0.02 | 0.01 | 0 | -0.04 | 0.02 | -0.04 | 0.01 | -0.02 | 0.03 | -0.01 | | | |
| (24) 2021 | -0.34 | -0.02 | -0.01 | -0.03 | 0.01 | -0.01 | -0.07 | -0.16 | -0.17 | -0.27 | 0.01 | -0.04 | -0.01 | 0 | -0.05 | 0.05 | 0 | -0.01 | -0.02 | 0.04 | 0 | -0.02 | -0.46 | | |
| (25) 2022 | 0.49 | 0.05 | 0.05 | 0.05 | 0.05 | 0.03 | 0.03 | 0.12 | 0.18 | 0.24 | -0.16 | 0.01 | 0.03 | -0.01 | 0.04 | -0.01 | -0.02 | 0.04 | 0.01 | -0.02 | -0.02 | 0.03 | -0.47 | -0.57 | |

*Panel B: CO2 Emissions Sample*

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) | (20) | (21) | (22) | (23) | (24) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) Spread | | | | | | | | | | | | | | | | | | | | | | | | |
| (2) Carbon Intensity | 0.09 | | | | | | | | | | | | | | | | | | | | | | | |
| (3) Soc Score | -0.22 | -0.03 | | | | | | | | | | | | | | | | | | | | | | |
| (4) Gov Score | -0.14 | 0.04 | 0.44 | | | | | | | | | | | | | | | | | | | | | |
| (5) Leverage | -0.07 | -0.05 | -0.12 | 0.26 | | | | | | | | | | | | | | | | | | | | |
| (6) Size | -0.22 | 0.15 | 0.22 | 0.52 | 0.25 | | | | | | | | | | | | | | | | | | | |
| (7) EBITDA/Debt | -0.2 | 0.15 | 0.12 | 0.17 | -0.09 | 0.22 | | | | | | | | | | | | | | | | | | |
| (8) Interest Coverage | -0.03 | -0.1 | 0.07 | -0.09 | -0.14 | 0 | 0.3 | | | | | | | | | | | | | | | | | |
| (9) Profitability | 0.07 | -0.21 | -0.09 | -0.18 | -0.31 | -0.18 | 0.29 | 0.52 | | | | | | | | | | | | | | | | |
| (10) Maturity (days) | -0.07 | 0.06 | 0.1 | 0.18 | 0.07 | 0.36 | 0.11 | 0.03 | -0.07 | | | | | | | | | | | | | | | |
| (11) Is fixed | -0.09 | 0.1 | 0.05 | 0.15 | 0.13 | 0.37 | 0.19 | 0.04 | -0.09 | 0.32 | | | | | | | | | | | | | | |
| (12) Is callable | -0.08 | 0.16 | -0.19 | -0.01 | 0.21 | 0.05 | 0.13 | -0.01 | -0.02 | 0.17 | 0.35 | | | | | | | | | | | | | |
| (13) Basic Materials | 0.02 | 0.49 | 0.3 | -0.02 | -0.36 | -0.08 | 0.07 | 0.14 | -0.01 | 0.02 | 0 | -0.01 | | | | | | | | | | | | |
| (14) Consumer Cyclicals | -0.01 | -0.17 | 0.09 | -0.03 | 0.04 | -0.17 | -0.02 | -0.02 | -0.01 | -0.11 | -0.04 | -0.14 | -0.14 | | | | | | | | | | | |
| (15) Consumer Non-Cyclicals | -0.05 | -0.07 | -0.07 | -0.12 | -0.11 | -0.16 | 0.07 | 0.03 | 0.11 | -0.06 | -0.13 | -0.01 | -0.11 | -0.08 | | | | | | | | | | |
| (16) Energy | -0.17 | 0.09 | 0.04 | 0.31 | 0.41 | 0.57 | 0.28 | 0.05 | -0.26 | 0.22 | 0.24 | 0.15 | -0.18 | -0.14 | -0.1 | | | | | | | | | |
| (17) Healthcare | 0 | -0.06 | 0.05 | 0.01 | -0.02 | -0.11 | 0.05 | 0.03 | 0.02 | -0.02 | -0.08 | -0.03 | -0.05 | -0.04 | -0.03 | -0.05 | | | | | | | | |
| (18) Industrials | 0.04 | 0.06 | -0.04 | -0.12 | -0.08 | -0.16 | 0.26 | 0.05 | 0.15 | -0.11 | -0.04 | 0.02 | -0.18 | -0.14 | -0.1 | -0.18 | -0.05 | | | | | | | |
| (19) Real Estate | 0.24 | -0.25 | -0.23 | -0.19 | -0.14 | -0.16 | -0.6 | -0.11 | 0.19 | -0.14 | -0.22 | -0.19 | -0.22 | -0.17 | -0.13 | -0.22 | -0.06 | -0.22 | | | | | | |
| (20) Technology | -0.14 | -0.19 | -0.03 | 0.16 | 0.22 | 0.08 | 0.08 | -0.12 | -0.18 | 0.08 | 0.17 | 0.14 | -0.17 | -0.13 | -0.1 | -0.17 | -0.04 | -0.17 | -0.21 | | | | | |
| (21) Utilities | 0.01 | 0.1 | -0.13 | 0.02 | 0.06 | 0.13 | -0.11 | -0.03 | 0 | 0.18 | 0.08 | 0.11 | -0.07 | -0.05 | -0.04 | -0.07 | -0.02 | -0.07 | -0.08 | -0.07 | | | | |
| (22) 2020 | -0.15 | 0 | -0.01 | -0.12 | -0.04 | 0 | 0.02 | 0 | 0.04 | 0.15 | 0.02 | -0.02 | 0.01 | 0 | -0.05 | 0.01 | -0.03 | 0.01 | -0.01 | 0.02 | -0.01 | | | |
| (23) 2021 | -0.35 | 0.06 | -0.03 | 0.03 | 0 | -0.06 | -0.18 | -0.12 | -0.27 | 0 | -0.04 | -0.01 | 0 | -0.03 | 0.05 | 0 | -0.01 | -0.02 | 0.04 | 0 | -0.02 | -0.47 | | |
| (24) 2022 | 0.49 | -0.06 | 0.04 | 0.08 | 0.04 | 0.05 | 0.15 | 0.12 | 0.24 | -0.15 | 0.01 | 0.04 | 0 | 0.03 | -0.01 | -0.01 | 0.04 | 0.01 | -0.03 | -0.02 | 0.04 | -0.47 | -0.55 | |

