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The impact of ESG on corporate Debt: Evidence from the Nordic Market

Analyzing Bond Yields and signaling effects in Sustainable Finance

Master's Thesis in Accounting and Finance

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Abstract

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Five key words: Sustainability, ESG Bonds, ESG Score, Signaling Theory, Information Asymmetry

Purpose: The purpose of this thesis is to investigate how the interaction between ESG bond issuances and ESG scores affects the cost of debt in Nordic corporations.

Methodology: This paper utilizes Pooled Ordinary Least Squared (POLS) models to examine the impact of ESG Scores and ESG bond Issuances on Yield to Maturity (YTM). Using an interaction term we aim to investigate the marginal benefit of issuing ESG bonds as a firm's ESG score increases.

Theoretical perspectives: This paper uses signaling theory and information asymmetry concepts to explore how firms communicate quality and sustainability commitments. We theorize that by issuing ESG bonds and improving ESG scores, firms signal their dedication to sustainable practices and transparency.

Empirical foundation: The sample is collected from public companies in the nordic region. The sample consists of a total of 474 bonds of which 150 are ESG bonds.

Conclusions: We find that ESG bonds on average trade at lower YTMs than comparable conventional bonds and that firms can achieve lower YTMs on their bond issues by increasing their ESG scores.

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Table of Contents

1. Introduction

1.1 Background

In 2007, a United Nations conference on the human impact on climate change ignited interest in the finance sector. Inspired by this, Swedish pension funds envisioned investing in environmentally friendly projects. This concept led to the World Bank issuing the first green bond in 2008 to finance climate-related projects. Nowadays, green bonds are a popular method for raising funds for environmental initiatives, widely used by both banks and corporations (The World Bank, 2021). New securities have also been invented as a result of increased demand for sustainable financing options. Recent examples of such an option are sustainability-linked bonds. Per S&P, borrowing through sustainable bonds came up just south of $1 trillion in 2023, and amounted for approximately 13% of global bond issuance (S&P Global, 2024). This demand for sustainable financing is due to more conscious investors and clients, but also due to new regulations that have put increasing pressure on corporations to comply with sustainable frameworks and guidelines (EU, 2022; Morgan Stanley; 2024). Additionally, with the new regulations and demands from investors, the ESG score has become increasingly important to determine how well entities comply with sustainable regulations and guidelines, as well as their attitude towards such practices (Harvard, 2024). An ESG score, which stands for Environmental, Social and Governance, is set by a handful of firms and is used as a guide on how firms are performing when it comes to ESG commitments. The importance of this measurement has increased for investors, but also when pricing securities, as the ESG score increases transparency with investors (Morgan Stanley, 2024). With increased pollution, rising sea levels and a threat to the planet's existence, new solutions like the introduction of ESG bonds allows firms to communicate about their sustainable practices. Previous research has established that the issuance of ESG bonds is also appreciated by investors and seems to lead to reduced cost of debt for the issuing firm (Flammer, 2021). In this paper, we aim to build on this, adding to the understanding and importance of ESG measures and its effect on firms financing.

1.2 Problem Discussion

As the bond market has progressed with new ways to raise money for corporations, researchers have been looking at how different factors affect bond prices. Some of these characteristics regard the sustainability aspect of firms and projects connected to bond issuings (Berrada et al, 2022). By understanding how different characteristics are linked to sustainable securities, both investors and borrowers can gain a deeper understanding of these types of bonds and mitigate knowledge gaps (Zerbib, 2019). For investors, the characterization of bonds as “Green" or “sustainable” translates into a better understanding of the sustainability aspect of the project that they are investing in. This is also beneficial for the companies issuing bonds as the labeling of the bond helps to mitigate information asymmetry regarding the purpose of the funding. Many studies have been conducted on the bond market throughout the years, and even if extensive research has been done on green bonds, there are still knowledge gaps and a need for further research as this market is still progressing. Previous research seems to suggest that investors perceive sustainable investments as less risky, leading to a willingness from investors to pay more for sustainable bonds (Flammer, 2021). The findings within the field differ, where some studies find that ESG bond issuings lead to lower financing costs while others find that these issuings make no significant difference (Tang & Zhang, 2020; Zerbib, 2019; Caramichael & Rapp, 2024; Kapraun et al, 2021).

For the studies that do find green bonds to be trading at a premium to conventional bonds, the reasoning behind why this occurs seems to differ. While Caramichael & Rapp (2024) argue that the increased demand in green bonds stemming from for example new EU initiatives and policies is what causes green bonds to be trading at a premium, other papers recognise other factors as the main drivers of the premium. Jang et al. (2020) for example argue that the reason for the premium is the increased transparency that the issuings provide, while Flammer (2021) argues that green bonds carry signaling value about a firm's sustainable commitments which increases bond prices. Tang & Zhang, (2020) extends the debate, and further suggests that increasing ESG scores, much like the issuance of ESG bonds, communicates something about the firm's sustainable practices to investors. They find that an increase in ESG score leads to cheaper financing for that specific firm. This is also studied by Caramichael & Rapp (2024), but from a different angle, as they argue that issuing ESG bonds leads to higher ESG scores. If this is the

case it might suggest that the ESG score is what actually carries signaling value and that the issuance of ESG bonds simply becomes a way to increase the ESG score, leading to cheaper financing.

Considering the findings presented above, it is evident that firms can potentially lower their cost of financing by effectively signaling their sustainability practices to investors. One way of doing this is through the issuance of ESG bonds and achieving higher ESG scores. Like previous literature, we aim to investigate whether ESG bonds and higher ESG scores can reduce the cost of debt for the issuing firm (Tang & Zhang, 2020; Zerbib, 2019; Carmichael & Rapp, 2024). We hypothesize that while both ESG bond issuances and ESG scores independently signal a firm's commitment towards sustainable practices, their combined effect on reducing the cost of debt has not been thoroughly examined. Specifically, we propose that the cost of debt reduction from issuing ESG bonds will be more significant for firms with lower ESG scores compared to those with higher scores. This approach addresses a gap in the literature by investigating the marginal benefit of issuing ESG bonds as a firm's ESG score increases. Consequently, this paper will provide new insights into how sustainability commitments impact a firm's financing.

1.3 Research Question

From the above we find it interesting to investigate whether firms can achieve lower cost of financing by issuing ESG bonds and increasing their ESG scores. We also aim to investigate if the marginal benefit achieved by issuing ESG bonds is diminishing as ESG scores increase. Thus we formulate the following two research questions:

Q1: How does the signaling value of issuing ESG bonds affect corporations' cost of financing?

Q2: How does an increase in ESG score affect the signaling value from issuing ESG bonds?

1.4 Main Findings

Conducting the study in the Nordic region and using signaling theory, we use a sample of 474 bonds of which 150 are ESG bonds to examine the marginal benefit of issuing ESG bonds as firms' ESG scores increase. We find that ESG bonds trade at YTMs that are on average 0.969 percentage points lower than those for conventional bonds. We further find that firms that increase their ESG Score by one point, on average can lower the YTM on their bonds by 0.03 percentage points. We find no significant indication however that a higher ESG score leads to a reduced marginal benefit of issuing ESG bonds.

1.5 Contributions

Looking at the relationship between the issuance of ESG bonds, issuing firms ESG scores and the subsequent effect of these on the YTM of bonds, we contribute to the previous literature with a deeper understanding of sustainable financing. Contrary to most previous research, this study does not isolate the sample to a single type of ESG bond, but rather looks at ESG bonds in general. By collecting data from Nordic public companies, we show that the effects of ESG considerations on the YTM of bonds is especially strong and significant within the Nordic region. Additionally, we contribute to previous literature by studying the marginal benefits achieved by issuing ESG bonds as a firm's ESG score increases. We do this using an interaction term representing ESG bonds issued by firms with high ESG scores, comparing them with ESG bonds issued by firms with low ESG scores, which we, to the best of our knowledge, are the first ones to do.

1.6 Structure

The paper starts with a theoretical background, laying the foundation with key concepts like ESG and signaling theory. This is followed by a literature review, hypothesis development, and methodology, which details the econometric approach. Next, the data and sample descriptions provide insights into the dataset. The results and analysis sections present and interpret the findings. Finally, the paper concludes with the main conclusions, limitations, and contributions to sustainable finance.

2. Theoretical Background

2.1 Environmental, Social and Governance

ESG stands for environmental, social and governance and refers to three pillars that are commonly used to measure sustainability. The ESG score varies between 0-100 and gives a general insight into a firm's performance in these different areas (Hayes, 2023). This metric is given by a handful of rating agencies, and even if no industry-wide rating process exists and the methods used to collect and measure data differs between agencies, the rating is considered trustworthy (PwC, 2024). In this process, all aspects of the company are thoroughly reviewed and measured. The agencies collect information from everywhere, both official reports, filed reports to governments and news articles (MSCI, 2024).

Researchers have focused on studying consequences that might arise as an effect of firms not complying with sustainable practices. According to Antonopoulos et al (2022), poor sustainable performance across the ESG pillars make firms more vulnerable and can result in financial reprimands. More importantly, bad ESG performance poses a reputational risk to many investors such as insurance companies, pension funds and institutional investors, who many times are pressured by their clients to consider sustainability when managing funds (Antonopolous et al, 2022). Furthermore, a study by Konar & Cohen (2001) documents an inverse correlation between legally emitted toxic chemicals and firm value, suggesting that firms with higher emissions are valued lower than others. Ashwin Kumar et al (2016) expands on this, and demonstrates that companies who incorporate ESG considerations present lower stock volatility compared to peers in the same industry. They also find that firms that achieve higher ESG ratings on average achieve higher risk-adjusted returns than peers with lower ESG ratings. Goss & Roberts (2011) finds that companies with higher social responsibility scores pay marginally lower bank rates than worse performers. ESG also differs across industries, as they are judged on different criterias depending on the sector but also as the ESG risk is higher for different industries, which has an impact on firms ESG scores. For example, real estate-, communication services-, consumer discretionary- and information technology companies usually achieve higher ESG scores than, for example, energy-, utilities- and raw materials companies (Sustainalytics,

2023; Harvard, 2024). As outlined above, research suggests that ESG considerations are of essence for firms to attract capital as well as achieving higher valuations.

2.2 Bond Types

Bonds are traded on the secondary market and the price can fluctuate based on multiple factors. If the price of the bond relative to its interest decreases, the Yield to Maturity (YTM) increases and vice versa (Byström, 2020). When talking about premiums in the context of bonds, we generally refer to the price increase in bonds that is observed because of a certain factor. In this paper we will look at premiums for ESG bonds, which mainly includes green bonds and sustainability linked bonds. Essentially, a premium means that ESG bonds trade at higher prices than conventional bonds which in turn brings down the YTM.

