Master's programme in Economics and Business Administration

Unveiling greenwashing and uncovering prominent sustainability premiums

Study on sustainability-linked bond issuances and second-party opinions

---

Antti Jalonen

Master's Thesis
2023

Aalto University
School of Economics

Author Antti Jalonen

Title Unveiling greenwashing and uncovering prominent sustainability premiums: Study on sustainability-linked bond issuances and second-party opinions

Degree programme Master of Science in Economics and Business Administration

Major Finance

Supervisor(s) Prof. Matti Keloharju

Year of approval 2023 **Number of pages** 68 **Language** English

Abstract

I study incentives behind sustainability-linked bond ("SLB") issuances, a novel instrument type usually structured to link reaching sustainability targets to coupon payments. SLB issuers can obtain second party opinions ("SPOs") to verify their instrument designs' alignment with general principles created by International Capital Markets Association. I show the presence of these opinions to predict greater sustainability premiums for SLBs, indicative of possible financial incentives behind obtaining one. However, despite even the issuers' explicit promises, I show SLB issuances to not be credible signals of sustainability commitments but to rather raise greenwashing concerns as the issuers' sustainability performance deteriorates in environmental, social and combined ESG measures post issuance, regardless of whether an SPO is present or not. Additionally, I show that high reputation of the SPO provider or whether the SPO has been publicly disclosed have no significant predictive capabilities over SLBs' cost of capital, nor that they would improve the credibility of sustainability commitment signals.

Keywords Sustainability-linked bonds, Second-party opinions, Sustainability premium, Sustainability signaling, Greenwashing

Aalto-yliopisto
Kauppakorkeakoulu

Tekijä Antti Jalonen

Työn nimi Viherpesun paljastaminen ja merkittävien vastuullisuuspreemioiden havaitseminen: Tutkimus vastuullisuustavoitteisiin sidottujen joukkovelkakirjalainojen liikkeeseenlaskuista ja ulkopuolisista arvioista

Koulutusohjelma Kauppatieteiden maisteri

Pääaine Rahoitus

Työn ohjaaja(t) Prof. Matti Keloharju

Hyväksymisvuosi 2023 **Sivumäärä** 68 **Kieli** Englanti

Tiivistelmä

Tässä tutkielmassa tutkin vastuullisuustavoitteisiin sidottujen joukkovelkakirjalainojen liikkeeseenlaskun insentiivejä. Nämä joukkovelkakirjalainat ovat uudenlainen rahoitusinstrumenttityyppi, jotka sitovat liikkeeseenlaskijoiden vastuullisuustavoitteet useimmissa tapauksissa liikkeeseenlasketun joukkovelkakirjalainan kuponkikorkoihin. Näiden joukkovelkakirjalainojen liikkeeseenlaskijat voivat hankkia instrumenteilleen ulkopuolisen arvion, jossa instrumenttien rakenteen yhtenäisyys vapaaehtoisen International Capital Markets Association:in luoman periaatekokoelman kanssa vahvistetaan. Tutkielmassani näytän tällaisten ulkopuolisten arvioiden ennustavan kyseisille joukkovelkakirjalainoille korkeampia vastuullisuuspreemioita, indikoiden liikkeeseenlaskijoilla mahdollisesti olevia taloudellisia kannustimia hankkia instrumenteilleen tällainen arvio. Huolimatta liikkeeseenlaskijoiden jopa eksplisiittisesti kommunikoimista tavoitelluista vastuullisuuskehityksistä, näytän että vastuullisuustavoitteisiin sidottujen joukkovelkakirjalainojen liikkeeseenlaskut eivät ole luotettavia signaaleja liikkeeseenlaskijoiden sitoutumisesta vastuullisuuskehityksen edistämiseen. Päinvastoin, nämä liikkeeseenlaskut herättävät huolta viherpesusta, koska niitä seuraa liikkeeseenlaskijan negatiivinen vastuullisuuskehitys niin ympäristöllisessä, sosiaalisessa kuin yhteenlasketussakin vastuullisuusulottuvuudessa, riippumatta siitä onko instrumentille hankittu ulkopuolinen arvio vai ei. Lisäksi, osoitan että ulkopuolisen arvion tarjoajan hyvällä maineella tai sillä, onko arvio julkinen ei ole merkittävää ennustuskykyä instrumenttien vastuullisuuspreemioon eivätkä ne myöskään indikoi luotettavasta sitoutumisesta vastuullisuuskehitykseen.

Avainsanat Vastuullisuustavoitteisiin sidotut joukkovelkakirjalainat, Ulkopuoliset arviot, Vastuullisuuspreemio, Vastuullisuussignalointi, Viherpesu

Contents

List of Tables

Glossary

ICMA International Capital Markets Association
KPI Key performance indicator
MD Mahalanobis distance
SPO Second-party opinion
SPT Sustainability performance target
SLB Sustainability-linked bond
SLL Sustainability-linked loan

1 Introduction

Sustainability-linked bonds ("SLBs") are novel instruments, the market for which has grown fast from only one issuance of $0.2bn in 2018 to over $220bn by the end of 2022. SLBs complement other sustainable debt instruments such as use-of-proceeds bonds (namely green and other sustainability bonds) by allowing flexibility as raised funds are not earmarked for specific projects but can rather be freely used for general corporate purposes. By design, SLBs should incentivize issuers to drive for sustainable developments by linking the instruments' cost of capital to reaching specified Sustainability Performance Targets ("SPTs") around selected Key Performance Indicators ("KPIs"). In a usual design, the cost of capital link is created by linking (parts of) coupon rates to reaching the targets.

By issuing an SLB, the issuers commit to quantitatively measurable and verifiable targets. Pre-specified SPT observation dates are checkpoints when issuers' performance in the agreed upon KPIs is weighed against these SPTs to see whether the issuing firms have achieved the set targets. In case an issuer fails to reach a set target it usually faces a penalty. On the other hand, some more uncommon instrument designs can work conversely by granting an issuer a benefit if they reach a target.

Despite flexibility around design, most (~83%) of SLBs within my sample that disclose SPT details have at least one (usually all) of their targets structured to lead to a coupon step-up (a median step-up of 25 bps) in case an issuer fails to reach a set SPT by a predefined observation date. A working paper by Berrada et al. (2022) collecting earlier data from a differing source reports comparable instrument designs by showing almost 95% of SLBs in their sample to be structured around coupon step-ups with also a median step-up of 25 bps.

SLBs predominantly align their targets with environmental sustainability aspects and KPIs, with Berrada et al. (2022) reporting 65% of SLBs exclusively committing to environmental KPIs in their issuance prospectus. The authors report the second most common SPT theme to be some combination of the three main sustainability pillars, namely environmental, social and governance aspects. In their comprehensive sample, 14% of SLBs do not disclose information about their SPTs. Due to SLBs' weak disclosure and the fast market growth, the International Capital Markets Association ("ICMA") has published Sustainability-Linked Bond Principles that have since become the market standard used as a benchmark and guideline in discretionary second-party opinions ("SPOs").[1]

In general, SPOs' purpose is to verify a given SLB design's uniformity with the Sustainability Linked Bond Principles' recommendations, confirming sufficient ambitiousness in SPTs and relevance in KPIs. In more detail, the principles instruct that SPTs ought to be material to the issuer's core business and the potential penalties to be meaningful for the issuer to incentivize and discipline them enough to pursue the required sustainable developments. Further, all SPT details

[1] All SLBs with an SPO in my sample report compliance with the ICMA's Sustainability-Linked Bond Principles and 75% of the SLBs without an SPO even self-label the same compliance.

about for example dates, trigger events and frequencies should be transparent and up-to-date information actively reported (ICMA, 2020). SPOs purpose is to reduce information asymmetries and uncertainties between the issuing companies and any prospective investors. In a sense, they attempt to make sure that SLBs are issued for "right" reasons (i.e., pursuing sustainable developments) by observing and verifying the instrument designs.

So far, comprehensive understanding of what drives companies first and foremost to issue SLBs and secondly to obtain SPOs is lacking. Signaling, greenwashing and financial incentives – defined by Flammer (2021) – have been quickly adopted as three distinct potential motivations for instrument issuances within sustainable finance literature. Signaling (in sustainable finance) refers to an issuer's (costly) possibility of demonstrating their sustainability commitments to the market by issuing a specific instrument. Greenwashing on the other hand is an attempt to send the same signal by "making unsubstantiated or misleading claims" (Flammer (2021), p. 500) without credibly committing to sustainability. Financial incentives refer to exploitation of the hypothesis according to which investors pay for sustainable societal developments by accepting a lower yield (i.e., a sustainability premium) from their investment to a given instrument. To my knowledge, financial incentives are the only motivation category empirically studied and identified to drive SLB issuances on average in a working paper by Kölbel and Lambillon (2023).

My thesis makes several novel contributions to the literature. First of all, I expand the existing literature studying SLBs' sustainability premiums and issuers' financial incentives to also cover the decisions to obtain SPOs. By matching SLBs with comparable conventional bonds issued by the same company I show the presence of an SPO to predict greater yield differences between the two bond types on average, indicating that there are financial incentives for issuers to obtain these external verifications for their instruments. Most of the prior literature around the topic is focused on the use-of-proceeds bonds' certifications and to my knowledge the cost of capital implications of SPOs have not been addressed before.

As a second novel contribution I separate signaling and greenwashing arguments from each other and empirically study whether SLB issuances send the market a credible sustainability commitment signal. I create a new matched sample by matching SLB issuers with as similar as possible conventional bond issuers and show SLB issuers' sustainability performance to in fact deteriorate in environmental, social and combined ESG metrics following the issuances compared to the conventional bond issuers. The finding contradicts with the signaling argument and raises serious greenwashing concerns over SLB issuances.

Thirdly, I address the signaling and greenwashing arguments as potential incentives for obtaining an SPO. Acquiring an SPO costs issuers both time and money, which according to the signaling argument should convert into a stronger signal being sent. However, I find the sustainability performance of issuers issuing SLBs with SPOs to also deteriorate post issuance, following the same trend as SLB issuances on average. This indicates that decisions to obtain SPOs are not credible sustainability commitment signals but can in fact be incentivized by

greenwashing attempts or attempts to tap into lower cost of capital, as discussed earlier.

Lastly, I develop a ranking table for SPO providers by measuring (i) the opinion providers' market shares in the SLBs' SPO market, as well as (ii) the sustainability bond underwriter market shares of syndicates that have underwritten the SLBs for which a given SPO provider has provided an opinion for. To my knowledge, no literature has previously made a distinction between reputable and non-reputable sustainable finance assurance providers, let alone address the distinction's implications for bond pricing or signaled sustainability commitments.[2]

Using the developed novel SPO provider rankings, I show that obtaining an SPO from a reputable top tier opinion provider does not seem to predict greater sustainability premiums nor serve as a credible sustainability commitment signal. Publicly disclosing an SPO's contents yields qualitatively similar results. Overall, this indicates that the market considers all SPOs to be somewhat homogeneous and rewards them with equal sustainability premiums. Further, all SLB issuances regardless of SPO related decisions contradict with the signaling argument and raise greenwashing concerns as the issuers' sustainability performance deteriorates and does not improve following the issuances.

Table 1 plots my thesis' novel key contributions against collected comparable literature's findings in a matrix presenting the studied instruments in rows and the addressed arguments in columns for a condensed overview of the related literature. The first two presented instruments, namely green loans and bonds represent the use of proceeds type of credit instruments. The last two represent the more novel sustainability-linked credit instrument designs. Next, I perform a literature review to address in more detail what the existing literature has covered so far.

[2]Assurance provider in this context refers to providers of certificates, verifications, second party opinions and other possible types of assurances a sustainable finance instrument issuer can obtain for their instrument from an external provider.

