SCHOOL OF
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Sustainability-Linked Bonds

An investigation of premiums associated with sustainability-linked bonds

by

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Abstract

Sustainable finance has become of great importance over the past years, especially due to global climate development, resulting in increased awareness among public and private sectors, and hence, more conscientious investors. In a market familiar with green bonds, Sustainability-Linked Bonds (SLBs) emerged as a new financial instrument posing a lesser greenwashing risk and, therefore, greater potential to make a material impact. This in turn is connected to the structure of SLBs, which encourages attainment of agreed upon Sustainability Performance Targets (SPTs) that are evaluated based on scientific key performance indicators (KPIs) with coupon penalties. Given the relevance and the urgency of SLB research, the aim of this study was to extend limited literature on SLBs by investigating the existence of what is known as sustainability premium among corporate SLB issuances within the European Union. In order to achieve this, a sample of SLBs was tightly matched with conventional bonds (CBs) based on factors such as issuer, maturity date, coupon, and size among others. A Wilcoxon signed-rank test was then conducted on the matched pairs, resulting in a statistically significant negative yield at issue difference between SLBs and CBs amounting to -53 bps with an average step-up coupon of 30.9, thus confirming the existence of a premium to investors. Furthermore, in order to account for robustness of an underlying assumption of such difference being caused by the sustainability dimension of SLBs, an OLS regression was performed. The output demonstrated that country of incorporation, sector, and SPT type were found to be significant factors, where respectively Austria, the consumer staples sector, and environmental SPTs were significant. However, since these factors do not represent differences between the matched bonds, the results of the Wilcoxon signed-rank test were proven to be robust. In addition, this paper presents potential explanations for substantial demand for SLBs, contribution to existing literature and practical implications, limitations as well as propositions for further research.

Keywords: Sustainability-linked bonds, Green bonds, Sustainability bonds, Sustainability premium, ESG.

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1 Introduction

Sustainability has become one of the most important topics within business and finance over the last decade. With scientific consensus regarding the maximum rise in temperature ideally being 1.5°C to avoid most of the negative effects of climate change, it is imperative that businesses, investors, and regulatory bodies alike, work in coordination to meet greenhouse gas and carbon emission reduction goals (United Nations Framework Convention on Climate Change, 2022). Furthermore, social and governance aspects have become very prominent in the business world, with stakeholders often being concerned about unethical practices in a business' supply chain, gender ratios, diversity, and workplace environment. In order to materialize, encourage and measure these efforts, various financial instruments related to sustainability have been created in the past few years. A new and therefore under-researched instrument is the sustainability-linked bond. Sustainability-linked bonds (SLBs) are debt instruments that change structure depending on the issuing company meeting key performance indicators (KPIs) related to environmental, social, or governance factors (ICMA, 2020). This paper investigates the existence of a premium to investors for SLBs, which would signify a lower cost of capital for issuers, and provides a measure of the value of sustainability. Additionally, the premium is examined to understand whether there are any potential differences among industries.

The following chapter offers a brief introduction to the background of sustainability and significant measures taken in order to tackle sustainability challenges. The brief introduction to the global sustainability objectives continues with green bonds, SLBs and any current regulations within the European Union that may apply to sustainable finance. The reason behind introducing green bonds prior to the main research topic - SLBs, is mainly due to the similar nature of these two financial instruments, which is to achieve sustainable company activities. Moreover, by introducing green bonds first, a chronological order of the development of these two different, yet similar types of bonds will be able to shed some light on the potential reason why SLBs emerged in the first place. Afterwards, aims, objectives, purpose, delimitations of this research and an outline of the thesis is introduced.

1.1 Background

The United Nations (UN) defines sustainable development as a development that fulfills the needs of the current generation, while not compromising the capability of the future generation to fulfill their needs (United Nations, 2022a). Often associated with environmental issues such as excessive greenhouse gas emissions and natural resource use, some other examples of the most pressing sustainability issues include poverty and social inequality (United Nations, 2022a). The increasing awareness has pressured governments and private organizations alike to implement measures in order to mitigate the negative impact of their actions on sustainability. The UN Agenda 2030 is a set of 17 economic, social and environmental goals and 169 targets established in 2015 and has been adopted by all 193 member states. The objective is to cease poverty, protect the planet and improve the general quality of life (United Nations, 2022a).

Another significant attempt to combine the forces of nations is the Paris Agreement, which was adopted by 193 parties in 2015 (United Nations Framework Convention on Climate Change, 2022). According to the United Nations Framework Convention on Climate Change, the Paris Agreement aims to set the limit of global warming to 2.0°C, however ideally to 1.5°C compared to pre-industrial levels (United Nations Framework Convention on Climate Change, 2022). In order to achieve the ideal scenario of limiting global warming to 1.5°C, the UN suggests a reduction of 45% in emissions by 2030 and down to zero by 2050. Zero emissions by mid-century is also referred to as the net-zero transition, which regards the amount of greenhouse gasses being emitted shall be no more than they are able to be removed from the atmosphere (United Nations, 2022b). Alternatively, it could mean that greenhouse gasses are not emitted at all (United Nations, 2022b). The Agreement is legally binding and stepped into force in 2016 (United Nations Framework Convention on Climate Change, 2022).

For businesses, ESG has been widely used as an approach to financial and non-financial business decisions. In terms of the individual pillars, the “E” in ESG stands for environment, which includes any action that has an impact on the environment, such as the waste and greenhouse gasses produced from operations (Henisz, Koller & Nuttall, 2019). The “S” stands for social, which can include issues such as gender equality in the management, diversity, and inclusion. The Social element essentially addresses how the business interacts with its key stakeholders (Henisz, Koller & Nuttall, 2019). Lastly, “G”, or governance, refers to internal procedures and controls that must comply with prevailing rules and regulations (Henisz, Koller & Nuttall, 2019). Moreover, governance enables effective decision-making, as well as meeting the needs of external stakeholders (Henisz, Koller & Nuttall, 2019). The three

elements combined are commonly the basis for the criteria that a business must fulfill in order to improve the sustainability of business operations (Henisz, Koller & Nuttall, 2019).

The shift to a net-zero economy and toward a more sustainable world requires substantial investments, which makes sustainable finance one of the most promising sources to achieve the goal. The European Commission defines sustainable finance as *"the process of taking environmental, social and governance (ESG) considerations into account when making investment decisions in the financial sector, leading to more long-term investments in sustainable economic activities and projects"* (European Commission, n.d.a, n.p). The European Union (EU) has been one of the global leaders in establishing legal and regulatory initiatives within sustainable finance (European Commission, n.d.a). The commitment to sustainability has in turn, supported the union in reconstructing the financial system towards sustainable growth and a more sustainable economy, thus making the EU an attractive market for sustainable finance (European Commission, n.d.a).

1.1.1 Green bonds

Fixed income securities allow governments and institutions alike to raise significant amounts of capital. Green bonds are a type of fixed-income security that has gained popularity since the first issuance in 2007 by the European Investment Bank (Spinaci, 2022). In essence, green bonds are used to finance or refinance environment and climate-related investments, projects and assets, with some examples being clean resource conservation and renewable energy (Spinaci, 2022).

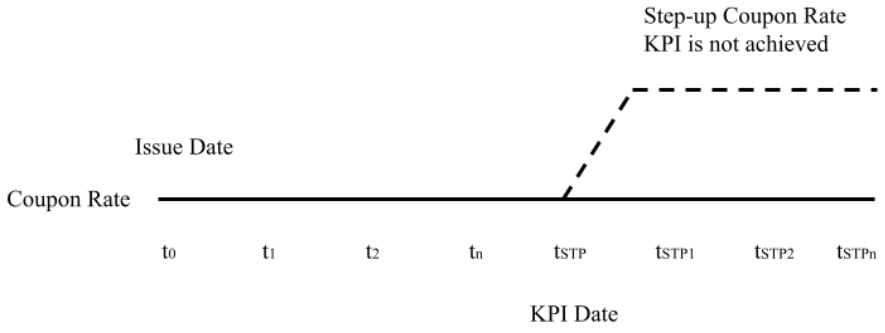
Like conventional bonds, periodic interest payments and the principal payment at maturity occur for green bonds. The International Capital Markets Association (ICMA) outlines several areas within environmental sustainability in the Green Bond Principles that qualify as green projects. These eligible green projects refer to the following: (1) renewable energy; (2) energy efficiency; (3) pollution prevention and control; (4) environmentally sustainable management of living natural resources and land use; (5) terrestrial and aquatic biodiversity conservation; (6) clean transportation; (7) sustainable water and wastewater management; (8) climate change adaptation; (9) eco-efficient and circular economy adapted products, production technologies; and (10) processes and green buildings (ICMA, 2021, p. 4-5). The ICMA advises the green bond issuer to have a clear communication on the objective of the green project, how the issuer determines the project to be fit within the green project categories and any social and environmental risks associated with the project with investors (ICMA, 2021). To ensure the validity of the green project, an external review on the alignment with the principle is encouraged prior to issuance (ICMA, 2021). The management of proceeds post issuance is also recommended to be evaluated and tracked by a third-party reviewer, for instance an external auditor, in order to ensure that bond proceeds are used

specifically on the green project (ICMA, 2021). Furthermore, annual reporting on the use of bond proceeds is strongly encouraged until fully allocated (ICMA, 2021).

Green bonds are issued by both governments and corporations, with corporate green bonds gaining popularity only after 2013 (Flammer, 2021). As of the 31st of December 2021, the global green bond market amounted to 1.6 trillion USD, with 75% more new issuances compared to 2020 (Climate Bonds Initiative, 2021). Despite the growth in popularity of green bonds, this specific type of bond only accounts for 3-3.5% of all bond issuances as of 2020 (Spinaci, 2022). In the European Union, the issuance of green bonds is influenced by regulations such as the Sustainable Finance Disclosure Regulation (Regulation 2019/2088), the EU Taxonomy (Regulation 2020/852) and the Green Bond Standard, which will be explained further in **Section 1.1.3**. It is however worth noting that the Green Bond Principle established by the ICMA and the EU Green Bond Standard are both voluntary, indicating that no firm is completely obliged to apply the instructions (ICMA, 2020; European Commission, 2022).

1.1.2 Sustainability-Linked Bonds

Sustainability-linked bonds (SLBs), also referred to as KPI bonds, are similar to green bonds in regard to sustainability being the financing objective. However, SLBs are tied to certain KPI and Sustainability Performance Targets (SPTs) that are considered to show an improvement in the sustainability of a company's operations. The International Capital Markets Association defines SLBs as: *"any type of bond instrument for which the financial and/or structural characteristics can vary depending on whether the issuer achieves predefined Sustainability/ ESG objectives"* (ICMA, 2020, p.1). In other words, SLBs are not considered as use-of-proceeds bonds, as the proceeds of the bond do not have to be used for a particular green project or in a specific manner (Giraldez & Fontana, 2022).



Source: *adapted from Kölbel & Lambillon (2021)*

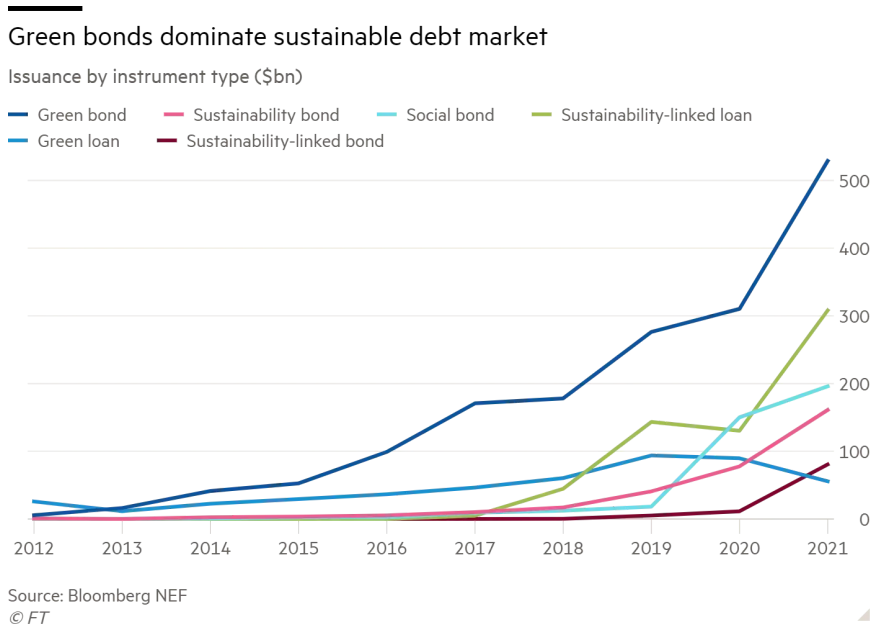
Figure 1.1 Typical SLB Coupon Step-up Mechanism

The issuing company of the SLB sets a single or multiple KPI targets, which shall be achieved within a certain time frame and be consistent with the company's SPTs (ICMA, 2020). However, if the KPI target or the SPT is not reached within a certain cut-off date, all companies to date have used a coupon step-up as compensation to investors, as visualized in **Figure 1.1** (ICMA, 2020). This essentially means that the issuing company must pay a higher interest to bondholders. The Sustainability-linked Bond Principles (SLBP) outlined by the ICMA suggest that the KPIs must be relevant, measurable, and benchmarkable (ICMA, 2020). The SPTs on the other hand, must exhibit a target that is ambitious enough to show a significant improvement in the sustainability of the company (ICMA, 2020). Furthermore, the ICMA encourages issuers to have external reviewers for assessing the applicability of the KPIs and the level of ambition of the SPTs prior to issuance (ICMA, 2020). If no external reviewers are used to assess the KPIs and the SPTs, the company is encouraged to develop its internal expertise in order to increase its reliability (ICMA, 2020). After issuance, the ICMA strongly advises the issuing company to seek an independent and external review of the company's performance against the KPIs and SPTs, no less than once a year. In summary, the SLBP is intended to reduce information asymmetry and increase transparency, in which the instructions are fairly similar to the ICMA's Green Bond Principles. However, it is worth noting that this guideline, like the Green Bond Principles and the European GBS, is solely voluntary (ICMA, 2020).

News sources suggest that the very first SLB, worth 1.5 billion USD, was issued by the Italian utility company Enel in 2019, where the company set a target to increase the renewable energy capacity from 46% to at least 55% by 2021 (Ranasinghe, 2021; BNP Paribas, 2019). Failing to meet the target results in a 25bp coupon step-up (Ranasinghe, 2021; BNP Paribas, 2019). On the contrary, Bloomberg data suggests that the first SLB was issued by a Chinese state-owned company, Beijing Infrastructure Investment Ltd. in 2018 (Kölbel & Lambillon, 2022). As of the 31st of December 2021, the global SLB market size is estimated to be approximately 135 billion USD, however the market has most likely grown since (Climate Bonds Initiative, 2021). The market has been dominated by corporate SLBs until Chile's announcement in early 2022 on the first issuance of a sovereign SLB, which intends to reduce emissions and increase the share of renewable energy use (BNP Paribas, 2022).

As of 2022, SLBs account for 10% of all green debt instruments (Kölbel & Lambillon, 2022). The amount of SLBs of all sustainable bond issuances has also increased significantly, by 7 percentage points from 2% in 2020 to 9% by the end of 2021 (Mylläri & Ray, 2022). Like green bonds, most SLBs have been issued within Europe, accounting for 68% of all SLB issuances (Kölbel & Lambillon, 2022). Another similarity with green bonds is that most SLBs

are tied to environmental targets such as reducing carbon emissions, while a fragment is tied to social targets, such as diversity and inclusion (Giraldez & Fontana, 2022).



Source: *Begum (2021)*

Figure 1.2 The Market Development of Green and Sustainable Bonds

Figure 1.2 shows the growth of sustainable debt instruments. While the growth in the issuance of SLBs has been rapid, green bonds still dominate the sustainable debt market, with the total market reaching more than 500 billions USD in 2021. The past 2-3 years have, however, marked a notable increase in the issuance for all types of sustainable debt instruments.

1.1.3 EU Regulations

The European Union has so far, been a pioneer in encouraging sustainable activities in all parts of the economy (Alexandraki, 2021). The Union has been active in introducing legislations to align with the goals of Agenda 2030 and the 2015 Paris Agreement. Through the EU's commitment, visible progress can be noted in sustainable finance, as all institutions alike are now urged to incorporate sustainability into decision-making processes (Alexandraki, 2021). In 2018, the European Commission announced the Action Plan for Sustainable Growth, aiming to direct capital flow towards sustainable investments, mitigate financial risks caused by sustainability issues and to promote transparency (Alexandraki, 2021). The commission presented the EU Green Deal in late 2019, whose purpose is to

establish a strategy in making Europe the first climate-neutral continent by 2050 (European Union, n.d.c).