2.2.1 Green Bonds

Green bonds fundamentally operate similarly to traditional bonds, but with notable distinctions. These bonds are specifically issued to fund environmentally friendly projects that companies undertake (Climate Bonds Initiative, 2018). The International Capital Market Association (ICMA), an international non-profit organization, has created the Green Bond Principles (GBP) to identify and classify bonds as green. They measure this through certain components and the ICMA calls these *"the four core components for alignment with the GBP"* and fills the purpose of creating more transparency. They are as follows: 1. The Use of Proceeds, 2. The Process for Project Evaluation and Selection, 3. The Management of Proceeds and 4. The Reporting. The use of proceeds (1), intends to appropriately describe in which way the proceeds will be used, and is disclosed in the legal documentation of the security. This could for example be renewable energy, green buildings, clean transportation etc. The second component (2) aims to disclose information about the environmental sustainable projects, how well the project will fit in the named category and environmental and social risks associated with the project. Management of proceeds (3), mitigates allocating net proceeds to accounts or projects that is counteracting the purpose of the fund. Reporting (4) means that the entity should update how the project progresses, for example in the annual report (ICMA, 2022). The Climate Bonds Initiative (CBI) is an independent third party organization and verifies the components and eventually gives the green bond a stamp of whether it is CBI certified or not. They also educate and certify other

companies in order for them to have the correct knowledge to issue green bonds that are more likely to be CBI certified.

2.2.2 Sustainability-Linked Bonds

A type of security that is relatively new on the market are Sustainability linked bonds (SLBs), and were issued for the first time in 2019 (Swedbank, 2019). SLBs fulfill a similar purpose as green bonds, which is to finance sustainable operations, but structurally differ from green bonds and regular ones, because the coupon is not set and can change. The issuing company sets predefined Key Performance Indicators (KPIs), which are in turn measured against Sustainability Performance Target (SPT). This could for example be a KPI of having 50% women in the management team in three years, and an SPT of having 30% and 40% women in the management team in the first and second years respectively. In case of failure to meet these SPTs, a penalty in the form of a bigger coupon will be incurred, thus incentivising the issuer to meet their preset goals (ICMA, 2023). Everything, even the penalty, is predefined by the company when issuing the bond. Similarly to green bonds, the ICMA has issued guidelines to follow for this type of security. These are called Sustainability-Linked Bond Principles (SLBPs) and work in a very similar fashion as GBPs.

2.3 Information Asymmetry

The efficient market hypothesis suggests that in perfect and fully efficient capital markets, prices of securities take into account all available information (Fama, 1970). If this would be the case, sellers and buyers of traded securities would be sure they were always paying a fair price. However, this is not always the case, and Akerlof (1970) best describes this in his article *The Market for Lemons*. By using the market for old cars as an example, Akerlof shows that situations will arise where buyers and sellers possess different information. He exemplifies this by showing how the quality of used cars can vary and how the seller has more knowledge about the car's quality than the buyer. The buyer is aware of this, and lacks the knowledge to determine the quality, and is therefore unable to tell if the price is correct or not. This will be reflected in the offer the buyer makes, which will be that of a bad quality car, since they do not want to risk paying more than the car is worth. This in turn leads to sellers of high quality cars not being willing to sell their cars to these prices, which leads to only bad cars, lemons, remaining. A

situation like this, where there is a difference in information possessed by the seller and the buyer, gives rise to information asymmetry. Information asymmetry in turn can lead to adverse selection and mispricing.

In the case of bonds, the information asymmetry stems from the information gap between issuer and investor related to the project that the bond is meant to finance. This leads to an adverse selection problem where investors run the risk of overpaying for the bonds leading to them demanding discounts to account for the information asymmetry. Therefore, in order to combat this mispricing issue, it is in the interest of the issuers of a high quality bond to provide as much information about the project as possible in order to mitigate information asymmetry. As outlined by previous researchers, one way of mitigating this information asymmetry is by communicating more information about how the proceeds will be used (Flammer, 2021). One way of doing this is through the issuance of ESG bonds that require more disclosure about the sustainability profile of the projects that the funds from the issue will be used for. Since the firm is now communicating more information about the funding to investors, the information asymmetry drops and if investors find the information valuable, they should become willing to pay more (Zerbib, 2019).

2.4 Signaling Theory

Spence (1973) explores how information asymmetry can be reduced in the context of the job market. As the employees know more than the employer about their own ability and how they will perform in a role, Spence (1973) suggests that job seekers can signal about their abilities, capabilities and potential productivity through education, job experience and other attributes. This signaling of capabilities reduces the information asymmetry between the employer and the potential employee, leading to the employee being more likely to be hired.

Within the field of bonds, there are measures that firms can take to signal about the quality of their projects and the quality of the firm. One example of this is the ESG score. Antonopoulos et al (2022) examines the relationship between firms' cost of debt and their ESG scores. They find that a higher ESG score leads to a lower cost of debt for the specific firm. This suggests that enhanced ESG initiatives generate value for investors, making them more inclined to invest in

companies and projects that adhere to ESG principles. Viewed through the lens of signaling theory, ESG score can lower the information asymmetry, as an improved ESG score signals to investors that the firm is investing in ESG aligned projects.

Another article by Flammer (2021) finds that the issuance of green bonds signals that the firm is committed towards environmentally beneficial projects which attracts long term investors that prioritize environmentally beneficial investments. Tang & Zhang (2020) observe that green bonds trade at a premium, once again indicating that capital providers value green commitments. From these findings it seems like the issuance of green bonds signals commitment to environmental causes and that this in turn is rewarded by investors. A recent study by Kölbel and Lambillion (2022) builds on this. Looking at SLBs, they suggest that much like green bonds, SLBs can send signals about the firm's sustainability commitments to investors. The big difference here is that SLBs account for social and governance projects as well, while green bonds only consider environmental commitments.

2.5 Sustainability in the Nordics

According to the United Nations sustainability development report, the top three most sustainable countries in the world are Finland, Sweden and Denmark. Norway is ranked 7th in the world and the ranks are based on how well the countries are achieving the 17 Sustainable Development Goals. These goals are targeted towards efforts of gender equality, clean energy, sustainable infrastructure, responsible consumption, environmental actions, peace and justice (Sachs, 2023). Many of these goals build on the ESG pillars, and the fact that the top three countries on the list's ranking are all nordic indicates that these countries are more committed towards ESG than the rest of the world. What's more, as mentioned in the introduction, the first green bond was issued by the world bank as a direct consequence of a Swedish pension fund expressing their interest and intentions to invest in climate friendly projects (The World Bank, 2021). As early as 2005, the Norwegian government passed a law enforcing a 40% gender quota for large and mid sized firms. In an attempt to make corporate boards more gender neutral and to improve governance, this law meant that firms had to have at least 40% of board members be women (Reuters, 2023). The Nordic countries also subsidize and stimulate environmental projects. The Finnish government, for example, has set aside funds that are specifically going to

be used for utilities, energy, infrastructure and research projects that are environmentally friendly and sustainably aligned (Ministry of Economic Affairs and Employment of Finland, 2022).

According to S&P, (2023) ESG bonds are the most popular in Europe where the issuance volume of ESG bonds is about five times higher than the issuance volume in North America. Comparing the volume of ESG bond issues to the total number of bonds in Europe in 2023, ESG bonds accounted for 17.4% of all corporate bonds issued (AFME, 2023). When comparing this to the Nordic region however, we see that the total issuance of ESG bonds in comparison to all corporate bonds issued amounted to 40% in the first quarter of 2023 (Nordsip, 2023). This further strengthens the assumptions that there is an extensive interest in sustainable forms of financing in the Nordic region compared to the rest of the world, making it a fittable region to conduct our study in. When looking at previous literature, most studies have been conducted globally or on the American market (Zerbib, 2019; Flammer, 2022; Tang & Zhang, 2020). The primary motive for conducting research in these areas is that larger geographic regions tend to provide a bigger sample size. This is reasonable considering that the issuance of ESG bonds has been relatively limited until 2021, when it doubled globally (Climate Bonds Initiative, 2024).

The Nordics is an eminent market regarding regulators, investors, and corporations demonstrating a distinct interest in sustainable practices. This heightened awareness has likely contributed to the growing popularity of sustainable financing, particularly for ESG bonds, which now form a significant component of corporate funding in the Nordic region. By focusing our study on the Nordic markets, we have the opportunity to contribute to existing literature by offering insights into how these markets differ globally, thereby aiding decision-making and laying the groundwork for future research.

3. Literature Review

3.1 Sustainability-Linked Bonds Premium

Even if green bonds and SLBs are relatively new financial instruments, some research has been made on the subject. One example of such a study is conducted by Kölbel and Lambillion (2022) who look at the yield to maturity of SLBs compared to regular counterparts. Their results suggest that SLBs trade at a premium of 31 basis points compared to similar conventional bonds for SLBs issued in 2021. An interesting take away from this study is that SLBs mainly benefit the issuer, as Kölbel & Lambillion (2022) find that the cost of debt is so much lower for SLBs that the premium outweighs the penalties that will incur if the issuer fails to meet the preset goal of the SLB. They also note that the premium is highest at the initial issuance of an SLB but decreases over time. This decline is due to the strong signal of commitment to sustainability that accompanies the first issuance. As additional SLBs are issued, the signaling value gradually diminishes. Kölbel & Lambillion uses a bond matching principle with 145 SLB observations. Liberadzki et al. (2021) explore a similar topic, comparing Tesco with Carrefour. Since the companies are similar with regards to their risk profiles and business models, by comparing the SLBs of Tesco with the conventional bonds of Carrefour, the premium of the SLB can be observed. In line with Kölbel and Lambillion (2022), they find a difference in yields and that even if companies fail to meet the targets of the SLB, the yield will still be lower than the corresponding regular bond for its competitor.

Affolter et al. (2024) adds to previous studies by investigating whether investors perceive investments in sustainability as value-creating. They analyze the issuance of SLBs and their impact on stock prices. Their findings indicate no significant effect when the goals are tied to greenhouse gas emission reductions, though there are effects on market valuations when the goals are related to other sustainability goals. Additionally, they find no significant connection between the bond issuance and the company's ESG rating. Furthermore, Berrada et al (2022) adds to the literature as they test multiple mechanisms that affect how SLBs are priced. Comparing the price of an SLB at issuance with the price of the same SLB on the secondary

market they find that SLBs tend to be overpriced at issuance. This results in a price decrease on the secondary market, creating value for the owners of the company at the expense of investors.