Table 1: My thesis' key contributions compared to prior literature

Arguments addressed	Cost of capital argument		Signaling & greenwashing arguments	
	In general	W/ external assurance	In general	W/ external assurance
Instruments studied				
Green loans	Issued at lower yields compared to non-ESG loans (Kim et al. (2023))	Not yet addressed in literature	Mixed evidence of signaling capabilities (Kim et al. (2023) & Dursun-de Neef et al. (2022))	Not yet addressed in literature
Green bonds	Mixed evidence for the presence of sustainability premiums with recent research trending towards no support (e.g., Flammer (2021) & Zerbib (2019))	Third-party reviewed bonds exhibit more pronounced sustainability premiums (Hyun et al. (2022))	Bond issuances supportive of the signaling argument (Flammer (2021))	Certified bond issuances send a more credible signal (Flammer (2021))
Sustainability-linked loans	Mixed evidence of SLLs' possibly differing yields compared to non-ESG loans (Kim et al. (2023) & Pohl et al. (2023))	Not yet addressed in literature	Evidence of signaling capabilities conflicting (Kim et al. (2023) & Dursun-de Neef et al. (2022))	Not yet addressed in literature
Sustainability-linked bonds	Sustainability premiums identified to exist on average (Kölbel & Lambillon (2023))	***My contribution:*** The presence of an SPO predicts greater sustainability premiums	***My contribution:*** SLB issuances contradict with the signaling argument, suggestive of greenwashing	***My contribution:*** SLB issuances with an SPO also raise greenwashing concerns

2 Literature Review

Sustainable finance literature has quickly adopted the three potential motivation arguments: signaling, greenwashing, and financial incentives defined for this use by Flammer (2021) as a framework for studying incentives in the space. The author originally studies these hypotheses in the green bond market, while individual arguments have been studied in relation to other sustainable finance instruments by other authors.

According to signaling, companies can do an action to reduce information asymmetries around desirable characteristics between them and investors. In order for the signal to be credible, the action should be costly (or difficult) to imitate by firms with less desirable features. The theory's roots lead all the way to Akerlof (1970) presenting the market for lemons problem and have since then been theoretically addressed further by for example another well-known paper by Riley (1979).

Within sustainable finance, Flammer (2021) defines signaling to refer to actions (e.g., green bond issuances in her case) whose purpose is to convey information about the issuer's sustainability commitments to the market. It is important to distinguish that signaling hypothesis does not imply that for example the funds raised through green bond issuances would cause sustainable developments but that they are a way for issuers to reduce information asymmetries and communicate the market of their future developments.

Flammer (2021) finds stock markets to react positively to green bond issuances, green bond issuers' environmental performance to improve, and share ownership of long-term and "green" investors to increase following the issuances, all supportive of the signaling argument. She also shows that obtaining a costly certificate sends an even stronger signal. A Swiss finance institute working paper by Dursun-de Neef et al. (2022) also reports similar findings in the sustainability-linked loan ("SLL") market by showing that SLL issuances precede improvements in issuers' overall ESG performance, while another working paper by Kim et al. (2023) studying the same market observes opposite findings to the signaling hypothesis.

In the SLB market, a working paper by Kölbel and Lambillon (2023) argue that in addition to financial incentives, SLBs are also driven by the signaling hypothesis, without clearly distinguishing it from greenwashing. The authors' argument relies solely on their findings that sustainability premiums are prevalent in the market and exceed potential penalties on average but that the issuers cannot know ex ante whether their SLB will benefit from a sustainability premium, let alone its size. Therefore, the authors argue that *"committing to a target and a penalty is a costly signal, as long as the target is not already achieved"* (Kölbel and Lambillon (2023), p. 25-26). The comment refers to widely discussed issuances where SLB issuers have already in theory achieved the instruments' SPTs at the time of issuance. One example of such an issuance is an SLB issued by Tesco as brought up by the authors and also discussed in more detail by Liberadzki et al. (2021). Issuances such as the one by Tesco have cast a bad reputation over the SLB market as discussed later.

However, findings Kölbel and Lambillon (2023) over the fact that sustainability premiums tend to be driven more by "qualitative" promises (i.e., issuing an SLB with potential penalties and sustainability targets in the first place) rather than SLBs' actual contractual details creates a large potential for greenwashing, especially as such behaviour has been observed in the related SLL market (Kim et al., 2023). If simply issuing an instrument of certain type is statistically enough to tap into lower cost of capital, issuers may exploit this phenomenon and make weak or even false sustainability commitment promises (i.e., participate in greenwashing). Additionally, as the stock market has been shown to value ESG commitments and punish issuers for their greenwashing attempts, the distinction is of high importance also in the SLB market. For example, Flammer (2021) shows stock market to react positively to green bond issuances, whose proceeds are used for sustainable developments. Similarly, Kim et al. (2023) find a positive stock market reaction for SLLs with good disclosure about sustainability targets and negative or negligible reaction for SLLs with poor disclosure. According to the papers, weak disclosure is considered indicative of greenwashing. In more general, a meta-analysis by Friede et al. (2015) reports several other examples supporting the findings.

Flammer (2021) (p. 500) defines greenwashing as the practice of *"making unsubstantiated or misleading claims about the company's environmental commitment"*, which in the context of sustainable finance instruments translates to the issuances not being a credible signal of sustainability commitments and consequently that sustainability performance should not improve nor the interest from sustainable investors increase following the issuance of an instrument. Despite SLBs by design link sustainable developments to coupon rates through SPTs and thus create issuers financial incentives to drive sustainable developments, different media outlets have widely stamped the instruments as tools for greenwashing by criticizing them for setting unambitious SPTs around irrelevant KPIs, preventing effective sustainable developments (e.g., articles in Bloomberg and Financial Times: Rocha (2022) & Rennison (2021)).

To my knowledge, empirical contributions to greenwashing arguments in the SLB market and correspondingly to the signaling aside the "inferred" arguments of Kölbel and Lambillon (2023) are limited to only discussions of problematic designs of a few handpicked SLB contracts (e.g., Liberadzki et al. (2021)). Despite not empirically distinguishing between greenwashing and signaling, Kölbel and Lambillon (2023) do however note that especially since the average penalties arising from not reaching SPTs are in many cases smaller than savings from the SLBs' sustainability premiums, some SLBs can in theory be issued entirely with financial benefits in mind without even a purpose to reach the SPTs.

In the related SLL market, Kim et al. (2023) raise concerns about greenwashing as the borrowers' environmental, overall ESG and average of environmental and social scores all deteriorate post issuance compared to matched non-SLL borrowers. The authors observe the decline in ESG scores to be driven by issuance of loans with poor contractual KPI disclosure, while borrowers with high quality disclosure experience no significant changes in sustainability

performance. Despite suggesting greater sustainability commitment compared to the borrowers with weak disclosure, these issuances still do not seem to be signals of credible (growing or increasing) sustainability commitments.

According to Flammer (2021) definition, financial incentives or cost of capital hypothesis refer to the argument according to which bond investors are willing to accept lower yields in exchange for their funds being used for societal good. Her paper shows no evidence for the existence of sustainability premiums among green bonds with for example Larcker and Watts (2020) finding qualitatively similar results for municipal green bonds. Prior research on the topic has observed small but significant sustainability premiums and hence and no clear consensus seems to exist (e.g. Karpf and Mandel (2017), Zerbib (2019) and Baker et al. (2018)). However, the more recent literature seems to be leaning towards no support, indicating either different research approaches or changing dynamics as the market matures.

To my knowledge, the cost of capital argument is the only empirically addressed incentive in the SLB market, with Kölbel and Lambillon (2023) estimating sustainability premiums of ~19 to ~22 bps at issue. Even using a conservative estimate of sustainability premiums of ~9 bps, the authors further highlight that despite an average worst-case coupon step-up of ~26 bps, SLB issuers enjoy an average free benefit of $3 million during an average SLB's lifetime as the penalties apply on average only for the last 3 years of an average bond's 7.1 year maturity. Interestingly, the authors find sustainability premiums to have decreased over time since the market's emergence in 2019 and find only the SLBs issued in 2021 to have benefited from sustainability premiums, while find no such support for issuances in 2022. However, in the related SLL market the evidence is conflicting. Pohl et al. (2023) find SLLs to be issued with lower yields compared to non-ESG loans while Kim et al. (2023) find no support for the claim when controlling for both firm and loan characteristics. However, in green loan market the authors find such loans to be issued at a lower spread, highlighting how mixed the literature about the sustainability premium's existence overall is.

Literature on sustainable finance certificates and especially their dynamics in terms of issuers' motivations remains scarce, especially aside the somewhat more established green bond market in which the topic has been addressed at least to a certain extent. For green bonds, Flammer (2021) finds certificates to strengthen the bonds' signaling capabilities or in other words to predict greater improvements in sustainability performance post issuances. A paper by Li et al. (2020) addressing the cost of capital side of certifications claims to be the first one to empirically address the certification aspect in green bond market. The authors show certified green bonds in China to have lower yield spreads and interest expenditures compared to non-certified ones. Another paper by Hyun et al. (2020) expanded beyond simply conventional bond attributes to pricing of the "greenness" information and showed certified and third-party reviewed green bonds to exhibit more pronounced sustainability premiums due to being a tool to signal greenness information. However, literature about the novel SLB market's SPOs is currently almost non-existent, with

the external reviews' existence merely acknowledged in a few papers as a sidenote (e.g., Kölbel and Lambillon (2023) and Berrada et al. (2022)). To my knowledge, the scarce existing literature for sustainable finance certifications seems to be limited to whether a certification or an external review is present in the first place and for example their reputational or other differentiation aspects and thus possibly different implications haven't been addressed so far.

Overall, this literature review's purpose is to describe the theoretical framework for different motivation arguments for sustainable finance instrument issuances and other related decisions and highlight how significantly the motives identified in literature differ between instrument types and even between studies of the same instruments. Currently, only financial incentives have been empirically studied among SLBs, with no empirical literature addressing signaling or greenwashing arguments nor motives behind obtaining an SPO seems to exist.

3 Hypotheses & Research Questions

In this section, I develop testable hypotheses and research questions and discuss the theoretical frameworks and logic behind them. The first subsection discusses potential financial incentives issuers may have to obtain SPOs and further why all SPOs may not possibly be created equal in this sense. The second subsection discusses whether SLB issuances could be credible signals of sustainability commitment and further why SPOs should in theory indicate greater commitments.

3.1 Financial Incentive Argument

The first part of my thesis builds on prior literature studying SLBs as a way of achieving lower cost of capital (i.e., investors paying for sustainability), as identified by Kölbel and Lambillon (2023) and links this potential motivation argument to decisions around SPOs. Since obtaining an SPO for an SLB costs issuers both time and money but is not a regulatory requirement like for example an audit, the issuers likely stand to gain something from doing so. By ICMA's definition, SPOs verify SLBs to have sufficiently ambitious SPTs and relevant KPIs to drive sustainable developments. If the credit market considers the promised developments credible, according to the sustainability premium argument this should convert to lower cost of capital because investors accept a lower yield in exchange for their funds being used for sustainable developments. As financial incentives have already been identified to at least partly drive the issuances in the first place, the verification provided by an SPO can be a major contributor to the instruments' observed sustainability premiums. In other words and as the paper's first testable hypothesis I study *whether the presence of an SPO predicts greater sustainability premiums for SLBs*. I test this and the subsequent cost of capital hypotheses by decomposing yield differences between SLBs and the same issuers' otherwise as similar as possible bonds except for the sustainability-link into a variety of different predictors. If the presence of an SPO predicts more

negative yield differences (measured as SLB yields less conventional bond yields), then at least statistically there can be financial incentives for SLB issuers to obtain one, although at the time of the decision the issuers cannot surely know whether their instrument is indeed rewarded with a premium. Additionally, the potential gains from lower cost of capital should be weighed against the costs of SPOs and whether they impose more severe potential penalties or more difficult to reach targets for the issuer. However, due to no data available either for the pricing of SPOs or issuers' probability of reaching the SPTs, I cannot conclusively test whether the potential benefits from SPOs exceed the costs.