A significant component of the Action Plan and the later revised Green Deal is the Sustainable Finance Disclosure Regulation (SFDR) published in 2019, which came into effect in 2021 (Alexandraki, 2021). In essence, the SFDR focuses on obligatory sustainability reporting for financial market participants (Regulation 2019/2088). Some examples of participants are portfolio management service providers and financial advisors providing consultancy regarding investments (Alexandraki, 2021). With clearer instructions on disclosures on both entity and product level, such as the kind of information to be disclosed and where it should be disclosed (i.e. websites and annual reports), it thus makes the SFDR a key factor in reducing risks of greenwashing, which entails corporations making false claims portraying themselves as environmentally committed without real actions (Flammer, 2021; Becker, Martin & Walter, 2022).

Another important part of the Green Deal is the EU Taxonomy, which stepped into force in 2020 (Regulation 2020/852). The EU Taxonomy lays out definitions on business activities that are considered as environmentally sustainable, covering a large proportion, but not all, of economic activities that account for EU's emissions (Schuetze & Stede, 2020; European Commission, n.d.b). It can thus be concluded that the EU Taxonomy is able to shed some light on whether a firm and its economic activities are considered as truly green.

When it comes to green bonds, the EU has established a common European Green Bond Standard (GBS), which is a voluntary framework and an extension of ICMA's Green Bond Principles (European Commission, n.d.c; Alexandraki, 2021). The objective of the GBS is to ensure that the green project is aligned with the EU Taxonomy, externally verified and disclosure on the bond proceeds are meticulously disclosed (European Commission, n.d.c). Furthermore, the EU aims to standardize the third-party rating agencies to increase comparability, as currently ESG rating agencies have varied methods behind the evaluation of sustainability, which has caused inconsistencies among ESG ratings (Alexandraki, 2021). Thus, the external reviewers shall be registered with the European Securities Markets Authority (ESMA) to allow for supervision (European Commission, n.d.d).

In summary, the objective of executing legislations on sustainable finance is to reduce information asymmetries by increasing transparency. The EU’s initiatives are able to establish a common ground for assessing financial and sustainability performance, while ensuring the flow of capital toward economic activities that promote sustainability.

1.2 Research Aim and Question

While sustainability-linked bonds might hold immense potential in facilitating businesses to act sustainably, there is still an issue of measuring the actual effect or impact these types of bonds have. Given that SLBs are a relatively new financial instrument, with the first ones being issued in 2019, there are very few that have matured or met the date of potential coupon step-up. Therefore, it is difficult to assess their impact on companies' meeting the agreed KPIs, and in the long term, improving their sustainability practices as a whole. However, by examining the structure of the instrument, the incentive mechanism for companies can be revealed. This paper aims to identify whether a premium to investors exists for SLBs at issue, prior to the coupon step-up, as this implies a lower cost of capital for the issuers, and represents the value placed on sustainability. Comparing this premium to the step-up values can also reveal whether firms failing to reach the agreed SPTs are actually materially affected with a higher cost of capital. If the premium is higher than the step-up, cheaper capital is still enjoyed by the issuer after failing to meet their target, thus not truly repaying investors the value for sustainable actions that they paid for. Additionally, potential differences in this premium are examined to discern whether firms truly have the incentives from the structure of SLBs, or if they benefit from using this type of funding instrument regardless of a coupon step-up being applied for failing to meet the proposed KPI.

To achieve this aim, the objectives are to pair SLBs issued by companies in the EU with a corresponding conventional bond, and to measure the difference between yields to maturity at issue before coupon step-ups. Yield refers to the expected return an investor can make by investing in a bond until maturity, determined by the total value of the coupons paid out over the bond's lifetime over the original price the investor paid for the bond (Byström, 2014). The difference is measured statistically, as well as tested for robustness and for any particular effect of industry, as outlined in the methodology section (**Section 3**) of the thesis and in line with previously used methodology for identifying the spread in SLBs and green bonds compared to conventional bonds. Then, this can be compared to the average coupon step-up for the sample to determine if the issuer can benefit from cheaper financing regardless of the potential step-up, similarly to Kölbel and Lambillon's (2022) approach.

There are several aspects that highlight the relevance of SLB research. One is related to the performance based structure of sustainability-linked bonds, which is considerably different from that of green, sustainable, and social bonds (Vulturius, Maltais, & Forsbacka, 2022). Hence, examination of numerous characteristics solely found among SLBs as well as their impact would provide valuable insights into its potential impact on the economy (Vulturius, Maltais, & Forsbacka, 2022). It is believed that such performance based bonds are likely to present intriguing and potentially attractive alternatives for future financing methods, fusing

the benefits of green, social, and sustainability bonds with the flexibility of the lack of a use of proceeds stipulation (Giraldez & Fontana, 2022). Furthermore, SLBs have been receiving greater attention from the regulatory institutions, which have started to promote initiatives dedicated to increasing the segment even further (Vulturius, Maltais, & Forsbacka, 2022). For example, in 2020 the European Central Bank (ECB) decided that SLBs will be now accepted as collateral, while the European Commission announced that sustainability-linked bonds label is going to be integrated into its sustainable finance strategy (Vulturius, Maltais, & Forsbacka, 2022). Apart from this, such development also sparked discussions about incorporating the SLBs into sovereign debt in the developing countries with national sustainability commitments (Vulturius, Maltais, & Forsbacka, 2022).

In addition, due to the novelty of SLBs, very minimal academic research is currently available covering any aspect of SLBs. A search on Google Scholar as of April 8th, 2022 of the combined keyword "sustainability-linked bonds" results in only 293 results, despite the 850% growth in issuances in 2021 from 2020, compared to the 115% growth in the total market for sustainable debt finance (Google Scholar, 2022; Vulturius, Maltais, & Forsbacka 2022). In contrast, another search on the same engine at the same time but with "green bonds" as a keyword instead results in 13 100 results, and "sustainable finance" results in 22 900 (Google Scholar, 2022). In addition, SLBs are the segment within the sustainable finance market with the highest growth rate with the number of issuances increasing by 8.5 times in 2021 compared to the previous year (Vulturius, Maltais, & Forsbacka, 2022). This is a clear signal that while sustainable finance as a research field is growing in popularity, SLBs, in particular, are under-researched. However, this is not to say that they are of little relevance, as industry articles by rating agencies, asset managers and banks alike can be identified in the last few years (Flintman, 2020; NN Investment Partners, 2021; Ramel & Michaelsen, 2020). The lack of research is pointed out by the few academic researchers covering the topic identified such as Kumar (2022), and Vulturius, Maltais, and Forsbacka (2022). Furthermore, the aforementioned authors do not cover any particular aspect of SLBs, but rather provide a general overview of the instruments and their implications, without any empirical findings, or provide more background on green bonds instead.

Research on sustainable debt finance has naturally been focused on green bonds, given that they are an older instrument and have had significant growth and recognition by EU regulatory frameworks. Through the literature review process, the discussion on the phenomenon of a "sustainability (or ESG) premium" came forward. This is a theoretical premium implying that investors pay more for sustainable actions in comparison to investment in "vanilla" or conventional bonds. Several papers have tested this in the green bond market with differing findings on its existence, with some citing a negative differential such as Zerbib (2019), while others finding no significant premium such as Larcker and Watts (2020) and Flammer (2021). Thus, this is an interesting angle to explore for SLBs. Given the

great prospects of SLBs as a sustainable finance instrument along with lack of academic research conducted regarding them, further research would provide grounds for closer investigation, potentially giving rise to numerous directions for future research within SLBs (Vulturius, Maltais, & Forsbacka, 2022).

Liberadzki, Jaworski, and Liberadzki (2021) provided evidence for a negative difference in yields between TESCO SLBs and a few similar selected vanilla bonds (suggesting a sustainability premium). However, the small sample size of four SLBs by three issuers, and the lack of statistical methods do not allow for the results to be generalized. Some working papers such as the study by Kölbel and Lambillon (2022), carry out statistical analysis with a more representative sample size of 109 SLB and vanilla bond pairs. Their findings also identified a negative yield differential (-29.9bps), further supporting an SLB premium for investors. However, there is scarce peer-reviewed academic research on the topic, and Kölbel and Lambillon (2022) do not discuss the difference between industries at length. Therefore, the purpose of this research is to contribute to the analysis of corporate SLBs through the evaluation of the existence of a sustainability premium and whether it truly incentivizes sustainable actions. In particular, this research examines any differences in premium between industries within the EU.

In order to fulfill the aim and purpose of the study, the research question to be answered in this thesis is:

"Is there a premium to investors among SLBs issued within the European Union?"

1.3 Delimitations

In order to improve analytical clarity, the scope of this thesis is delimited in several ways which include decisions regarding the source of data, the market being analyzed, and methodology.

As previously mentioned, SLBs are emerging instruments within sustainable finance, establishing the first ever issue in December 2018. Thus, there is still a relatively limited amount of literature and data available on the subject compared to the green and conventional bonds (Kölbel & Lambillon, 2022). Fortunately, after investigating the Bloomberg database, it was confirmed that it possessed the necessary information about all the SLBs ever issued. Hence, the analysis is mainly based on and is limited to this data.

Furthermore, the scope of this research is limited to only the corporate sustainability-linked bonds issued within the European Union. Such a decision was made mainly due to

comparability purposes as EU states share legislative frameworks, which include but are not limited to EU Taxonomy for sustainable activities, corporate disclosures of climate-related information, European green bond standard, and EU labels for benchmarks (European Commission, 2022). Decreasing the ambiguity of the legal factor by selecting this specific market area thus allows for achieving greater accuracy when drawing conclusions from the results of the analysis.

Additionally, the methodology of this research acts as a synthesis of methodologies used by Liberadzki, Jaworski, and Liberadzki (2021) and Kölbel and Lambillon (2022) in their papers investigating premiums generated by SLBs in comparison to conventional bonds, while also incorporating an original element. Unlike the previous research, this paper looks into sustainability premium across industries and provides theoretical insights into the incentives produced by the structure of SLBs. This in turn is done due to the evidence confirming that in case of a failure to reach related goals, enforcing the step-up still leaves the firms better off compared to traditional bonds (Liberadzki, Jaworski & Liberadzki, 2021). The methodology is hence delimited to these tools and subjects of analysis. Lastly, it is also important to highlight that the used methodology involves a matching process of SLBs with comparable conventional bonds based on several factors that will be more elaborated on in **Section 3**, which considerably decreases the sample size of SLBs analyzed.

1.4 Outline of the Thesis

This thesis is structured into five distinct sections. Chapter 1 introduces the overall subject of the thesis, background, problematization, research question, and purpose. Further, Chapter 2 provides the literature review and theoretical framework synthesizing the information on sustainable finance and bonds, ending with SLBs and previous investigations of premiums. Following this, Chapter 3 states the methodology and motivation for the choice of analytical tools used. Then, the empirical findings of the research are presented in Chapter 4. Chapter 5 analyzes the empirical findings and compares them to the existing literature. Lastly, in Chapter 6, these findings are summarized, leading to conclusions, implications, and suggestions for future research.

2 Literature Review

The literature review chapter provides the theoretical background to the formulated hypotheses to answer the research question. This chapter is divided into two main sections, sustainable finance and sustainable bonds, funneling down to the chosen unit of analysis, sustainability-linked bonds. The literature review first focuses on the background on the reason why firms would choose to incorporate sustainability into their practices, followed by an exploration of literature on ESG and its correlation with financial performance, as it might incentivize firms to integrate more sustainability-related actions if sustainable actions result in improved financial performance. Finally, the literature narrows down the focus on two types of sustainable fixed income securities, shedding light on prior research and literature on green bonds and SLBs. Given the scarcity of research on SLBs, a proportion of the literature review relies on academic research investigating green bonds from different perspectives and approaches. Due to the similar nature of the two sustainable bonds in addition to the scarcity of prior research on SLBs, prior research on green bonds will be introduced first in order to offer a more comprehensive understanding on these specific financial instruments. Finally, the chapter concludes with the derived hypotheses to be tested.

2.1 Sustainable Finance

Traditionally, finance has been concerned with shareholder value maximization through financial return (Schoenmaker, 2017). However according to Schoenmaker (2017), the main purpose of finance is to allocate funds to the most productive use, which considering the increased pressure for action toward a more sustainable economy, would be to promote financial decisions that take sustainability issues into account. Thus, it can be concluded that finance and its main contributors – banks, investors and governments – have a key role in making strategic decisions to accelerate the transition towards a net-zero economy and achieving the goals of Agenda 2030 (Schoenmaker, 2017).

The definition of sustainable finance has not reached a complete consensus due to the large amount of terms related to sustainable finance and investments, which have been found to lack theoretical clarity and have unclear boundaries (Cunha, Meira & Orsato, 2021). However, a common characteristic for all sustainable finance and investments related terms is that all relate to the integration of societal or environmental matters into conventional

financial activities (Cunha, Meira & Orsato, 2021). Thus, Cunha, Meira and Orsato (2021) have proposed a definition for sustainable finance, which is the management of financial resources whose objective is to promote positive, measurable and long-term impacts on the society and environment. Chan (2021) on the other hand, provides a more simplified definition for sustainable finance, which states that sustainable finance refers to investments in green technologies and projects through financial products. Recalling from the background section of this research, the European Commission also provides a definition for sustainable finance, which is the process of incorporating ESG considerations into investment strategies within the financial sector, resulting in more long-term sustainable economic activities (European Commission, n.d.a).

2.1.1 Sustainability Theoretical Background

When it comes to sustainability-related management research, the stakeholder theory is one of the most widely used theories to analyze such issues, as it incorporates the societal environment to a larger extent into the considerations of organizations (Hörisch, Freeman & Schaltegger, 2014). According to Freeman (1984, p. 46), stakeholders are defined as *"any group or individual who can affect or is affected by the achievement of the organization's objectives".* In essence, the stakeholder theory addresses the relationship between a business and groups and individuals who have a stake in the organization (Hörisch, Freeman & Schaltegger, 2014).

Aside from the stakeholder theory, corporate social responsibility (CSR) also addresses the community and society around the company's operations. Freeman and Dmytriyev (2017) propose that the main difference between the two theories is that responsibilities for the stakeholder theory are addressed towards the immediate surroundings, while CSR tends to view the responsibility as reaching much further and only in one direction - to the society and environment. The authors mention that despite some differences, there are three common elements: purpose, value creation, and stakeholder interdependence that combine corporate responsibilities for stakeholders and CSR (Freeman & Dmytriyev, 2017). The purpose and value creation activities are both based on the focus on the individuals and groups that are affected by the business. Having a purpose that is ethically driven from the birth of the organization is able to shield an organization from having to choose between false dichotomies, such as economic profit versus social wellbeing and stakeholder gains versus societal gains. Furthermore, Freeman and Dmytriyev (2017) argue that a good performance in CSR is equally important as creating value for stakeholders, as it may counteract the effect of sometimes businesses using CSR to hide behind their ethical misconduct.

Lastly, when it comes to stakeholder interrelatedness, Hörisch, Freeman and Schaltegger (2014) suggest that instead of separating business and ethics, value creation and sustainability

issues must be considered in conjunction as the two parts are most of the time, tightly connected. To explain the interconnectedness further, Freeman and Dmytriyev (2017) suggest that traditional dichotomies such as improving the living conditions of the suppliers will hurt customers as it results in a higher price for customers, are essentially false. Creating value for one stakeholder or the community often tends to have a ripple-effect. An example provided by Freeman and Dmytriyev (2017) demonstrates that improving employee working conditions will increase productivity and employee motivation, which is further likely to lead to improved company reputation and increased sales. A firm adopting and embracing sustainability in their business practices is argued to be a step ahead in terms of value creation for its shareholders, compared to peers that neglect sustainability in their business practices (Fatemi & Fooladi, 2021). Furthermore, there has been a large amount of empirical support on the theory that firms are being rewarded for their sustainability efforts, as well as a growing amount of evidence that the market valuation of the firm internalizes the expectations of improving sustainability performance (Fatemi & Fooladi, 2021). Thus, it may be implied that a company focusing on its stakeholders and is mindful of its social and environmental responsibility have an increased chance at outperforming its peers, as speculated by Orlitzky, Siegel and Waldman (2011).

2.1.2 ESG and Financial Performance

Since the 1970s, the amount of academic studies on ESG and financial performance has increased drastically, with the most notable increase happening after the 1990s (Friede, Busch & Bassen, 2015). It has been argued that firms that adopt a framework of sustainable value creation will be rewarded with a market value premium (Fatemi & Fooladi, 2013).