Table 3 presents correlations in the two different main samples used between all the variables used in this study, including the dummies for industry and year fixed effects. Panel A presents the correlations in the ESG Score Sample, Panel B presents the correlations in the CO2 Emissions Sample. The following TRBC sectors (retrieved from Refinitiv as 'TR.TRBCEconomicSector') are present in the samples: Basic Materials, Consumer Cyclicals, Consumer Non-Cyclicals, Energy, Healthcare, Industrials, Real Estate, Technology, Utilities. Financial and ESG variable definitions are described in Table 4. The bond spreads are retrieved on the third Wednesday of November in 2020 to 2022, with the latest full year ESG and financial data available in Refinitiv at that time.

The correlations among most independent variables are low, indicating that multicollinearity is unlikely to be an issue. This is also confirmed by VIF scores being below five for all the independent variables in all the regressions.

Both panels show initial findings indicating ESG or environmental conscientiousness on the part of investors, with spreads being negatively correlated with ESG scores and positively correlated with CO2 emissions. Correlations with the sector control variables should be viewed cautiously as some sectors have relatively much fewer observations: See Panel C of Table 1. The positive correlation between spreads and observations from the year 2022 reflect the increased interest rates during the year, which also affected spreads between corporate and government bonds. There is also a high correlation between the different pillar scores in both samples, suggesting that the same companies perform well on several metrics.

**Table 4: ESG score, carbon intensity and cost of debt regression results**

| Dependent Variable: Spread | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| | ESG score | Individual Pillar Score | Carbon Intensity |
| ESG Score | -0.0236***<br>(-5.46) | | |
| Env Score | | 0.0094**<br>(2.16) | |
| Carbon Intensity | | | 0.0008***<br>(5.08) |
| Soc Score | | -0.0293***<br>(-4.72) | -0.0241***<br>(-5.29) |
| Gov Score | | -0.0041<br>(-0.93) | 0.009***<br>(2.83) |
| Leverage | -0.2927<br>(-0.61) | -0.0889<br>(-0.18) | -0.7485*<br>(-1.75) |
| Size | -0.2737***<br>(-3.73) | -0.3033***<br>(-4.08) | -0.3694***<br>(-5.08) |
| EBITDA/Debt | -3.1684***<br>(-4.24) | -3.2474***<br>(-4.65) | -2.3809***<br>(-3.89) |
| Interest Coverage | -0.0085***<br>(-2.81) | -0.007**<br>(-2.28) | 0.003<br>(1.58) |
| Profitability | -1.1197<br>(-0.54) | -1.8325<br>(-0.89) | -4.1864***<br>(-2.88) |
| Maturity (days) | 0.3152***<br>(3.14) | 0.3108***<br>(3.16) | 0.4497***<br>(4.90) |
| Is fixed | 0.1485<br>(1.35) | 0.1273<br>(1.18) | 0.1354<br>(1.55) |
| Is callable | -0.2099*<br>(-1.92) | -0.2086*<br>(-1.87) | -0.4115***<br>(-4.16) |
| Sector fixed effects | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes |

**Table 4: ESG score, carbon intensity and cost of debt regression results (continued)**

| Dependent Variable: Spread | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| | ESG score | Individual Pillar Score | Carbon Intensity |
| Constant | 5.7514***<br>(4.87) | 6.2395***<br>(5.17) | 6.08***<br>(4.96) |
| Observations | 1,268 | 1,268 | 1,112 |
| Firms | 120 | 120 | 91 |
| Adj. R-squared | 0.458 | 0.469 | 0.481 |
| F-statistic | 93.37*** | 90.47*** | 90.9*** |

Linear regression with Newey-West standard errors using data from 2020, 2021, and 2022. Spread, the dependent variable measured in percentages, is the difference between the yield to maturity and a matched through linear interpolation yield of a benchmark government bond of the same domicile and the same maturity. The independent variables are: ESG as the ESG score from Refinitiv. Env Score is the environmental pillar score from Refinitiv. Soc Score is the social pillar score from Refinitiv. Gov Score is the governance pillar score from Refinitiv. Carbon Intensity is the total CO2 emission equivalents in tons divided by million euros in revenue. Profitability is the net income before extraordinary items of the firm divided by its total assets. Leverage is the total debt of the firm divided by total assets. Size is the natural logarithm of total assets. Interest Coverage is the operating profit of the firm divided by its interest expenses. EBITDA/Debt is the firm's EBITDA divided by its total short- and long-term liabilities. Maturity (days) is the natural logarithm of the time to maturity in days. Is fixed is a constructed dummy variable based on coupon type in Refinitiv (see section 3.7.2.). Coefficients are listed above, z-statistics in parenthesis. *** represents significance at a 1% level, ** at a 5% level, and * at a 10% level.

### *4.3. ESG score and cost of debt*

In model 1, consistent with hypothesis 1, there is a statistically significant impact of ESG performance on the cost of debt. The impact is negative with statistical significance on a 1% level and has a coefficient of -0.0237 on the cost of debt measured in percentages. These findings are consistent with the risk-mitigating view of ESG performance. The results are in line with the findings of Eliwa et al. (2021) and Apergis et al. (2022) by showing a significant and negative impact of ESG performance on cost of debt. These findings add to research by finding this effect in the Nordics, using a market-based measure of cost of debt. Moreover, the results support the risk-mitigating view of Lins et al. (2017) and Sun and Cui (2014) in also pointing to the fact that firms with good ESG performance have a lower probability of default, and the view of Godfrey et al. (2009) by indicating that a good ESG performance could offer insurance-like effects. Without specifically accounting for the mediating effect of reputation, these findings support what Maaloul et al. (2021) find regarding a lower debt financing cost for companies that manage ESG issues well.