Inspired by findings in equity market literature that has shown high reputation underwriters to mitigate uncertainty in IPOs and consequently that firms going public with such underwriters to be associated with lower underpricing (e.g., Carter and Manaster (1990), Megginson and Weiss (1991) & Barry et al. (1990)), I develop the paper's second testable hypothesis of *whether obtaining an SPO from a reputable opinion provider can predict greater sustainability premiums for SLBs*. Drawing inspiration from the underwriter literature, I similarly hypothesize that a reputable SPO provider can mitigate uncertainty about SLBs' disciplinary capabilities to drive sustainable developments as the opinion providers have to maintain the highest quality standards of independence to remain relevant and especially as not all SPOs are disclosed to the public. Hence, simply the provider's name can in theory be indicative of the whole issuance's quality in terms of whether or not it properly disciplines the issuer. In theory, increased certainty over upcoming sustainable developments should lead to greater sustainability premiums and voluntary disclosure of non-financial aspects is also empirically shown to be beneficial for green bonds' pricing (Baker et al., 2018; Hyun et al., 2020). Thus, as the third additional testable hypothesis I test *whether publicly disclosing the SPO and thus communicating its details to the market can predict higher sustainability premiums* as expected due to greater transparency.

3.2 Signaling & Greenwashing Arguments

To my knowledge, the second part of my thesis is the first contribution to the signaling and greenwashing arguments in the SLB context and tests whether SLB issuances are motivated by signaling or greenwashing, aside the financial incentives already identified in literature. Specifically, as the first testable hypothesis in terms of the signaling framework I test *whether SLB issuances precede ESG performance improvements measured by ESG scores* or in other words, whether the issuances are credible signals of sustainability commitments. Positive predictiveness would be indicative of signaling whereas negative (or lack of) predictiveness raise greenwashing concerns. It is worth noting that I do not hypothesize for example the use of funds raised through SLBs or issuers' attempts to reach the SPTs would cause sustainable developments but rather whether the issuances themselves are credible tools for issuers to signal their commitments to the market. Despite the term greenwashing is traditionally considered to cover mainly the environmental aspects, in terms of this thesis I expand the term to cover the whole sustainability

spectrum. In terms of sustainability performance development being tested, I rely on scoring of several separate sustainability dimensions calculated by Refinitiv analysts and further on 3 more specific environmental scores that are possibly more objective to measure and thus less prone to analysts' subjective judgement.

The same setting is also expanded to indirectly study the signaling and/or greenwashing arguments behind obtaining an SPO. To study this, I test the second hypothesis within the signaling framework of *whether SLB issuances with an SPO send a superior sustainability commitment signal*, or in more practical terms whether they precede greater sustainability performance improvements. The presence of an SPO should indicate greater sustainability commitments due to costing time and money to obtain and due to being more difficult to obtain by issuers with weak SLB designs. Similarly as with financial incentives, I also test the hypothesis of *whether the presence of an SPO from a reputable opinion provider indicates greater sustainability commitments*, as obtaining one may require adherence to stricter requirements (i.e., be costlier) as the more reputable providers may impose stricter targets to maintain their high standards. Additionally, I test *whether the credibility of sustainability commitment signal is strengthened by publicly disclosing SPOs to increase transparency.*

4 Data

This section discusses the data required to test my paper's hypotheses. The first subsection discusses SLB data collection process and reports SLB issuances' key descriptive statistics. The second subsection similarly reports the data collection process to obtain numerous pieces of information for the SLBs' issuers. Literature has already provided comprehensive overviews of the SLB issuers' general characteristics and what kind of companies are likely to issue the instruments. Thus, I only report key statistics of the observations usable for my research later in section 5. In the third subsection I briefly discuss the data and data provider quality as well as my data set's comparability with those used in literature. Lastly, I collect information about SLB market underwritings to develop SPO providers a reputation ranking. The rankings are later used to address the research questions of whether an SLB issuer obtaining an SPO from a reputable opinion provider can expect to be rewarded with greater sustainability premiums and further whether the decisions to obtain one precede greater sustainability commitments by the issuers.

4.1 SLB Data & Descriptive Statistics

Refinitiv Eikon's GRNBNDG (Green Bond Guide), a specialized screener for ESG bonds and loans is used to extract all bonds labeled as "sustainability linked" issued until the end of 2022, excluding 5 government bonds as well as 4 putable and 2 convertible bonds to create a comprehensive sample of 475 corporate SLBs issued between October 9, 2019 and December

14, 2022 by 255 different issuers. For all bonds where the information is available, I collect issuance dates and amounts, maturity, maturity type (at maturity/callable), currency, coupon, seniority, indicator for whether the SPT(s) is aligned with EU taxonomy, as well as yields and credit spreads at issue. The same information is extracted for potential matching candidate conventional bonds using Refinitiv Eikon's deal screener. For SLBs with an SPO, I further collect the SPO observation dates, coupon step-ups, other quantifiable penalties and the name of the SPO provider. Additionally, I collect the names of the SLBs' lead and joint lead underwriters.[3]

Table 2 reports descriptive key statistics of all collected SLB issuances in relation to issuance year (Panel A) and region (Panel B) as well as SPO SLBs' descriptive statistics in relation to the opinion provider (Panel C). Additionally, the table reports the number of SLBs usable for sustainability premium and signaling analyses. Usability for sustainability premium analysis requires all necessary pieces of information to be available for an SLB and its issuer. Further, the issuer is required to have issued a matchable conventional bond with the same information available. Usability for the signaling analysis requires a different set of information to be available for an SLB issuer and a matchable conventional bond issuer with the same information available to exist. Information required to exist for both of the matching approaches is discussed in section section 5 in detail.

The descriptive statistics highlight the fast market growth in the SLB market from 2019 to 2021, which seems to have stalled in 2022. Increased uncertainty and volatility after invasion of Ukraine combined with sharp increases in inflation and correspondingly in interest rates likely are the main drivers behind issuers' reduced interest in issuing the instruments. Kölbel and Lambillon (2023) also hypothesize the same aspects to have been major contributors for the evanescence of sustainability premiums during the first half of 2022.

SLBs usable for the sustainability premium analysis are representative of the whole sample in terms of SLB issuance years. However, the 2022 issuances are underrepresented within the signaling analysis sample simply as most issuers' 2022 ESG scores have not yet been updated to Refinitiv as of February 2023 and therefore their post issuance sustainability performance development and signaling capabilities cannot be studied.

All geographical regions are proportionally represented in the sample of SLBs usable for the signaling analysis. Availability of information about European and North American SLBs' yields at issue is significantly better than that for APAC (especially China) and the rest of the world, causing the latter observations to be underrepresented in the sustainability premium sample.

Panel C distinguishes Sustainalytics, Moody's and ISS as the clear market leading opinion providers. Table 4 in subsection 4.4 provides a more comperehensive comparison between the opinion providers in an attempt to separate reputable providers from others.

Despite negative development in both the number and average size of issuances in 2022, the share of SLBs issued with an SPO has continued to grow. In 2022, 73% of SLBs were issued with

[3]See section 5 for the matched sample approach description.

Table 2: SLB issuances' descriptive statistics. The table reports key descriptive statistics of all SLBs issued until the end of 2022 available in Refinitiv Eikon's Green Bond Guide. The issuances are sorted by issuance years in panel A and by country in panel B. Panel C restricts the sample to SLBs issued with an SPO, indexed by the entity providing the opinion.

Panel A: Descriptive statistics by issuance year					
Year	# SLBs	Amounts issued ($bn)	# w/ an SPO	# usable for cost of capital study	# usable for signaling study
2019	5	5.6	5	2	1
2020	19	8.7	7	7	3
2021	267	126.2	171	87	52
2022	184	80.7	134	57	4
Total	475	221.2	317	153	60
Panel B: Descriptive statistics by region					
Region	# SLBs	Amounts issued ($bn)	# w/ an SPO	# usable for cost of capital study	# usable for signaling study
Europe	251	140.7	168	92	30
APAC	110	22.5	82	18	18
North America	65	43.4	35	35	8
Rest of the World	49	14.7	32	8	4
Total	475	221.2	317	153	60
Panel C: SPO SLBs' descriptive statistics					
SPO provider	# SLBs	Amounts issued ($bn)	% of all SLB proceeds	# usable for cost of capital study	# usable for signaling study
Sustainalytics	74	39.9	18.2	35	13
Moody's	63	46.9	21.2	27	6
ISS	61	37.4	17.2	28	8
DNV	39	11.8	5.4	11	5
Rating and Investment Information Inc.	13	2.2	1.1	3	6
S&P	12	6.4	3.1	2	1
Japan Credit Rating Agency Ltd.	10	1.5	0.7	5	1
10 least frequent opinion providers	45	8.5	4.1	1	5
Total	317	154.6	71	112	45

an SPO, up from 64% in 2021, indicating SPO market growth and thus either better availability or supply of the opinions or that issuers continue to see value in obtaining one. Although 67% of all SLBs within the sample are issued with an SPO and represent a qualitatively equal proportion (69%) of the issuance amounts, the SLBs issued with an SPO are significantly larger in size. Average SLB issuances with an SPO are sized $488 million, while the ones without an SPO have averaged $421 million. Due to non-normality of the data, I rely on non-parametric Wilcoxon t-test to compare differences in the averages. Table 3 reports the averages and differences in

issuance amounts.

Table 3: SLB issuance amount comparisons. The table reports comparison statistics between SLBs with and without SPOs.

Variable	SLBs w/ SPOs		SLBs w/o SPOs		Δ	Wilcoxon test (p-value)
	Avg.	SD	Avg.	SD		
Issuance amounts (USDm)	488.2	362.3	420.5	364.7	67.7	0.02

ICMA's Sustainable Bonds Database is used to complement Refinitiv's information about whether an SLB issuer has publicly disclosed their SPO or filed the relevant forms to ICMA in which the SPO's contents are disclosed. Although SLBs' KPIs, SPTs or other instrument design aspects could be in theory criticized in SPOs, I find no major critique given to the issuers about their SLB designs by performing a review of the sample's all 56 SPOs published in ICMA's Sustainability Bonds Database. Although I cannot confirm the contents of undisclosed SPOs, the most frequent minor critique I find is that the ambitiousness is (somewhat) difficult to assess against past performance. This is usually due to lack of either disclosure or tracking of certain metric in the past. The finding of overall positive opinions raises concerns about the SPOs published being subject to a bias in that issuers whose instrument designs are critiqued may not decide to disclose their reports. On the other hand, publicly disclosing an SPO can thus in theory be a tool to indicate greater sustainability commitments which is tested later.

4.2 Bond Issuer Data

Names, industries, domiciles, company structures (parent/subsidiary hierarchy) and several financial metrics including relevant Fitch and Moody's credit ratings of the SLB and matched bond issuers are extracted from Refinitiv Eikon and Refinitiv datastream as well.[4] [5]

The same platform is further used to extract risk-free rate development of all SLB issuer domiciles/regions. Additionally, five different metrics of sustainability performance are collected from 2014 through 2022. Refinitiv's ESG analysts create the scores around publicly available and auditable data points by creating almost 200 comparable measures that are grouped into 10 categories and further rolled over to three main pillars collected: environmental, social, and governance. The fourth metric is an additional pillar called ESG controversy, measuring controversies and a degree of transparency in reporting across all 10 main ESG categories. The fifth metric collected is combined ESG score that captures the performance of the main pillars

[4] Obtained Moody's credit ratings: Derived long-term issuer rating (MDL), Long-term issuer rating (MIS), Short-term issuer rating (MSS) and Backed long-term issuer rating (MBI). Those of Fitch: Long-term issuer default rating (FDL), Short-term issuer default rating (FDS), Short-term issuer rating (FSS) and Long-term issuer rating (FIS)

[5] See section 5 for more details of the financial metrics used in the signaling/greenwashing analysis matching.

discounted by controversies. New scores are updated to the database annually, usually following publication of annual reports, leading most scores to be dated at the end of the year. I roll over mid-year updates to the end of the year to allow for year-on-year comparisons in the signaling study.