An extensive review on ESG and corporate financial performance by Friede, Busch and Bassen (2015) analyzed more than 2,200 primary studies and numerous secondary studies in order to find any commonalities that may exist. Using a combination of vote-count and meta-analytical method of analysis, Friede, Busch and Bassen (2015) discovered that there seems to be a positive correlation between ESG and corporate financial performance. The study divides the analysis into three different subtopics: asset class, ESG individual pillars and geographical region. Among the different classes of securities, bonds and real estate were found to have the highest amount of positive studies, followed by equity. The authors have also split ESG into individual pillars, and discovered that governance appeared to show the most positive findings by prior research, amounting to 62.3%, while Environmental and Social amounted to 58.7% and 55.1%, respectively. During the COVID-19 pandemic however, a study on 1452 different European companies has shown that the Social pillar has seen an outperformance instead, indicating the potential effects of a crisis on the financial markets and a change since Friede, Busch and Bassen (2015) published their research. Other

prior studies on ESG and financial performance have also found support for improved performance when it comes to engaging in social activities, namely activities exhibiting corporate social responsibility (Tang, Hull & Rothenberg, 2012; Cordeiro & Tewari, 2015). Cordeiro and Tewari (2015) in particular, have discovered that investors tend to react positively to improved CSR rankings. However, a more recent study found that not only social activities seem to receive positive market reactions - environmental activities also appear to be well-received by the market, more specifically announcements of green bond issuances (Flammer, 2021).

The study by Friede, Busch and Bassen (2015) provides a significant insight - 90% of the reviewed studies showed a non-negative correlation between ESG and corporate financial performance, of which most are positive. Furthermore, the impact of ESG appeared to be stable overtime between 1970 and the end of 2014 (Friede, Busch & Bassen, 2015). During the COVID-19 pandemic, it has been found that investors tended to gravitate more towards ESG companies with above-average ESG ratings, indicating the perception of ESG being a safer investment option. The same study found that investment-grade ESG bonds appeared to perform better compared to high-yield equivalents. This can however, be explained solely by risk-aversion, resulting in higher demand (Singh, 2021). Nevertheless, sustainability seems to be rewarded with an improved performance.

Within the European Union, more rules and regulations have been established in order to encourage the transition towards sustainable sources of capital (Alexandraki, 2021). One of such policies was recently enforced by the European Union's Sustainable Finance Disclosure Regulation (SFDR), which came into effect on March 10, 2021 and forces management to disclose how sustainable its investments are (Delabye & Fross, 2021). Becker, Martin and Walter (2022) examined the effects of increasing sustainable finance regulations, in particular the SFDR (Regulation 2019/2088), and discovered that sustainability ratings of EU-based funds increased significantly. Moreover, the announcement of the SFDR resulted in a net fund inflow post-announcement (Becker, Martin & Walter, 2022). Thus, it is reasonable to presume regulations on sustainable finance may directly influence the direction of capital inflow.

2.2 Sustainable Bonds

As a financial innovation within sustainable finance, sustainability, social, green and sustainability-linked bonds have been created in order for investors to allocate funds towards ESG projects and activities (Chan, 2022). While the names of each instrument may overlap, the differences lie in the structure and use of proceeds for each instrument. Sustainability bonds require the proceeds to be directed towards social and green projects, while social and

green only require their respective names' project categories (Kumar, 2022). In contrast, sustainability-linked bonds do not have a requirement for use of proceeds, but rather their coupon structure is tied to KPIs and SPTs, in which the issuing company will have a – in most cases– a step-up in the coupon paid out to investors if they fail to meet the KPI by the agreed date (Berrada, Engelhardt, Gibson & Krueger, 2022). Given the infancy of sustainability and social bonds, and the relative maturity of green bonds, the next section focuses on research on green bonds as a precedent to the unit of analysis, sustainability-linked bonds (Kumar, 2022).

2.2.1 Green bonds

Green bonds are debt instruments which proceeds are committed towards environmental projects such as investments in renewable energy, green buildings and resource conservation (Flammer, 2021). From a stakeholder theory point of view, it has been suggested that green bonds are in essence, internalizing negative externalities related to the environment, which is meeting the needs of environmentally conscious investors (Tang & Zhang, 2020). While a green bond can be issued to finance a new project, they can also be used to refinance an existing project (Chan, 2021). The first green bond was issued in 2007 by the European Investment Bank, while the first corporate green bonds were issued in 2013 (Chan, 2021; Flammer, 2020). Corporate green bond issuances have grown exponentially in Europe, North America and Asia, amounting to the majority of the green bond market in 2020 (Baldi & Pandimiglio, 2022).

What characterizes a green bond is not formally regulated by any public body, rather issuers can voluntarily follow the Green Bond Principles, which were created and endorsed by financial actors through ICMA (Maltais & Nykvist, 2020). These principles state that the four components of a green bond should be (1) the use of proceeds, (2) process for evaluation and selection, (3) management of proceeds and (4) reporting (ICMA, 2021). This means that the legal documentation of the bond must describe a green project for which the funds are allocated, within, but not limited to, the project categories in the principles (ICMA, 2021). Issuers should also communicate the process by how the issuer decides how the chosen project fits within the eligible green project categories, the proceeds should be tracked in a sub-account, and the use of proceeds should be reported on an annual basis (ICMA, 2021). Furthermore, it is recommended to outline the alignment of the green bond to these principles in a "green bond framework", and to appoint an external review from parties with relevant credentials, as well as to audit the use of proceeds by an external auditor (ICMA, 2021). This implies increased issue costs, which brings forth the question as to why issuers would choose to use green bonds as financing instruments rather than conventional bonds (Maltais & Nykvist, 2020).

Dan and Tiron-Tudor (2021) conducted a study on the determinants of green bond issuance in the European Union from the period of 2014 to 2019. Most green bond issuances within the European Union are France, Germany, the Netherlands and Sweden, accounting for 60% of all issuances within the region. At the same time, the bonds issued from these countries have received the highest ratings. Within the region, the authors have discovered that the size of the issuance, ESG risk index, fiscal balance, inflation rate and the size of the population exhibited the most statistical significance when it comes to green bond issuance. On the contrary, factors such as credit rating, unemployment rate, trade openness and GDP per capita did not show a statistical significance. Thus, the findings indicate that a certain mix of security-specific and macroeconomic factors provide an explanatory ability for the issuance of green bonds in the region (Dan & Tiron-Tudor, 2021).

The research around this financial instrument could be subdivided into research about the pricing or premium differences to conventional bonds and efficacy of the instrument, with the prior representing the bulk of literature. Academic researchers highlight the different motivations for investment and issuance of green bonds, which could be further extended into sustainability-linked bonds to some extent. This can also serve as a basis of examining the pricing and efficacy of such instruments. Flammer (2021) lays out a framework of three possible rationales for issuing green bonds consisting of capital cost reductions, signaling opportunities, and greenwashing. Maltais and Nykvist (2020) propose finance, business and legitimacy/institutional-oriented incentives for both issuers and investors in green bonds, which somewhat align with Flammer's (2021) framework.

2.2.1.1. Incentives and Pricing

In regards to the financial incentives for investors, portfolio diversification, lower risk and long term orientation are factors driving this incentive (Maltais & Nykvist, 2020). Portfolio diversification is defined by Byström (2014) as the process of investing in multiple asset classes as a means to minimize the overall risk of the portfolio. Having a blend of different assets such as stocks and bonds is able to reduce one's exposure to the sole risk of one single asset or asset class, while maximizing return (Byström, 2014). Ferrer, Shahzad and Soriano (2021) propose that investors tend to perceive green fixed-income assets to be less risky, as green bonds tend to attract climate-oriented investors. These types of investors see green fixed-income securities to offer the ability to mitigate environmental risks in the long run, thus lowering the overall risk. Moreover, Ferrer, Shahzad and Soriano (2021) suggest that a large proportion of green fixed-income securities are held by institutional investors. These investors tend to have a more long-term strategic outlook, resulting in them adopting a "buy-and-hold" investment strategy, which further leads to decreased volatility for green fixed-income securities during times of instability compared to other asset classes. The study conducted by Ferrer, Shahzad and Soriano (2021) has discovered a limited connection between the green fixed-income market and the stock market in terms of return and volatility,

indicating that investors could benefit from investing in green bonds if the aim is portfolio diversification (Ferrer, Shahzad & Soriano, 2021). The findings by Ferrer, Shahzad and Soriano (2021) are consistent with other studies indicating limited relationship between the green bond market and other asset classes (except for treasury and investment-grade corporate bonds), as well as the hedging properties of green bonds (Reboredo, Ugolini & Aiube, 2020; Reboredo & Ugolini, 2020; Kuang, 2021; Haq, Chupradit & Huo 2021).

The financial incentive for issuers in the form of a lower yield in comparison to conventional bonds and therefore lower cost of capital is perhaps the most widely discussed topic within green bond research. The discussion around green bond premiums, also referred to as "greenium" has mixed views and findings, although with some consensus on the existence of the premium, but with widely different estimates. With all bond pricing factors such as maturity, issuer, currency, coupon type, bond structure, etc. held equal, it follows that the risk and returns between green and conventional bonds should be equal, unless investors are willing accept lower returns for the opportunity to invest in a green project (Zerbib, 2019).

This is indeed the finding that Zerbib (2019) presents in their research, identifying a -2bps yield differential through creating 110 public and private matching green to conventional bond triplets on the secondary market between 2013 and 2017. A systematic literature review by MacAskill, Roca, Liu, Stewart, and Sahin (2021) between years 2017 to 2019 on 30 academic articles on green bond premium further reveals a consensus of a negative yield difference in 56% of studies in the primary market, and 70% in the secondary market. It is important to note that the studies reviewed included all types of green bonds, and while there is evidence on the existence of a green bond premium, this premium varies widely by study, with some finding no negative yield difference or even a positive difference.

In more recent studies, Larcker and Watts (2020) do not find any premium in U.S. municipal green bonds, and neither does Flammer (2021) in examining green corporate bonds on a global scale, both using very similar methodologies to Zerbib (2019). Maltais and Nykvist (2020) also found that Swedish institutional investors in green bonds hold the opinion overall that they are not willing to sacrifice returns for a green bond investment, but rather expect equal returns to a conventional bond. In the same interviews in the study, counterintuitively, all investment managers acknowledged that they perceived a green bond premium in the market. This perhaps shows the mixed evidence and opinions of researchers and financial players in relation to green bond premiums.

A study on factors determining the pricing of green bonds by Hachenberg & Schiereck (2018) found that common bond characteristics such as maturity, volume or currency do not necessarily determine the price. Industry and issuer rating on the other hand, appear to have more influence. Green bonds have been found to be oversubscribed, resulting in a premium

(Chan, 2021). While the issuance of green bonds may cost more to the issuer due to the process of planning and selecting the project and regular reporting post-issuance, numerous studies have discovered that external certifications are the very reason of superior price performance and increased demand of green bonds (Hachenberg & Schiereck, 2018; Russo, Mariani & Caragnano 2020; Flammer, 2021; MacAskill et al., 2021; Dorfleitner, Utz & Zhang, 2022). However, Wu (2022) argues that the higher price of green bonds is due to the external certifications and revisions advised by the existing sustainability bond guidelines, causing the costs from such services to be incorporated in the bond price. Baldi and Pandimiglio (2022) find that investors are willing to accept lower returns if they have confidence in their contribution to projects with a greater impact on sustainability targets of a given community, and require a higher premia if they suspect a risk of greenwashing. This further supports that external certifications have a greater impact on the pricing of green bonds. Nonetheless, among other potential explanations for relatively better performance of green bonds, one could be perhaps more straightforward and simply relate to the newness of the financial instrument, giving rise to 'novelty premium' (Costa, Chamon, & Ricci, 2008).

2.2.1.2. Efficacy and Greenwashing

While many studies focus on green bond pricing differences, research has also been conducted on the actual impact of green bonds on the sustainability performance of their issuers. Despite the concern shown in the literature of greenwashing risks, those being issuers making misleading claims to portray themselves as environmentally committed without actual action, research shows green bond issuers have a positive environmental impact post issuance (Chan, 2021; Flammer, 2021; Baldi & Pandimiglio, 2022). The greenwashing risk can be mainly attributed to the lack of public regulation, most concerning issuances by the private sector, and by specific industries (Chan, 2021; Kumar, 2022; Baldi & Pandimiglio, 2022). Interestingly, among corporate issuances, those within manufacturing were found to have a higher greenwashing risk than services, but highest within the financial sector (Baldi & Pandimiglio, 2022). However, Flammer (2021) argues that greenwashing is not necessarily the reason behind green bond issuance, as companies have shown improved environmental performance post-issuance, when the commitment to the green project materializes. External certifications also seem to be received well by the stock market, resulting in a positive reaction following the announcement of issuance (Flammer, 2021). Therefore, while public regulations are currently lacking, the existing frameworks and transparency seem to increase the confidence of investors in green bonds. Flammer (2021) explains that the effect is possibly due to the signal of environmental commitment, which is perceived by many investors, especially environmentally-conscious ones, as positive.

While there is evidence of environmental commitment by corporations issuing green bonds in varying degrees by industry, Maltais and Nykvist (2020) find that Swedish institutional green bond investors rarely mention green bonds as impactful tools for impact investing. Rather

ESG criteria within investment decisions, active ownership, negative screening and long-term investment strategies are highlighted. Furthermore, issuers state that the green projects assigned to the bonds would have been completed regardless of the issuance, however the bond allowed them to increase that investment (Maltais & Nykvist, 2020). Therefore the authors suggest that the impact of green bonds (in the Swedish market) is perhaps not directly shifting capital towards green projects directly, but rather to create awareness, signal, and raise sustainability ambitions among issuers. This could raise the question about the efficacy of green bonds as financial instruments to incentivize environmental responsibility, given that their scope is only within the project they finance.

2.2.2 Sustainability-Linked Bonds

A relatively new type of bond called the "Sustainability-Linked Bond", has been emerging as an alternative debt instrument to the green bonds (Berrada, et al., 2022). The core difference between the two is that SLBs are not restricted to specific investments, instead, the raised capital may be utilized in a great variety of activities, leaving it up to the issuer's discretion (Giraldez & Fontana, 2022). When it comes to SLBs, the focus lies primarily on attainment of the stipulated objectives measured using Key Performance Indicators (KPIs), which in turn are connected to the coupon penalty (Berrada, et al., 2022). The financial structure of the SLBs may be subject to change after the issuance, more specifically due to a trigger event. Usually, it corresponds to the issuing company failing to accomplish the agreed upon targets by the term stated in the agreement, hence, exercising a coupon penalty (Giraldez & Fontana, 2022). Such a coupon penalty is referred to as a step-up as it increases the coupon payments; however, it may also take a step-down form, which is much less common (Liberadzki, Jaworski, & Liberadzki, 2021). It is important to highlight the flexibility of the formulation of what an actual SLB penalty is going to be, for example, a penalty may be determined to be a donation to a charitable organization as well as an investment that would offset the damage caused by the failure to accomplish the objectives (Berrada, et al., 2022). Apart from this, it is also possible for SLB structure to incorporate both step-up and step-down coupons; however, such format is rarely observed as only one private bond has ever used both of these instruments (Liberadzki, Jaworski, & Liberadzki, 2021).

Though coupons are the most widely used tools among SLBs, they are not limited only to them. Other possible alternatives include a premium payment to the investors at the maturity of the bond in case of a failure to meet the obligations as well as the put-options that allow to put the bonds, if the issuer does not reach the objectives (Liberadzki, Jaworski, & Liberadzki, 2021). It is important to highlight that in order to facilitate an SLB issue, the objectives have to be measurable through KPIs as well as assessed against the Sustainability Performance Targets (SPTs) by an external party (Giraldez & Fontana, 2022). Another contrasting feature

of SLBs is that they may possess a scope beyond just climate and environmental projects, which green bonds are limited to, allowing them to pursue social and governance related objectives as well (Liberadzki, Jaworski, & Liberadzki, 2021). Despite this, the majority of SLBs happen to be addressing environmental targets (Berrada, et al., 2022).

2.2.2.1. Potential Existence of Premium

Some studies investigated the potential existence of a premium among SLBs similar to the research on "greenium" associated with the green bonds mentioned above. One of such investigations was performed by Liberadzki, Jaworski, & Liberadzki (2021) with the aim of examining the presence of what they called 'ESG Spread', a premium due to a negative yield difference between SLBs and conventional bonds. Their study was based on the analysis of Tesco, Carrefour, and Metro SLBs, where the methodology included matching the sustainability-linked bonds with comparable regular bonds based on value, maturity, issue date, and coupon size and calculating the interpolated yields (Liberadzki, Jaworski, & Liberadzki, 2021). The result was that investors agreed to lower yields generated by SLBs when compared to regular bonds, observing a negative spread and, thus, confirming the presence of ESG spread (Liberadzki, Jaworski, & Liberadzki, 2021). Additionally, the research looked further into how a coupon step-up would affect this spread and showed that even when the coupon was imposed, the yield was still below the corresponding regular bonds, meaning that firms would still be left in a more advantageous position even in a case of a failure of accomplishing the sustainability targets (Liberadzki, Jaworski, & Liberadzki, 2021). However, as some Tesco's SLBs were benchmarked against traditional bonds of Carrefour and Metro, it left a bias associated with different issuers.