3.2 Green Bond Premium

While SLBs are quite new financial instruments, green bonds have been around for some time, and more research exists on the subject. Zerbib (2019) investigates if there is a yield differential between green bonds and conventional ones between 2013 and 2017. He finds that green bonds on average trade at yields of 2 basis points lower than conventional ones. The main determinant of the premium is credit rating and issuer type, where the differences are most pronounced for bonds issued by firms with low credit ratings in the financial industry. Zerbib's sample consists of 110 green bonds of all kinds, such as supra-national, sovereign, corporate, financial etc. His research method consists of matching synthetic conventional bonds with green bonds from the same issuer. Characteristics that determine a bond's price are the same and the maturity has to be within two years of the issuance of the green bond. Similarly, Tang & Zhang (2020) examine stock reactions concerning green bond announcements, aiming to determine whether the stock price reflects the reduced cost of debt associated with the projects linked to the green bond. Like Zerbib (2019), they discover a green premium of 6.94 bps when analyzing corporate bonds issued by peers. However, when comparing yield spread within the same firm and year, they find no significant effect and conclude that the stock's increase is not driven by lower cost of debt. One important conclusion is that firms issue green bonds to increase or keep a high ESG score (Tang & Zhang, 2020). They examine a total of 1500 bonds during the period 2007-2017, and compare each bond with a conventional bond issued by the same public firm in the same year. They have a total of 241 public issuers of which 132 are unique.

In *The green corporate bond issuance premium*, Carmichael & Rapp (2024) thoroughly investigate the yield spread between green and conventional corporate bonds at issuance during the years 2014-2021. They collect a sample of 1169 green and 129 043 conventional bonds. They use a fixed-effects regression, but do a control of matched samples, containing 249 green bonds, where they find no differences in the results. They find that green bonds have a yield spread between 3 and 8 basis points lower compared to conventional bonds. Comparing green bonds with conventional bonds, this means that green bonds have an average of 2-7 percent lower

borrowing costs. They only find a significant "greenium" between 2019 and 2021, which tightens gradually from 15 to 8 basis points and find that this effect is the most prevalent in large investment grade firms. They state a variety of reasons for this, but hypothesize that this is mainly due to the imbalance in supply and demand for sustainable bonds, and argue that EU's new regulations and broad finance policies might have impacted the demand. They further conclude that lenders investing in green bonds care less about the likelihood that the funds will be used for the stated purpose and more about the fact that the bond is classified as green. Lastly, they find that firms issue green bonds to be perceived as more environmentally aware rather than actually caring about shifting towards more environmentally beneficial operations. In contrast to Carmichael and Rapp (2024), looking at both the primary and secondary market Kapraun et al (2021), finds a significant premium of 15 points for governments and supranational issuers and a non-significant 4 bps yield differential for corporate issuers. This difference is mainly attributed to the fact that supranationals and governments are more credible in the sense that they are less prone to use the proceeds of the green bond issue for non-green investments. They also find a significant yield difference for the variabel ESI rating, which is an ESG score for countries, but nothing for ESG score, even if the results indicate a premium between 7 & 9 basis points in yield reduction for companies with high score compared to companies with lower. Kapraun et al (2021) uses both matched bond pairs and general regression on the secondary market, with 1500 green bonds in their sample and 20 000 regular ones.

In *Corporate green bonds*, Flammer (2021) tries to uncover if investors are willing to sacrifice returns for societal benefits and if so, what factors determine the investment. The article covers the years 2013-2018 and is very extensive, covering both green bond yield compared to conventional bonds and stock market reactions to issuance of green bonds. Similarly to Tang & Zhang (2020), Flammer (2021) finds a positive reaction in stock prices following firms announcing green bond issuances and reporting decreases in CO2 emissions. More importantly, she finds no premium at all between corporate green and conventional bonds. In her sample, she has a majority of issuings during 2016-2018, which is the same as many other authors in this review with low or no significance. She has 1189 bonds in her sample, with 400 unique issuers.

Baldi & Pandimiglio (2022) also tries to uncover if there is significant difference in yields for green bonds, but look at it from the perspective of ESG scoring. They elaborate on how YTM differ when there is a higher risk of greenwashing, where the greenwashing risk is measured by an interaction variable calculated as a product of the ESG score and the sector dummy. They hypothesize that the risk of greenwashing is greater in the manufacturing sector compared to the service sector. Explanatory variables used in the study are sector, greenwashing risk and ESG score. Their findings indicate that investors on average accept a 0.76% reduction in yield for one unit increase in ESG score. Their research also shows a 40.64% lower yield for green bonds in the service sector compared to the manufacturing industry, and a 0.75% higher risk of greenwashing in the manufacturing sector compared to the service sector. Baldi & Pandimiglio (2022) control for volatility, S&P rating and maturity in similarity with Zerbib (2019) and Tang & Zhang (2020), They examine international bonds, with the majority issued in Europe by SNATs (Baldi & Pandimiglio, 2022).

When looking at green bonds compared to conventional bonds, Hachenberg & Schiereck (2018) find that green bonds tend to trade at lower yields than conventional bonds. When comparing different sectors, the difference in yield is the most prevalent in the financial sector and among government issues. Additionally, they find that the reason for the variation in premium stems from the ESG rating and the type of industry the issuing firm operates in. This indicates that the industry affects the perceived value of the signaling achieved by issuing green bonds. Notably, they use a sample consisting of 63 green bonds which is quite low compared to other studies by for example Tang & Zhang (2020) and Zerbib (2019).

Larcker & Watts (2019) researches high vs low ESG rating and bonds, but examines only American municipal bonds due to their large issuing. They write that no “greenium” at all is to be found, and further states that investors' reluctance to forgo returns in favor of backing environmentally sustainable initiatives is to be blamed for this. Furthermore, they observe on average 10% higher underwriting cost for issuing green bonds, as investment banks perceive them as riskier, which in turn is incompatible with the cheaper borrowing cost argument. They have a total of 640 pairs, also matched against a conventional bond.

Larcker & Watts (2020), has done one of the most comprehensive researches of sustainable bonds to date on the US market. They find no premium, but most importantly, they also uncover something else. Even if some researchers find a very small premium for green bonds and SLBs at issuing, and only under certain circumstances, the premium occurs in the secondary market. This is because many green bonds are issued in bundles. Baker et al (2022) have a mix of corporate green bonds and municipal bonds, where one third of their 3900 green bonds are issued on the same day as conventional ones from the same firm. These are oftentimes issued with the same yield and state the same purpose for use of the proceeds. The bundles issuance has its advantages, for example the marketing effort when selling your bonds. When bonds are not issued in bundles, there is a higher probability of a premium (Baker et al, 2022). This is further supported by Larcker & Watts (2020), as they have 85% of their sample with exactly zero spread.

3.3 Signaling value of ESG Scores

Pandimiglio & Baldi (2022) writes that ESG ratings and green bond market has improved significantly over the last years in the sense that the ratings have become more trustworthy. They continue by saying that the independent certification reduces information asymmetry and that green bond issuers, through signaling their ESG commitment, can enhance their value creation and benefit shareholders. However, they also state that rating agencies need to improve their rating models to better capture the greenwashing risk embedded in issuing green securities. Looking at the effect that ESG scores have on YTM of corporate bonds, their analysis indicates that a one point increase in a firm's ESG score, on average, leads to the YTM of that firm's bonds to drop by 0.76%. This indicates that the ESG score also carries signaling value and that investors seem to be willing to pay more for bonds issued by firms with high ESG scores.

Furthermore, Asimakopoulos et al. (2023) conclude that an ESG rating provision reduces information asymmetry, but more importantly functions as a signaling mechanism to the market, which enables corporations to achieve safer financing, i.e moving up the pecking order ladder and lowering their risk. They find that ESG scores carry signaling value and that firms simply getting an ESG score affects their cost of debt. Furthermore, they conclude that firm's borrowing costs from issuing bonds decreases by 6.7% for every one percent increase in ESG score.

Because they use the natural logarithm of the ESG score the findings are hard to compare to those of Pandimiglio & Baldi (2022), but both papers suggest that an increase in ESG score, subsequently leads to lower borrowing costs through bond issues.

From the above, it seems like both SLBs and green bonds usually trade at lower yields compared to conventional bonds. The size of the premium varies depending on factors regarding the specific issue as well as the issuing firm. Research also shows that an increase in ESG scores usually leads to lower Yields for a firm's bonds as this metric reduces information asymmetry. For a specified summary of the findings and circumstances of each paper provided above, please refer to table 1.

4. Hypothesis Development

Previous research indicates that green bonds trade at lower yields compared to regular ones (Tang & Zhang, 2020; Zerbib, 2019; Carmichael & Rapp, 2024; Kapraun, 2021). However, the results differ based on the setting of the study and the time period when it was conducted. As the sustainable bond market is undergoing rapid changes, it becomes interesting to study how these changes impact the premium of ESG bonds. This paper aims to contribute to the existing literature, by providing new perspectives and a deepened understanding for ESG bonds. As presented above, although studies exist on the topic, most previous papers focus on green bonds, and with the introduction of SLBs, further research on SLBs and green bonds is needed to broaden the knowledge within the field. In similarity to Zerbib (2019) we aim to study the premium of ESG bonds. What sets us apart from them and most previous research however, is that this paper includes SLBs as well as green bonds in the analyzed sample. As Carmichael & Rapp (2024) state in their paper, the results are most pronounced between 2019-2021, and therefore we might get a different result compared to studies made in earlier years. As discussed in previous sections, ESG bonds are increasing in popularity and by looking at bonds issued from 2022 to 2024, in addition to the years already analyzed by previous researchers, we hope to contribute with new findings. Looking at the findings of Kölbel & Lambillion (2022) and Zerbib (2019), SLBs and green bonds seem to be trading at higher prices than conventional bonds as these types of bond issues carry signaling value about the firm's commitment to sustainable practices, establishing a clearer picture of the riskiness of the bond. As the surfacing of SLBs is quite recent and because the field is not extensively studied, we add to previous literature by also including SLBs in our sample, to study whether the premium found by previous researchers exists when looking at ESG bonds as a group. Our first hypothesis therefore aims to investigate whether ESG bonds do in fact trade at higher prices than conventional bonds:

Hypothesis 1: ESG bonds have a lower YTM than conventional bonds.

Similarly to ESG bonds, ESG scores also seem to carry signaling value about a firm's commitment to sustainability. Looking at the findings of Baldi & Pandimiglio (2022), they find that the increase of a firm's ESG score does lead to a decrease in the YTM for the firm's bonds.