Bond issuance structures can be complex within large corporations' group structures and sometimes SLB issuances are structured to take place through a financing subsidiary, a special purpose "bondco" or an international subsidiary. ESG scores mostly exist for public companies and hence are missing for some of these special structures. Sometimes Refinitiv Eikon rolls over parent corporations' ESG scores for these subsidiaries but does not seem to do so when there are one or more subsidiaries between the parent with the ESG score and the contractual issuer of the bond. In these cases issuer information and the ESG scores are collected for the "closest" possible parent company with the information available to be used as a proxy by moving from the contractual issuer's immediate parent through intermediate parent(s) to the ultimate parent. Based on my interpretation of the contractual issuers' profiles, there are 29 financing/holding subsidiaries and 19 foreign subsidiaries in the sample for which the scoring is unavailable but for which a parent company's information can be used as a proxy. The approach provides as comprehensive set of issuers' ESG scores as the database allows and covers all possible structures such as cases where a private subsidiary of a public company issues the bond as well as cases where the ultimate parent is a private company holding a controlling share in a public intermediary.

4.3 Comments on Data Quality & Comparability

Overall, the data quality (quantity) seems to be slightly weaker but still sufficient compared to descriptive statistics of more frequently used Bloomberg data reported by Kölbel and Lambillon (2023) and Berrada et al. (2022). Refinitiv data seems to have one shortcoming: it is not as comprehensive when it comes to smaller issuances from smaller issuers in the first few years of the SLB market with observations missing from all geographic areas and industries. However, this should not drastically affect the outcome of either the sustainability premium study nor the study on signaling and greenwashing. As described in detail in section 5, the former requires issuers to have issued comparable matchable conventional bonds (which smaller issuers are less likely to have done) and the latter due to ESG scoring availability's strong correlation with issuer and issuance sizes which would most likely lead to exclusion of most of the smaller issuances anyhow.

More detailed shortcomings of the data compared to Kölbel and Lambillon (2023) include very weak availability of yields at issue for floating rate bonds with the yield available only for 6 of 62 floating coupon SLBs within the whole sample, forcing the sustainability premium analysis to be based purely on fixed rate bonds. Additionally, callable bonds make up 66% of my SLBs until mid-2022, but only 44% of the authors' observations. Further, the Refinitiv data seems to

be overrepresentative in terms of the presence of an SPO, with approx. 65% of SLBs issued by February 2022 having an SPO, while the opposite is true for the data of Berrada et al. (2022) who find only 35% of SLBs to have been issued with an SPO by the same date. Regardless of the few discussed shortcomings the Refinitiv sourced data has compared to the literature's samples collected from Bloomberg, my sample still covers a longer and more recent time period than either of the discussed papers, a significant advantage in such a nascent market. The importance of the length of the time series is highlighted by for example the finding of Kölbel and Lambillon (2023) who identify sustainability premiums to have been present only in SLBs issued during 2021. Thus, a longer time period may even out some time-variant dynamics that are only present in some parts of the data. [6]

Due to not having access to other applicable databases, I unfortunately cannot complement Refinitiv data with for example a data set collected from Bloomberg.

4.4 SPO Provider Data & Reputation Ranking

To my knowledge, no literature has expanded beyond simply identifying whether an external sustainable finance certification or opinion can predict differing bond pricing to distinct between reputable and non-reputable assurance providers. Hence, I make a novel contribution inspired by equity underwriter reputation literature (e.g., Megginson and Weiss (1991) & Carter and Manaster (1990)) and similarly use market shares (issuance amounts) of both the SPOs and the bond underwriters for whose issuances the providers have given opinions for as proxies for reputation.

Table 4 reports SPO provider rankings based on three distinct metrics. The first metric *SPO market share* measures market shares based on SLB amounts issued with the respective SPO provider's opinion in place within the whole SLB sample extracted from Refinitiv. The second metric *Sum of underwriter market shares* is created by first calculating each of the 302 SPO SLB issuances with underwriter information available a sum of all lead and joint lead underwriters' market shares. Further, these issuances are then categorized based on their SPO provider and lastly the underwriters' summed market shares are averaged to derive the metric. The third metric *Average of underwriter market shares* differs from the second one in that the underwriters' market shares are averaged instead of summed. Effectively, the third metric ought to capture possible smaller issuances still underwritten by top tier underwriters which may end up being ignored by the second metric that places more weight on large issuances usually requiring the presence of more underwriters. Refinitiv Eikon Global Sustainability Bond League table dated from the start of 2021 to February 9, 2023 is used to extract information about underwriters'

[6] Data of the most recent versions of Kölbel and Lambillon (2023) dated January 31, 2023 runs until June 30, 2022, and that of Berrada et al. (2022) dated September, 14 2022 runs until February 10, 2022, while my sample consists of issuances until the end of 2022.

market shares and is likely to serve as a better measure for presence in the specialty market than a more generalist bond underwriter ranking.

Table 4: SPO providers' reputation ranking. The table reports different SPO providers' rankings and scores (%) in three different proxy measures used to distinguish between top tier opinion providers and others. *SPO market share* measures each SPO provider's market share based on SLB issuance amounts with the respective opinion provider's SPO in place. *Sum of underwriter market share* captures the average reputation (size) of the underwriter syndicate of an SLB for which the SPO provider has provided an opinion for. Similarly, *Avg. of underwriter market share* captures the reputation of an average individiual underwriter within the syndicate.

Rank	*SPO market share (%)*	*Sum of underwriter market share (%)*	*Avg. of underwriter market share (%)*
1	Moody's (29.7)	Moody's (29.4)	Moody's (3.2)
2	Sustainalytics (27.4)	ISS (16.5)	S&P (3.0)
3	ISS (23.6)	Sustainalytics (16.3)	Sustainalytics (3.0)
4	DNV (7.5)	S&P (13.0)	ISS (2.9)
5	S&P(4.1)	EY (12.5)	EY (2.5)
6	Lianhe Equator (1.8)	DNV (9.9)	Rating and Investment Info Inc. (1.9)
Smallest 9 providers	(5.9)	(4.5)	(0.4)

The results show Moody's, Sustainalytics and ISS to clearly outperform the other providers in the first two metrics that are more inclined towards absolute issuance size. The third metric further shows that the SLBs with the highest quality (largest) underwriters regardless of the issuance sizes on average obtain their SPO from one of these providers. Interestingly, S&P with a relatively small market share (metric one) is ranked second in the third metric, indicating that it's presence in the market is more geared towards high quality but not neccessarily the largest issuances. Based on the rankings I define Moody's with a top score in all metrics and Sustainalytics as well as ISS as tier 1 providers to be used in hypothesis testing.

5 Methods

This section describes approaches used to address two distinct groups of research questions. Although the approaches significantly differ from one another, they share similarities in that both start with matching either SLBs or SLB issuers with as similar as possible conventional bonds or these bonds' issuers, respectively. First, I develop an approach to address the potential predictive capabilities SPOs have over sustainability premiums. In the second subsection, I develop an approach used to measure issuers' sustainability development post issuance to address whether SLB issuances serve as credible signals of sustainability commitments.

5.1 Methods to Study the Presence of Sustainability Premiums

5.1.1 Matched Sample Development for Addressing Yield Differences

Working with empirical data makes the best methodological approaches such as randomized experiments unusable to answer the research questions. Hence, I will rely on matched sample analysis in addressing both of the hypothesis categories of the thesis, a commonly used method to study (yield) differences between sustainable finance instruments (see e.g., Flammer (2021), Bachelet et al. (2019) & Zerbib (2019)). In order to study the financial incentive hypothesis behind SPO decisions, each treatment observation (SLB) is matched with a control observation (non-SLB) from the same issuer with similar characteristics to create an as identical as possible pair, except for the "sustainability-link". This section describes the matching approach and reports comparisons between the matched samples.

Inspired by Flammer (2021) and Frésard and Valta (2016), Mahalanobis distance ("MD") is used to identify the closest neighbor for each SLB among the candidate pool by observing four characteristics. First, a candidate pool consisting of the same issuer's all conventional bond issuances with the same seniority, maturity group (5 years and below or above 5 years), coupon type (fixed) and maturity type (callable or not) is created for each SLB. Further, MD is used to match each SLB with the "closest neighbor" within the candidate pool based on the following three characteristics: difference in issuance dates (days), maturity (years) and logarithmic measure of amounts issued. The variables used for matching are similar as those used by Kölbel and Lambillon (2023).

Theoretically, MD measures distance relative to the centroid – a mean point for multivariate data where all variables' means intersect (Mahalanobis, 1936). MD between an SLB i and a matching candidate j is thus formally defined as $[(X_i - X_j)^T * C^{-1} * (X_i - X_j)]^{0.5}$, where X is (3x1) vector of variables for both observations. C^{-1} is an (3x3) inverse covariance matrix of the variables. Each SLB is thus matched with a conventional issue with the smallest MD. MD approach is used to avoid having to arbitrarily select matching criteria thresholds like done for example by Kölbel and Lambillon (2023) and Zerbib (2019). Instead of trying to find the closest match by simultaneously considering multiple variables, the authors create thresholds for different variables and for example restrict the difference between SLB and conventional bond maturities to 3 and 2 years, respectively. Furthermore, the MD approach matches each SLB with only a single conventional bond and hence does not require me to either arbitrarily select a matching pair for an SLB from all bonds whose characteristics lie within the set thresholds, nor include all of the bonds passing the criteria into the matched sample, which would effectively make the observations of issuers with numerous conventional bond issuances overrepresented. Despite the MD approach allows for a smaller number of observations as only one pair is created for each SLB, my matched sample still contains 153 bond pairs, exceeding the sample size of Kölbel and Lambillon (2023) by 18 pairs, as of the working paper version dated January 31,

2023. Table 5 reports comparison of the matched bond pairs' key variables' means. Seniority or coupon type differences are not reported as they are required to be identical between an SLB and the matched conventional bond and hence do not differ. Only 7 matched bond pairs' seniority is higher than senior unsecured (the most common SLB seniority) and due to limitations discussed in the data section 4, all pairs within the sample pay a fixed coupon.

A dependent variable used throughout the paper to address the sustainability premiums is calculated for each bond pair by subtracting a matched bond's yield at issue from an SLB's yield. Due to basing the hypothesis of lower cost of capital on bond yields at issuance, there is no need to restrict for example the minimum issuance amount as liquidity concerns should not affect the outcome. As SLBs are such a nascent market, most of the instruments have no bond credit ratings available and hence this is not included as a criterion for matching despite used elsewhere in the matching literature. However, I perform an additional robustness check for the matching approach by creating a new sample consisting of only the SLBs with a rating available. Within this sample each SLB ends up being matched with the same conventional bond as in the approach excluding the ratings. This gives additional comfort that seniority functions as a sufficient matching criterion while allowing for a larger number of observations.

Table 5: Comparison of sustainability premium analysis' matched sample's means

Variable	SLBs		Matched bonds		Δ	Paired t-test
	Avg.	SD	Avg.	SD		(p-value)
Maturity (years)	9.38	5.23	8.33	3.66	1.05	0.001
Issuance date (days)	October 21, 2021	218.93	April 2, 2020	637.23	567.69	0.000
Issuance size (USDm)	686.32	344.50	658.45	350.51	27.88	0.184
Coupon (%)	3.11	1.85	3.55	2.40	-0.43	0.004
Observations	153			153		

Table 5 shows issuance sizes to not differ significantly between SLBs and their counterfactuals. The table also serves as my paper's first empirical suggestion that sustainability premiums may possibly exist within the instruments by showing that despite an average SLB has approximately a year longer maturity compared to matched bonds, they still pay 43 bps lower coupons. There is also understandably a significant difference of 1.6 years in issuance dates due to SLBs being a novel instrument type with fast market growth.