Another study was conducted by Kölbel and Lambillon (2022), where the purpose of research was to answer a question "Who pays for sustainability?", in other words, investors or the issuers. Firstly, they began by analyzing how SLBs were priced at the date of issuance in comparison to conventional or "brown" bonds (Kölbel & Lambillon, 2022). This was done by pairing SLBs with regular bonds with the exact same issuer, maturity and coupon type, bond seniority, and currency, which then were further matched with closest issue date, bond maturity, and size (Kölbel & Lambillon, 2022). Unlike the previous study, this research had a more conservative criteria in regards to the matching procedure. The results were similar and showed evidence that there is in fact a statistically significant premium among SLBs represented by the difference in yield of SLBs and conventional bonds amounting to -29.2 bps on average (Kölbel & Lambillon, 2022). Hence, the investors paid for the sustainability related impact, while issuers or firms acquired capital at lower cost (Kölbel & Lambillon, 2022). Moreover, due to the size of average coupon step-up being less than the sustainability premium and existence of time lag before the coupon step-up is actually enforced, companies still are able to benefit from lower cost of capital even if they fail to reach the sustainability objectives (Kölbel & Lambillon, 2022). Secondly, in order to account for robustness of the

findings an OLS regression was conducted, which showed different results for callable and at maturity SLBs with the prior exhibiting considerably greater premium (Kölbel & Lambillon, 2022). Lastly, the research suggests that issuers are still better off even upon an enforcement of a step-up due to a failure to meet the targets, which creates vague incentives for the parties to actually pursue sustainability related initiatives (Kölbel & Lambillon, 2022).

2.2.2.2. Incentives and Regulations

From a first glance at this instrument, it is not precisely clear which incentives facilitate the issuance of SLBs. When examining the financial incentives, the evidence points at investors and issuers still holding more advantageous positions even in the event of an issuing firm not accomplishing the set objectives. From the investors point of view, an issuer's failure is deemed as the investors' financial success, as an enforcement of a step-up coupon implies greater payments to the investors. Taking on the issuer's perspective, the studies also confirm that companies are still left with relatively less costly capital in comparison to traditional bonds due to the premium similar to the greenium associated with the green bonds (Vulturius, Maltais, & Forsbacka, 2022).

The governance of SLBs is generally structured more vaguely in comparison to green, social, or sustainability bonds as there is no formal regulation with respect to election, measurement, verification, and reporting of KPIs (Giraldez & Fontana, 2022). ICMA's (2020) SLBP define SLBs as an instrument implementing KPIs that are material to the issuer's central sustainability and business strategy, addressing relevant issues of the industry sector. The common practice for SLBs is to obtain a verification through a second party that examines the KPI bond framework against the SLBPs (Giraldez & Fontana, 2022). However, there are neither the exact definitions provided of "materiality" nor "relevance" to guide the determination of appropriate KPIs and Sustainability Performance Targets (SPTs). Numerous research points at how there is a great need for regulatory reforms directed at this gap to formulate adequate KPIs and related targets, for example, a relatively new EU taxonomy regulation on sustainable finance provides technical screening criteria that can be used to qualify the objectives as 'eligible' for SLBs (ICMA, 2021). However, these taxonomy regulations are still not sufficient enough and are likely to be the subject of continuous development as result of regulators' efforts to ensure a significant and relevant impact of SPTs (Vulturius, Maltais, & Forsbacka, 2022).

Moreover, just like with green bonds, the magnitude of the premium among SLBs largely depends on investor's preferences and risk perception. From green bonds, it can be observed that investors are ready to agree to lower yields as long as the bonds are likely to have material impact and reduced risk connected to transparency (Maltais & Nykvist, 2020; Maltais & Nykvist, 2020; Sartzetakis, 2020). Thus, there are several factors deemed important when assessing the attractiveness of SLBs to investors. Firstly, the nature of SLBs allows

firms to withhold full discretion of the ways the capital will be exploited that leaves investors with lesser control over the use of proceeds as well as the outcomes, increasing the concern of exposure to the greenwashing risk (Vulturius, Maltais, & Forsbacka, 2022). Furthermore, the absence of a common science-based benchmarks and metrics to formulate SPTs along with vagueness of the exact degree of a step-up coupon necessary to incentivize the issuing firms only further intensify investors' worries over legitimacy of SLBs (Vulturius, Maltais, & Forsbacka, 2022). Therefore, regulations as well as certifications related to governance of SLBs appear to be crucial factors in determining investors' confidence in this financial instrument.

2.3 Chapter Summary and Hypotheses

The literature review explored the background of sustainability and how it has impacted businesses through applying the stakeholder theory in combination with sustainable finance. ESG has proved to be an important factor of consideration for businesses, especially since the turn of the 21th century. The issuance of green bonds has been increasing exponentially over the last years, resulting in extensive research on the subject including the 'greenium'. A relatively recent development shows an emergence of SLBs as an instrument within sustainable finance that has demonstrated new possible structures and incentives within issuance of bonds, giving rise to numerous research gaps some of which this paper tries to address in the following chapters by testing the hypothesis presented below.

NH1: There is no statistically significant yield differential at issue between corporate SLBs and conventional bonds prior to the coupon step-up.

AH1: There is a statistically significant yield differential at issue between corporate SLBs and conventional bonds prior to the coupon step-up.

Given the mixed findings of green bond literature on the topic of yield differentials, and only one study (Kölbel & Lambillon, 2022) covering the existence of SLB yield differentials at issue, it is reasonable to test the existence of any yield difference in the first place as in NH1.

NH2: There is a statistically significant positive (greater than zero) yield differential at issue between corporate SLBs and conventional bonds.

AH2: There is a statistically significant negative yield differential at issue between corporate SLBs and conventional bonds.

The rationale for AH2 (and thus testing NH2) is that given that SLBs are also sustainability-related, it is reasonable to assume that investors would be willing to sacrifice

returns as they do for green bonds, which have already been shown in multiple studies to be traded at a premium.

NH3: Financial industry corporate SLBs will have a statistically significant negative effect on the yield differential at issue between corporate SLBs and conventional bonds.

AH3: Financial industry corporate SLBs will have a statistically significant positive effect on the yield differential at issue between corporate SLBs and conventional bonds.

The formulation of the hypothesis AH3 (and thus testing NH3) was based on the research by Baldi and Pandimiglio (2022) on green bonds demonstrating that investors expect a higher premium from the corporate issuers in the financial industry, given that they perceive the highest greenwashing risk for issuers within the industry.

3 Methodology

The methodology chapter outlines and describes the chosen research design to answer the research question for this thesis through hypothesis testing. The research approach, design, data collection, data analysis, validity and reliability and limitations are explained in this chapter.

3.1 Research Approach

This study follows a quantitative research strategy entailing a deductive approach,a positivist epistemological consideration, and objectivist ontological consideration. The research is based on previous research and theories within sustainable finance, green bonds and SLBs are utilized in order to deduce null hypotheses in section 2.3 tested statistically SLB data.

The ontological orientation can be described as objectivism, which is explained as social phenomena being external facts which are beyond the reach or influence of individuals (Bryman & Bell, 2011). This study interprets the observable phenomena in this case to be the pricing differences of SLBs in comparison to conventional bonds (CBs), which theoretically represents a “sustainability premium”, which can be objectively measured through the use of historical secondary data. Furthermore, the explanatory factors to the yield difference are to be examined through statistical methods to ensure robustness. The epistemological consideration is positivism, defined as the “application of the natural sciences to study the social reality and beyond” (Bryman & Bell, 2011, pp. 15). This entails that only observable phenomena can be considered as knowledge, the purpose of theory is to generate hypotheses that allow for testing and have explanatory power of theories, science should be conducted objectively, and there is a difference between scientific statements and normative statements (Bryman & Bell, 2011). This is the case for this study as hypothesis testing is conducted through statistical tests to scientifically reject or accept the null hypothesis.

Deductive theory is defined by Bryman and Bell (2011) as the researcher utilizing previous knowledge and theories relating to a particular domain to deduce one or multiple hypotheses, which are then tested empirically. The process follows the identification of relevant literature to (1) establish the contemporary concepts and theories in the field, which are used to (2) develop hypotheses, which (3) data is collected for in order to (4) reject or not reject the hypotheses (Bryman & Bell, 2011). The results of the study can then be analyzed to infer the

implications on the theory, and therefore (6) revise the theory in an inductive manner (Bryman & Bell, 2011). Despite being a deductive research strategy, elements of inductive theory are present at the end of the process, with inductive theory being essentially the relationship between theory and research in the opposite direction of deductive theory (Bryman & Bell, 2011). In a deductive approach, researchers collect data to formulate theories (Bryman & Bell, 2011). Furthermore, new theoretical ideas may be brought forward by the data or not fit in with the original hypotheses leading to new theories (Bryman & Bell, 2011). This describes the process this thesis partakes in the use of sustainable finance theory relating to impact investing, greenwashing and the role of institutions and regulations impacting the pricing of sustainable bonds. The aforementioned are used to formulate the hypothesis that a negative yield differential exists for EU issued corporate SLBs, and that the financial sector issued SLBs have a positive effect on yield differential.

The study follows a quantitative research strategy, which essentially follows the process of deductive theory described above, with the addition that the method in which the hypothesis is tested is through a research design which devises a measure of concepts (Bryman & Bell, 2011). The concept for this study being sustainability premiums, which are measured by the indicator difference in yield between SLBs and CBs. The quantification of this indicator allows for findings to be developed and add support to the existing literature on the existence of this phenomena across different financial instruments.

3.2 Research Design

The research design can be described as a quantitative, cross-sectional, secondary statistical analysis with the purpose of null hypothesis testing with statistical significance and multivariate analysis. A cross-sectional study refers to studying a sample of data at a single point in time (Bryman & Bell, 2011). This is the case for this paper, as the yield differences at the issue date of SLBs in comparison to matching CBs, described further in the data collection section, are examined at that single point in time, however across the date of the first issued SLB by an EU firm to 22/04/2022. This is following the numerous studies investigating green bond premiums and sustainability-linked premiums, although it is only the matching procedure which is used for the studies performing a time series analysis (Zerbib, 2019; Larcker & Watts, 2021; Flammer, 2021; Liberadzki, Jaworski, & Liberadzki, 2021; Kölbel & Lambillon, 2022). The decision to do a cross-sectional study was due to the short time frame SLBs have been in the market, therefore an investigation post issuance might not be representative. Furthermore, a smaller scope allows the inclusion of more data points as there is no need for additional calculations, unlike in Liberadzki, Jaworski, and Liberadzki's (2021) time series study, which only included a sample of 4 SLBs.

3.3 Data Collection Method

The data collection method for this thesis is through a secondary analysis, as data is retrieved from a database on historical financial instrument data collected by Bloomberg and Refinitiv. This decision was made due to the nature of the research question, which to be answered concretely requires data on the financial instruments themselves. The benefit of such a data collection approach is that a high quality of data is ensured, with the largest universe of data points possible within a short collection time frame (Bryman & Bell, 2011). This both reduces the time to collect and clean the data, allowing for more resources in the analysis of the empirical results, but also greater robustness given the increased possible sample size. It is important to ensure that all fields of data collected are correctly interpreted, especially as the Bloomberg database has many fields available, all with varying definitions despite similar names. However, this is remedied as Bloomberg provides extensive descriptions of each field.

The aim of the data collection is to collect pairs of corporate bonds (one SLB and one CBl) through exactly matching data on their issuer, bond seniority, maturity type, coupon type, currency, and call option, and closest matching issue date, maturity date and amount issued as in Kölbel and Lambillon (2022) and Liberadzki, Jaworski, and Liberadzki (2021). This is in order to identify pairs which are functionally identical with the exception of the type of bond in question, in order to be able to judge differences in yield being due to the difference in sustainability purpose. Thus, the sample of SLBs issued by EU member states is determined by the data availability of SLBs and matching possibilities to CBs.

Table 3.1 Bond Pair Matching Criteria and Rationales

Variable	**Matching criteria**	**Rationale**
Issuer	Identical	To remove firm specific differences that affect pricing.
Bond seniority	Identical	In place of credit ratings due to missing rating scores in alignment with Kölbel & Lambillon, 2022.
Maturity type	Identical	Including only at maturity and callable types, and excluding convertible and putable types.
Coupon type	Identical	To control for price differences due to different coupon frequencies.
Currency	Identical	To avoid currency differences and risk affecting the pricing of the different bonds.
Issue date	Maximum difference of 5 years	To allow for a greater number of possible matches while reducing the effect on the change in monetary policy by the European Central Bank and

		macroeconomic variability (Kölbel & Lambillon, 2022).
Maturity date	Maximum difference of 3 years	To reduce differences in credit spread while maximizing the number of matches (Kölbel & Lambillon, 2022).
Size/Issue amount	Maximum factor of 4 and minimum of 0.25	To minimize difference in liquidity, although not extremely important due to the choice to analyze at issue yields (Larcker & Watts, 2021).

The bond matching is accomplished through two major steps. First, to identify all SLBs in the Bloomberg database, utilizing the Bloomberg fixed income security search, all corporate bonds are filtered as "self-reported sustainability-linked bonds", "self-reported sustainability-linked loans" and country of incorporation of issuer being within the members of the European Union as of 21/04/2022. Secondly, each SLB is then matched with a CB based on the criteria in **Table 3.1** through a Python script.

In line with Kölbel and Lambillon (2022), putable and convertible SLBs are excluded in the matching process due to the very small number of bonds, thus not being representative of the entire universe. Additionally, the yield at issue, coupon step up credit rating, ESG rating, country of incorporation of each issuer, as well as their industry is collected for further explanatory analysis of the yield differential, if identified. The industry is categorized through Bloomberg's Industry Classification Standard, which is slightly different from the Global Industry Classification Standard after the first level of classification, used in Kölbel and Lambillon (2022). For any missing data fields such as yields at issue, the Refinitiv database is utilized to maximize the number of possible pairings.

3.4 Data Analysis

To begin, exploratory data analysis will be carried out by visualizing the data and examining the distributions in order to validate the assumptions for the statistical tests used to test the hypotheses. This will be accomplished through plots of all available data points to explore any interesting patterns that might emerge outside of the scope of the research question or have any more explanatory power for the results which can support the discussion section of this paper. All statistical analysis and plots will be conducted through the program R.

The null hypotheses NH1 and NH2 refer to the differences between groups, which requires statistical tests that address this specific purpose. Berenson, Levine and Szabat (2014) list several statistical methods for the purpose of comparing two groups for numerical variables,

with the Wilcoxon signed rank test and paired t test in the list of these methods. These tests or variations of them were used by Kölbel and Lambillon (2022) in their study of SLBs, as well as previous studies such as Larcker and Watts (2020) studying the differences in bond yields, however only the Wilcoxon signed rank test is used in this study. This is because the Wilcoxon signed rank test is a nonparametric method to compare two matched populations, which means that it does not assume that the populations have normal distributions, and the matched dimension is very relevant to this study as we are pairing the bonds (Berenson, Levine & Szabat, 2014). This is especially an alternative to utilize if the sample sizes in a study are small and thus it is not possible to assume that the population is normally distributed (Berenson, Levine & Szabat, 2014). This is an important consideration given the universe in this study is just under 300 bonds, and the sample size is likely to be comparable or smaller to Kölbel and Lambillon's (2022) study, which was about 34% of the entire SLB universe and overrepresented Asia and Oceania, whilst this study only considers EU bonds. In contrast, the parametric paired t test assumes normality of the population (Berenson, Levine & Szabat, 2014). Therefore, given the non-normality of the sample shown in section 4.2, a Wilcoxon signed rank test is chosen.