The results in model 1 do not support the overinvestment view as this regression fails to find a positive relationship between ESG performance and cost of debt. Thus, the results speak to the opposite of what Sharfman and Fernando (2008) find regarding the impact of environmental risk management on the cost of debt for firms in the S&P500. Moreover, the results go against the claimed positive relationship between ESG performance and the cost of debt that Gonçalves et al. (2022) find for European firms.

The findings in model 1 imply an expected 2.4 basis points lower spread for every improved point in ESG score for the companies in the sample. The results thus suggest that a company moving from the bottom quartile (see Table 2) of ESG score in the Nordics (61.64) to the top quartile (80.45) would have a cost of debt saving of 44.6 basis points, which could be considered economically significant. However, to make this determination, research is needed that follows companies that actively change their ESG score.

The adjusted $R^2$ is 0.458 in model 1 with an accompanying F-statistic of 93.37, meaning that 45.8% of the variance in the sample is explained by the model which is statistically significantly different from zero on a 1% level. This coefficient of determination is higher than previous studies that are using accounting-based cost of debt measures when assessing the impact of ESG scores on cost of debt. For example, Eliwa et al. (2021) achieves an adjusted $R^2$ score of 0.099, while Erragragui (2018) achieves a 0.12 adjusted $R^2$. The higher adjusted $R^2$ in this study indicates that market-based spreads could be a better cost of debt measure for studies assessing the impact of ESG performance on financial performance metrics. This finding points in the opposite direction to the conclusions of Orlitzky et al. (2003), which indicates that the meta-analysis of what measures in studies of ESG and financial performance are most appropriate need to be re-made and that the conclusions from two decades ago should not be taken as facts.

### *4.4. Individual pillar score and cost of debt*

Since there could be different effects from different pillars of ESG, we proceed with model 2 where the E, S, and G pillars are separated. When looking at the ESG scores separated as individual pillars, the perception of the result changes. Notably, the environmental pillar positively impacts cost of debt with a coefficient of 0.0094, statistically significant at a 5% level. This suggests that bond investors view the company activities that improve environmental pillar scores as overinvestment of limited resources. The results in model 2 are thus, regarding the environmental pillar, consistent with the findings of Sharfman and Fernando (2008), who find a higher cost of debt for companies engaging in environmental risk management. However, 5% significance and a coefficient of 0.0094 are weak results, and we should be careful to draw any conclusions about the environmental pillar from the findings in model 2. In the robustness tests further below (see Table 5), the significance of the environmental pillar score deteriorates to a 10% level in model 5, and statistical insignificance in model 8.

In model 2, we also find a –0.0293 coefficient on the dependent variable for one unit of social pillar score which is statistically significant at a 1% level. The results are in line with what La Rosa et al. (2018) find when examining the Refinitiv social pillar score and its impact on cost of debt while using a different measure of cost of debt. The results are also in line with the negative effect on spreads that Apergis et al. (2022) find from the social pillar score. If considering sin companies as companies with a low social score, as is done by Pedersen et al. (2021), we can determine that these results are the opposite of the findings of Fabozzi et al. (2019) regarding the bonds of sin companies, by us finding a lower spread for companies with a high social score. The social pillar having an impact on cost of debt is a different finding from what Ng and Rezaee (2015) find for cost of equity. In our results, the social pillar is impactful, whereas Ng and Rezaee (2015) find no impact on cost of capital from the social pillar, but rather from the environmental pillar and governance pillar. Our results are in line with the findings of Apergis et al. (2022), who also find that the social pillar score has the highest coefficient among the ESG pillars on the cost of debt.

Notably, there is no statistically significant negative impact of high governance pillar scores on cost of debt in model 2, which is similar to the findings of Erragragui (2018). Previous research regarding the governance aspects is more inconclusive than for the other pillars, and mainly looks at specific components of the governance metric rather than an aggregated score. This could to some extent explain the absence of a conclusive result in this sample (Akdogu and Alp, 2016; Borisova et al., 2012).

### *4.5. Carbon intensity and cost of debt*

Consistent with hypothesis 2, we find carbon intensity to increase cost of debt. The results in model 3 are in line with the theoretical ground of a higher risk of regulations considering carbon emissions, and what is suggested by Krueger et al. (2020), who argue that institutional investors are mostly concerned about regulatory risks when considering climate risks in their investment decision-making. The results are in line with Palea and Drogo (2020), who find a higher cost of debt for European firms when high $CO_2$ emissions per unit of revenue are observed in the company. Moreover, Jung et al. (2018) find that a higher scope 1 carbon intensity is related to a higher cost of debt in Australia, which our result for the Nordic countries also supports. Lastly, Matsumura et al. (2014) find that high $CO_2$

emissions are related to a lower market cap. These results point in the same direction, by showing that $CO_2$ emissions per million euro in revenue positively impact cost of debt.

If guiding corporate decisions based on the indications in model 3, an executive with a company for example in the 75th percentile of carbon emissions in our sample (at 265.5 tons of $CO_2$ equivalents per million euro in revenue) would have to judge if it is reasonable to improve carbon efficiency down to the 25th percentile (17.34 tons of $CO_2$ equivalents per million euro in revenue), a 93.8% drop, for a cost of debt saving of 19.9 basis points. Alternatively, if it is more reasonable to attempt moving from the 25th percentile of the Refinitiv Social pillar Score (67.29) to the 75th percentile (83.70) for a cost of debt saving of 39.5 basis points. However, we encourage future researchers to look at specific situations when a company has changed its carbon emissions and how it affects its cost of debt to reach conclusions on this matter.

The fact that there is a statistically significant spread effect for $CO_2$ emissions, a component of the environmental pillar score, but not for the pillar score taken together, suggests that high scores on other components of the pillar could even increase a company's cost of debt, ceteris paribus. Other components of the environmental pillar include investments in innovation and decreased resource use and are probably less likely to be scrutinized or regulated, a factor put forward by Krueger et al. (2020) as an important concern for investors. If such findings were to be validated by separate studies, it would support the overinvestment view of such efforts being wasteful (Goss & Roberts, 2011). However, since we do not directly test the influence of innovation and resource use and their respective impact on cost of debt, we are careful to draw conclusions.