Due to comprehensive matching approach whose goal is to find the optimal matching candidate based on multiple characteristics considered relevant in the literature, I see no reason to perform any further restrictive analyses. The holistic matching approach weighing several characteristics ensures that although a few relatively large differences may arise in some characteristics, the matching should overall be of high quality. Further, the observed differences in maturity and issuance dates among other variables will be controlled for in the regression model described next in subsubsection 5.1.2.

Panel A of Table 6 reports comparisons of means for the regression's dependent variable (yields at issue), for the whole sample as well as callable and at maturity subsamples. Panel B reports the same metrics for SLBs with and without SPOs.

Table 6: Comparison of matched bond pairs' yields at issue

Panel A			
	Whole sample	*Callable*	*At Maturity*
SLB mean yields	317.7	340.3	207.6
Matched bond mean yields	359.6	383.1	244.8
ΔYield	-41.9	-42.8	-37.2
Nonparametric Wilcoxon test (p-value)	0.168	0.155	0.876
Paired t-test (p-value)	0.006	0.015	0.162
Observations	153	127	26
Panel B			
	SLBs w/ SPOs	*SLBs w/o SPOs*	
SLB mean yields	297.1	374.0	
Matched bond mean yields	364.3	346.5	
ΔYield	-67.2	27	
Nonparametric Wilcoxon test (p-value)	0.050	0.581	
Paired t-test (p-value)	0.0002	0.301	
Observations	112	41	

According to the paired t-tests of Table 6, significant yield differences exist between SLBs and the matched conventional bonds in the whole sample as well as in the callable subsample. However, the possibly more suitable metric (due to non-normality of the data) Wilcoxon rank sum test indicates no significance in panel A. The small number of observations within the at maturity subsample likely limits observing any significant differences through either test.

Panel B highlights how the SLBs with SPOs exhibit both statistically and economically significant average yield differences of 67 bps using both t-test metrics. Average yield differences for SLBs without an SPO are positive (although insignificant), indicating SLBs' yields to in fact exceed those of matched conventional bonds. This statistical observation further provides preliminary support for the theoretical hypothesis that obtaining an SPO can be a tool to achieve lower cost of capital. Next, I develop a regression model to control for several factors and to separate predictive capabilities the presence of an SPO can have on yield differences.

5.1.2 Yield difference OLS Regression Model

In this section I develop a model to control for a set of variables to separate the predictability the presence of an SPO can have on yield differences. An optimal model built around using yield differences between SPO and non-SPO SLBs as a dependent variable becomes infeasible as it would require matching of the two SLB "types" from the same issuer with one another. Even with very loose matching criteria, this would diminish the sample size excessively. Hence, I create an OLS regression inspired by Kölbel and Lambillon (2023) to estimate yield differences at issue between the previously described matched SLB and conventional bond pairs i by controlling for 6 distinct categories of variables:

$$\begin{aligned} \Delta Yield_i = \alpha + \sum \beta_1 * SLB\ Characteristics_{i,1} \\ + \sum \beta_2 * Matching\ Differences_{i,2} + \sum \beta_3 * Common\ Characteristics_{i,3} \\ + \sum \beta_4 * Issuer\ Characteristics_{i,4} + \sum \beta_5 * Credit\ Environment_{i,5} \\ + \sum \beta_6 * Other_{i,6} + \epsilon_i \end{aligned} \tag{1}$$

Equation 1's first grouped category of variables *SLB Characteristics* controls for variables specific to the matched pair's SLB that may predict yield differences, including an indicator for the presence of an SPO. Other variables include indicators for whether the possible SPO has been obtained from a reputable provider, as defined in subsection 4.4 or has been publicly disclosed as well as whether the SLB is the issuer's first such issuance and whether the bond's SPT(s) are aligned with EU taxonomy. Inclusion of the indicator variable for the first SLB issuance is inspired by Kölbel and Lambillon (2023), who observe the market to reward such issuances by accepting lower yields. First time issuance of a novel instrument may for example draw wider media coverage and attention or investors may interpret a first time issuance to be more indicative of sustainability commitments and thus worthy of a greater sustainability premium compared to subsequent issuances. (Self-labeled) alignment with EU Taxonomy should qualitatively capture similar aspects as alignment with the science-based initiative, a predictor used by the authors to control for SPTs' alignment with a renown framework. For data quality matters, I cannot confidently rely on Refinitiv's reported science-based initiative alignment but rather am forced to work with a control variable with unfortunately strong correlation with European issuances in an attempt to control for similar factors.

As for SLBs' contractual aspects, a time-weighted step-up variable measured in bps is developed to measure the financial impact of the realization of the coupon step-up SPT(s). Due to varying contract designs, the potential penalty may compound e.g., only once, impact only a specified number of years or become part of the annual or semiannual coupon until the maturity. Additionally, as the bonds have varying time periods between maturities and SPT observation dates (i.e., the time period during which e.g., annual penalties can impact the issuer) and the

scarcity of data does not feasibly allow the creation of separate variables for e.g., one-time and annual penalties, I develop a comparable variable measuring the potential worst-case impact for the SLB issuer throughout the lifetime of the instrument's maturity. The variable is calculated by weighing the potential penalties Refinitiv reports for an SLB's SPT leg(s) for the fraction of the bond's maturity over which it applies. Thus, for example the impact of a same size (in contractual bps) one-time penalty compared to an annual one of an SLB with 3 years between maturity and SPT observation date is reduced to approx. 1/3. The approach effectively makes different types of step-up penalties comparable to each other and to my understanding is similar to that of Kölbel and Lambillon (2023), although the used approach is not explained in high detail. The last grouped variables within the *SLB Characteristics* variable group are related to differing step-up dynamics between callable and at maturity bonds the authors' prior working paper version dated January 12, 2022 discusses. The authors observe callable bonds to exhibit greater yield differences in the first place and further find higher coupon step-ups to predict lower yield differences for these types of bonds. The opposite is found to hold true for at maturity bonds. Despite not discussed or reported in the authors' latest working paper version dated January 31, 2023, I find my data and model specifications to also support the differing dynamics and thus consider them relevant to the regression model. The differing dynamics are accounted for by including in an indicator for whether the bond (pair) is not callable and further an interaction variable between the indicator and the previously introduced coupon step-up variable.

The second variable category *Matching Differences* controls for differences between matched pairs arising from matching and the absence of a perfect match. Differences in issuance dates and maturities as well as in issuance sizes are grouped under this category. *Common Characteristics* control for variables shared by both of the matched bonds that were previously used to create the SLB a pool of potential matching candidates. The grouped variables include indicators for whether the bond pair's seniority is higher than senior unsecured (the most common SLB seniority) and whether maturity is equal to or less than 5 years.

Issuer Characteristics capture issuer-level differences between different pairs i from different issuers with indicator variables for the bond pair issuers' sectors and regions. Third variable within the group indicates whether the bond pair's SLB has been issued at a time when the issuer's relevant credit rating has been lower compared to the matched conventional issuance. The matched sample includes no bond pairs where the SLB would have been issued at a time of higher issuer credit rating, eliminating the need for such variable. Altogether 8 both long and short-term issuer credit ratings by Moody's and Fitch are considered relevant for the control purpose and are listed in detail in footnote 4 in subsection 4.2. Issuer-level credit ratings are used in place of instrument specific ratings as most SLBs still lack a rating in the first place as discussed when describing the matching approach. The category's last variable is a Refinitiv combined ESG score in the year of the SLB issuance, inclusion of which into the model effectively creates a sustainability performance controlled subsample due to not being available for all issuers.

The expected sign for the ESG performance's coefficient is unclear. In a sense investors can consider an SLB issuance from a weak sustainability performer to be indicative of increased focus on sustainability, converting into more actionable sustainable developments and consequently sustainability premiums. On the other hand, sustainability commitments communicated by SLB issuances of more established ESG performers can be considered to be more credible, converting into lower bond yields. Existing literature has not conclusively assessed the role of issuers' sustainability performance in achieving sustainability premiums.

Changes in *Credit Environment* between the matched bonds' issuances are controlled through variables measuring change in the respective region's relevant risk-free rate between the issuance dates as well as through differences in the bond pairs' credit spreads over treasury yields at issuance. The rates used to control the risk-free rates are either the domicile's or region's 5 or 10-year rates based on bond pair's maturity distance to a 7.5 year cut-off point. For bonds issued in the Eurozone a 10-year swap rate is used. The approach follows that of Kölbel and Lambillon (2023). As for the credit spreads at issuance, a measure calculated by Refinitiv for the difference between the bond's yield at issue and the yield of a respective treasury is used while manually screening through to make sure that the spreads within bond pairs are calculated against the same benchmark. The last category *Other* includes year fixed effects, an important control variable to capture potential momentum of the very fast growing market.

Table 7 collects all of the regression's variables with descriptions and units of measurement. The regression model's results are reported and discussed later in subsection 6.1.

Table 7: Description of yield difference regression variables

Variable	Description	Unit
Dependent variable		
Δ *Yield*	Yield at issue difference for the bond pair	Bps
SLB Characteristics		
SPO	Presence of an SPO verifying the SLB design	Dummy
Reputable SPO Provider	Indicator for whether the SPO has been obtained from a top tier provider	Dummy
Publicly Disclosed SPO	Indicator for whether the SPO has been disclosed to ICMA or published elsewhere	Dummy
First SLB	Indicator for the first SLB by the issuer	Dummy
EU Taxonomy	Indicator for whether the SPT(s) are aligned with EU taxonomy	Dummy
At Maturity	Indicator separating at maturity bonds from callable ones	Dummy
Time-weighted Step-up	Annualized worst-case step-up weighted by the fraction of SLB maturity it applies to in case of not reaching the SPT(s)	Bps
At maturity X Step-up	Time-weighted step-up for at maturity SLBs to account for different step-up dynamics	Bps
Matching Differences		
Δ *Issue Date*	Difference in issuance dates between the SLB and the matched bond	Years
Δ *Maturity*	Difference in maturity between the SLB and the matched bond	Years
Issue Size Ratio	Ratio of the SLB's issuance amount to that of the matched bond	Ratio (e.g., 0.5x)
Common Bond Pair Characteristics		
Senior	Bond (pair) seniority higher than senior unsecured	Dummy
Short Maturity	Bond (pair) maturity shorter than 5 years	Dummy
Issuer Characteristics		
ESG Score	Refinitiv combined ESG score in the year of the SLB issuance	Score (0-100)
Credit Rating Change	Relevant issuer credit rating (Moody's & Fitch) lower at the SLB issuance compared to the matched issuance	Dummy
Issuer Region	Domicile area of the issuer (Europe, APAC, North America & Rest of the World)	Dummy
Issuer Sector	2-digit TRBC sector of the issuer	Dummy
Credit Environment		
Risk-free Rate Change	Change in the respective region's risk-free rate between SLB and matched bond issuances.	Bps
Credit Spread Change	Difference in credit spreads over treasury yields at issuance of the SLB and the matched bond	Bps
Other		
Year FE	Fixed effects for the year of SLB issuances to control for the momentum of the nascent market	Dummy

5.2 Methods to Study Bond Issuers' Sustainability Development

5.2.1 Matched Sample Development for Signaling & Greenwashing Study

Cross-sectional comparison of sustainability performance development following SLB issuances to study the signaling and greenwashing arguments requires the creation of a new matched sample. Issuer-based matching used in the financial incentives study is substituted by issuer domicile and industry-based matching. Due to matching instruments of different issuers with one another, focus is moved from instruments' financial characteristics towards matching based on issuers' sustainability performance and business profiles. Drawing inspiration from the matching approach of the green bond study by Flammer (2021), I require each SLB's potential matches to be issued in the same year by an issuer in the same domicile and industry (2-digit TRBC). As before, MD is used to find the SLB issuers the closest match among the remaining candidates based on a set of variables. The variables used for the matching are reported and described in Table 8. The characteristics – except for the amount issued – are observed in the year preceding the issuance (*t-1*) and by their pre-trend change from *t-2* to *t-1*, basing the matching on altogether 15 different variables in an attempt to match the SLB issuers with firms as similar in multiple dimensions as possible.