Table 3.2 Regression Variable Descriptions

Variable type	**Variable**	**Data type**	**Unit**
Dependent	Difference in yield at issue	Ordinal	Basis points
Independent	Issuer Sector	Dichotomous	Binary coded dummy variables for each sector
Independent	Country of issuer incorporation	Dichotomous	Binary coded dummy variables for each industry
Independent	Maturity type	Dichotomous	Binary coded dummy variable for callable or at maturity
Independent	Credit rating of SLB	Dichotomous	Binary coded dummy variables for each rating
Independent	ESG Rating	Dichotomous	Binary coded dummy variables for each rating
Independent	SPT Type	Dichotomous	Binary coded dummy variables for each SPT type
Independent	Step-up	Ordinal	Basis points
Independent	Ratio between SLB and	Ordinal	US dollars

	CB issuance size		
Independent	Difference in issue date between SLB and CB	Ordinal	Years
Independent	Difference in maturity date between SLB and CB	Ordinal	Years

In order to examine the robustness of the results, and test NH3, an ordinary least squares (OLS) multiple regression will follow the group comparison tests in order to test what independent variables, if any, can explain the difference in yields. The assumption of this paper is that the difference in yields should represent the difference in the sustainability dimension and investors preference for sustainability rather than other bond differences, due to the extensive bond matching process. However there may be differences between groups of bonds depending on differing factors such as sector, which is also interesting to explore. An ordinary least squares linear regression identifies the mathematical relationship between independent and dependent variables, allowing the quantification of the effect an independent variable has on the dependent variable, by minimizing the differences between the sum of squared differences around the prediction line (Berenson, Levine & Szabat, 2014). **Table 3.2** describes the variables used in the regression model. The chosen variables to explore came forward from the literature review section of this thesis.

Some important notes on specific variables are that the SPT type was manually coded using the definition of ESG presented in the background as a guideline to classify between either environmental, social, ESG or ESG rating, where goals related to for example GHG emission reductions, waste management, etc. were environmental, whereas the wellbeing of people was coded as social. Any bond having a combination target or multiple target within different areas were coded ESG, and ESG rating was used for those specifically citing ESG rating maintenance or change as the target. Governance was also considered but all bonds either fell into social or the governance factor was combined with other ESG factors.

The following is the definition of (1) difference in yield and the (2) regression equation for estimating the independent variable.

$$\Delta Yield = SLB\ Yield\ at\ Issue - CB\ Yield\ at\ Issue \quad (1)$$

$$\Delta Yield \sim Country\ of\ Incorporation + Sector + Maturity\ Type + Coupon\ Type + Credit\ Rating + ESG\ Rating + SPT\ Type + Step\ Up + Issue\ Date\ Difference + Maturity\ Date\ Difference + Issue\ Amount\ Ratio \quad (2)$$

3.5 Validity and Reliability

Bryman and Bell (2021) defines validity as whether the chosen measure in fact, measures the concept in question, and reliability as the level of consistency of the measure. The consistency of SLBs is verified through the criteria set in **Table 3.1**, ensuring the comparability between the CB and the SLB from the same company. Moreover, inconsistencies caused by legal and regulatory factors are eliminated by limiting the research scope to the European Union.

The validity of this methodology can be evaluated through several different types of validity. The methodology of this research has been used by Kölbel and Lambillon (2022), and a number of prior studies on green bonds have applied the Wilcoxon signed rank test to evaluate the statistical significance of the pricing differentials of the matched bonds. The face validity of this research methodology is thus, based on the methodology of prior research of similar nature.

Concurrent validity of this methodology will be validated if the results from this research align with previous research on green bonds that found a premium. At the same time, the constructive validity of the methodology is tested, as the tests used in this research are essentially used to validate the hypotheses.

For reliability, two measures shall be considered for evaluation for this research: stability and inter-observer consistency. The stability of the research is ensured through bond-matching criteria issue date, maturity date and issue size, in order to minimize risks of external factors, such as macroeconomic and differences in credit spread and liquidity, which may cause fluctuations in the research results over time. Inter-observer consistency refers to any kind of inconsistencies that involve subjective judgment (Bryman & Bell, 2021). The risk for inter-observer inconsistency is minimized through a meticulous examination of prior research bond-matching criteria used on green bonds and SLBs.

3.6 Limitations

Currently as of the 22nd of April 2022, the amount of outstanding SLBs amounts to 487 on the Bloomberg database, of which 292 are issued by companies incorporated within the European Union. In order to fulfill the criteria presented in **Table 3.1**, the amount of SLBs and the final sample size to be analyzed may be significantly limited in order to ensure the comparability of the ordinary vanilla bond and the SLB from the same issuer. A time-series analysis on a sample of four SLBs has been conducted in the research by Liberadzki, Jaworski, and Liberadzki (2021), which has allowed for the evaluation of any changes in the

sample over a specific period of time, as well as possible influences behind the changes. However, as one of the main objectives of this research is to evaluate whether a similar premium exists among SLBs as it does for green bonds, a time-series analysis will not be conducted due to the scope and the limited time available for this research. Another barrier for conducting a time-series analysis is the maturity of the security, as the first SLB was issued in 2019, which indicates a limited amount of time to conduct such analysis with a large enough sample that allows for generalization.

The research on green bond premiums has shown mixed results due to the reason that the methodology design differs among prior research. For instance, more recent studies by Larcker and Watts (2020) on municipal green bonds and Flammer (2021) on corporate green bonds, adopting an identical methodology, found no green premium for either bond category due to a tighter bond-matching method. For both studies, ESG ratings have been used as a matching criteria. However, considering that SLBs are relatively new fixed-income instruments, many individual SLBs do not have an ESG rating yet. Thus, it excludes the possibility for this research to replicate the exact same methodology design as that of Larcker and Watts (2020) and Flammer (2021).

Interest rates are not examined in the OLS regression due to time limitations. This was a factor that was investigated by Kölbel and Lambillon (2022), which was found to have significance only in regressions without all explanatory variables inputted. Therefore, it is reasonable to assume that for a full model with 10 variables, this variable could be omitted without losing explanatory power in the model. However, it is important to highlight this difference in approach.

Causality is defined by Bryman and Bell (2011) as an event directly influencing the birth of another event. For this research, the hypothesis expects a premium for SLBs due to the research by Liberadzki, Jaworski, and Liberadzki (2021) and Kölbel and Lambillon (2022) showing positive indications on a premium for SLBs. Furthermore, considering the numerous amount of research supporting the existence of a premium for green bonds, the sustainability-related nature of SLBs and the fact that approximately 90% of SLBs are related to environmental targets, will potentially support the reasoning that SLBs issued in the EU are also likely to exhibit a premium (Kölbel & Lambillon, 2022). For green bonds, however, the research on premium has shown mixed results, which may cause the causality assumption to be incorrect. The potential incorrectness of the assumption is emphasized due to the very limited amount of identified prior research on SLB premiums, amounting to two articles, of which one is a working paper. Lastly, it is also worth noting that due to the potentially limited amount of final sample after bond-matching, a risk for generalization for the results on SLBs may occur.

Replicability is defined as the ability to recreate an independent repetition of a study published earlier, which is conducted in adequately similar circumstances (Peels, 2019). A limitation in terms of replicability mainly relates to the data source available for future research. This research retrieves financial data of SLBs from the Bloomberg database, which may or may not be accessible for individuals conducting similar research in the future. Within the Bloomberg database, some examples of potential barriers in terms of replicability include if any of the bonds are for some reason, not listed any longer, or if the keywords utilized are removed or changed for a given bond.

3.7 Chapter Summary

The methodology for this thesis follows a quantitative research strategy entailing a deductive approach, a positivist epistemological consideration, and objectivist ontological consideration through a cross-sectional, secondary statistical analysis of EU issued sustainability-linked bond premiums. The data collected is historical sustainability-linked bond yield at issue and characteristic data through the Bloomberg and Refinitiv financial databases, which is then matched to corresponding CBs through criteria used in previous papers investigating green bond and SLB premiums. The difference in yield at issue is tested for significance using a Wilcoxon signed rank test, and a multivariable OLS linear regression is utilized to test the robustness of results and explain the difference in yields, including the potential discrepancies among industries. In terms of the reliability and validity of the measures, a strict bond-matching as well as using a methodology that is in line with prior research is believed to yield a result that is robust.

There are however some limitations to this research methodology. First, a time series analysis will not be conducted due to the limited amount of time and the scope of the research. Second, the limited availability of the ESG ratings for SLBs significantly restricts the ability of this research to adopt a similar methodology used by numerous prior studies on green bond premiums. Lastly, limitations in terms of the possibility for invalid generalization and factors related to the financial database may exist due to the relatively small sample size.

4 Empirical Findings

This section provides empirical findings from statistical analysis, both on the general EU SLB market level and specific SLB-CB bonds pairs. The section begins with descriptive statistics on all 292 SLBs issued within the European Union, where findings on issuing country, industry, bond maturity type, SLB theme, step-ups and ESG ratings are presented. Additionally, mean yields at issue are presented for the 166 SLBs for which the yield at issue was successfully collected. Descriptive statistics of the bond pairs are then followed by the results of the Wilcoxon Signed Rank Test, which exhibits whether the mean yield difference between SLBs and CBs is statistically significant. Lastly, a robustness test for any potential effects of different variables on SLBs is performed through an OLS regression.

4.1 SLB Descriptive Statistics

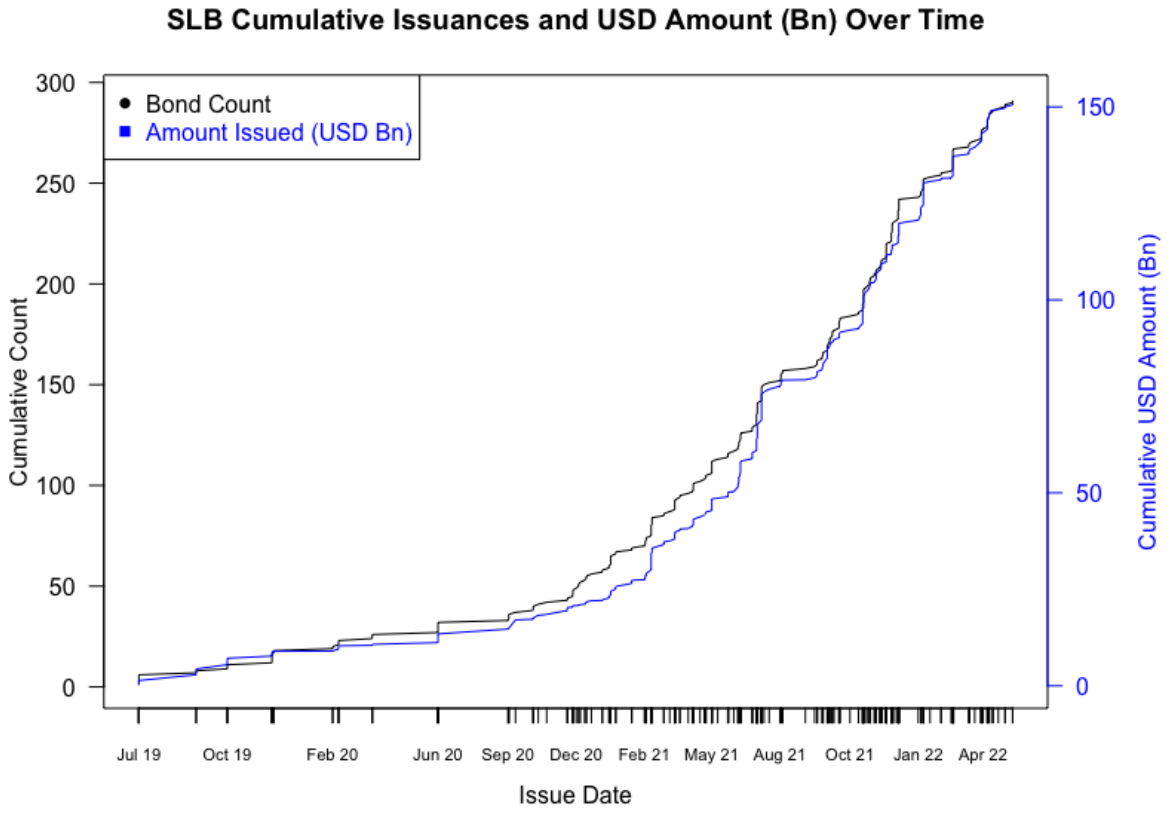


Figure 4.1 EU SLB Issuances Over Time

To validate the understanding of SLB issuance popularity in the EU with the data used in this study, cumulative SLB issuances are plotted from July 2019 to April 2022 in **Figure 4.1**. A clear positive trend can be identified which increases in slope at around the end of 2020, ending with more than a 6 fold increase between November 2020 and April 2022. This clearly shows the rise in popularity of the SLB instrument in the EU, with 292 issuances at the end of April 2022, with a total market size of 150 billion USD.

Table 4.1 SLB Issuances by Industry

Sector	**Count**	**Amount (USD Bn)**	**Pct. of Amount Issued**
Utilities	43	35.8	23.5%
Industrials	70	26.7	17.5%
Materials	57	24.9	16.4%
Consumer Discretionary	37	15.8	10.4%
Consumer Staples	23	13.5	8.9%
Financials	25	11.6	7.6%
Health Care	10	8.3	5.5%
Communications	9	7.0	4.6%
Energy	11	5.8	3.8%
Technology	7	2.9	1.9%

Through an analysis of the raw data from Bloomberg, several characteristics of SLBs could be detected. The industry classification used for the data analysis is based on the Bloomberg Industry Classification Standard (BICS). **Table 4.1** presents the amount of SLBs in billions USD, as well as the mean yield per industry, sorted by the percentage of total amount of issuance. The sectors with the most SLB issuances in terms of billions USD amount are utilities and industrials, followed by materials. However, in terms of the absolute amount of issuance, industrials rank as first, followed by materials and utilities.

Table 4.2 SLB issuances by Country

Country	Count	Amount (USD Bn)	Pct. of Amount Issued
NL	48	43.4	28.50%
DE	96	34.8	22.80%
FR	39	22.2	14.60%
LU	31	19.1	12.60%
IT	21	12.5	8.20%
AT	26	10.6	7.00%
SE	16	3.8	2.50%
IE	3	2.2	1.40%
GR	3	1.9	1.20%
PL	3	0.8	0.50%
CZ	1	0.7	0.40%
ES	3	0.1	0.10%
PT	1	0.1	0.10%
FI	1	0	0.00%

Table 4.2 exhibits the amount of SLBs issued per country within the EU. Most SLBs were issued in Germany, followed by the Netherlands and France, amounting to 22.8%, 28.5% and 14.6% of total value of all EU SLBs, respectively.

Table 4.3 SLBs by Maturity Type

Maturity Type	Count	Amount (USD Bn)	Pct. of Amount Issued
Callable	147	104.2	68.5%
At Maturity	140	46.3	30.4%
Convertible	2	1.3	0.8%
Perpetual/Call	2	0.3	0.2%
Sinkable	1	0.1	0.1%

Table 4.4 SLBs by Coupon Type

Coupon Type	Count	Amount (USD Bn)	Pct. of Amount Issued
Fixed	184	116.8	76.7%
Floating	105	34.6	22.8%
Zero Coupon	1	0.5	0.3%
Variable	2	0.3	0.2%

The break-down of European SLBs by maturity type in **Table 4.3** shows callable SLBs to be the preferred maturity type, followed by at maturity. In terms of coupon type, fixed coupon payments appear to exceed other coupon payment types significantly, as seen from **Table 4.4.**

Table 4.5 SLBs by SPT Type

SPT Type	Count	Amount (USD Bn)	Pct. of Amount Issued
Environment	158	100.9	66.3%
ESG	36	18.4	12.1%
ESG Score	67	18.2	12.0%
N/A	21	9.0	5.9%
Social	10	5.6	3.7%

When it comes to the area within sustainability, the majority of European SLBs are linked to environmental Sustainability Performance Targets (SPTs), such as reductions in GHG emissions and increasing the use of renewable energy, as seen in **Table 4.5**. ESG score appears to be the second most common theme, followed by ESG, meaning a company has multiple SPTs and/or KPIs related to more than one of all three ESG components. For instance, the Swedish company Kinnevik AB has several SPTs that fall under more than one of the ESG pillars, such as greenhouse gas emissions, gender equality and ESG score targets. A fragment of all SLBs are solely tied to Social SPTs or KPIs. The French healthcare multinational Sanofi aims to improve the access to essential medicines for at least 1.5 million patients in low or lower-middle income countries through the company's non-profit branch (Sanofi, 2022).

Table 4.6 Coupon Margin Adjustment

Step-up	Count	Amount (USD Bn)	Pct. of Amount Issued
Step-up: < 25bps	113	44.3	29.1%
Step-up: 25bps	99	73.0	28.0%
Step-up: > 25bps	48	22.0	14.5%
No information	32	12.8	8.4%

In terms of coupon step-ups, **Table 4.6** shows that the majority of European SLBs use a coupon step-up of 25 basis points or less, with an average of 24.3 basis points, in the event of failing to reach the predefined sustainability target. However, **Table 4.6** shows that a significant number of European SLBs appear to have both a step-up and a step-down option. For instance, Varta AG offers a step-up of 2.5bps if the company does not meet its Sustainalytics ESG rating target, however in the event of meeting the ESG rating target, the company will reduce its coupon payments by 2.5bps.