Since the governance pillar score in the model 3 sample is significantly associated with cost of debt, we perform a robustness test with the individual ESG score pillars, but using the sample which necessitates $CO_2$ emissions to be available in Refinitiv. This robustness test can be seen in model 8.

### *4.6. Control variables*

Most control variables are highly statistically significant in at least one of the models and have the expected coefficients. Despite being statistically insignificant in some of the regression models, the control variables for fixed, profitability, and leverage are kept due to being included in similar previous research. The variables have, as mentioned in the method section, a theoretical justification for being included and could still have an effect on other variables of interest to increase the overall grade of explanation in the models.

Surprisingly and inconsistent with the literature, in model 3 firm leverage holds a negative coefficient to cost of debt, although only significant at a 10% level. A possible explanation for this is the endogeneity problem. The companies in this particular sample with a low cost of debt might have been able to increase leverage to obtain the benefits associated with it, as seen in Korteweg (2010).

The callability of the bonds has a coefficient inconsistent with the literature in all the three models in Table 4. The callability of a bond is expected to increase the credit spread due to bond investors demanding a higher return for the possibility that the issuer calls back the bond for refinancing (Qui and Yu, 2008). However, if the interest rates are projected to rise in the foreseeable future, the relationship is not necessarily positive. Furthermore, although no level of interest rates would logically lead to the opposite effect of callable bonds having lower spreads than non-callable ones, there could be a sample bias as rising interest rates may force companies already issuing bonds in the high yield segment to do so at an even greater discount when adding a call option, with the effect of them choosing not to issue these bonds at all.

### *4.7. Robustness Tests*

The models are repeated to see if the results hold when bonds with a floating rate are excluded. Since float coupon types are a main part of the Nordic bond market (as seen in Table 2), the coupon type is included in the primary analysis. In previous studies on bond spreads, it is common to only include fixed coupon type bonds (see for example Borisova et al., 2015). Moreover, in these sensitivity tests, convexity ('TR.CONVEXITY') is included as a bond characteristic variable in line with Qiu and Yu (2008) and Borisova et al. (2015). Convexity was excluded as a variable in the primary analysis due to missing values limiting the sample to an unacceptable magnitude, as floating-rate notes would lack convexity data. Models 4, 5 and 6 are identical to the main models 1, 2 and 3 apart from the exclusion of floating coupon bonds. The results and associated conclusions about impact on cost of debt hold through all the robustness tests for the independent variables ESG score, social pillar score, and carbon intensity. Considering model 7 and model 8, the main regressions for models 2 and 3 are repeated with what we call the CO2 emissions sample.

**Table 5: ESG score, carbon intensity and cost of debt robustness tests**

| Dependent Variable: Spread | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 |
|---|---|---|---|---|---|
| | ESG score | Individual Pillar Score | Carbon Intensity | ESG score | Individual Pillar Score |
| ESG Score | -0.0277*** (-3.91) | | | -0.0211*** (-3.67) | |
| Env Score | | 0.0097* (1.80) | | | 0.0042 (1.01) |
| Carbon Intensity | | | 0.0007*** (3.78) | | |
| Soc Score | | -0.0333*** (-4.06) | -0.0254*** (-3.97) | | -0.0325*** (-5.97) |
| Gov Score | | -0.0041 (-0.79) | 0.0085** (1.99) | | 0.0099*** (3.03) |
| Leverage | -0.4735 (-0.84) | -0.3359 (-0.57) | -0.9503* (-1.84) | -0.2643 (-0.59) | -0.5038 (-1.12) |
| Size | -0.2296** (-2.46) | -0.2739*** (-2.88) | -0.3453*** (-3.54) | -0.2494*** (-3.28) | -0.32*** (-4.38) |
| EBITDA/Debt | -1.5697* (-1.76) | -1.7582** (-2.04) | -1.4614* (-1.95) | -1.4941** (-2.39) | -1.8742*** (-3.04) |
| Interest Coverage | -0.0105*** (-2.70) | -0.0096** (-2.45) | -0.0019 (-0.64) | -0.0007 (-0.28) | 0.0014 (0.66) |
| Profitability | -2.3943 (-0.98) | -2.9697 (-1.21) | -3.5530* (-1.86) | -5.0133*** (-2.95) | -5.75*** (-3.60) |
| Maturity (days) | 0.3697*** (2.65) | 0.3595*** (2.65) | 0.4652*** (3.72) | 0.4196*** (4.45) | 0.4223*** (4.60) |
| Convexity | 0.0005 (0.36) | 0.0005 (0.32) | 0.0007 (0.53) | | |
| Is fixed | | | | 0.116 (1.19) | 0.137 (1.52) |
| Is callable | -0.4441*** (-3.94) | -0.4596*** (-3.96) | -0.5523*** (-5.20) | -0.317*** (-3.08) | -0.3501*** (-3.45) |
| Sector fixed effects | Yes | Yes | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | Yes | Yes | Yes |
| Constant | 5.0562*** (2.98) | 5.8367*** (3.35) | 5.8043*** (3.41) | 4.4522*** (3.46) | 5.7326*** (4.53) |
| Observations | 849 | 849 | 797 | 1,112 | 1,112 |
| Firms | 75 | 75 | 63 | 91 | 91 |
| Adj. R-squared | 0.428 | 0.439 | 0.444 | 0.434 | 0.461 |
| F-statistic | 62.42*** | 59.99*** | 70.07*** | 93.6*** | 86.6*** |

Linear regression with Newey-west standard errors using data from 2020, 2021, and 2022. Spread, the dependent variable measured in percentages, is the difference between the yield to maturity and a matched through linear interpolation yield of a benchmark government bond of the same domicile and the same maturity. The independent variables are: ESG as the ESG score from Refinitiv. Env Score is the environmental pillar score from Refinitiv. Soc Score is the social pillar score from Refinitiv. Gov Score is the governance pillar score from Refinitiv. Carbon Intensity is the total CO2 emission equivalents in tons divided by million euros in revenue. Profitability is the net income before extraordinary items of the firm divided by its total assets. Leverage is the total debt of the firm divided by total assets. Size is the natural logarithm of total assets. Interest Coverage is the operating profit of the firm divided by its interest expenses. EBITDA/Debt is the firm's EBITDA divided by its total short- and long-term liabilities. Maturity (days) is the natural logarithm of the time to maturity in days. Is fixed is a constructed dummy variable based on coupon type in Refinitiv (see page 17). Convexity is the bond sensitivity to interest rate change, as reported in Refinitiv. Coefficients are listed above, z-statistics in parenthesis. *** represents significance at a 1% level, ** at a 5% level, and * at a 10% level.