This is also found by Asimakopoulos (2023) who argues that an ESG rating reduces information asymmetry because it signals dedication towards sustainable investments. This signal adds value for investors and leads to a reduced cost of debt. Baldi & Pandimiglio (2022) also argues in favor of the signaling value that an ESG score carries, and claims that it reduces the risk of greenwashing. Previous studies that test this hypothesis also state that ESG scores fill an important role when it comes to its impact on the premium on green bonds (Baldi & Pandimiglio, 2022; Hachenberg & Schiereck, 2018; Kapraun, 2021). Drawing upon this, it seems like an increase in a firm's ESG score increases transparency towards investors and leads to more favorable terms for the issuers of bonds, resulting in firms being able to reduce their cost of debt. Building on previous literature, we also aim to investigate whether this holds. Most previous researchers have studied this relationship in a green bond context or a conventional bond context, whereas this study looks at ESG bonds more broadly, including both green bonds and SLBs in our sample. If there is in fact value in committing to sustainable projects, this should mean that a higher ESG score leads to a lower YTM as investors value the bonds higher because information asymmetry is mitigated when firms signal about their ESG commitments. Similarly to Baldi & Pandimiglio, (2022) we will be looking at the relationship between an increase in ESG scores and the effect this has on a firm's YTM as a proxy for the effect of ESG scores on firms' cost of debt. Thus our third hypothesis is formulated as follows:

Hypothesis 2: An increase in ESG score leads to lower YTM for corporate bonds.

As discussed above, previous research indicates that by issuing ESG bonds, firms should be able to reduce their cost of debt. Previous research also finds that an increase in a firm's ESG score leads to a lower cost of debt. The reason behind these findings seems to be attributable to the fact that both the ESG issuance and the increase in ESG score, carries signaling value about how sustainable the firm's projects are (Baldi & Pandimiglio, 2022; Zerbib, 2019; Asimakopoulos, 2023; Tang & Zhang, 2020). Sustainability and ESG are of course broad fields and the information that an ESG bond issue signals might very well differ from the information that is signaled by firms improving their ESG scores. But because both these actions essentially signal about a firm's ESG commitments, some of the information signaled by issuing ESG bonds, might also be signaled by increasing a firm's ESG ratings. Because both the ESG score, and the

issuance of ESG bonds, signals to investors about a firm's ESG commitment, we hypothesize that the added benefit of issuing ESG bonds should be lower for firms with high ESG scores compared to those with low ESG scores. The reasoning behind this is based on the fact that the firms with high ESG scores have already signaled their commitment to sustainability. Thus, by issuing ESG bonds, the firm is not mitigating information asymmetry as much as a firm with a low ESG score, since the information signaled through the ESG bond issue, has already been signaled through the high ESG score. This hypothesis builds on the findings of Kölbel & Lambillion (2022). They find that the first SLB issue is usually attributed a larger premium than subsequent SLB issues. They argue this is due to the firm already having signaled their intention to engage in sustainable projects with their first SLB issue, and thus the subsequent issues do not signal as much new information as the first issue did. From this, we argue that the added benefit of issuing ESG bonds should be diminishing as a firm's ESG score increases, formulating the following hypothesis:

Hypothesis 3: The marginal benefit of issuing green bonds is lower for firms with high ESG scores compared to firms with low ESG scores.

5. Methodology

5.1 Econometric Approach

5.1.1 Multivariate analysis

This study aims to investigate whether firms can achieve a lower cost of debt as a result of issuing ESG bonds instead of conventional bonds and if the marginal effect on the YTM of these bonds is lower for firms that already have high ESG scores. To arrive at a conclusion on whether this relationship actually exists, we need to study the causality between the explanatory variable and the dependent variable. In this study we use a Pooled Ordinary Least Squares (POLS) estimation to study this. The POLS regression can be seen as an extension to the Ordinary least squares (OLS) estimator, as it estimates the best fitting regression line for the sample provided to predict coefficients of the model variables. This is done by minimizing the sum of squares of the differences between the observed values (Stock & Watson, 2020).

When a model is estimated in a way such that it minimizes the sum of the squares of the residuals, it is said to be the Best Linear Unbiased Estimator (BLUE). This is hopefully achieved when applying OLS. However, for the OLS to be BLUE, there are some assumptions that should not be violated. These assumptions are that: the regression model is linear in its parameters, the sample used is randomly selected, the conditional mean is zero, no multicollinearity and no autocorrelation. Although these assumptions need to be upheld for the OLS to be BLUE, when an assumption is violated, there are some measures to take to make the model robust (Stock & Watson, 2020; Albert, 2022).

The difference in using POLS instead of OLS is that the data structure is interpreted and handled differently. When using POLS, the estimation adjusts for the panel structure of the data, pooling the data across different cross sections. This is appropriate when the data is organized in a panel structure, as the main interest in such cases is understanding how the dependent variable is influenced by changes in variables within groups. Thus, the use of POLS clarifies the overall data trend, accounting for the different groups in the panel data. (Woolridge, 2016; Stock & Watson, 2020).

In this study we aim to investigate the effect that ESG bond issuances and increases in ESG scores have on Yield to Maturity (YTM). To do this we need an estimation method that allows us to study whether a causal relationship exists between these variables. Our data is in a panel structure but since the YTM is taken from the same point in time we do not have time series data (Stock & Watson, 2020). Since this is the case, by using POLS, the data will be treated as a large cross sectional dataset, allowing us to capture the general trend and the impact of ESG bond issues and increases in ESG scores on the YTM of the bonds in our sample. To do this we develop different models to test our different hypotheses to see whether a causal relationship exists in the way that is hypothesized.

In our first model we aim to test our first hypothesis, comparing the YTM of ESG bonds to that of conventional bonds. To do this we set the *YTM* as the dependent variable and the *ESG bond* variable as the main explanatory variable. In addition to this we also add control variables. These are variables that are assumed to affect the *YTM* of bonds and are added to improve the models ability to explain the variance in *YTM* across observations. If the coefficient of the *ESG bond* variable is negative, it indicates that ESG bonds on average have lower YTMs than conventional bonds. This in turn means that ESG bonds are more expensive than conventional bonds, indicating that investors are willing to pay more for these issues, thereby reducing the firm's cost of debt.

Model 1 (Hypothesis 1)

$$Yield\ to\ Maturity_i = \beta_0 + \beta_1 esgbond + \beta_2 controls + \mu_i \quad [1]$$

In the next model the main explanatory variable is the *ESGScore*. By adding the ESG score to the model, we expect to see two things. The first one is the effect that an increase in ESG score has on a bond's YTM. The second thing we will look for is if the addition of this variable changes the coefficient of the ESG bonds variable. If the *ESG bond* variable changes, this might insinuate that some of the variance in YTM that is explained in model 1 might actually be attributable to the firm's ESG score. Furthermore, like the model above, we also include control variables to strengthen the model's coefficient determination. In similarity to the *ESG bond*

variable, a negative coefficient for the variable *ESGScore* indicates that firms with higher ESG scores can achieve lower YTMs on their bonds issuing, thereby indicating their ability to more extensively access cheaper debt.

Model 2 (Hypothesis 2)

$$Yield\ to\ Maturity_i = \beta_0 + \beta_1 ESGScore + \beta_2 esgbond + \beta_3 controls + \mu_i \quad [2]$$

In the last model the main explanatory variable is now *highesgxesgbond*. This variable is activated when a firm has an above average ESG score and has issued an ESG bond. Its coefficient indicates the difference in YTM between ESG bonds issued by firms with low ESG scores compared to those issued by firms with high ESG scores. By still including the ESG bond and ESG score variables on their own as well as adding the *highesgxesgbond*, we change the way the coefficients of these variables should be interpreted. The ESG bond variables coefficient now represents the change in *YTM* when comparing ESG bonds issued by firms with below average ESG scores with conventional bonds. To arrive at the total effect that ESG bond issuances have on firms with high ESG scores one has to add the coefficient of the ESG bond variable to the highest score variable. What this means for the interpretation of the model is that a positive coefficient in the *highesgxesgbond* variable indicates that the marginal benefit of issuing ESG bonds is lower for firms with high ESG scores compared to firms with low ESG scores.

Model 3 (Hypothesis 3)

$$Yield\ to\ Maturity_i = \beta_0 + \beta_1 highesgxesgbond + \beta_2 ESGScore + \beta_3 esgbond + \beta_4 controls + \mu_i \quad [3]$$

Consistent across all three of our models is the error term represented by μ_i. This term represents the variables that are left out of the model that still have an effect on our dependent variable. In our case it can be said to represent the factors that might be needed to explain all the variance in YTM between our observations. Another thing kept constant is the inclusion of β_0. In our case this has no economic significance but merely represents the point where the estimated regression line crosses the Y-axis (Stock & Watson, 2020).

5.1.2 Dependent variable

In this study, in similarity to Baldi & Pandimiglio (2022), the *Yield to Maturity* (YTM) will be used as the main explanatory variable. According to Koller et al. (2020), the YTM of a firm's long term current bonds is a good proxy for a firm's cost of debt, as it shows the cost of raising new debt today. In a bond setting, the YTM is the minimum rate of return that investors demand when investing in a bond (Investopedia, 2024). Three main components determine the YTM: the price, the coupon rate and the time to expiration. Since the coupon and time to expiration is usually set beforehand, the central component in this study is the price of the bond. A higher YTM indicates that investors are demanding more in return for lending funds to a specific firm or project. The demand for higher returns indicates that the specific project is riskier than a bond with a lower YTM. Thus, comparing two bonds where the YTMs are different should in theory mean that their risk profiles are different (Baldi & Pandimiglio, 2022). As outlined by Baldi & Pandimiglio (2022) and Zerbib (2019), by observing how the yield differs between bonds and firms with different characteristics, we can see whether those characteristics contain any signaling value that may mitigate or increase the perceived riskiness of the bond. One thing to consider when looking at YTMs is that the yield from when the bond was issued can change because the price in the secondary market is affected by, for example, changes in the risk free rate and credit rating of a company (Kapraun et al., 2021). However, as we are interested in the signaling value of ESG commitments and its implications on bond yields compared to conventional bonds, we look at the current YTM. By looking at the current YTMs of bonds, we increase the comparability between the bonds in our sample, as the market climate is as similar as possible for all of our observations when gathering the YTMs from the same point in time, as previously done by Zerbib (2019).

5.1.3 Explanatory variables

In our regression, we have three explanatory variables. These are *ESG score*, *ESG bond* and the interaction variable *highesgxesgscore* which looks at ESG bonds issued by firms with above average ESG scores. The first variable, *ESG bond* is a dummy and is equal to 1 if the bond is an ESG bond, in similarity with several other papers (Flammer, 2021; Caramichael & C. Rapp, 2024; Larcker & Watts, 2019). The coefficient of this variable will indicate the average difference in YTM that ESG bonds trade at compared to conventional bonds.

Our second dependent variable is *ESGScore*. The *ESGScore* variables coefficient will show the increase (or decrease) in *YTM* when a firm's ESG score increases by one unit. As described in section 2.2, the ESG score is a combined score of how the firm performs based on the three pillars Environmental, Social and Governance. This is set by rating agencies and was extracted together with the rest of our bond data. As outlined in section 3 its effect on YTM has been studied and established by previous researchers within the context of signaling about a firm's sustainability commitments (Baldi & Pandimiglio, 2022; Antonopoulos et al, 2022; Berrada et al, 2023).