Table 4.7 Additional Information on SLB Penalties

Step-up Type	Count	Pct. of Count
Step-up and Down	73	25.0%
Cumulative Step-up	57	19.5%

It is also relatively common for companies to have multiple SPT or KPI targets, resulting in a cumulative step-up bps per each SPT or KPI targets. Thus, the step-up will depend on the amount of SPTs or KPIs met. **Table 4.7** displays the amount of SLBs containing a cumulative step-up, which is close to 20% of all European SLBs.

Table 4.8 SLB Mean Yield at Issue by Industry

Sector	Count	Amount (USD Bn)	Avg. Yield at Issue (bps)
Utilities	39	35.3	169
Financials	12	5.9	228
Energy	10	5.5	231
Consumer Staples	16	11	270
Health Care	8	8	272
Industrials	22	12.8	275
Materials	35	17.6	350
Communications	5	5.5	373
Consumer Discretionary	17	9.4	397
Technology	2	1.1	501

Table 4.8 and **4.9** show the average yields for the 166 SLBs by different variables for which the yield at issue was successfully collected, sorted in ascending order of the yield. **Table 4.8** provides an overview of the average yield at issue per sector, in which the lowest average yield is for utilities, while the highest is for technology. However, it is worth noting that the amount of SLBs belonging to some particular industries are relatively low, indicating a potential shortcoming when trying to identify whether there is a correlation between the mean yield and the industry. There does not seem to be a particular pattern by for example production versus service sectors.

Table 4.9 SLB Mean Yield at Issue by ESG ratings

ESG Rating	Count	Amount (USD Bn)	Avg. Yield at Issue (bps)
AAA	5	4.4	44.2
AA	14	8.0	121
A	7	6.1	146
BB	1	1.4	240
BBB	4	2.0	266
Not Specified	135	90.3	310

As mentioned in section 3.6, one of the limitations is the lack of available ESG ratings due to the novelty of the instrument. However, based on the amount of ESG ratings available for European SLBs, it can still be observed that the higher the ESG rating, the lower the yield, as presented in **Table 4.9**. This indicates a potential connection between ESG rating and bond yield.

4.2 Matched Bond Descriptive Statistics

Table 4.10 Matched Bonds Yields Descriptive Statistics

Variable	**Mean**	**Median**	**S.D.**	**Min**	**1st Q.**	**3rd Q.**	**Max**
Issue Date Difference (years)	1.7	1.8	1.1	-0.8	0.9	2.3	4.4
Maturity SLB (years)	8.7	7.5	5.4	30.0	10.0	5.5	4.3
Maturity CB (years)	9.8	10.0	5.3	30.0	10.0	7.4	2.0
Maturity Difference (years)	0.6	0.8	1.5	-2.7	-0.4	1.8	2.9
Amount Issued SLB (USD Bn)	0.8	0.8	0.4	0.2	0.5	1.0	2.2
Amount Issued CB (USD Bn)	0.8	0.8	0.4	0.1	0.6	1.1	2.0
Amount Issued Ratio	1.1	1.1	0.4	0.3	0.8	1.3	2.3
Yield at Issue SLB (bps)	216.1	193.7	143.5	3.9	85.4	317.5	506.8
Yield at Issue CB (bps)	268.9	213.9	214.7	2.9	77.6	452.9	670.4
Yield at Issue Difference (bps)	-52.8	-27.2	119.3	-357.2	-142.7	28.5	172.4
Step Up (bps)	30.9	25.0	21.0	12.5	25.0	25.0	100.0
SLB Coupon (bps)	2.156	1.8855	1.433	0	0.875	3.2	5.125
CB Coupon (bps)	2.75	2.5625	2.146	0	0.754	4.625	6.75

Table 4.10 shows descriptive statistics for the 40 bond pairs which were matched in accordance to the methodology denoted in **Section 3.3**. This sample represents 14% of the entire EU SLB universe. The average issue date difference is 1.7 years, with a mean maturity difference of 0.6 years and an average issued amount ratio of 1.1, all well within the limits set by the matching method. SLBs have a slightly shorter maturity and smaller issue size on average. The median and mean difference in yields are -27 and -53 bps respectively. The average step-up value is 30.9 bps, with all SLBs considered having only step-up non-cumulative ratchets. The average coupon for SLBs is 2.2 USD, while CBs have an average coupon of 2.8 USD.

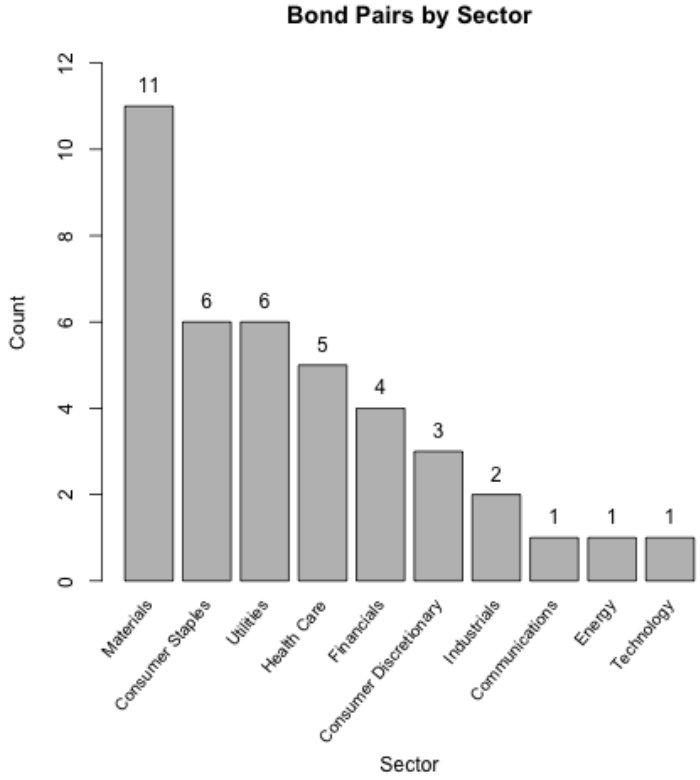


Figure 4.2 Bond Pairs by Sector

The sector with the highest issuances in the sample is materials as seen in **Figure 4.2**, while the sector with most issuances in the entire universe of SLBs is industrials. It is important to note that communications, energy and technology all only have one bond pair representing the sector.

Table 4.11 Shapiro-Wilk Normality Test Statistics

Statistic	**SLBs**	**CBs**	**Difference**
W	0.94365	0.89149	0.97055
p-value	0.04598	0.001091	0.3747

While **Table 4.11** shows that the distribution of yields at issue for SLBs and CBs are not normal (as the p value is below 0.5 for the Shapiro-Wilk normality test), the difference in yields can be said to be normally distributed due to its p-value scoring higher than 0.5. Thus, this is the rationale for performing the non-parametric Wilcoxon signed rank test on the matched bond data. Furthermore, based on the normality of the yield difference, an ordinary least squares regression is carried out with the yield difference as the independent variable.

4.3 Wilcoxon Signed Rank Test

The Wilcoxon signed rank compares two related or matched samples and determines whether there is a statistically significant difference. The test can be performed as two-tailed to test whether the difference is not 0, or one-tailed to test if the difference skews towards positive or negative. For this thesis, both a two-tailed and a left-tailed test are performed, in which a p-value lower than 0.05 rejects the null hypothesis and accepts the alternative hypothesis.

Table 4.12 Wilcoxon Signed-rank Test Statistics

Wilcoxon statistic	**Two-sided test (NH1)**	**Left-sided test (NH2)**
V	243	243
p-value	0.025	0.013

The difference between SLB and CB yield at issue is statistically significant at a 95% confidence level through the Wilcoxon signed-rank test results shown in **Table 4.12**, with a p-value of 0.025 for NH1, and 0.013 for NH2, signifying that there is a statistically significant difference in yields between the bonds groups and that this difference is a negative one. Therefore NH1 and NH2 can be rejected and AH1 and AH2 can be accepted.

4.4 OLS Regression

Table 4.13 Analysis of Variance

Variable	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
Country of Incorporation	7	19.761	2.823	16.379	0.002	**
Sector	9	19.744	2.194	12.728	0.003	**
Maturity Type	1	0.127	0.127	0.737	0.424	
Credit Rating	8	11.394	1.424	8.263	0.010	**
ESG Rating	2	0.257	0.129	0.746	0.513	
SPT Type	2	2.098	1.049	6.085	0.036	*
Step Up	1	0.839	0.839	4.870	0.069	.
Issue Date Difference	1	0.000	0.000	0.002	0.962	
Maturity Difference	1	0.007	0.007	0.040	0.848	
Issue Size Ratio	1	0.282	0.281	1.633	0.249	
Residuals	6	1.034	0.172			

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

The analysis of variance for the regression of the full model is presented in **Table 4.13**, which shows that the country of incorporation, sector, credit rating and SPT type are all statistically significant at at least the 95% confidence level. It is important to note that no model building process was followed as the purpose of the regression was not to identify which combination of variables had the best predictive power, but rather to explore the effect on the yield difference, if any, of all variables possible.

Table 4.14 Regression Coefficient Estimates and t values by Deconstructed Variable

Coefficients	**Estimate**	**Std. Error**	**t value**	**Pr(>|t|)**	
Intercept	3.344	2.603	1.285	0.246	
DE	-0.091	1.002	-0.090	0.931	
FR	3.591	2.182	1.646	0.151	
IE	2.365	3.957	0.598	0.572	
IT	0.221	3.907	0.057	0.957	
LU	-0.641	1.460	-0.439	0.676	
NL	-0.690	2.218	-0.311	0.766	
SE	-0.087	4.951	-0.018	0.987	
Consumer Discretionary	-4.276	1.954	-2.188	0.071	.
Consumer Staples	-4.188	1.515	-2.764	0.033	*
Energy	-6.505	3.476	-1.871	0.111	
Financials	-3.359	4.260	-0.788	0.460	
Health care	-3.672	1.887	-1.946	0.100	.
Industrials	-2.448	2.238	-1.094	0.316	
Materials	-2.593	3.473	-0.747	0.484	
Technology	-7.666	1.599	-4.795	0.003	**
Utilities	-5.226	2.713	-1.926	0.102	
Callable	-3.011	2.528	-1.191	0.279	
Floating	NA	NA	NA	NA	
AA	-0.004	1.273	-0.003	0.998	
AA-	0.131	2.310	0.057	0.957	
B	-4.910	3.670	-1.338	0.229	
BB	-0.790	1.439	-0.549	0.603	
BB-	2.798	1.375	2.034	0.088	
BB+	-0.045	0.781	-0.058	0.956	
BBB	4.144	2.928	1.415	0.207	

BBB-	NA	NA	NA	NA
BBB+	1.644	2.820	0.583	0.581
NR	NA	NA	NA	NA
ESG AA	-1.693	1.876	-0.902	0.402
ESG AAA	NA	NA	NA	NA
ESG B	NA	NA	NA	NA
ESG N.S.	-0.527	0.453	-1.163	0.289
SPT ESG	0.362	1.221	0.296	0.777
SPT Social	0.087	1.645	0.053	0.960
Step Up	-0.032	0.025	-1.303	0.240
Issue Date Difference	-0.175	0.210	-0.830	0.438
Maturity Date Difference	-0.101	0.167	-0.605	0.567
Issue Size Ratio	1.757	1.375	1.278	0.249

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1, NA: Not enough values

Upon further inspection through **Table 4.14**, Consumer Staples and Technology are significant to at least the 95% confidence level, with a 4.1 and 7.6 negative effect on the difference in yields in comparison to the reference variable, Communications. As the reference dummy variables for the country, credit rating and SPT type are omitted in **Table 4.14**, Austria, A+ and Environment are all significant to the 95% confidence level as well. In contrast to Kölbel and Lambillon (2021), no significance to the callable feature of SLBs was identified through the OLS regression.

Table 4.15 Regression Error and Statistics

Statistic	**Value**
Residual Standard Error	0.4152 on 6 degrees of freedom
Multiple R-squared	0.9814
Adjusted R-squared	0.879
F-statistic	9.584 on 33 and 5 DF
p-value	0.004628

The entire model is significant on a 95% confidence interval with a p-value of 0.004628 by **Table 4.15**. It can be noted that there is a negative effect on the R squared value by the number of dependent variables used, as the change between the Multiple R-squared value and the adjusted R-square value is negative 1.1, however still at a high level of 0.879, meaning that 88% of the variation in yield difference can be explained by all the variables combined in the regression.

4.5 Further Dependent Variable Exploration

In order to understand the full effect of the significant variables, more tables were created grouping bond pairs by the different dependent variables.

Table 4.16 Bond Pair Yield Difference by Sector

Sector	**Count**	**Amount (USD Bn)**	**Avg. Yield Diff. (bps)**
Materials	11	7.34	-137
Health Care	5	6.15	-101
Utilities	6	5.84	-19.6
Consumer Staples	6	5.44	11.7
Consumer Discretionary	3	2.35	27.1
Financials	4	1.96	51.6
Energy	1	1.21	-24.8
Industrials	2	1.14	-88.4
Technology	1	0.92	-145
Communications	1	0.80	11.3

Table 4.16 shows that while consumer staples and technology were significant in the regression, and while technology has the most negative average yield difference, it only contains one observation. Consumer staples has 6 observations and the fourth highest issuance amount, but a positive yield difference, perhaps meaning that while it has a negative effect relative to the reference variable in the regression (communications), the effect is still positive. Materials, which has the highest number of bond pairs and amount issued have the second most negative average yield difference, however do not show as a significant variable

in the regression. Interestingly, finance has the highest positive average yield difference, however this factor is not deemed significant either, and only has 4 observations.

Table 4.17 Bond Pair Yield Difference by Country

Country	**Count**	**Amount (USD Bn)**	**Avg. Yield Diff. (bps)**
FR	11	9.36	-30.5
NL	9	8.79	-58.6
IT	6	4.50	-11.9
LU	3	3.97	-36
AT	6	3.93	-197
DE	2	1.34	109
IE	1	0.85	13
SE	2	0.40	-59

Table 4.17 shows that Austria has the most negative average yield difference, with 6 sample bond pairs. Only Germany and Ireland have positive yield differences, but with only 2 and 1 sample respectively. The Netherlands has the most negative yield difference with 9 observations, but was not significant in the regression.

Table 4.18 Bond Pair Yield Difference by Credit Rating of SLB

Credit Rating	**Count**	**Amount (USD Bn)**	**Avg. Yield Diff. (bps)**
BBB	12	8.55	37.6
BBB+	4	5.03	-26.5
NR	7	3.87	-37.8
BB-	4	3.72	-140
BBB-	4	3.55	-178
A+	1	2.16	-141
BB+	3	1.79	-168
AA	1	1.39	50.2

BB	1	1.38	23
B	2	1.00	-200
AA-	1	0.71	54.8

In terms of credit rating, this variable was significant in the model, with specifically reference variable A+ being significant. However, **Table 4.18** shows that most SLBs in the sample are rated as BBB, and there seems to be a trend towards lower rated bonds having higher negative difference, with the expectation of the single A+ rated bond having a negative difference.

Table 4.19 Bond Pair Yield Difference by Coupon Type

Coupon Type	**Count**	**Amount (USD Bn)**	**Avg. Yield Diff. (bps)**
Fixed	38	32.74	-52.4
Floating	2	0.40	-59

The vast majority of bond pairs in the sample have a fixed coupon, as seen in **Table 4.19**. This factor was not significant in the regression and no estimation could be made for floating coupon types due to the lack of data.

Table 4.20 Bond Pair Yield Difference by Maturity Type

Maturity Type	**Count**	**Amount (USD Bn)**	**Avg. Yield Diff. (bps)**
Callable	34	28.3	-53.2
At maturity	6	4.8	-50.4

The majority of the matched bonds had a callable maturity type, which had coefficient estimation of -3 in comparison to the reference variable “at maturity”, and a slightly lower average yield difference but was not significant in the regression, as seen in **Table 4.20**.

Table 4.21 Bond Pair Yield Difference by SPT Type

SPT Type	**Count**	**Amount (USD Bn)**	**Avg. Yield Diff. (bps)**
Environment	29	23.40	-50.2
ESG	8	5.62	-50.8
Social	3	4.12	-83

For the SPT type, most SLBs had solely an environment target, with a less negative average difference for solely social SPTs, however with only a sample of 3 as seen in **Table 4.21**. It is interesting to note that there is a much smaller difference for bond pairs with a social SPT type.

Table 4.22 Bond Pair Yield Difference by ESG Rating

ESG Rating	**Count**	**Amount (USD Bn)**	**Avg. Yield Diff. (bps)**
A	7	6.08	16
AA	6	3.73	29.3
AAA	2	2.18	30.7
BB	1	1.38	23
N.S.	24	19.76	-103

Lastly, the ESG rating distribution is presented in **Table 4.22**, and while this factor was also not significant, it is interesting to see a somewhat negative trend with a lower ESG rating or no rating, with most SLBs having no rating and this group having a negative difference.