The negative relationship between spreads and ESG score remains in model 4 and 7, and so does the significance at a 1% level. Moreover, the coefficient increases from –0.236 in model 2 to –0.277 in model 4. Changes are mainly evident for certain control variables. In this regression, the significance of the variable 'Is callable' increases compared to the main regression. This is expected, as call options are typically not included when issuing floating rate notes as the adjustment for interest rates over the duration of the bond negates the need for this. Furthermore, convexity is added as a variable in models four through six, however, it is not statistically significant in any of the models.

The conclusions regarding the social pillar score hold when only using fixed-coupon rate bonds in models 5 and 6, as well as when using the CO2 sample in model 8. The results are statistically significant at a 1% level, moreover the coefficient is larger at –0.0333 versus –0.0293 in the original sample.

In model 5, the environmental pillar score decreases in significance to 10%, and becomes statistically insignificant in model 8. Therefore, since the initial findings are not robust to sensitivity tests and different samples, we cannot draw any conclusions about the environmental pillar score and cost of debt.

In model 8, when using the CO2 sample, the governance pillar is significant at a 1% level. This strengthens the suspicion that the difference between model 2 and 3 probably is due to sample differences. We cannot however draw any conclusions about differences in importance of governance score for disclosers of CO2 and non-disclosers. Moreover, since the results regarding the governance pillar are inconsistent though the different nine models, this indicates that the results are not robust to changes in sample. Therefore, we should not draw any conclusions regarding the governance pillar score and cost of debt.

### *4.8. Endogeneity*

To account for endogeneity, studies in the field (Eliwa et al., 2021; Erragragui, 2018; Palea & Drogo, 2021) use a one-year lag between the measurements of ESG metric and the cost of debt. Since this study uses a timelier market-based measure of cost of debt in credit spreads, we have the ability to use more recent ESG data and still get a time lag between March-April (when sustainability reports generally are reported and the Refinitiv ESG score can be constructed for that year) and November, when the credit spread is gathered. However, the problem with endogeneity is not fully eliminated, and the companies that are able to achieve a low cost of debt might very well be the companies that can spend resources on ESG initiatives and achieve a better assessment from Refinitiv.

# 5. Discussion

With regards to ESG and carbon intensity effects on cost of debt, the findings in this thesis validate H1 and H2, something which is also in line with previous research on the subject. Although, as found by Berg et al. (2022), there can be notable differences in how ESG data providers score companies, there is nevertheless ample evidence of Refinitiv scores being used as proxies for either ESG top level or pillar performance (Apergis et al., 2022; Eliwa et al., 2021; La Rosa et al., 2018). Achieving statistically significant and similar results as the Apergis et al. (2022) study of a negative impact of ESG scores on spreads, also in markets that are judged to be stakeholder oriented (Poulsen et al., 2010), supports the view that ESG scores have an impact on cost of debt and that the choice of Refinitiv scores as proxies is valid. This is useful information for future researchers since this study and Apergis et al. (2022) are among the first studies to assess the impact of ESG scores on credit spreads. As noted in the section on endogeneity, financially sound companies may be the ones that have resources to spend on measures to improve their ESG performance. The results nevertheless indicate both that bond investors reward such performance in secondary markets and that they could be beneficial for companies as they issue debt in the future.

Possibly, the low significance found in model 2 and 5 regarding the impact of environmental pillar score, and complete statistical insignificance in model 8, is due to environmental pillar scores being an insufficient measure of environmental performance, as is discussed by Berg et al. (2022). If so, it is possible that they are therefore largely ignored by the market. As suggested by Apergis et al. (2022), current environmental pillar score metrics might poorly incorporate the regulatory risks that Krueger et al. (2020) argue to be the environmental risks of the highest importance to institutional investors. The stronger results found when using the carbon intensity measure in model 3 suggest to future researchers that it might be a more useful measure when assessing the impact of successful environmental management on financing costs. While the Refinitiv ESG score is 15% made up of emission data, and the Refinitiv environmental pillar score is 35% based on emissions (Refinitiv, 2022), the more focused carbon intensity measure might have a larger explanatory power when aiming to assess the impact of environmental performance on financial performance metrics. Alternatively, this study finding a significant mitigating effect of carbon emissions on spreads, with only weak or insignificant findings regarding the effect of environmental pillar score, suggests that for the purpose of lowering its cost of debt, the other environmental initiatives included in the environmental pillar measure (product innovation and resource use) may be harmful to the company. ESG initiatives in innovation and reduced resource use could be an overinvestment of resources, as discussed by Goss and Roberts (2011) and Di Giuli and Kostovetsky (2014). However, we call on future researchers to address these specific aspects to be able to draw any conclusions.

Additionally, the explanatory power of environmental pillar scores on cost of debt could be somewhat diminished by the fact that even companies with low ESG scores may issue sustainability-linked green bonds, which can exhibit a premium on similar conventional bonds (Zerbib, 2019). As green bonds become a larger share of the overall bond market, future researchers could include control variables for green bonds to investigate if sustainability-linked bonds affect the cost of debt for such companies in the Nordics.

Although the methodology for measuring the social pillar is different in Fabozzi et al. (2019), the findings in our study, demonstrated in model 2, of lower spreads related to high social pillar scores are opposite to those of Fabozzi et al. (2019). However, our results do validate the findings by Capelle-Blancard et al. (2019) and Drago et al. (2019). It is worth noting that the relationship between high social performance and reduced cost of debt could be more outsized in the Nordic markets that have a high stakeholder focus, as suggested by Eliwa et al. (2021) together with Poulsen et al. (2010). More research is needed, however, to be able to draw such conclusions.