We also include the interaction variable *highesgxesgbond* to test hypothesis 3. This variable consists of the dummy variables High ESG score and ESG bond multiplied by each other. The High ESG score part is equal to one when an issuing firm has an ESG score that is above the average for the sample. The ESG bond part is equal to 1 if the bond is an ESG bond. Thus the variable *highesgxesgbond* is equal to 1 only for ESG bonds issued by a firm with an above average ESG score. While Kapraun et al. (2021) use an interaction variable to capture country effects among sovereign bonds, and Baldi & Pandimiglio (2022) employ a similar variable to account for greenwashing risk by multiplying the ESG score with a sector dummy, our approach is unique. We use an interaction variable to test the marginal benefit of issuing ESG bonds for firms that already have high ESG scores.

5.1.4 Control variables

In addition to our explanatory variables, we also include both firm specific and bond specific variables, in order to create models that explain as much of the variance in our dependent variable as possible. The bond specific variables included are: *coupon, issuance year, maturity* and *amount issued*. The firm specific variables include: *industry, country of incorporation, debt coverage, leverage, return on assets* and the *assets* of the issuing firm.

Like Flammer (2021) and Larcker & Watts (2020), we control for the coupon of the bonds, as it accounts for the periodic payments that owners of bonds receive (Caramichael & C. Rapp, 2024). The same reasoning goes for maturity of the bond as the maturity can greatly differ and

affects the yield depending on how long investors need to wait to get the final bond payment. We further control for the amount issued. Assuming that an increased supply of a security leads to a lower price (keeping demand constant), this should lead to higher YTMs for larger issues as you want a full subscription (Caramichael & C. Rapp, 2024).

Moving on to the firm specific variables, assets is a proxy for company size (Antonopoulos et al, 2022). As sustainable bond issuers tend to be larger than conventional bond issuers, assets may provide meaningful insight in how YTM in the context of this study is affected by a company's size. Incorporated as a control variable is also debt coverage. Debt coverage is measured as the EBITDA divided by the amount of debt and is expressed as a ratio (Mazars, 2021). This ratio is a very important measurement as it is directly correlated to the firm's ability to meet debt payments, hence affecting the credit risk (Antonopoulos et al, 2022). We also control for the amount of leverage, which is arrived at by dividing total debt with total assets. This ratio does not consider cash flow and does not catch the short term payment capacity but rather focuses on the assets that can be used to cover the firm's debt if they struggle to meet debt payments. However, this is also something that impacts the credit risk of the firm. Return on assets gives a proxy for the profitability of a firm and is incorporated as a determiner of the issuer's quality (Li et al, 2020).

5.2 Statistical Tests

5.2.1 Univariate analysis

The sample description part in our data chapter will focus on breaking down our sample and the variables included. The summary statistics chapter will further provide insight in how our data is distributed and if any skewness is present. By conducting a pairwise correlation test we can see whether our variables are intercorrelated. If variables turn out to be highly correlated, adjustments might have to be made to the estimation methods to assure the model's reliability. We will also run a VIF test to further identify the presence of multicollinearity.

5.2.2 Heteroscedasticity test

To check for heteroscedasticity, we conduct a White's test. This test looks at the errors in the model and estimates if the variance of these errors is constant across observations If this is the case the model is homoskedastic but if the variance of the residuals is not constant then the model suffers from heteroskedasticity. If the p-value is less than 0.05 the model is assumed to be heteroskedastic and to adjust for this, the model might have to be estimated using robust or cluster standard errors. The use of robust standard errors adjusts for within cluster correlation to adjust for the fact that the variance between the variables is not constant (Woolridge, 2016).

5.3 Robustness Check

The robustness of results is ensured by a few measures taken. For starters the regressions ran will introduce new control variables in stages to see how these affect and change the outputs of our models. The different results are then compared and we see how the addition of different control variables interact with the main explanatory variables. Furthermore, we also use robust standard errors instead of regular standard errors. This is important since it adjusts for potential heterogeneity in the variance of residuals. By changing the models assumptions to allow for different variance across different observations, the use of robust standard errors assures robustness of standard errors even when heteroskedasticity is present. Taking it one step further we also cluster the standard errors. The use of clustered standard errors adjusts for within cluster correlation. If not addressed, this heterogeneity could make the standard errors unreliable (Stock & Watson, 2020). This is important because our panel data includes multiple bonds issued by the same firm. Since numerous firm-specific characteristics influence the YTM of a firm's bonds, we face the risk of autocorrelation among bonds issued by the same firm (Caramichael & Rapp 2024). Thus, by clustering by firm, implementing clustered robust standard errors, we adjust for both heteroskedasticity and within cluster autocorrelation, ensuring that the significance tests and outputs of the model are robust and accurate (Stock & Watson, 2020).

6. Data and Sample Descriptions

6.1 Data Collection

As a first stage of collecting data for the study, we screened for all corporate bonds issued by Nordic firms from 2021 and onwards using the Refinitive eikon terminal. By only looking at years where SLBs were issued, we assure that they are as accurately represented in our sample as possible. Furthermore, we only looked at public firms as well as firms that had an ESG score rating and where the industry of the issuing firm was known, which provided a sample of 546 bonds of which 178 were ESG bonds. We then disregarded observations where we could not access data on the company's debt, assets or EBITDA. This left us with a total of 474 observations in which 150 were ESG bonds.

6.2 Sample Description

To study if ESG bonds trade at higher YTMs than conventional bonds, we collected both conventional bonds and ESG bonds in our sample. The distribution between ESG bonds and conventional bonds is displayed in table 2 and as shown, the sample consists of 150 or 31.65% ESG bonds and 328 or 68.35% conventional bonds. Although the distribution shows that most of the bonds in the sample are conventional, the sample still contains a significant number of ESG bonds and further confirms the assumption that ESG bonds are an appreciated form of financing in the Nordic region.

Table 2: Distribution between bond types

	Freq.	Percent	Cum.
Conventional	324	68.35	68.35
ESG Bonds	150	31.65	100.00
Total	**474**	**100.00**	

The distribution between green bonds and SLBs in our sample is shown in table 3. We see that 20 of the ESG bonds are SLBs, 89 are CBI aligned green bonds, 40 are self-labeled green bonds and 1 is a social bond. Social bonds have not been discussed previously but are a type of ESG bonds although not very commonly used. Since there is only one in the sample we don't view it

to have a significant effect on the findings of the study and chose to keep it as it is an ESG bond and omitting it runs the risk of making our models biased. The SLBs only represent around 13.5% of the ESG bonds in the sample, which means that they are not represented to as large of an extent as green bonds. This is because green bonds have been around for a long time and are more popular than SLBs, even though SLBs are becoming increasingly popular. Consequently, since most ESG bonds are green, the distribution observed in our sample is assumed to be representative of ESG bonds in general.

Table 3: Tabulation of ESG bonds

ESG Bond Type	Freq.	Percent	Cum.
CBI Aligned Green bond	89	59.33	59.33
Self-Labeled Green Bond	40	26.67	86.00
Social Bond	1	0.67	86.67
Sustainability Linked Bond	20	13.33	100.00
Total	**150**	**100.00**	

The sample used in this study is collected from the nordic countries of Denmark, Finland, Norway and Sweden. As can be seen in table 4, most of the bonds in the sample are issued by corporations that are incorporated in either Sweden or Norway, with 214 of the samples bonds coming from Swedish firms and 200 bonds coming from Norwegian firms. Further only 28 and 32 bonds were issued in Denmark and Finland respectively.

Table 4: Distribution between countries

Country of Incorporation	Freq.	Percent	Cum.
Denmark	28	5.91	5.91
Finland	32	6.75	12.66
Norway	200	42.19	54.85
Sweden	214	45.15	100.00
Total	**474**	**100.00**	

Furthermore we include bonds issued by firms in a multitude of industries. These are displayed in table 4 and show that there are two industries that are represented to a significantly higher degree than the others. These are the banking and real estate sectors. Both real estate and banking are very capital intensive. This creates a need for raising capital, and since bond issuances are a

common method for doing so, it is unsurprising that these industries are overrepresented in our sample. Otherwise the distribution between industries is fairly even as expected.

6.3 Statistical Analysis

6.3.1 Summary Statistic

The summary statistic presented in table 6 provides an overview of the sample used when conducting the regressions. As can be seen, the sample consists of 474 observations and the table further provides measures like means, medians, minimum values, maximum values and standard deviation. The results indicate the presence of extreme values from the inclusion of outliers. Not addressing these outliers makes the estimation models less efficient and makes the results less accurate. However, simply omitting these variables is not an alternative as this would lead to omission bias since the sample is no longer truly random (Stock & Watson, 2020). Instead we address these outliers by winsorizing the variables where extreme values are present. In our sample these variables are *Yield to Maturity*, *Assets, Maturity year* and *Amount Issued*.

Table 6: Descriptive Statistics Pre Winsorization

Variable	Obs	Mean	Median	Std. Dev.	Min	Max
Yield to Maturity	474	6.337	5.597	3.733	1.552	42.812
ESG Score	474	54.288	52.792	17.597	9.746	89.913
ESG Bond	474	0.316	0	0.466	0	1
High ESG score	474	0.441	0	0.497	0	1
highesgxesgbond	474	0.148	0	0.355	0	1
Coupon	474	5.34	5.383	2.027	0	12.87
Debt Coverage	474	0.313	0.147	0.488	-0.562	3.311
Leverage	474	0.326	0.33	0.147	0.027	0.689
Return On Assets	474	0.065	0.039	0.059	-0.235	0.223
Assets (mUSD)	474	50676.567	8266.613	136840.59	78.136	645273.88
Amount Issued (mUSD)	474	90.321	67.496	75.27	14.189	542.7
Maturity Year	474	2029.534	2027	45.819	2024	3022

**For variable explanation see table 13*

Implementing these changes into our dataset, we get the results displayed in table 7. As can be seen, the *Yield to Maturity* variable varies from 1.74% for the most expensive bond, to 25.33% for the cheapest bond. *High ESG score* has a mean of 0.445 indicating that 44.5% of the firms in the sample have an above average ESG score. It also shows that the *highxesgbond* variable has a mean of 0.152 indicating that 15.2% of the ESG bonds in our sample were issued by firms with high ESG scores. The *Coupon* rate varies from 0 for zero coupon bonds to 12.87 for the bond that pays the highest annual coupon. The *Debt Coverage* variable has an average of 0.313 indicating that the average firm in the sample can cover 31.3% of their current debt with their current EBITDA. The *Leverage* has an average of 0.326 which means that the average firm's debt amounts to 32.6% of that same firm's assets. The *Assets* vary between 1.12 billion USD for the firm with the least assets to around 340 billion USD for the firm with the most assets. The *Amount Issued* variable shows that the average bond issue amounts to 85.1 Million USD. Comparing the results in table 7 with those of table 6, we see that the max and min values have changed and the spread between them has shrunk. This is also displayed by looking at the mean and median values which are closer to each other after these variables have been winsorized, leading to a more normalized distribution among observations.