Table 8: Signaling analysis matching criteria. The table describes the criteria used to match bond issuers operating in the same industry and domicile and who have issued bonds during the same year.

Criterion	Variable captures
Financial Metrics	
Return on Assets	Measure of profitability
Tobin's Q	Market valuation differences (i.e., indicative of e.g., nature of operations and growth opportunities)
Log(Assets)	Issuer size
Leverage (D/E)	Pre-issue leverage, indicative of capital intensity of operations and the level of access to capital markets
Sustainability Metrics	
Refinitiv Environmental Score	Pre-issue environmental performance
Refinitiv Social Score	Pre-issue social performance
Refinitiv Governance Score	Pre-issue governance performance
Other	
Log(Issuance amount)	Significance (measured as size) of the issuance to the issuer, pairing issuances of similar importance

The matching yields 60 unique bond pairs between 60 unique SLB issuers and 53 unique matched conventional bond issuers. No issuer within the final matched sample has issued an SLB in more than one year, and therefore signaling differences between first and subsequent

SLB issuances cannot be addressed. Firms with SLB issuances in several years did exist in the whole sample initially collected from Refinitiv but ended up being restricted out of the matched sample due to not having certain information available or due to the lack of a matchable issuer. Additionally, I treat SLB issuers with several SLB issuances during a given year as if they had had only one issuance for two reasons. First of all, Refinitiv sustainability scores are reported only for whole financial years as their main sources of information are companies' annual reports and other related material. This combined with several sustainability aspects not being easy to measure quantitative metrics but rather subjective ones makes studying subtle differences in short time periods not feasible. Secondly, including issuers with several issuances in one year as multiple entries to the matched sample would effectively account for the issuers' sustainability performance numerous times by considering these as separate observations. In a small sample where majority of the issuers still have issued only one SLB, this could easily overweigh few issuers' observations and skew the whole sample.

Table 9 reports ex-ante univariate mean ESG score and financial metric comparisons between the SLB and matched conventional bond issuers and highlights the SLB issuers' stronger sustainability performance in the year preceding the bond issuances in environmental and social categories, the two main categories into whose KPIs the SPTs are linked. As the scores can range from 0 to 100, the differences are also economically very significant and exhibit the same dynamics as those identified by Kim et al. (2023) in the SLL market where firms with superior ESG profiles tend to be more likely to borrow through SLLs. Interestingly, within my matched sample the counterfactual bond issuers are scored significantly higher in the ESG controversies metric, indicating better performance in either avoiding controversies or higher quality of sustainability disclosure. SLB issuers' weak performance in this metric likely also discounts their combined ESG performance which does not significantly differ between the two bond types' issuers.[7]

The median scores exhibit overall the same dynamics as averages. The small difference of only 2 points in the ESG controversy category combined with the significant differences in averages and high standard deviations could in theory suggest a few observations with extremely poor performance to weaken the whole sample's scoring. However, manual screening of the data shows only 41 of the 60 SLB issuers to have an ex-ante controversy score exceeding 90, with the respective figure being 46 for the conventional bond issuers. In the bottom end of the range, only 3 conventional bond issuers have received a score weaker than 20, while 6 SLB issuers have been scored in the bottom 20%. Thus, although the median comparison makes the difference less pronounced, there seems to be clear underperformance in ESG controversy aspects across the SLB issuer sample not explained simply by weak performance of a few observations. Regardless of the small sample size, this is an interesting finding likely emerging from the exclusion of the

[7]Similar to the other potentially more straightforward to interpret sustainability performance metrics, a higher score in Refinitiv's ESG Controversy measure indicates either better controversy avoidance or higher quality of disclosure, while a low score is indicative of some issues regarding the aspects captured by the measure.

controversy score from the matching variables. I will describe the approach to briefly empirically address these unexpected dynamics next after discussing first differences in the matched pairs' financial ex-ante variables.

In terms of the issuers' (and issuances') financial metrics, the matching approach weighing variables at time *t* and their change from *t-2* to *t-1* seems to have resulted in a rather balanced sample in which SLB and conventional bond issuers significantly differ from each other only in size related metrics at year *t-1*. In terms of profitability (ROA), market valuations (Tobin's Q) and leverage (D/E), no significant differences seem to exist, suggesting the approach to have successfully matched firms with similar nature of operations with one another. Requiring an issuer to operate in the same industry and to have issued a conventional bond in the same year and domicile as an SLB issuer likely positively contributed to the outcome of the matching process. These pre-matching restrictions likely capture especially the more time-variant profitability (for a given industry) and market valuation variables but may not be as meaningful for leverage, total assets, or issuance sizes. Qualitatively there is no major difference in the matching outcome regardless of whether winsorized ROA or leverage were used in the place of raw data. Such an approach would yield one SLB issuer in the final matched sample split to be matched with a different conventional bond issuer.

It is worth noting that comparisons of sample wide ex-ante averages across several industries and years may not necessarily be fully indicative of how individual matched issuers' metrics compare against each other. However, the outcome provides me a sufficient level of comfort that the matching has effectively succeeded in creating two highly comparable samples of issuers with the difference that the others have issued an SLB in the place of a conventional bond, albeit some mismatching some between bond pairs' individual variables likely has happened as no perfect matches can in most cases be found. Thus, I continue the analysis using this matched sample to avoid having to rely on pair-wise matching comparisons requiring subjective judgement which my choice of matching approach tried to avoid in the first place.

The only significant statistical differences within the financial metrics between the two samples exist in issuers' total assets and issuance sizes, with SLB issuers being on average almost 4 times the size of the matched conventional bond issuers and their issuance amounts over 20% larger than the conventional issuances in dollar values. The finding of SLB issuers and issuances being larger than their otherwise as similar as possible counterparts exhibits the same dynamics as observed in the related SLL market by Kim et al. (2023). The dollar value variables' very high standard deviations combined with the fact that in a sense the variables have no upper boundary indicates the samples to contain at least some large observations possibly skewing the means significantly. As expected, the differences do not seem as drastic when observing the medians between the samples. Even further, as both the issuance and issuer sizes are larger for the SLB sample, the issuances' relative importance remains the same for both samples. This is highlighted by Table 9's last reported descriptive variable which measures issuance sizes in

relation to the respective issuer's total assets and shows the issuances to be of equal financial importance to issuers of both of the samples. This is an important requirement for the subsequent signaling analysis as it rules out the possibility of SLBs sending either a stronger or a weaker sustainability commitment signal compared to the counterfactual bonds simply due to being of more or less importance to the issuer. As discussed in section 2 and further in subsection 3.2, the costlier or in this case the more "important" an action is, the stronger the signal it should send.

Table 9: Matched bond pairs' issuers' univariate ex-ante ESG score and financial metric comparisons. The table reports ex-ante descriptive statistics for 60 unique bond issuer pairs consisting of SLB issuers and matched as similar as possible conventional bond issuers. Panel A reports the issuers' average and median ex-ante sustainability performance scores in the year preceding the issuance of *SLBs* and *Matched bonds* separately. SD reports the variables' standard deviations. The last two columns report average differences between SLB and the counterfactual bond issuers within the respective score and report the differences' significance. Panel B reports the same measures for a set of financial metrics. The variables denoted with a superscript $\top$ (and their change from *t-2* to *t-1*, except for issuance amounts) were used in matching to find each SLB issuer the closest match among the conventional bond issuers who have issued a bond in the same domicile, industry, and year as the given SLB issuer in question.

Panel A: Sustainability scores								
Variable	SLBs			Matched bonds			Δ	Paired t-test
	Median	Avg.	SD	Median	Avg.	SD	Avg.	(p-value)
Environmental$^\top$	77.5	75.7	18.5	71.6	66.0	20.4	9.7	0.000
Social$^\top$	81.1	78.6	16.1	73.8	69.8	20.8	8.8	0.000
Governance$^\top$	76.3	69.9	17.6	74.4	67.3	21.1	2.6	0.159
ESG controversies	97.7	71.2	36.0	100.0	89.0	25.1	-17.8	0.000
Combined ESG	68.7	65.4	15.2	65.8	64.5	17.0	0.9	0.636
Panel B: Financial metrics								
Variable	SLBs			Matched bonds			Δ	Paired t-test
	Median	Avg.	SD	Median	Avg.	SD	Avg.	(p-value)
Return on assets (%)$^\top$	2.4	3.0	7.2	3.7	2.2	5.5	0.7	0.347
Tobin's Q$^\top$	0.9	1.2	1.3	1.1	1.4	1.7	-0.2	0.188
Leverage (D/E) (%)$^\top$	121.3	144.8	128.2	123.9	145.9	104.1	-1.1	0.925
Log(Total assets)$^\top$	10.4	10.5	0.7	10.2	10.2	0.6	0.3	0.001
Total assets (USDbn)	22.9	142.0	596.8	17.5	36.6	57.6	105.3	0.074
Log(Amount issued)$^\top$	8.7	8.7	0.4	8.7	8.6	0.4	0.1	0.041
Amount issued (USDm)	526.0	610.5	401.4	528.7	501.1	319.0	109.4	0.014
Amount issued / Total assets (%)	1.6	3.2	4.4	2.8	4.6	8.1	-1.4	0.108

5.2.2 Ex-ante Sustainability Performance's Predictiveness of SLB Issuances

Dynamics of the observed unexpectedly large differences especially in ESG controversy score between SLB and conventional bond issuers and this finding's implications create interesting grounds for future research but go beyond my paper's main scope. However, I still briefly empirically address the interesting dynamics further and develop Equation 2 to be estimated against the matched bond pair sample's issuers' sustainability scores at time *t-1* to predict the probability of an SLB issuance at time *t* based on firm *i*'s ex-ante sustainability performance.

$$\begin{aligned} SLB\ Issuer_{i,t} &= \alpha + \beta_1 * Environmental\ Score_{i,t-1} \\ &+ \beta_2 * Social\ Score_{i,t-1} + \beta_3 * Governance\ Score_{i,t-1} \\ &+ \beta_4 * Controversy\ Score_{i,t-1} + \beta_5 * Combined\ ESG\ Score_{i,t-1} + \epsilon_{i,t} \end{aligned} \tag{2}$$

In the equation, the dependent variable is an indicator equal to one for the matched sample's SLB issuers (i.e., half of the sample) and zero for the conventional bond issuers. The independent variables are the respective issuers' sustainability ex-ante performance scores in the year preceding the issuance year. An attempt to fully capture the predictors of an SLB issuance would require a more comprehensive analysis and for example controlling of numerous other factors aside simply the sustainability performance. Hence, this part of my thesis shall only be seen as the first empirical step into an area that according to my knowledge has not been addressed in the literature before. The results of Equation 2 are reported in subsubsection 6.2.1.