Studies show that companies with low social scores, when defined as sin stocks, have less institutional ownership because of exclusion or divestment policies (Hong & Kacperczyk, 2009). This, combined with the high share of institutional investors in the corporate bond market, could be a possible explanation for the significant effect of social pillar scores, as spreads would increase due to fewer potential investors causing decreased liquidity in the instruments (ECB, 2022). The reason for this could in turn be that social criteria more often are measured in binary terms, i.e., whether a company follows a set of social requirements or not, and investors can then screen companies according to such requirements. Environmental impact, however, is more commonly measured on a sliding scale, as is the case with carbon emissions. There can therefore be incentives for investors to engage with badly performing companies rather than excluding them from investment.

The absence of conclusive findings for the governance pillar is in line with previous research, which finds that although certain specifics which are scored in the governance rating may have an impact on cost of debt (Akdogu & Alp, 2016; Bhojraj & Sengupta, 2003), the overall governance rating may not be a similarly strong predictor (Erragragui, 2018). A possible explanation for this is that the governance metrics for which previous research has found an effect on cost of debt are the metrics most closely related to investor protection and are therefore more likely impact investor returns. The governance pillar score composed by Refinitiv, however, also includes metrics such as CSR strategy (Refinitiv, 2022), which may not have a similarly direct impact on investors.

# 6. Conclusions

The findings in this thesis validate both initial hypotheses. First, in the Nordic countries there is a noticeable impact on spreads from ESG scores, with indications that a high company ESG performance reduces cost of debt. Second, the findings support the hypothesis that carbon intensity increases cost of debt, by finding a positive and significant effect on spreads from this variable. Statistical significance on a 1% level is found for the effect of the top-level ESG score, the social pillar score, and the carbon intensity. The results are robust through sensitivity tests using different samples and excluding floating rate bonds. However, only weak and inconclusive effects are found for the governance pillar score and environmental pillar score, where the effects are not robust to sample differences.

In model 1, using a sample of 1,268 spreads in four Nordic countries across 2020–2022, the coefficient for ESG score on the spread measured in percentages is -0.024. In model 2, using a sample of 1,268 spreads in four Nordic countries across 2020–2022, the coefficient for the social pillar score on the spread is -0.029. In model 3, using a sample of 1,112 spreads in four Nordic countries across 2020–2022, the coefficient for one unit of carbon intensity on the spread is 0.0008.

This study adds to existing research by assessing the impact of ESG performance and carbon intensity on cost of debt using the market-based proxy of credit spreads and is the first such study conducted specifically on the Nordic credit markets. This study also indicates that if executives of companies are to reduce their cost of debt, actively focusing on reducing carbon emissions as a share of revenue might be helpful. Moreover, the study indicates that actions to improve the assessment of the company's social performance could be important to reduce the perception of credit risk in the company.

The rising spreads for corporate bonds brought on by rises in interest rates during the period covered by the study may lead to some limitations in interpreting the data, as these events and the market uncertainty in this period may have affected companies unevenly. Furthermore, there is little previous research on possible differences in the impact of ESG performance on cost of debt when measured between industries. While such differences could show up in our sample as well, the results put forward here nevertheless provide findings for future research on specific industries to build on.

Future researchers could compare how cost of debt changes over time as the ESG score, social pillar score, and carbon intensity changes. Our results suggest that there can be an effect on the cost of debt from taking active measures to improve company sustainability. However, research is needed where longitudinally following companies as they are changing company ESG metrics and how it affects financing costs. Moreover, a similar study in the Nordic countries, with cost of equity instead of cost of debt, could be of benefit to get the whole picture of cost of capital and more specifically advise financing decisions.

Furthermore, although Refinitiv's ESG score is used both in this study and most previous literature, competing data providers such as MSCI and Sustainalytics are also commonly available in the financial industry. A future study applying data from these sources could perhaps be preferable to Refinitiv ESG scores, as the more widespread the use of a provider's data is, the more influential it is likely to be in practitioners' actual debt and equity purchasing decisions. Moreover, due to Berg et al. (2022) proving a divergence between ESG scores, a similar study using the average ESG assessment of several data providers could be beneficial to ensure that an adequate proxy for ESG performance is being used.

# 7. References


Agnese, P. & Giacomini, E. (2023) Bank's funding costs: Do ESG factors really matter? Finance research letters. 51103437–.

Akdoğu, E. & Alp, A. (2016) Credit risk and governance: Evidence from credit default swap spreads. Finance research letters. 17211–217.

Albers, S. et al. (2009) Will the EU-ETS instigate airline network reconfigurations? Journal of air transport management. 15 (1), 1–6.

Apergis, N. et al. (2022) ESG scores and cost of debt. Energy economics. 112106186–.

Atif, M. & Ali, S. (2021) Environmental, social and governance disclosure and default risk. Business strategy and the environment. 30 (8), 3937–3959.

Attig, N. et al. (2013) Corporate Social Responsibility and Credit Ratings. Journal of business ethics. 117 (4), 679–694.

Auer, B. R. & Schuhmacher, F. (2016) Do socially (ir)responsible investments pay? New evidence from international ESG data. The Quarterly review of economics and finance. 5951–62.

Bannier, C. E. et al. (2022) Corporate social responsibility and credit risk. Finance research letters. 44102052–.

Berg, F. et al. (2022) Aggregate Confusion: The Divergence of ESG Ratings. Review of Finance. 26 (6), 1315–1344.

Bhojraj, S. & Sengupta, P. (2003) Effect of Corporate Governance on Bond Ratings and Yields: The Role of Institutional Investors and Outside Directors. The Journal of business (Chicago, Ill.). 76 (3), 455–475.

Borisova, G. et al. (2012) Government ownership and corporate governance: Evidence from the EU. Journal of banking & finance. 36 (11), 2917–2934.

Borisova, G. et al. (2015) Government ownership and the cost of debt: Evidence from government investments in publicly traded firms. Journal of financial economics. 118 (1), 168–191.

Bradley, M. et al. (1984) On the Existence of an Optimal Capital Structure: Theory and Evidence. The Journal of finance (New York). 39 (3), 857–878.