4.6 Chapter Summary

The empirical findings chapter describes the entire EU SLB universe consisting of 292 bonds primarily issued in Germany, by industrial companies, with approximately equal amounts of callable and at maturity types, having mostly 25 bps or lower as step-ups, with most having single step-ups. It later describes the matched bonds sample, denoting a mean difference of -53 bps in yield at issue between the matched SLBs and CBs, which is statistically significant at a 95% confidence interval. An OLS regression is presented showing that country of incorporation, sector,credit rating and SPT type are significant factors in explaining the yield difference at a 95% confidence interval. In particular Austria, consumer staples, technology and a rating of A+ and an SPT type of environment have a significant negative effect, however technology and the A+ credit rating have only one sample. Lastly, some additional data per dependent variable is presented, in which ESG rating shows a somewhat negative trend by lower rating to yield difference.

5 Analysis and Discussion

This chapter analyzes the empirical findings of the entire EU SLB universe as well as the statistical tests performed on the bond pairs in order to address the hypotheses and research question. The reasons for the premium and the effects of the sector on this yield difference are explained, and prior academic research is utilized to provide a synthesis on the implications on SLBs issued within the European Union.

5.1 SLB Characteristics

The issuance of SLBs within the European Union has increased ever since the first issuance, with a CAGR of 563% between 2019 and the date of data extraction in April 2022. There seems to be a general increase in the issuance of ESG fixed-income securities, as can be seen from **Figure 1.2**, indicating a positive trend for sustainability-themed securities in the debt capital market.

On a country-level, the issuance of SLBs appears to deviate. The finding on issuing countries presented in **Table 4.2** is similar to that of Dan and Tiron-Tudor (2021) on green bonds, where Germany, the Netherlands and France were also found to be the top three issuers. This indicates that the issuance of SLBs as well, may be impacted by similar security-specific and macroeconomic factors. Furthermore, the descriptive statistics on outstanding SLBs among industries suggest that the debt instrument is favored among production intensive industries, which could be argued to be in line with Flammer's (2021) study on green bonds. Industrials, materials and utilities contain the largest amount of SLB issuances, however simultaneously having the greatest impact of sustainability activities.

The SLBs issued in the EU show a preference of environmental Sustainability Performance Targets (SPTs) over other SPTs, as presented in **Table 4.5**. Considering that industries with the highest amount of issuance are production intensive, it is therefore reasonable to presume that SPTs such as GHG emissions reduction and increasing the use of renewable energy are the most relevant and achievable for these particular industries. The variety of different SPTs in **Table 4.6** also shows the flexibility of the instrument in terms of achieving different sustainability targets, including non-environmental ones.

By dividing European SLBs into different maturity types, the findings indicate callable SLBs to be preferred among issuers, followed by at maturity. This contrasts the data presented by Kölbel and Lambillon (2022), which suggests vice versa. The difference may indicate a difference in maturity type preference among geographical areas, as the SLBs analyzed by Kölbel and Lambillon (2022) were not solely limited to the European Union. However, the preference of callable bonds raises a question. Callable bonds allow issuers to redeem the bond prior to maturity, thus providing an opportunity for issuers to exempt themselves from the obligation of paying for the coupon step-up in the event of failing to reach the KPI or SPT target(s) (Kölbel & Lambillon, 2022). Another indication of issuers' cautiousness is the coupon step-up. A majority of European SLBs use a coupon step-up of less than 25 basis points, which may be an expression of issuers attempting to minimize their financial liability in the event of failing to reach the predefined sustainability target. Moreover, in contrast to the findings by Liberadzki, Jaworski, and Liberadzki (2021) that proposes only one SLB had both a step-up and down option, this research discovered substantially more. In particular, 73 of all 292 SLBs had both a step-up and step-down option depending on whether the SPTs or KPIs are achieved.

5.2 Hypothesis Verification

In order to answer the research question, "Is there a premium to investors among SLBs issued within the European Union?" three null hypotheses were formulated to be tested in section 4. The Wilcoxon signed rank test addressed the NH1 and NH2 and has rejected both, meaning that AH1 and AH2 can be accepted. An average difference in yields, which is negative at -53 bps is identified and is statistically significant at a 95% confidence level in **Tables 4.10** and **4.12**, which reflects a premium to investors on average when investing in SLBs. This finding is about 24 bps higher than Kölbel and Lambillon's (2021) finding, however they do not only consider SLBs issued by EU companies, which could drive this difference. The negative result is consistent with Liberadzki, Jaworski, and Liberadzki (2021) as well. The negative yield is because while investors could pay the same price for an SLB or a CB, the yield or return they receive when the bonds mature is lower for an SLB on average due to a lower coupon. Alternatively, this could reflect a high demand for these bonds, given that the yield to maturity is calculated using the price, and a high demand driving up the price would decrease this yield. Therefore, the research question can be answered affirmatively, with more elaboration on the reasons and theoretical explanations for this premium in the following section.

All bond pairings had very similar issue dates and maturities as seen in **Table 4.10**, with the highest average difference among them being 1.7 years, with the highest standard deviation

being 1.5, and an average issue amount ratio well within the defined limits 0.25 to 4 at 1.1 with a standard deviation of 0.4. Despite this tight matching, the standard deviation of the yield difference is somewhat high at 119.3, with the lowest difference being -357.2 bps versus the maximum difference being 172.4 bps. Therefore it can be said there is some variability in the differences in bonds but from the initial descriptive statistics it does not seem that this somewhat wide range is due to matching differences. It is also interesting to note that there are some bonds that exhibit a positive difference in comparison to CBs, meaning that investors receive a higher return in comparison to the CB counterpart, which could mean there is less demand for these specific bonds, or that they have a higher coupon.

Lastly, the average step-up in the sample is 30.9 bps, with the lowest step-up being 12.5 and the highest 100, with a standard deviation of 21, as seen in **Table 4.10**. Thus, most step-ups are around 30.9 bps, which is lower than the average yield difference identified. This is in alignment with Kölbel and Lambillon (2021), and Liberadzki, Jaworski, and Liberadzki's (2021) findings, as they too found that the premium was higher than the average coupon-step up. This reflects that if an investor were to buy an SLB at issue and hold it until maturity, even if the SPT was not met, the investor would still pay a premium, and the issuer would enjoy capital at a lower cost than if they issued a CB.

An assumption in this paper is that due to the extensive matching process, the difference in yields should be due to the difference in sustainability relatedness of the bonds (and thus investor preferences for sustainability), rather than other explanatory factors. However, in order to objectively further understand what factors lead to this yield difference apart from this assumption, the OLS regression was conducted. The explanatory variables country of incorporation, sector, credit rating and SPT were found to be significant at a 95% confidence level. The entire model had an adjusted R squared value of 0.88 with a residual standard error of 0.42 and was overall significant at a 95% confidence level as seen in **Table 4.15**. The variables that were significant do not represent non-sustainability differences between the bond pairings with perhaps the exception of credit rating, as all bond pairs were issued by the same issuer which was incorporated in the same country and belongs to the same sector. The credit rating is that of the SLB, which may or may not be equivalent to its CB match, however given they that they were issued by the same issuer within maximum 4.4 years of each other and mature at maximum within 2.9 years of each other, it is reasonable to assume the credit rating, if any, would be similar between bonds. This could be further verified with more data, however this assumption does not seem unrealistic. The SPT type is a feature of only SLBs, but this is related to the sustainability of the bond, as this is the sustainability performance target type (environmental, social, ESG, or ESG score related) that must be fulfilled to avoid a step-up. The variables that represent differences between bonds, issue date difference, maturity data difference and issue size ratio are not significant, and all have coefficient estimates within the boundaries of -1 to 2, meaning the effect they have on the yield

difference is minimal. Therefore, it can be concluded that while the significant factors have an effect on the yield difference, the results of the Wilcoxon signed rank test are robust, as these factors do not represent differences between the bonds, but rather features of the issuer or are sustainability related.

In more detail, Austria had significance and similar slightly less negative effect as Germany, Luxembourg, the Netherlands and Sweden. It is not clear the reason for this effect. Consumer staples and technology had a significant negative effect on the yield difference in comparison to the reference variable, communications. However, while technology had the most negative effect, the sample size is too small to fully trust this estimate. Therefore, consumer staples seems to be the only trustable estimate of -4.2 in comparison to communications as seen in **Table 4.14**. However **Table 4.16** shows that the average yield difference for the 6 consumer staples SLBS is 11.7bps, with a possible explanation being that companies in the consumer staples sector have less credible or material SPTs, thus perhaps needing a slightly higher yield to attract investors. The credit rating of A+ had a negative significant effect, however, given the sample size is only of one bond pair, it could be misleading to use this estimate, and therefore is not considered as actually significant in the regression. Lastly, for SPT Type, having an SPT related solely to the environment has a significant negative effect on the yield difference, suggesting that investors value SLBs with environmental targets. However, it is important to note that the majority of matched SLBs have solely environmental targets. The difference in yield can thus be said to be explained by the sustainability aspect of SLBs, as well as its issuer's country of incorporation, sector and SLB SPT type.

In contrast to Kölbel and Lambillon's (2021), this study did not find a significance to the callable feature of SLBs, however the regression did show that it had a more negative effect than at maturity bonds. The reason for this could potentially be that the callable feature has a greater effect in regions outside of the EU. It is also interesting that **Table 4.3** showed that overall SLBs are about 60% callable, however **Table 4.20** shows that in the sample test 85% of the SLBs are callable. This could have also affected the results as Kölbel and Lambillon (2021) found that overall SLBs were mostly at maturity rather than callable in their sample.

To address AH3, this study did not find that SLBs belonging to the financial industry had a significant positive effect on the yield difference. Therefore the null hypothesis cannot be rejected, although the coefficient estimate was -3.4 in comparison to the reference variable for the sector, communications, as seen in **Table 4.14**. This does not necessarily mean that it has an overall negative effect on the yield, only that the effect is more negative than communications. However, the average yield difference for the four SLBs whose issuers were categorized as belonging to the financial sector is 51.6 bps in **Table 4.16**. This could mean that on average investors are not willing to accept a lower return for SLBs issued by financial companies, perhaps as there is a greater greenwashing risk perception on average as identified

by Baldi and Pandimiglio (2022) for green bonds. However, any effect of the financial industry is not significant by the regression.

Despite this, there did seem to be a pattern in **Table 4.16**, where materials, health care, utilities, energy, industrials and technology had negative average yield differences, while consumer staples, consumer discretionary, financials and communications had positive yield differences. This could suggest that industries that are more production intensive have a premium while more service based industries do not have premiums, perhaps due to investors perceiving a greater greenwashing risk in less productive intensive industries, requiring a lower premium or even discount.

5.3 Investor Preference for Sustainability

Relying on the theoretical framework of stakeholder theory, the SLB premium could be explained by the influence of stakeholders on corporate debt financing. The most relevant stakeholders with major decision-making power regarding SLB issuances include investors, issuers or managers and regulators. In particular, institutional investors' demand for sustainability could be encouraging firms to issue more innovative sustainable debt instruments, and conveying the value placed on these initiatives, allowing firms to price them accordingly. Furthermore, society in the EU is experiencing a shift in sustainability awareness and concern, which could mean that the newer generations of managers also drive sustainable finance initiatives, which have a material impact on both the business financial performance and sustainability activities. Perhaps most importantly, the EU itself plays a large role as a stakeholder as it relates to encouraging sustainable financing by introducing new regulations, which oblige firms to materially disclose sustainability practices. The issuance of an SLB thus allows firms to signal these practices, in the same way as for green bonds (Flammer, 2021). The interaction between issuers, investors and regulators may thus lead to the agreement on a price which represents the value of sustainable activities, leading to a sustainability premium.

Investors can be argued to give rise to the SLB premium through sustainability preferences and demand for novel financial instruments. A prior study by Fatemi & Fooladi (2013) proposes that a sustainable value creation framework can be rewarded with a market premium. The authors are essentially referring to stocks, however a similar occurrence can be observed on both green bonds and SLBs. Fried, Busch and Bassen (2015) have in their study, confirmed bonds to have the most correlation between ESG and financial performance, which provides a potential explanation on the likely existing premium among sustainability-linked and green bonds. The sustainable nature of the fixed income securities is essentially rewarded with a premium pricing, compared with comparable CBs. One possible explanation for the

existence of premium is provided by Liberadzki, Jaworski, and Liberadzki (2021), who states that such phenomena may exist simply due to the demand for SLBs being greater than its supply. Taking into consideration that the SLB is an emerging financial instrument, it may be reasonable to assume that SLBs possess what is called a novelty premium (Costa, Chamon, & Ricci, 2008). This in turn may stem from the risk preferences as well as market concerns about the accuracy of variables that affect the payment, which in SLB case could be KPI-tied SPTs.

One potential explanation for such substantial demand in the first place is risk management. Numerous prior research (Ferrer, Shahzad and Soriano, 2021; Reboredo, Ugolini & Aiube, 2020; Reboredo & Ugolini, 2020; Kuang, 2021; Haq, Chupradit & Huo 2021) have demonstrated ESG and green bonds in particular, to be associated with lower risk and attracting risk-averse investors, which was further confirmed by Singh's (2021) study on the preference over investment-grade ESG bonds during the COVID-19 pandemic. This suggests sustainable bonds to be an attractive investment choice, when considering the option of portfolio diversification. Although most prior research is conducted on green bonds, the rapid growth of SLBs since the first issuance in 2018/2019 evince that similar perceptions may exist on SLBs. Furthermore, all existing SLB research (Liberadzki, Jaworski, & Liberadzki, 2021; Kölbel & Lambillon, 2022) in combination with the high growth since 2019, suggest that the existence of a SLB premium may point to financial market participants' willingness to pay more for lower risk and sustainability, especially during the volatile times of the COVID-19 pandemic.

Another indication of investors' willingness to pay more for sustainability is the connection between ESG ratings and mean yield, as presented in **Table 4.9**. The higher the ESG rating is, the lower the mean yield, pointing to the fact that investors are likely to be more accepting of lower returns if they believe a company exhibits superior sustainability performance. This is in line with the study by Baldi and Pandimiglio (2022), who found that investors are willing to accept lower returns if they have confidence that their investment will contribute to a greater sustainability impact. In other words, reliable companies that have attained a higher rating are more likely to achieve sustainability goals. Furthermore, numerous studies have shown that external certificates are the very source of price outperformance in the case of green bonds (Hachenberg & Schiereck, 2018; Russo, Mariani & Caragnano 2020; Flammer, 2021; MacAskill et al., 2021; Dorfleitner, Utz & Zhang, 2022). Wu (2022) proposes that bonds of sustainable nature are inherently higher-cost due to third-party reviews, audits as well as certificates, which the ICMA suggests should be attained on at least annual basis for both SLBs and green bonds (ICMA, 2020). Therefore, in parallel with green bonds, SLBs are also likely to internalize the costs of external revision, which is in line with the proposition by Wu (2022) on green bonds. Combined with the risk component, lower yield for a higher ESG rating indicates that investors are willing to pay for SLBs of higher reliability.

In addition, new restrictive policies related to sustainable finance could be yet another potential explanation for such strong demand for SLBs. Such idea is supported by Liberadzki, Jaworski, & Liberadzki's (2021) research, where they state that apart from ESG factors, investors are willing to acquire SLBs also due to anticipation of further extension of rules and regulations encouraging sustainable investment as part of portfolios as well as business strategies. This can be visibly demonstrated by the recently enforced regulation by the European Union's Sustainable Finance Disclosure Regulation (SFDR), which came into effect on March 10, 2021 (Delabye & Fross, 2021). This policy makes it now mandatory for every fund manager raising capital in Europe to make disclosures regarding how sustainable their investments are, which are then ought to be conveyed at management company and product levels through various channels (Delabye & Fross, 2021). In fact, the study by Becker, Martin, & Walter (2022) discovered the extent to which such regulation incentivizes the movement of capital within the financial sector towards sustainable investments. After the new regulation, in particular the SFDR, a significant increase in sustainability ratings among EU-based funds was observed, confirming the mobilization of capital towards greener alternatives (Becker, Martin, & Walter, 2022). Additionally, investors were found to assign greater value to greater integration of sustainability factors, resulting in associated funds experiencing greater net fund flows (Becker, Martin, & Walter, 2022). All in all, jurisdictional evolution provides evidence demonstrating the increasing incorporation of sustainability aspects into legal bodies regulating the business activities. This is accompanied by a greater interest from investors, which is highlighted throughout numerous literature.