Table 7 also shows some indication of skewed distributions in some variables. Looking at the variable *Assets*, the median value is significantly lower than the mean. This indicates that the distribution in this variable might still be skewed. The same applies to the *Amount Issued*, where the median is significantly lower than the mean, suggesting a skewed distribution. To address this issue, we use the natural logarithm of these variables to make the distribution more normalized. This means that the coefficient of these variables will represent the change in the dependent variable when the specific explanatory variables increase by one percent.

Table 7: Descriptive Statistics post Winsorization

Variable	Obs	Mean	Median	Std. Dev.	Min	Max
Yield to Maturity	474	6.26	5.597	3.151	1.736	25.326
ESG Score	474	54.288	52.792	17.597	9.746	89.913
ESG Bond	474	0.316	0	0.466	0	1
High ESG score	474	0.445	0	0.498	0	1
highesgxesgbond	474	0.152	0	0.359	0	1
Coupon	474	5.34	5.383	2.027	0	12.87
Debt Coverage	474	0.313	0.147	0.488	-0.562	3.311
Leverage	474	0.326	0.33	0.147	0.027	0.689
Return On Assets	474	0.065	0.039	0.059	-0.235	0.223
Assets (mUSD)	474	38588.61	8266.613	90482.071	1118	339387.28
Amount Issued (mUSD)	474	85.13	67.496	56.041	23.648	226.593
Maturity Year	474	2027.477	2027	3.644987	2024	2052

**For variable explanation, see table 13*

6.4 Intercorrelation Analysis

A correlation table provides insight on how the variables in the sample correlate with each other. If two or more variables correlated with each other in a significant way, this might indicate the presence of intercorrelation and might violate the assumption of independence among variables (Stock & Watson, 2016). In table 8 the results from a pairwise correlation matrix are displayed. The results show that the *ESGscore* variable is significantly correlated with *Yield to Maturity* with a coefficient of -0.192. As described in hypothesis 2 this was expected and shows that when disregarding all other variables, ESG score does seem to have an effect on the YTM of corporate bonds. Significant correlation with *Yield to Maturity* exists for all explanatory variables except *ESGbond*, *highesgxesgbond* and *Maturity year*. Although this indicates there is no significant relationship between these variables and *yield to maturity* on their own, it does not say anything about their effect in a context where other variables are also considered. Looking at the coefficients of the variables, all of them are negative except for *Leverage*, *Coupon*, and *Amount Issued*, indicating that all else ignored, an increase in coupon payments and amount issued leads to an increase in the bonds YTM making the bond cheaper. It also suggests that as firms increase their leverage, the YTM of their bonds increases and leads to the bonds being traded at cheaper prices.

Additionally, the correlation between *Leverage* and *Debt Coverage*, is highly significant with a correlation of -0.511. This is reasonable since they are both measures of a firm's debt levels. There is one important distinction between them in that *Debt coverage* shows the indebtedness in relation to the firm's earnings, while *Leverage* shows the indebtedness in relation to the firm's total assets. So although they explain some of the same variance, they also have features making them distinct to each other, making both relevant to the regressions. Further, the table shows that *Assets* are significantly correlated with the *Amount issued*. From an economic sense, this might be because bigger firms also have bigger issues, thus in a sense both these variables capture the size of the firm. There are some differences however. For example, the *Amount issued* is assumed to also capture the capital need of a firm. If the firm needs more capital they will likely issue more debt through bonds than if they did not need capital. This is exemplified looking at the highly significant and positive correlation between *Amount issued* and *Leverage*, indicating that firms with larger bond issues are generally more indebted.

Furthermore, looking at the correlation between *Assets* and *ESGscore*, and between *ROA* and *ESGscore*, it shows a strong and significant relationship. This indicates that larger and more profitable firms are more likely to perform well in sustainability measures, achieving higher ESG scores. This makes sense as larger firms are often more scrutinized than smaller firms, thus to avoid bad press and scandals, larger firms are more incentivized to invest in sustainability. Firms that are more profitable, likely have excess cash in addition to the capital needed for essential investments and therefore have more room to invest in sustainability than those with lower profitability. Additionally, there is also some high and significant correlation between *Highesg* and *ESGscore*. This is expected since *highesg* is simply a function for when an *ESGscore* is above average. The same thing goes for *highesgxesgbond*. Because this interaction term is a function of ESG bonds issued by firms with above average ESG scores, the significant relationship between *highesgxesgbond* and *ESGbond* and *ESGscore* is expected.

Table 8: Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) YieldtoMaturity	1.000													
(2) ESGScore	-0.192***	1.000												
(3) esgbond	-0.005	0.069	1.000											
(4) highesg	-0.138***	0.867***	0.048	1.000										
(5) highesgxesgbond	-0.036	0.404***	0.622***	0.472***	1.000									
(6) Coupon	0.465***	-0.143***	0.017	-0.120***	-0.048	1.000								
(7) DC	-0.178***	0.045	-0.123***	0.004	-0.008	-0.074*	1.000							
(8) Leverage	0.346***	-0.107**	0.186***	-0.036	0.035	0.253***	-0.511***	1.000						
(9) ROA	-0.182***	0.238***	-0.078*	0.092**	0.019	0.049	0.599***	-0.198***	1.000					
(10) Assets (mUSD)	-0.136***	0.260***	-0.150***	0.317***	-0.045	-0.180***	-0.155***	-0.015	-0.243***	1.000				
(11) (log) Assets	-0.287***	0.143***	-0.223***	0.192***	-0.110**	-0.299***	-0.134***	-0.071	-0.347***	0.812***	1.000			
(12) Amount issued (mUSD)	0.092**	0.095**	-0.044	0.151***	0.059	-0.030	-0.061	0.121***	0.020	0.214***	0.158***	1.000		
(13) (log) Amount Issued	0.084*	0.085*	-0.062	0.150***	0.059	-0.012	-0.043	0.095**	0.021	0.193***	0.161***	0.950***	1.000	
(14) Maturity Year	-0.039	0.010	-0.115**	0.066	-0.043	0.101**	0.081*	-0.247***	-0.095**	0.088*	0.163***	-0.015	-0.009	1.000

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

**For variable explanation, see table 13*

7. Results

Table 9 shows the first regressions of the paper containing models 1-4. These models only have *esgbond* as the main explanatory variable and vary between each other as certain controls have been removed and added. Looking at model 1, it displays the results of running the model with all the control variables included and using robust standard errors. The results indicate that all variables included in the model have a significant effect on the *Yield to Maturity* of corporate bonds. Using model 1, we conduct the white's test displayed in table 10, testing for heteroskedasticity. The results indicate the presence of heteroskedasticity, which as discussed in section 5.2.2 is adjusted for using robust standard errors. Going back to table 9, looking at model 2, the robustness is further strengthened by using clustered robust standard errors. This adjusts the standard errors to consider the panel structure of the data in addition to addressing the heteroskedasticity. The results show that the coefficients do not change from model 1 to model 2 but looking at the standard errors and significance, a change is observed. The model now shows significance for all variables except for the *Maturity year* variable. The results displayed in model 2 show a coefficient of -1.078 for the *esgbond* variable, significant at the 1% level. The results indicate that ESG bonds on average trade at 1.078 percentage points lower yields to maturity than conventional bonds. This finding indicates support for hypothesis 1, which states that ESG bonds have lower YTMs than conventional bonds, excluding the *ESGscore* variable.

Moving on to model 3 and 4, we make some adjustments to the control variables included in the regressions. In model 3 the *Assets* variable has been removed from the regression. As a highly significant correlation was identified between *Amount Issued* and *Assets*, an adjustment was made to see if the exclusion has an effect on the coefficient of *Amount Issued* and on the regression results in general. This adjustment results in the coefficient of *Amount Issued* going from 0.636 in model 2 to 0.447 in model 3. The significance of the variable's impact also drops and is insignificant in model 3 compared to being weakly significant in model 2. Additionally the effect of the *ESGbond* variable also changes, going from -1.078 in model 2 to -0.855 in model 3. Moving on to model 4, the country control has been removed from the regression. As is hypothesized in the background, there are some distinct characteristics that make the nordic countries ideal for this study. By excluding the country control variables, we can observe

whether there are any meaningful differences in how ESG financing is perceived between the Nordic countries. Looking at the results from model 4 however, the *ESGbond* variable changes slightly from -1.078 to -1.05 in model 4. Other variables like the effects of assets or debt coverage seem to be more affected by dropping the country control however.

Moving on to table 11 the regressions now also include the variable *ESGScore*. Model 5 includes all control variables as well as using clustered robust standard errors. The results show that including the *ESGScore* variable changes the effect of *ESGbond*. Looking at the coefficient and the significance for *ESGbond*, the significance drops from the 1% level to the 5% level and the coefficient goes from -1.078 to -0.969. The model also shows that the ESGscore variable has a weakly significant coefficient of -0.03. This result indicates that by increasing their ESG score by 1 unit, a firm can lower the YTM on their bonds by on average 0.03 percentage points. This finding supports hypothesis 2, that an increase in ESG score leads to lower YTMs of corporate bonds. The change in the coefficient of *ESGbond* further indicates that some of the variance in *Yield to Maturity* explained by the *ESGbond* variable in model 2 is actually attributable to the *ESGscore* variable. As is displayed in table 12, a VIF test is conducted. The test indicates if there are any variables causing multicollinearity in our regressions. The results from the test show that no variables cause severe multicollinearity, however the VIF for the variable *ROA* is at a level that is somewhat higher than desirable, and a regression will be conducted to test for the impact of this variable.

As discussed previously, the ESG score of a firm seems to be largely dependent on what industry the firm operates in. To test for this, moving on to model 6 we remove the industry control and observe that the effect of the *ESGScore* variable becomes insignificant and its coefficient goes from -0.03 to -0.009. Model 7 and 8 includes all the control variables but model 7 excludes the *ROA* variable and model 8 excludes the *Assets* variable. These regressions are run to control for the observed intercorrelation between *ROA* and *ESGscore* as well as the correlation between *Assets* and *ESGscore* that was found in table 8. The results of model 7 and 8 show that the exclusion of these variables does in fact have an effect on the coefficient and significance of the ESG score variable, further indicating that there exists some multicollinearity between these

variables. However, as discussed in section 6.4 they also differ and capture a substantial amount of unique variance and are therefore deemed suitable to keep in the main model.