Capelle-Blancard, G. et al. (2019) Sovereign bond yield spreads and sustainability: An empirical analysis of OECD countries. Journal of banking & finance. 98156–169.

Chapple, L. et al. (2013) The Cost of Carbon: Capital Market Effects of the Proposed Emission Trading Scheme (ETS). Abacus (Sydney). 49 (1), 1–33.

Chen, K. C. W. et al. (2009) Legal protection of investors, corporate governance, and the cost of equity capital. Journal of corporate finance (Amsterdam, Netherlands). 15 (3), 273–289.

Chen, Y. et al. (2023) Effect of ESG performance on the cost of equity capital: Evidence from China. International review of economics & finance. 83348–364.

Christensen, H. B. et al. (2021) Mandatory CSR and sustainability reporting: economic analysis and literature review. Review of accounting studies. 26 (3), 1176–1248.

Cicchiello, A. F. et al. (2022) Non-financial disclosure regulation and environmental, social, and governance (ESG) performance: The case of EU and US firms. Corporate social-responsibility and environmental management.

Colonnello, S. et al. (2019) Pricing sin stocks: Ethical preference vs. risk aversion. European economic review. 11869–100.

Cui, Q. et al. (2016) Exploring the impacts of the EU ETS emission limits on airline performance via the Dynamic Environmental DEA approach. Applied energy. 183984–994.

Damodaran. (2021) Estimating the Cost of Debt. Lecture at NYU Stern. Retrieved from: https://pages.stern.nyu.edu/~adamodar/podcasts/valspr21/session7slides.pdf [Accessed 2023-02-25]

Darmouni, O. & Papoutsi, M. (2022) Europe's growing league of small corporate bond issuers: new players, different game dynamics. ECB RESEARCH BULLETIN NO. 96.

De Fiore, F. & Uhlig, H. (2011) Bank Finance versus Bond Finance. Journal of money, credit and banking. 43 (7), 1399–1421. Retrieved from: https://www.ecb.europa.eu/pub/economic-research/resbull/2022/html/ecb.rb220615~b69a5f0ce5.en.pdf [Accessed 2023-03-21]

Di Giuli, A. & Kostovetsky, L. (2014) Are red or blue companies more likely to go green? Politics and corporate social responsibility. Journal of financial economics. 111 (1), 158–180.

Drago, D. et al. (2019) Do corporate social responsibility ratings affect credit default swap spreads? Corporate social-responsibility and environmental management. 26 (3), 644–652.

El Ghoul, S. et al. (2011) Does corporate social responsibility affect the cost of capital? Journal of banking & finance. 35 (9), 2388–2406.

Eliwa, Y. et al. (2021) ESG practices and the cost of debt: Evidence from EU countries. Critical perspectives on accounting. 79102097–.

EPA – United States Environmental Protection Agency (2022) Scope 1 and Scope 2 Inventory Guidance. Retrieved from: https://www.epa.gov/climateleadership/scope-1-and-scope-2-inventory-guidance [Accessed 2023-03-24]

Erragragui, E. (2018) Do creditors price firms' environmental, social and governance risks? Research in international business and finance. 45197–207.

European Union. Official Journal of the European Union L 317/1 (2019). REGULATION (EU) 2019/2088 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 November 2019 on sustainability-related disclosures in the financial services sector. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R2088&from=SV [Accessed 2023-03-21]

Fabozzi, F. J. et al. (2019) Does the corporate bond market overvalue bonds of sin companies? Finance research letters. 28165–170.

Flammer, C. (2021) Corporate green bonds. Journal of financial economics. 142 (2), 499–516.

Gazheli, A. et al. (2016) How realistic is green growth? Sectoral-level carbon intensity versus productivity. Journal of cleaner production. 129 (August), 449–467.

Godfrey, P. C. et al. (2009) The relationship between corporate social responsibility and shareholder value: an empirical test of the risk management hypothesis. Strategic management journal. 30 (4), 425–445.

Gonçalves, T. C. et al. (2022) Sustainability Performance and the Cost of Capital. International journal of financial studies. 10 (3), 63–.

Goss, A. & Roberts, G. S. (2011) The impact of corporate social responsibility on the cost of bank loans. Journal of banking & finance. 35 (7), 1794–1810.

Greene, W.H. (2003) Econometric Analysis. 5th Edition, Prentice Hall, Upper Saddle River, 200.

Hale, G. & Santos, J. A. C. (2008) The decision to first enter the public bond market: The role of firm reputation, funding choices, and bank relationships. Journal of banking & finance. 32 (9), 1928–1940.

Hartzmark, S. M. & Sussman, A. B. (2019) Do Investors Value Sustainability? A Natural Experiment Examining Ranking and Fund Flows. The Journal of finance (New York). 74 (6), 2789–2837.

Hoepner, A. G. F. & Schopohl, L. (2018) On the Price of Morals in Markets: An Empirical Study of the Swedish AP-Funds and the Norwegian Government Pension Fund. Journal of business ethics. 151 (3), 665–692.

Hong, H. & Kacperczyk, M. (2009) The price of sin: The effects of social norms on markets. Journal of financial economics. 93 (1), 15–36.

Jeanneret, A. (2018) Sovereign credit spreads under good/bad governance. Journal of banking & finance. 93230–246.

Jung, J. et al. (2018) Carbon Risk, Carbon Risk Awareness and the Cost of Debt Financing. Journal of business ethics. 150 (4), 1151–1171.

Klevan, Y. (2016) Fixed income investments in a carbon conscious world. Lazard Asset Management Research Report, October 24, 2016. Retrieved from: http://www.lazardnet.com/investment-research/ [Accessed 2023-03-24]

Korteweg, A. (2010) The Net Benefits to Leverage. The Journal of finance (New York). 65 (6), 2137–2170.

Krueger, P. et al. (2020) The Importance of Climate Risks for Institutional Investors. The Review of financial studies. 33 (3), 1067–1111.

Kölbel, J. F. et al. (2017) How Media Coverage of Corporate Social Irresponsibility Increases Financial Risk. Strategic management journal. 38 (11), 2266–2284.

La Rosa, F. et al. (2018) The impact of corporate social performance on the cost of debt and access to debt financing for listed European non-financial firms. European management journal. 36 (4), 519–529.