Nonetheless, the value that some stakeholders assign to sustainable finance instruments such as SLBs pivots around the fact that such investments will have ambitious and material impact on environmental, social, or corporate governance factors; however, one may question to which extent the assumption holds. As it has been mentioned previously, the structure of SLBs differs from green bonds as it utilizes Sustainability Performance Targets based on KPIs. Despite this, Sustainability-Linked Bond Principles stipulated by ICMA do not provide any definition for what exactly 'material' or 'ambitious' means (ICMA, 2020). Such a gap creates an ambiguity that could result in greenwashing outcomes as there is no universal agreement on what is the most adequate way to measure materiality or which indicators are the most relevant, which further might differ based on the industry (Vulturius, Maltais, & Forsbacka, 2022). In addition, while the EU is one of the pioneers in establishing sustainability ambitions that applies to all industries and business areas alike, regulations related to sustainability bonds remain scarce. All regulations to date are voluntary in nature, albeit most companies do seek third-party reviewers, as advised in the Green Bond Principles and the Sustainability-Linked-Bond principles by the ICMA, as well as in the EU Green Bond Standard. Thus, from the literature it can be concluded that regulative actions are currently more targeted at green bonds and lack coercive power inherent to policies enforced by the government. Nevertheless, it appears that there is a lesser risk for greenwashing in the EU due

to the existence of universal regulations across regions such as the SFDR and the EU Taxonomy, as well as the monetary incentives provided by external audits on sustainable bonds.

Moreover, the empirical findings of this paper show that issuers of SLBs still experience a -22.1 bps yield difference compared to CBs after the average coupon step up. This in turn, means that a company raising capital through the issuance of SLB would still be able to enjoy a cheaper source of capital, despite the penalty enforcement in the form of a coupon step-up. When taking the investors' perspective, in financial terms they would benefit the most in an alternative where the firm fails to meet its obligations as step-up would mean a greater interest rate that has to be paid by the company. These two significant observations call into question whether the SLB design is suitable to create appropriate incentives towards actual realization of SPTs, thus making an impact. Such evidence is consistent with the previous research discussed in the literature review and calls attention to distorted incentives produced by the very structure of SLBs. In conclusion, factors increasing the risks of greenwashing include absence of 'ambitious' and 'material' definitions and metrics in ICMA's SLBP, the lack of mandatory regulations around SLBs, distorted financial incentives for both investors and issuers, as well as the flexibility related to use of proceeds, which urge for further research and improvement. More importantly, this shows that while investors may display greater demand for SLBs due to its potential effect on ESG aspects, such instrument might fail to ensure that the desired impact is achieved; however, this is yet to be able to be objectively proven as the majority of SLBs have not reached their SPT date.

Using the definition of sustainable finance by Cunha, Meira and Orsato (2021), SLBs can be seen to have a noticeable impact in sustainable finance, enabling the creation of positive, long-term impacts on society and the environment. The issuing companies are able to improve their sustainability performance, which in turn improves the prospects of achieving sustainability objectives such as the Agenda 2030 and the net-zero transition. Moreover, the option of issuing SLBs allows even more companies to contribute to sustainability, as the use of bond proceeds is not solely limited to a specific project. The sustainability impacts of SLBs is likely to become more materialized over time with increasing amounts of issuance.

In terms of the stakeholder theory, the effects of SLBs can be seen to reach various stakeholders. The achievement of SPT and KPI targets, as well as every part in the process can be seen to affect a company's stakeholders - employees, investors and the society at large. SLBs generally, can be seen as a way for a business to take the interests of its socially and environmentally conscious stakeholders into account, which is done through creating more sustainability impact in business decisions. By engaging in CSR activities, as well as incorporating ESG in business decisions, businesses are creating a ripple effect through stakeholder interrelatedness, a concept that is elaborated by Freeman and Dmytriyev (2017).

Freeman and Dmytriyev (2017) suggest that stakeholders are essentially interconnected, as business decisions may have an effect on stakeholders that reach beyond those who were initially intended. The existing SLB premium can cause a ripple effect through first financing and then achieving SPT or KPI targets, assuming that these instruments provide a sufficient incentive to do so. The achievement of these quantifiable targets could increase the trust of stakeholders and the incentive for a business to incorporate sustainability even more in business objectives.

Furthermore, when looking at potential differences among industries, it can be observed that the majority of SLBs possess mainly environmental SPTs, which is displayed in **Appendix 1**. In terms of the percentage of environment related SPTs, in descending order Utilities and Energy industries come first, while Financial industry comes last. This in turn is consistent with Flammer's (2021) findings that sustainable bonds have become more widespread among the industries where environment is financially material to companies' activities. Furthermore, despite OLS regression output showing that the financial sector did not have a significant positive effect on the yield difference, the average yield difference for that sector was positive. While previous research also concluded that there is a relatively more substantial greenwashing risk within the Financial industry (Baldi & Pandimiglio, 2022); however, the empirical findings presented in this paper are not able to provide grounds to neither support nor reject such statement.

5.4 Validity, Reliability and Limitations

The validity of this study relies on the validity of the assumption that a premium for a bond can be identified using the yield difference within a very similar bond pair, if this difference in yield can represent a sustainability premium, and if the methodology used to measure this is suitable. All three of these points are fulfilled, as many previous studies on debt securities utilize a bond matching approach to measure the difference in yields, representing a premium if the difference is negative. This is the case as well in this study. The assumption that this premium could represent a sustainability premium is also validated by the OLS regression, as no variables representing differences between bonds were significant, meaning the difference can be explained by the sustainability aspect of SLBs, and some issuer specific characteristics, such as country of incorporation and sector, and SLB specific characteristics like the SPT type. There is a possibility that there were some factors missed in the regression that could further explain the difference, such as for example interest rates which were used in Kölbel and Lambillon's (2021) study but were not used in this study due to time constraints. However, 88% of the difference can be explained with the combination of factors examined (10 variables), meaning there is not much explanatory power left for additional variables.

In terms of the reliability for this study, overall, given that the data was sourced from highly reputable financial databases and the matching methodology and statistical analyses are described with great detail, it can be stated that the results from the study are reliable. Replication of this study could easily be carried out with access to the Bloomberg and Refinitiv databases and any statistical software. Using the same methodology as other yield difference studies ensures that the findings can be more easily compared with others in the debt finance field.

One of the main limitations of this study that could restrict the generalizability of the findings is the bond pair sample size. The sample size was mainly reduced due to the lack of yields at issue for approximately half of the total EU SLB universe. This was partly mitigated by gathering these values using an alternative Bloomberg formula, which did not require the yield at issue to be a specific field in the database but rather fetched the yield at issue at market open on the day of issuance. The sample of 40 bond pairs represented 14% of the EU SLB universe, representing 7 of the 14 countries, and all 10 of the sectors. However the countries it represented had the most data points with the exception of Ireland. The Wilcoxon Signed Rank test is particularly suited for small same sizes, which was taken into consideration when designing the methodology for this thesis (Berenson, Levine & Szabat, 2014). Thus the main finding of this thesis, that a negative yield difference of -53 bps on average exists between the populations of comparable SLBs and CBs, is not limited by the small sample size.

However, the findings relating to the OLS regression could be more affected by the small sample size, as linear regressions generally require more data points to create a suitable model (Berenson, Levine & Szabat, 2014). Nevertheless, a sample of 40 is still sufficient to generate significant statistical findings (Berenson, Levine & Szabat, 2014). Another limitation in particular to the regression is that there were a lot of missing credit and ESG ratings, and some countries and sectors had only one pair as a representative. The potential effect of this can be seen in **Appendix 3** and **Appendix 4**, in which the residuals can be seen to be exactly zero for a part of the data points, and does not seem entirely normally distributed in the QQ plot. There was also some missing information on the step-up mechanism for some of the bonds, where the description was very short on Bloomberg, which limited some of the analysis.

In terms of the theoretical framework used, the stakeholder theory can explain the observations in this study to some extent, however there are various other factors at play. In reality, not all stakeholders are held equal by businesses, especially as stakeholder expectations do not always align. Furthermore, the role of regulations imposes obligation towards companies rather than companies acting out of their own judgment to satisfy a particular stakeholder.

The newness of the SLB market also imposes a limitation on these findings, as it can be expected that the companies that have issued these bonds are pioneers and therefore could be much more sustainability inclined or have more resources to issue such bonds. This also means that this study could not be reliably designed as a time-series due to the short time of data available. Thus this paper provides no insight into the development of the phenomena post issuance. The findings of this paper only relate to the primary market and the investors which have the resources to acquire the SLBs at issuance, which could have a different inclination to sustainability than investors in the larger secondary market. As such, the findings of this paper should be considered as preliminary evidence for a SLB premium, specifically for primary market investors, and especially considering the somewhat smaller sample size.

6 Conclusion

6.1 Achievement of Research Aims and Objectives

In conclusion, SLBs undoubtedly are likely to receive greater attention within academic research given their relevance as an emerging financial instrument in driving transition towards more sustainable operations, its significant growth trajectory over the recent years as well as continuously developing legislature. The aim of this paper was to examine whether there is a premium to investors among SLBs issued within the European Union, which was confirmed to be true. After tightly matching SLBs with CBs and conducting a Wilcoxon signed-rank test, it was found that there is a difference in yield at issue between SLBs and CBs that is statistically significant at 95% confidence level. Despite the careful matching process, the standard deviation of the yield difference could perhaps be considered high at 119.3. The SLBs were found to have an average yield difference amounting to -53 bps with an average step up of 30.9. These findings are consistent with the previous research, confirming the existence of a negative differential resulting in a premium among SLBs and, thus, rejecting the null hypothesis NH1 and NH2. This implies that SLB issuing firms are still in a more advantageous position compared to ones issuing CBs as they appear to possess -22.1 premium despite the enforcement of penalty in the form of coupon step-up. Nevertheless, such observation does not necessarily apply to all of the SLBs as some did exhibit a positive difference in comparison to CBs.

Following the test, in order to account for the underlying assumption that difference in yields is caused by differences in the sustainability dimension of bonds rather than other potentially explanatory factors, an OLS regression was performed. The results demonstrated that country of incorporation, sector, and SPT type were found to be significant factors, where respectively Austria, Consumer Staples, and environmental SPTs were significant. However, issue date and maturity differences as well as issue size ratio are the only variables that represent differences between bonds and were not found to be statistically significant. Therefore, while the variables found to be significant do have an effect on the yield difference, the results of the Wilcoxon signed rank test were proven to be robust. When addressing the NH3, this study did not find that SLBs belonging to the financial industry had any significant positive effect on the yield difference, thus, the null hypothesis was not rejected. In addition, SLBs were generally found to be characterized by having multiple SPTs mostly related to the environmental factors.

6.2 Contributions to Literature and Practical Implications

The novelty of this type of financial instrument and the scarcity of prior studies on SLBs provide an opportunity for contribution to existing literature. Being among the first studies performed on the SLB premium based on the extensive literature review, this study on European SLBs can be seen to contribute to existing literature through providing a detailed overview of the financial instrument in the European Union. This study has also discovered industry-wise differences, and concludes that industries with more direct environmental impact tend to prefer a SPT that is related to the environment, such as GHG emissions reduction. Furthermore, this research solidifies the prior findings by Liberadzki, Jaworski, and Liberadzki (2021), and Kölbel and Lambillon (2022) on the existence of a sustainability premium, focusing on the geographical area with the largest amount of issuances. In contrast to Kölbel and Lambillon's (2022) study on global SLBs, this study has a reduced risk of including factors such as different stakeholder preferences and regulatory frameworks that apply to geographical regions in the analysis of a sustainability premium.

Besides the contribution to the existing literature, implications to different stakeholders can also be identified. From an issuer perspective, the existence of a SLB premium can potentially allow issuers to obtain a cheaper source of debt financing. In addition to the lower cost of debt financing, SLBs may serve as an attractive alternative to green bonds for issuers looking to incorporate or improve their sustainability practices, as the bond proceeds are not limited to a specific green project. Investors on the other hand, can expect the existence of a sustainability premium.

6.3 Future Research

Given the novelty of the subject of this study, as well as its scope and limitations, there are many avenues for further research. Future studies on a larger sample of SLBs once they are more established would increase the observations and be more reliable due to the greater sample size. A time series study when the instrument is more established including all samples possible would add knowledge toward the development of the sustainability premium phenomena post-issuance and perhaps reveal more concrete findings in relation to an industry's role on this premium. Further investigation into the reasons for the premium could be to dive down into whether this premium is due more to the supply or demand side, whether it's due to the costs imposed on SLB issuance or more reliant on investor demand. Given that it was found that the average coupon step-up is lower than the average difference in yields, it could be interesting to further investigate what an optimal coupon step up would be in order

for the penalty to actually affect the issuer. It could be interesting also to investigate the materiality of the SPTs, as this study did not specifically focus on SPTs, how they are measured, and if they are truly material especially to a specific industry. This could be done by looking more in depth at each individual bond, or conducting interviews with those responsible for designing the bonds. In terms of more theoretical research, it could be relevant to develop a theoretical framework for SLBs to be able to have a frame of reference to explain the impact. Perhaps building on stakeholder theory through the impact of SLBs through interviews with different SLB stakeholders. Additionally, investigating the owners of SLBs and how the different types of owners have developed over time could shine a light on the risk preferences of investors attracted to SLBs, as the frequency of the type of investor could inform on their investment objectives, and how SLBs fulfill those. Lastly, as great number of the literature used in this thesis pertained to green bonds, it would be interesting to compare the two instruments, for example if one is more effective than the other in increasing sustainability initiatives, or if one has less risk, or a lower premium due to differences in greenwashing perceptions by investors.

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Appendix

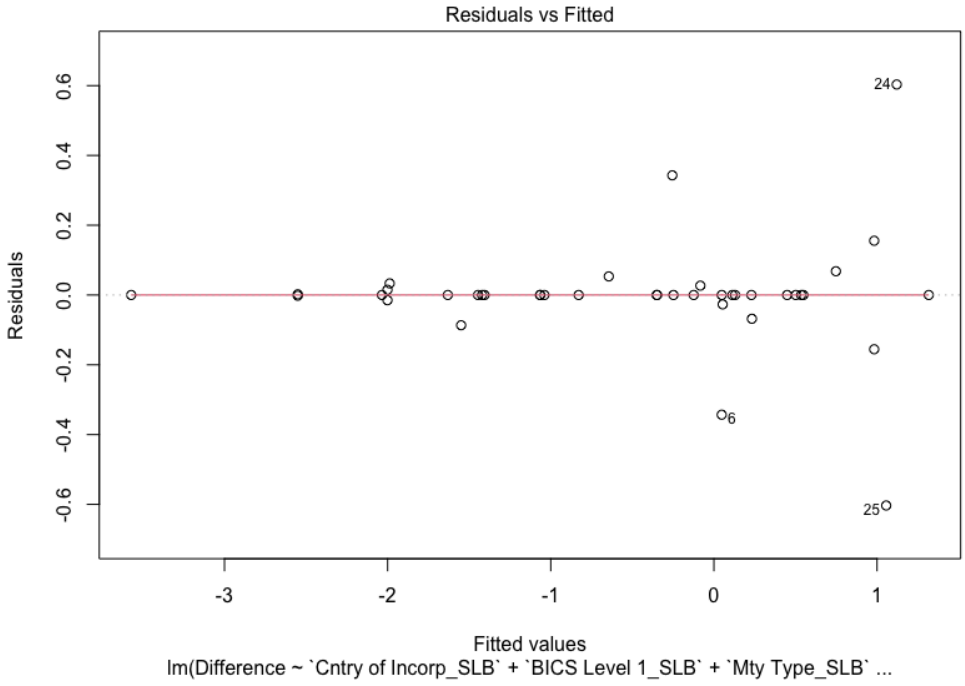
Appendix 1 SPT Type Percentage by Sector for all SLBs

Sector/SPT Type	Environment	ESG	ESG Score	Social	N/A
Utilities	91%	5%	5%		
Energy	82%		18%		
Consumer Discretionary	76%	3%	11%	5%	5%
Consumer Staples	70%		30%		
Materials	58%	11%	30%	2%	
Communications	56%		44%		
Industrials	29%	4%	44%	6%	17%
Technology	29%				71%
Health Care	20%	40%		20%	20%
Financials	16%	80%		4%	
Type Percentage	**54%**	**12%**	**23%**	**3%**	**7%**

Appendix 2 SPT Type Percentage by Sector for Matched SLBs

Sector/SPT Type	Environment	ESG	ESG Score	Social	N/A
Communications	100%				
Consumer Staples	100%				
Energy	100%				
Technology	100%				
Utilities	100%				
Materials	77%	8%	8%	8%	
Consumer Discretionary	57%		14%		29%
Financials	40%	60%			
Industrials	20%		70%	10%	
Health Care	17%	50%		33%	
Type Percentage	**61%**	**13%**	**16%**	**7%**	**4%**

Appendix 3 Residuals versus Fitted Values for Regression



Appendix 4 Residuals QQ Plot for Regression