Model 9 includes an additional variable to test hypothesis 3. Here the interaction variable *highesgxesgscore* captures the marginal benefit of issuing ESG bonds for firms with high ESG scores compared to firms with low ESG scores. The result shows that the *highesgxesgscore* variable has no significant impact on *YTM* on any level, and thus does not support our third hypothesis.

To summarize, the results presented above indicate that there is in fact a premium paid for ESG bonds compared to conventional bonds, indicating support for hypothesis 1. The results further provide weak support for hypothesis 2, indicating that an increase in a firm's ESG score leads to lower YTMs and lower financing costs. More specifically the results indicate that ESG bond issues on average trade at 0.969 percentage points lower YTMs than conventional bonds. The results also imply that an increase by one point in a firm's ESG score leads to an average decrease in that same firm's bonds YTM of 0.03 percentage points. When looking at the marginal benefit of issuing bonds for firms with high ESG scores compared to firms with low ESG scores the findings are not significant and thus do not confidently support hypothesis 3.

Table 9: Regression models

	Model 1	Model 2	Model 3	Model 4
ESG Bond	-1.078***	-1.078**	-.855*	-1.05**
	(.331)	(.441)	(.464)	(.435)
Leverage	7.211***	7.211***	6.817***	7.572**
	(1.358)	(2.412)	(2.596)	(2.923)
Debt Coverage	1.037***	1.037***	.802**	1.137***
	(.286)	(.375)	(.361)	(.406)
Coupon	.564***	.564***	.7***	.592***
	(.066)	(.086)	(.102)	(.099)
ROA	-19.331***	-19.331***	-16.182***	-20.796***
	(5.296)	(5.433)	(5.36)	(5.543)
(ln) Amount Issued	.636**	.636*	.447	.469
	(.268)	(.367)	(.388)	(.32)
(ln) Assets	-.647***	-.647**		-.524**
	(.177)	(.249)		(.217)
Maturity year	.071*	.071	.045	.021
	(.038)	(.045)	(.049)	(.044)
Country control	YES	YES	YES	NO
Year control	YES	YES	YES	YES
Industry control	YES	YES	YES	YES
_cons	-138.022*	-138.022	-96.319	-37.389
	(81.399)	(99.635)	(103.891)	(94.632)
Observations	474	474	474	474
Adjusted R-squared	.571	.571	.541	.547
Standard errors	Robust	Clusterd	Clusterd	Clusterd
Method	POLS	POLS	POLS	POLS

Standard errors are in parentheses

**** p<.01, ** p<.05, * p<.1*

**For variable explanation, see table 13*

Table 10: White's test

Source	chi2	df	p-value
Heteroskedasticity	417.8	263	0
Skewness	52.83	50	0.3652
Kurtosis	3.49	1	0.0617
Total	**474.12**	**314**	**0**

Table 11: Regression 2

	Model 5	Model 6	Model 7	Model 8	Model 9
ESG Bond	-.969**	-.882**	-.929**	-.806*	-1.227**
	(.403)	(.368)	(.41)	(.442)	(.586)
ESG Score	-.03*	-.009	-.034*	-.043***	-.037*
	(.018)	(.009)	(.019)	(.016)	(.021)
highesgxesgbond					.606
					(.678)
Coupon	.558***	.703***	.557***	.628***	.558***
	(.087)	(.109)	(.09)	(.101)	(.086)
Maturity year	.08*	.031	.108**	.069	.075
	(.048)	(.033)	(.048)	(.051)	(.047)
(ln) Assets	-.432	-.531***	-.34		-.403
	(.291)	(.176)	(.283)		(.295)
(ln) Amount Issued	.676*	.495	.64*	.592	.643*
	(.369)	(.31)	(.372)	(.388)	(.358)
Debt Coverage	.822**	.65**	-.165	.61*	.819**
	(.35)	(.253)	(.342)	(.33)	(.348)
ROA	-17.874***	-16.357***		-15.602***	-18.395***
	(5.129)	(3.285)		(5.097)	(5.184)
Leverage	7.047***	4.383**	6.186**	6.77**	7.128***
	(2.501)	(1.765)	(2.436)	(2.692)	(2.579)
	(.427)	(.329)	(.428)	(.417)	(.442)
Country control	YES	YES	YES	YES	YES
Year control	YES	YES	YES	YES	YES
Industry control	YES	NO	YES	YES	YES
_cons	-159.869	-57.581	-220.375**	-146.498	-149.524
	(105.411)	(71.535)	(105.335)	(108.708)	(104.68)
Observations	474	474	474	474	474
Adjusted R-squared	.583	.44	.566	.573	.584
Standard errors	Clustred	Clustred	Clustred	Clustred	Clustred
Method	POLS	POLS	POLS	POLS	POLS

Standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

**For variable explanation, see table 13*

8. Analysis

Our first finding suggests that ESG bonds trade at lower YTMs than conventional bonds, indicating that issuers can raise debt cheaper when issuing ESG bonds than when issuing conventional bonds. Building on signaling theory, as outlined in previous sections, this difference is attributable to the fact that ESG bonds need to meet certain criterias that make the project or firm sustainable in accordance with at least one of the Environmental, Social or Governance pillars. This is in line with previous studies done by for example Flammer (2021), Zerbib (2019) and Tang & Zhang (2020). However this also contradicts the findings of Kapraun et al (2021) who finds that there is no observable premium comparing corporate green bonds with conventional bonds. One probable explanation between our different findings is the years from which our samples were collected. Kapraun et al (2021) collect their sample from the years 2009 to 2021 while we include the years after 2021. As outlined in section 2.5, the amount of ESG bonds issued doubled in 2021, implying that the demand and relevance of these bonds has increased in recent years. Coupling this with our finding that ESG bonds do in fact trade at premiums to conventional bonds, suggests that the findings of Kapraun et al (2021) might already be outdated, further strengthening the notion that the field of sustainable finance is rapidly expanding with a need for future research.

Furthermore, this paper differentiates itself from previous studies by looking at ESG bonds in general rather than looking at green bonds and SLBs separately (Liberadzki et al, 2021; Berrada et al, 2022; Caramichael & Rapp, 2024). By including SLBs and green bonds in the same sample, we can draw conclusions about the ESG bonds in general and how investors perceive these investments. Our finding that ESG bonds trade at lower yields than conventional bonds, suggests that investors are willing to pay more for these bonds. This suggests that the value of issuing ESG bonds stems from the perceived lower riskiness of these investments, reflected in cost of debt. Unlike previous studies however, these findings indicate that it is not commitment to one specific ESG pillar that reduces the risk, but rather the firm's commitments to sustainable practices as a whole. This is in line with the findings of Hachenberg & Schiereck (2020), who suggests that firms can achieve lower cost of debt by increasing their ESG scores. This is attributable to a lower risk of the company getting a bad reputation, impairing stakeholder relationships, which could harm the company financially, ultimately leading to an increased risk

of not meeting debt payments (Antonopoulos, 2022). From this perspective, the value for investors lies mainly in that the issuance of ESG bonds, regardless of ESG bond type, signals that a firm has a low risk of being scrutinized and penalized as a consequence of not following sustainable practices.

As previously discussed, our study compares conventional bonds with all ESG bonds in a general sample. This differs from the bond-matching approach used by many previous researchers, who compare sustainable bonds with conventional bonds issued by the same firm (Zerbib 2019; Larcker & Watts, 2019, Liberadzki et al 2021). By comparing ESG bonds with conventional bonds from all firms, our study reveals insights into the types of firms that issue ESG bonds. Unlike studies using bond-matching samples, which only highlight differences between securities issued by the same firm, our approach uncovers broader differences between firms and captures general factors influencing bond YTMs. Caramichael & Rapp (2024) suggests that firms issue ESG bonds to maintain a high ESG score and suggests that this signals something about the whole firm's sustainability profile. Similarly, looking at our findings, the reason for the premium could be attributed to the kind of firms that issue ESG bonds. This is further supported by Kölbel & Lambillions (2022) findings that the reaction from investors is the largest for their first SLB issuance. If a firm has already issued an SLB, they have already signaled about their sustainability commitments and thus following issues do not carry the same signaling value as the previous issues. From this, we suggest that the reason for the lower YTM on ESG bonds is not because the specific bond is less risky than a comparable conventional bond. Instead we suggest that the type of firms that issue ESG bonds are less risky than those who do not. Therefore, it is not the fact that the bond is labeled as an ESG bond that causes the premium, instead we suggest that firms who issue ESG bonds already are less risky than those that do not, and that issuing ESG bonds simply is one way of signaling this to the market.

Moving on to the influence of ESG scores on YTM, our analysis indicates that higher ESG scores are associated with lower YTMs. This implies that investors are inclined to pay a premium for bonds from companies with high ESG ratings. This finding aligns with hypothesis 2 and with the findings of Antonopoulos et al. (2022) and Baldi & Pandimiglio (2022), who both concluded that firms can lower their cost of debt by improving their ESG scores. As mentioned

earlier, from a signaling standpoint, this relationship indicates that ESG scores signal meaningful information about a firm's commitment to sustainability. Furthermore, when we move from a model only including the ESG bonds effect on YTM to a model including the variable ESG score, the implied effect of issuing ESG bonds drops. This suggests that some of the variance in YTM, that was explained by ESG bond in the first model, is actually attributable to the ESG score variable. From a theoretical perspective this indicates that some of the information that is signaled by issuing ESG bonds can actually be attributable to the ESG score of the issuing firm. This is also found by Antonopoulos et al. (2022) and Baldi & Pandimiglio (2022). Looking specifically at Baldi & Pandimiglio (2022), they find that a one unit increase in a firm's ESG score reduces the YTM by 0.76 percentage points. At a first glance, this seems high compared to our finding that a one point increase leads to a 0.03 percentage point decrease in YTM. However, there are multiple explanations behind the deviation. Firstly, Baldi & Pandimiglio (2022) only look at the effect of ESG scores on green labeled bonds, while we look at the effect of ESG score on all bonds in the sample. Secondly their sample is of global character while our sample is collected from the Nordics. As discussed in section 2.5, the focus on sustainability is higher in the Nordics compared to other parts of the world. Firms face higher pressure from stakeholders and there are extensive regulations around what firms can and can not do with regards to sustainability (Nordsip, 2023; Sachs, 2023). Coupling this with our finding that the signaling value of increasing a firm's ESG score has a lower effect in our sample than in Baldi & Pandamiglios (2022) sample, it suggests that firms in the Nordics are assumed to already be compliant with the ESG pillars to a larger extent than firms in other countries, thus leading to the ESG score achieving a lower signaling value on nordic firms.