5.2.3 Signaling & Greenwashing OLS Regression Approach

Inspired by Flammer (2021) and especially Kim et al. (2023) who study instrument issuances' signaling capabilities within the green bond and sustainability-linked loan markets, respectively – I estimate a similar OLS regression (Equation 3) against a panel data of issuer-year observations consisting of both SLB and their matched bond issuers to study whether SLB issuances are signaling tools or whether they raise greenwashing concerns.

$$\begin{aligned} ESG\ Score_{i,t} &= \alpha + \beta_1 * SLB\ Issuer_i * Post\ Issuance_{i,t} \\ &+ \beta_2 * SLB\ Issuer_i + \beta_3 * Post\ Issuance_{i,t} + Firm\ FE \\ &+ Country * Year\ FE + Sector * Year\ FE + \epsilon_{i,t} \end{aligned} \tag{3}$$

$ESG\ Score_{i,t}$ refers to several different tested sustainability scores of the issuer at time *t*. $SLB\ Issuer_i$ is a cross-sectional indicator variable separating SLB issuers from the matched non-SLB issuers. $Post\ Issuance_{i,t}$ is an indicator variable indicating whether either an SLB or a matched counterfactual has been issued by an issuer *i* either during or before the current year *t*. The

last three independent variables are fixed effects for firms, country-by-year (issuer domicile), and industry-by-year (2-digit TRBC) to account for differences between issuers as well as geographical locations and industries during different years. β_1 is a quasi difference-in-differences coefficient for interaction variable between treatment group (*SLB Issuer*) and time (*Post Issuance*) indicator variables. The coefficient tests the hypothesis of whether SLB issuers' ESG scores change post issuance compared to the matched sample's non-SLB issuances, effectively separating between the signaling and greenwashing arguments. Improving ESG performance indicates credible sustainability commitments, whereas performance deterioration (or lack of significant development) raises greenwashing concerns. β_2 measures the differences in ESG scores between SLB and non-SLB issuers. When firm fixed effects are included to a model specification, they subsume the $SLB\ Issuer_i$ variable.

Equation 3 is further applied to study the thesis' last research questions of whether SPOs are a signaling tool that can strengthen or alter the signal sent by SLB issuances and whether there are differences if the SPO is obtained from a reputable provider or disclosed to the public. First, I estimate the equation against an issuer-year sustainability score panel of a subsample consisting of scores of issuers that have obtained SPOs for their SLBs and those of these issuers' matched conventional bond issuers. Secondly, to further limit down the sample and to address whether SLB issuances with an SPO from a top tier provider serve as greater signals of sustainability commitments, I estimate the equation against a new subsample consisting of SLBs with an SPO from a top tier provider (Moody's, Sustainalytics or ISS) and these issuers' matched pairs. The approach to rank the SPO providers' reputation is described in detail in subsection 4.4. Similarly, I also estimate the equation against a subsample of SLB issuers who have publicly disclosed their SPO and their matched pairs. In terms of my research questions related to SPOs' signaling capabilities, these three subsample analyses are of core interest. However, I also estimate the regression as a secondary analysis against the first two subsample's "out-of-sample" observations (i.e., sustainability scores of the remaining SLB issuers and these issuers' matched pairs) to observe if they exhibit differing dynamics possibly providing new insights. A similar subsample approach is used by Kim et al. (2023) to separate SLL borrowers with good contractual disclosure from those with poor disclosure to show that only the borrowers with poor disclosure experience deteriorating ESG performance after obtaining an SLL.

To sanity check the results of the subsample approach, I perform a secondary analysis by estimating a model identical to the one used by Flammer (2021) to address the signaling capabilities certified green bonds can have. Following in the author's footsteps, I subsume both the *SLB Issuer* and *Post Issuance* variables into one variable called *SLB* for those issuer-year observations where the issuer in question has issued an SLB during the current or previous years. Further, I interact this new variable with indicators for whether or not an SPO has been obtained for the SLB in question. In the second model specification I interact the variable with indicators for whether the SPO has been obtained from a top or a lower tier provider. Implications of the

approach slightly differ from those of Equation 3 estimated against subsamples, as instead of addressing differences-in-differences between treated (SLB) and control (matched conventional bonds) observations, the interaction variables now measure the differences in the sustainability performance between differently classified SLBs. This is because econometric limitations do not allow to include the regression main effects into such model specification. Additionally, this secondary approach yields relatively high levels of significance for the coefficients, with Flammer (2021) also observing several coefficients to be significant at more than 1% level.

6 Results

The results section follows the same structure as prior sections in that the first subsection reports and discusses the findings of the sustainability premium analysis, while the second subsection reports and the results of the signaling analysis. The second subsection also includes an analysis addressing interesting sustainability performance dynamics SLB issuers exhibit ex-ante. Due to very comprehensive robustness testing, several ancillary regression results tables discussed throughout the section are relocated to the appendix to ensure clarity and to place focus on key findings.

6.1 Results of the Yield Difference Regression Model

6.1.1 SPOs and Other Variables as Bond Pairs' Yield Difference Predictors: Regression Model Results

Table 10 reports results of yield differences between matched bond pairs consisting of SLBs and comparable conventional bonds from the same issuer being estimated against Equation 1. Model specifications 1 and 2 estimate the regression against the whole matched sample, with the latter separating the predictability an SPO from a top tier provider can have on yield differences. Aside a wide set of variables already controlled for in the first two models, specifications 3 and 4 additionally control for the issuer's combined ESG score in the year of issuance. Due to the scoring not being available for all issuers, this leads to a redcution in sample size. Results and implications of the model specifications 2 and 4 are discussed in the next subsubsection when addressing SPO providers' reputational characteristics' predictability of yield differences.

The results show how the decision to obtain an SPO can predict a statistically significant yield difference with estimates ranging from -46.7 bps up to -69.9 when controlling for ESG scores. Aside the statistical significance, these differences are also economically very significant when compared to for example the sample's average yield at issue of 317.7 bps. The findings are supportive of the hypothesis according to which obtaining an SPO can allow SLB issuers to tap into significantly lower cost of capital. Of the sample's average issuance size of $686 million, the

presence of an SPO indicates annual savings worth $0.3 million for an issuer. The savings due to reduced cost of capital can thus be economically very significant especially when compounded over an SLB's lifetime. The lack of data for the pricing of SPOs and/or issuers' required extra commitment and time to obtain one make it difficult to conclusively assess whether obtaining one is beneficial for the issuers. However, a simplistic back of the envelope calculation using the sample's average maturity of 7.6 years would indicate savings of approx. $2.3 million throughout the maturity of an average instrument, which intuitively would suggest the savings to exceed the additional costs obtaining an SPO could at least in most scenarios generate. When issuing an SLB, the issuers may already need or want to for example revamp their ESG disclosure standards. Hence, only the marginal cost arising from obtaining an SPO should be weighed against one's potential benefits.

Overall, even though the presence of SPOs do seem to predict lower cost of capital for SLBs, future research ought to aim to compare the savings against the potential costs arising from obtaining one. The observed significant predictive capabilities the SPO variable's coefficient has over yield differences qualitatively survives several robustness tests that (i) winsorize the yield differences at 90% level, (ii) exclude at maturity bond pairs for which the step-up dynamics are different, and (iii) exclude issuers whose credit ratings have been updated between the bond pair issuances. The complete regression tables can be found in the appendix. Please refer to Tables A1, A2, and A3 for detailed robustness check results.

The findings first and foremost support the presence of sustainability premiums within SLBs, indicating that investors are willing to accept lower yields in exchange for their funds being allocated to investments that are likely to advance sustainable developments. Secondly, the fact that investors reward issuers for obtaining SPOs indicates that investors do value the confirmatory role that SPOs can provide for instrument designs. Investors themselves may have difficulties in properly assessing whether the agreed upon SPTs are ambitious or relevant enough to drive sustainable developments for example due to low transparency caused by weak disclosure not only in the SLBs' issuance prospectuses but also in issuer level filings. Thus, investors seem to consider that when an SPO verifying an instrument's design is present, the issuers are more committed to sustainable developments, which effectively converts into the investors accepting lower yields for investing in such SLBs.

Table 10: Yield difference regression results. The table reports regression estimates for yield differences between SLBs and matched conventional bonds from the same issuer. *SPO* is an indicator variable for whether an SPO has been obtained and *Reputable SPO provider* indicates whether the possible SPO has been obtained from a tier 1 opinion provider. *Time-weighted step-up* is the SLB's weighted step-up margin in the worst case scenario for the fraction of the bond's maturity over which it applies and *At maturity X step-up* controls for different dynamics of step-ups and yield differences between callable and at maturity bonds. The other variables include indicators for whether the bond pair is not callable (*At maturity*), whether an SLB is the issuer's first such issuance and whether the SLB's sustainability targets are aligned with EU taxonomy. *ESG score* is a combined ESG score reducing the sample size in models (3) and (4) due to lack of availability. *Credit rating change* controls for changes in relevant issuer credit ratings between the issuances, while *Matching differences*, *Common Bond Pair Characteristics* and *Credit Environment* control for several other possible drivers described in more detail in Table 7. Robust t-values are reported in parenthesis and *, **, *** represent significance levels of 10%, 5% and 1%, respectively.

		Dependent variable: ΔYield			
		Whole sample		*ESG score sample*	
Independent variables	Exp. sign	(1)	(2)	(3)	(4)
SLB Characteristics					
SPO	-	−46.70**	−21.78	−69.88***	−68.77*
		(−2.45)	(−0.82)	(−3.04)	(−1.82)
Reputable SPO provider	-		−29.04		−1.19
			(−1.23)		(−0.03)
Time-weighted step-up	-	−0.04	−0.03	0.05	0.05
		(−0.51)	(−0.43)	(0.20)	(0.20)
At maturity *X* step-up	-	−0.74*	−0.71*	6.92	−6.95
		(−1.71)	(−1.68)	(1.10)	(−1.08)
At maturity	+	3.63	3.52	−150.50	−150.76
		(0.11)	(0.11)	(−1.27)	(−1.27)
First SLB issuance	-	5.62	3.86	10.62	10.57
		(0.36)	(0.25)	(0.62)	(0.62)
EU taxonomy aligned SPT	-	−3.99	−2.29	−62.71***	−62.70**
		(−0.20)	(−0.12)	(−2.62)	(−2.62)
Issuer Characteristics					
ESG score	?			0.89	0.88
				(1.10)	(1.06)
Credit rating change	+	−49.52	−43.87	−163.39**	−163.07**
		(−1.38)	(−1.19)	(−2.52)	(−2.50)
Matching Differences		Yes	Yes	Yes	Yes
Common Bond Pair Characteristics		Yes	Yes	Yes	Yes
Credit Environment		Yes	Yes	Yes	Yes
Sector FE		Yes	Yes	Yes	Yes
Region FE		Yes	Yes	Yes	Yes
Year FE		Yes	Yes	Yes	Yes
Observations		153	153	96	96
Adj. R^2		0.82	0.82	0.85	0.84

As for the other variables which yield differences are regressed on, I observe (self labeled) alignment with EU taxonomy to significantly increase the model fit even when controlling for Europe as a region, despite not being a significant predictor in model specifications 1 and 2. Qualitatively, the inclusion of EU taxonomy variable should capture similar aspects as alignment with the science based initiative, a predictor used by Kölbel and Lambillon (2023) to control for SPTs' alignment with a framework. When controlling for ESG scores, the coefficient turns significant what first seems indicative of bond investors valuing sustainability commitments demonstrated by labeling an SLB's SPTs to be aligned with a concrete framework. However, when the model is estimated without controlling for ESG scores against the same restricted subsample, the statistical and economical significances remain, indicating the strong predictability of the variable to actually be driven by the characteristics within the subsample and not the additional controls provided by the inclusion of the ESG scores as variables. Overall, this indicates that the self labeled alignment may thus not predict greater sustainability premiums within the whole SLB market.

Unlike Kölbel and Lambillon (2023) who observe issuers' first SLBs to benefit from greater sustainability premiums by approx. 30 bps compared to subsequent issuances, I find no support of such phenomenon and observe insignificant coefficients. There are several possible reasons for the observed differences. For example, simply differences arising from the differing matching approach may cause the observed differences despite the controls in place. A second possibility is that the subsequent SLB issuers may have continued to benefit from sustainability premiums again in late 2022, after the authors showed yield differences to have disappeared in the early parts of 2022. This would decrease the differences between first-time and subsequent SLBs' yield differences and correspondingly the variable's significance. There is also a data quality related possibility that Refinitiv data's weak representativeness of the early SLB market may falsely label some issuers' subsequent SLBs as the first issuances due to the lack of information about prior ones (i.e., the real first SLBs).