Landi, G. C. et al. (2022) Embedding sustainability in risk management: The impact of environmental, social, and governance ratings on corporate financial risk. Corporate social-responsibility and environmental management. 29 (4), 1096–1107.

Lins, K. V. et al. (2017) Social Capital, Trust, and Firm Performance: The Value of Corporate Social Responsibility during the Financial Crisis: Social Capital, Trust, and Firm Performance. The Journal of finance (New York). 72 (4), 1785–1824.

Maaloul, A. et al. (2023) The Effect of Environmental, Social, and Governance (ESG) Performance and Disclosure on Cost of Debt: The Mediating Effect of Corporate Reputation. Corporate reputation review. 26 (1), 1–18.

Mansi, S. A. et al. (2011) Analyst forecast characteristics and the cost of debt. Review of accounting studies. 16 (1), 116–142.

Masulis, R. W. & Reza, S. W. (2015) Agency Problems of Corporate Philanthropy. The Review of financial studies. 28 (2), 592–636.

Matsumura, E. M. et al. (2014) Firm-Value Effects of Carbon Emissions and Carbon Disclosures. The Accounting review. 89 (2), 695–724.

Menz, K. M. (2010) Corporate Social Responsibility: Is it Rewarded by the Corporate Bond Market? A Critical Note. Journal of business ethics. 96 (1), 117–134.

Morellec, E. et al. (2015) Financing Investment: The Choice Between Bonds and Bank Loans. Management science. 61 (11), 2580–2602.

MSCI (2023) MSCI Nordic Countries Index (EUR) Index Factsheet, March 31, 2023. Retrieved from: https://www.msci.com/documents/10199/c0915dd6-7016-4b8d-aa1d-1266eadcad35 [Accessed 2023-04-15]

Ng, A. C. & Rezaee, Z. (2015) Business sustainability performance and cost of equity capital. Journal of corporate finance (Amsterdam, Netherlands). 34128–149.

Nordic Trustee (2020) Nordic Corporate Bond Market Report. Retrieved from: https://nordictrustee.com/app/uploads/2021/02/NordicTrustee_CorporateBondMarketReport_2020.pdf [Accessed 2023-04-15]

Orlitzky, M. et al. (2003) Corporate Social and Financial Performance: A Meta-Analysis. Organization studies. 24 (3), 403–441.

Palea, V. & Drogo, F. (2020) Carbon emissions and the cost of debt in the eurozone: The role of public policies, climate-related disclosure and corporate governance. Business strategy and the environment. 29 (8), 2953–2972.

Pedersen, L. H. et al. (2021) Responsible investing: The ESG-efficient frontier. Journal of financial economics. 142 (2), 572–597.

Perez Liston, D. & Soydemir, G. (2010) Faithbased and sin portfolios. Managerial finance. 36 (10), 876–885.

Poulsen, T. et al. (2010) Voting Power and Shareholder Activism: A Study of Swedish Shareholder Meetings. Corporate governance: an international review. 18 (4), 329–343.

Qiu, J. & Yu, F. (2009) The market for corporate control and the cost of debt. Journal of financial economics. 93 (3), 505–524.

Refinitiv (2022) ESG Scores Methodology. Retrieved from: https://www.refinitiv.com/content/dam/marketing/en_us/documents/methodology/refinitiv-esg-scores-methodology.pdf [Accessed 2023-03-21]

Reuters. Abnett, K. (2022) EU agrees law to make airlines pay more to pollute. Retrieved from: https://www.reuters.com/business/environment/eu-agrees-law-make-airlines-pay-more-pollute-2022-12-07/ [Accessed 2023-02-24]

Rezaee, Z. et al. (2023) Comparative analysis of environmental, social, and governance disclosures. Global finance journal. 55100804–.

S&P (2014) Corporate Methodology. Retrieved from: https://www.maalot.co.il/Publications/MT20190703113602.PDF [Accessed 2023-03-21]

S&P Dow Jones Indices (2020) Index Carbon Metrics Explained. Retrieved from: https://www.spglobal.com/spdji/en/documents/additional-material/spdji-esg-carbon-metrics.pdf [Accessed 2023-03-29].

Schneider, T. E. (2011) Is Environmental Performance a Determinant of Bond Pricing? Evidence from the U.S. Pulp and Paper and Chemical Industries: Is Environmental Performance a Determinant of Bond Pricing? Contemporary accounting research. 28 (5), 1537-1561.

Sharfman, M. P. & Fernando, C. S. (2008) Environmental risk management and the cost of capital. Strategic management journal. 29 (6), 569–592.

Soh Young In et al. (2017) Is 'Being Green' Rewarded in the Market? An Empirical Investigation of Decarbonization Risk and Stock Returns. IAEE Energy Forum. 2017.

Somoza, A. (2023) Voluntary sustainability assurance in small and medium-sized entities: The role of country origin in Europe. Business strategy and the environment. 32 (1), 462–483.

Stellner, C. et al. (2015) Corporate social responsibility and Eurozone corporate bonds: The moderating role of country sustainability. Journal of banking & finance. 59538–549.

Sun, W. & Cui, K. (2014) Linking corporate social responsibility to firm default risk. European management journal. 32 (2), 275–287.

Thompson, P. & Cowton, C. J. (2004) Bringing the environment into bank lending: implications for environmental reporting. The British accounting review. 36 (2), 197–218.

Wang, Q. & Wang, S. (2020) Why does China's carbon intensity decline and India's carbon intensity rise? a decomposition analysis on the sectors. Journal of cleaner production. 265121569–.

Weber, O. (2012) Environmental Credit Risk Management in Banks and Financial Service Institutions: Environmental Credit Risk Management. Business strategy and the environment. 21 (4), 248–263.

Weber, O. et al. (2014) Corporate Social Responsibility of the Financial Sector - Strengths, Weaknesses and the Impact on Sustainable Development. Sustainable development (Bradford, West Yorkshire, England). 22 (5), 321–335.

Zerbib, O. D. (2019) The effect of pro-environmental preferences on bond prices: Evidence from green bonds. Journal of banking & finance. 9839–60.