We hypothesized that the marginal benefit of issuing ESG bonds should decrease as a firm's ESG score increases. Using an interaction variable to test this, the results show this relationship does not hold. This is a rather unique angle and something that has not been extensively studied before. From our hypothesis development, it seemed like ESG bonds and ESG score largely signaled the same thing (Kölbel & Lambillion, 2022; Baldi & Pandimiglios, 2022). However, looking at our findings, there seems to be some unique value in signaling through ESG bonds compared to ESG scores and vice versa. One reason for this is likely that ESG scores are set looking at how sustainable the firm's operations have been in the years leading up to the setting

of the ESG score. This differs from ESG bonds, where the firms need to meet certain criterias that are pre specified when the ESG bonds are issued. Therefore, while ESG scores signal about how the firm has performed and is performing with regards to the ESG pillars today, the ESG bonds signal about how the firm will perform with regards to these pillars in the future.

Another interesting angle is the effect of different countries and industries. In section 2 and 3 we discuss how the industry that a firm operates in has a large effect on its ESG score and also make the assumption that the Nordic countries are rather similar when it comes to the approach towards ESG commitments. The assumption that Nordic investors and corporations value ESG bond issuances similarly is tested by removing the country control in model 4. The coefficient of the ESG bond variable does not change by much and its significance remains at the same level. It indicates that the effect of issuing ESG bonds does not differ significantly between the Nordic countries. However, looking at model 6 where the industry control has been dropped, the change is tangible. The ESG score variables coefficient goes from -0.03 to -0.009 and loses its significance. This suggests that industries do in fact affect the ESG score of a firm and that it might be harder for a firm in certain sectors to achieve high ESG scores even if they are investing heavily into making their operations more sustainable, in line with the findings of (Hachenberg & Schiereck, 2018). If a firm operates in an industry where achieving high ESG scores is challenging, issuing ESG bonds might prove particularly valuable. By setting concrete and specific sustainability targets through these bonds, the firm provides investors with a clear and measurable way to assess its sustainability commitments.

9. Conclusion

9.1 Main Conclusions

The main purpose of this paper was to investigate the marginal benefit of issuing ESG bonds as ESG scores increase. Using a sample of 474 bonds traded on the Nordic markets we compare the yields of ESG bonds with the yields of conventional bonds to investigate if a premium exists and how this premium is affected by the issuing firm's ESG score. Unlike previous research we do not isolate the sample to a single type of sustainable bond, instead we analyze ESG bonds in general, including both green bonds and SLBs. This approach contributes with a more comprehensive understanding of the effect of issuing ESG bonds and increasing ESG scores on corporations' cost of debt.

The analysis shows that ESG bonds, on average, trade at 0.969 percentage points lower YTMs than comparable conventional bonds. This supports our first hypothesis that ESG bonds trade at premiums, reflecting that investors are willing to accept lower returns for securities that are inline with the ESG pillars. More specifically, we find that firms can lower their YTMs by 0.03 percentage points for every one point increase in their ESG score. The signaling about how sustainable a firm or project is, seems to reduce information asymmetry, leading to investors being willing to pay more for corporate bonds. This is especially evident in our sample gathered from the Nordics, where sustainable practices are appreciated and encouraged by governments, corporations and investors. These findings contribute to previous literature with a deeper understanding of the value in signaling ESG commitments and how this impacts a firm's cost of debt.

By introducing an interaction term representing ESG bonds issued by firms with high ESG scores, we investigate the marginal benefit of issuing ESG bonds as a firm's ESG score increases. This approach is, to the best of our knowledge, the first to quantify the marginal benefits of issuing ESG bonds in relation to a firm's ESG score, providing new insights into sustainable financing practices. The results show no significant support that the marginal benefit of issuing ESG bonds decreases as a firm's ESG score increases. This is likely because ESG bonds convey

information about a firm's future sustainability ambitions, whereas ESG scores reflect its current sustainability profile, thereby offering partially distinct signaling values.

Given the lack of support for our third hypothesis, this opens up for future research to study how the signaling value of ESG scores and ESG bonds differ. Specifically there is an apparent need for further research what ESG bonds signal that ESG scores do not and vice versa. Additionally, since the Nordic countries have similar regulatory approaches to sustainability, it becomes interesting to also conduct this study with samples from other regions where the push towards sustainability is not as prominent, to see how these differences affect the signaling value of ESG scores and ESG bonds.

9.2 Limitations

While this study provides meaningful insights into the subject, it also has certain limitations. By focusing exclusively on the Nordic markets, the sample size is reduced compared to encompassing a larger geographic region. However, the decision to focus on the Nordic region is justified due to its unique emphasis on ESG principles, both from investors and corporations. The sample in this study includes 474 bonds, of which 150 were ESG bonds, representing approximately 31.6%. This is a significantly higher concentration compared to other notable studies, such as Kapraun et al. (2021) with 7.5% and Caramichael & Rapp (2024) with 0.9%. Although our findings are primarily applicable to the Nordic markets, they offer valuable insights into a region that is leading in ESG adoption. This can provide a benchmark for other regions as they advance in ESG integration. Another limitation is the composition of the ESG bonds in our sample. The majority of these were green bonds, resulting in an underrepresentation of Sustainability-Linked Bonds (SLBs). However, as noted, SLBs are relatively new and have not yet achieved widespread adoption. Therefore, their smaller representation is reflective of their current market presence compared to green bonds, which have been established for a longer period and are more prevalent.

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Tables

Table 1: Summary of empirical findings

Author	Subject	Time Period	Market	Results
Kölbel & Lambillion (2022)	Pricing of SLBs compared to regular bonds	2019-2022	Global	Significant results in 2021, and strongest signal with the first issuance of SLB, if more issued.
Liberadzki et al (2021)	Pricing of SLBs compared to regular bonds, in relation to emission targets	2021	UK, France	Significant results, looks at issuance from two companies
Affolter et al (2024)	Stock reaction on SLB issuance	2018-2022	Global	Signaling value of ESG in terms of value-creation, no effect.
Berrada et al (2022)	Pricing of SLBs	2018-2022	Global	The market generally overstates the benefits with SLB issuance, and the price falls in the secondary market.
Zerbib (2019)	Yield differential between green and conventional bonds	2013-2017	Global	-2 bps yield premium throughout the whole sample, rating and issuer typ determine yield. Financial industry most pronounced and significant.
Tang & Zhang (2020)	Stock reaction at green bond issuance	2007-2017	Global	6.94 bps lower yield on average, but no results when comparing within the same firm.
Caramichael & Rapp (2024)	Green bond issuance premium	2014-2021	Global	Significant results in 2019-21, with results of 15-8 bps.
Kapraun et al (2021)	Green bond premium and differences between bond issuers	2009-2021	Global	No significance for the corporate bond market, credibility of project matters a lot.
Baldi & Pandimiglio (2022)	ESG scoring and green washing risk in explaining bond yields	2012-2020	Global, mainly Europe	0.76% yield reduction for one unit increase in ESG score, lower yield for bonds in industry with lower greenwashing risk.

Hachenberg & Schiereck (2020)	The role of credit rating and ESG score in pricing of green bonds	2015-2016	Global	No significant results, except in the financial industry and for governments. ESG rating significantly impacts.
Larcker & Watts (2019)	Green premium among US government bonds	2013-2018	USA	No effect, ESG bonds more risky than conventional ones for underwriters
Flammer (2021)	Abnormal avkastning inom FoU-intensiva bolag i relation till övriga bolag vid insynshandel	2013-2018	Global	No greenium, but positive relationship between CO2 reduction and issuance of green bonds.

Table 5: Tabulation of Industry distribution

Industry	Frequency	Percent	Cum.
Aerospace Defence	6	1.27	1.27
Automobile Parts	1	0.21	1.48
Banking Services	168	35.44	36.92
Chemicals	8	1.69	38.61
Household Electronics	1	0.21	38.82
Construction Engeneering	2	0.42	39.24
Consumer Goods Conglomerates	13	2.74	41.98
Container Packaging	7	1.48	43.46
Diversified Retail	1	0.21	43.67
Electrical Utilities	5	1.05	44.73
Electronic Equipment Parts	5	1.05	45.78
Food - Tobaco	16	3.38	49.16
Freight Logistics Services	5	1.05	50.21
Healthcare Equipment	11	2.32	52.53
Healthcare Service Providers	1	0.21	52.74
Holding Companies	25	5.27	58.02
Homebuiding and Construction Supplies	3	0.63	58.65
Hotels and Entertainment Services	2	0.42	59.07
Household Goods	8	1.69	60.76
Insurance	6	1.27	62.03
Investment services	1	0.21	62.24
Machinery Equipment Components	22	4.64	66.88
Media Publishing	6	1.27	68.14
Metals Mining	13	2.74	70.89
Oil and Gas	7	1.48	72.36
Oil and Gas Equipment	1	0.21	72.57
Paper and Forest productions	2	0.42	73.00
Passenger Transportation	2	0.42	73.42
Pharmaceuticals	1	0.21	73.63
Proffessional Comersial Services	7	1.48	75.11
Real Estate	104	21.94	97.05
Renewable Energu	2	0.42	97.47
Semiconductors and Semiconductor equipment	1	0.21	97.68
Software and IT Services	5	1.05	98.73
Specialty retailers	2	0.42	99.16
Telecommunications	3	0.63	99.79
Textile and apparel	1	0.21	100.00
Total	**474**	**100.00**	

Table 12: Variance inflation factor

	VIF	1/VIF
ROA	6.803	.147
logassets	3.736	.268
DC	3.638	.275
leverage	2.778	.36
Maturityyear win	2.6	.385
ESGScore	2.42	.413
Coupon	2.033	.492
esgbond	1.587	.63
logAI	1.409	.71
Year control	YES	YES
Industry control	YES	YES
Country control	YES	YES
Mean VIF	**10.366**	**-**

Table 13: Variable Explanation

Variable	Explanation	Source
Yield to maturity (YTM)	The current Yield to Maturity	(a)
ESG Bond	Dummy variable, equal to 1 if bond is labeled as SLB, Social or Green and 0 otherwise	(a)
ESG Score	Ranges from 0-100 is a score for the firms ESG performance	(a)
highesgxesgbond	Dummy variable, equal to 1 if bond is ESG labeled and issued by a firm with an above average ESG score and 0 otherwise	(a)
Coupon	The annual coupon paid to owners of a bond	(a)
Maturity year	The year in which the bond matures	(a)
(ln) Assets	The natural logarithm of a firms assets	(a)
(ln) Amounts Issued	The natural logarithm of the amount issued of a specific bond issue	(a)
Debt Coverage	Firm EBITDA / total Debt	(a)
Return on Assets (ROA)	Firm EBITDA / total Assets	(a)
Leverage	Firm total Debt / total Assets	(a)
Source: (a) refinitive eikon		