Although excluded from the table due to being simply control variables and irrelevant to my research question, changes in credit environment variables seem to be significant drivers of the yield differences. I find SLBs issued with a one basis point higher credit spread compared to their matched bonds to predict an extremely significant increase of 1.1 to 1.5 bps (depending on the model specification) in the yield difference. This finding suggests that SLBs issued during better economic conditions compared to their counterfactuals have led to greater sustainability premiums, supporting the findings of Kölbel and Lambillon (2023) of sustainability premiums disappearing in 2022. Using a partly different model specification, the authors observe qualitatively similar changes in yield differences for one basis point change in spreads. Similarly, I find changes in risk-free rates to be significant predictors before controlling for ESG scores with one bps higher risk-free rate at SLB issuance compared to the matched bond issuance predicting 0.2 bps higher sustainability premiums.

When controlling for ESG scores, the coefficients for credit rating change control variable turn statistically and economically very significant. However, as discussed earlier, the robustness check omitting the observations (and consequently the variable) with changes in credit ratings yields qualitatively similar results for the SPO variables relevant to the research questions. Due to insignificant coefficients for the issuers' ESG score variable, I find no conclusive evidence for either of the previously discussed opposing directions of predictability. Likely, the dynamics are at least somewhat mixed with investors in some cases rewarding previously weak ESG performing issuers' SLBs with higher sustainability premiums when the issuers' new sustainability commitments are considered credible. On the other hand, sometimes issuances by strong and established ESG performers are rewarded highly as well. Thus, further research is required to assess finer details of how investors value issuers' pre-issuance sustainability performance when pricing their bonds.

Full regression results with detailed estimates for all of the grouped variables is reported in the appendix Table A8 along with simpler models with fewer control variables that exhibit how the model was constructed.

6.1.2 SPO Providers' Reputation as a Predictor of Sustainability Premiums: Regression Model Results

Despite observing very consistent significance over the indicator for whether an SPO is present in the first place, I find only very weak evidence for whether the reputation of the SPO provider can predict greater sustainability premiums. As discussed in subsection 4.4, I consider Moody's, Sustainalytics and ISS to constitute the top tier SPO providers. The coefficients for the indicator variable *Reputable SPO provider* capturing whether the bond pairs' SLBs' SPOs are obtained from one of these providers remain insignificant not only in Table 10 but also in the model specifications of the robustness checks discussed in last subsubsection. As discussed earlier, these robustness checks' detailed regression results are reported in the appendix in Tables A1, A2, and A3.

To further robustness check the results I develop two new stricter classifications for which SPO providers are considered to be top tier. Firstly, I tighten the criteria only slightly to consist of Moody's and Sustainalytics, the two highest reputation providers as shown in subsection 4.4. Presence of an SPO from these providers does seem to predict significant sustainability premiums for an SLB, unless issuers' ESG performance is controlled for. Additionally, the significant coefficient does not survive similar robustness tests as before where I either (i) omit the bond pairs whose issuers' credit ratings have been updated between the bond pair issuances, or (ii) winsorize the yield differences, regardless of whether ESG scores are controlled for or not.

Secondly, I tighten the criteria further to only consist of Moody's, the clear outperformer in all of the observed reputational measures. Surprisingly, when controlling for ESG scores and developing an unfortunately noisy estimate for SPOs obtained from Moody's (n=16 within the

ESG score restricted sample), the coefficient turns significantly positive. I observe similar results also in the additional robustness checks that omit issuers with credit rating changes or winsorize the yield differences at 90% level. In fact, when omitting issuers with credit rating changes from the sample the coefficient turns significantly positive also in a model specification in which ESG scores are not controlled for. In all of the model specifications where the coefficient for an SPO obtained from Moody's is significant, its size is also economically significant predicting over 50 bps higher yields for SLBs. Table A4 in the appendix reports regression results for the robustness check tightening the classification for top tier SPO providers. Further, Tables A5 and A6 in the appendix report regression results with the tightened classifications estimated against a sample omitting issuers with credit rating changes and against winsorized yield differences, respectively.

Due to the very small number of observations with an SPO from Moody's, I cannot confidently argue these findings to indicate that an SPO obtained from Moody's would in fact necessarily predict significantly smaller sustainability premiums for SLBs. However, the finding still contradicts with my hypothesis of investors valuing SPOs obtained from top tier providers by rewarding SLB issuers obtaining them with higher sustainability premiums. The both statistically and economically highly significant positive coefficients for an SPO from Moody's variable are noteworthy given a model controlling for altogether 20 distinct factors and Moody's being the most prominent performer in all of the observed reputation metrics and thus in theory expected to be rewarded with the highest sustainability premiums.

Put together, I find no robust support for the hypothesis that investors would consider an SPO from a top tier provider to reduce uncertainty about SLB issuers' sustainability commitments that would effectively convert into larger sustainability premiums. The observed surprising dynamics of SPOs obtained from Moody's can possibly indicate that some other SPO provider related characteristics may have predictive capabilities over bonds' yield differences but based on my findings, I argue that reputational aspects at least in terms of how I measured them are not a key predictor.

Similarly, publicly disclosing an SPO does not seem to predict greater sustainability premiums. Due to the relatively strong overlap (n=62) between SPOs provided by a top tier provider (n=90) and publicly disclosed SPOs (n=88), the results between models estimated using either of the two variable categories are relatively similar and hence the disclosed SPO regression results indicating no signficance are moved to the appendix and reported in Table A7.[8]

[8]Top tier provider here refers to the original classification of the SPO providers and consists of Moody's, Sustainalytics and ISS.

6.2 Results of Bond Issuers' Sustainability Performance Regressions

6.2.1 Ex-ante Sustainability Performance as a Predictor of SLB Issuances: Regression Model Results

This section moves away from comparing one issuers' instruments against each other and transitions into cross-sectional issuer comparisons. Table 11 reports the results of Equation 2 developed in subsubsection 5.2.2, which estimates issuers' sustainability scores in the year preceding bond issuances against an indicator equal to one when the firm is an SLB issuer. Before addressing the signaling and/or greenwashing arguments, the attempt is to empirically address the predictiveness of ex-ante sustainability performance over the probability of an SLB issuance, with special interest especially in the observed SLB issuers' weaker ex-ante controversy scoring compared to conventional bond issuers.

The equation is estimated against a matched sample of SLB and conventional bond issuers first separately against each score (model specifications 1-5) and then together against the three main pillars and the additional controversy score pillar in specification 6. The model specification 7 further includes in the Refinitiv developed combined ESG score which effectively in itself is already a weighted average capturing the scoring of the four pillars.

The last two specifications show the controversy score's coefficient to remain significantly negative even when factoring in the three main pillars and also the combined ESG performance which in itself already captures some parts of the controversy performance. The finding indicates a higher probability of an SLB issuance for issuers with weak controversy score performance (i.e., surfaced controversies or weak ESG disclosure transparency). Out of the five separately observed scores, the controversy scoring also seems to have the best explanatory power over the probability of an SLB issuance when measured by (adjusted) R^2.

The finding of SLB issuers being on average weaker ESG controversy performers suggests that firms may issue SLBs in an attempt to for example redirect attention away from scandals or alternatively credibly signal of improved focus on sustainability aspects. In the simpler model specifications, environmental and social scores are positive and significant, as expected from the earlier discussion of issuers' ex-ante scores. Despite losing (some) significance in the last model specifications when the other scores are included, the simpler models and the previously discussed differences in ex-ante scoring indicate SLB issuers to still be on average somewhat stronger sustainability performers in metrics relevant to most of the SLBs' sustainability targets than the matched bond issuers. However, the SLB issuers may be more likely to have faced some controversies recently or having adhered to weaker ESG disclosure, thus deflating their controversy scoring. The argument of SLB issuers being stronger performers in certain scores but weaker in one is further supported by the fact that the combined ESG score variable exhibits the table's weakest explanatory power over the dependent variable. If different variables have differing directions of predictiveness, their average (i.e., the combined ESG score) is likely to

Table 11: Issuers' ex-ante sustainability performance as a predictor for SLB issuances. The table reports regression coefficient estimates for the probability of an SLB issuance in the year *t* estimated against ex-ante (*t-1*) sustainability scores for a sample of SLB issuers and their matched conventional bond issuers. Models 1 through 5 estimate the dependent variable indicator equal to 1 when the respective company has issued an SLB during the year *t* separately against each of the 5 separate scores. The model specifications 6 and 7 pool together the simpler model specifications and estimate the dependent variable against several scores simultaneously. Robust t-values are reported in parenthesis. *, **, *** represent significance levels of 10%, 5% and 1%, respectively.

	Dependent variable: SLB issuance indicator						
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Environmental Score	0.006*** (3.96)					0.003 (1.18)	0.000 (0.12)
Social Score		0.006*** (3.66)				0.004* (1.74)	0.001 (0.192)
Governance Score			0.002 (0.96)			−0.003 (−1.19)	−0.005 (−1.61)
Controversy Score				−0.004*** (−4.46)		−0.003*** (−2.77)	−0.006** (−2.10)
Combined ESG Score					0.001 (0.39)		0.009 (1.21)
Observations	120	120	120	120	120	120	120
Adj. R^2	0.05	0.05	-0.00	0.07	-0.00	0.09	0.09

exhibit only low to none predictive capabilities.

As discussed in the methods section 5, this simplistic approach does not provide conclusive evidence over the dynamics between ex-ante sustainability performance and decisions to issue an SLB. As bond issuances first and foremost serve as a way for issuers to raise capital and most likely are not random or fully dependent on firms' prior sustainability performance, any future research should seek to control for a wide variety of factors beyond simply sustainability aspects that possibly drive the issuance decisions. Whether SLB issuances indeed are attempts to for example save the issuing firm's face following controversies or signal of disclosure level improvements is an interesting question for future research, especially when considered together with my paper's core findings regarding signaling discussed next.

6.2.2 SLB Issuances' Sustainability Commitment Signaling Capabilities: Regression Model Results

To assess whether SLB issuances serve as credible signals of sustainability commitment or in other words whether the issuers' sustainability performance improves post issuance, I estimate Equation 3 discussed in the Methods section 5 against a panel of issuer-year observations consisting of SLB issuers as well as the matched bond issuers' environmental, social, controversy and combined ESG scores. Table 12 reports the regression results.

Table 12: Bond issuer sustainability performance development The table reports regression estimates of different sustainability score developments following bond issuances for an issuer-year panel data consisting of SLB issuers and their matched conventional bond issuers from 2014 to 2022. *SLB Issuer* is an indicator variable equal to one if the firm issues an SLB during the sample period. *Post Issuance* indicates whether the firm has issued an SLB or a control conventional bond during the current or previous years. The variable is subsumed when *Firm FE* are introduced to the model in specifications 2, 4, 6 and 8. *SLB Issuer X Post Issuance* is an interaction variable between the other two variables equal to one if the firm has issued an SLB during the current or previous years and captures whether the SLB issuers experience differential changes in sustainability performance post issuance compared to the matched bond issuers. Standard errors are clustered at sector level (2-digit TRBC) and t-values are reported in parenthesis. *, **, *** represent significance levels of 10%, 5% and 1%, respectively.

Dependent variable	*Environmental score*		*Social score*		*Controversy score*		*Combined ESG score*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SLB Issuer *X* Post Issuance	−7.42** (−2.00)	−7.51*** (−2.91)	−3.45 (−1.21)	−3.63** (−2.21)	−4.97 (−0.42)	−2.57 (−0.54)	−7.32* (−1.94)	−5.71** (−1.99)
SLB Issuer	10.02** (2.53)		11.15*** (3.18)		−3.72 (−0.81)		7.61** (2.32)	
Post Issuance	3.49 (0.99)	2.92 (1.33)	8.35 (1.35)	1.28 (0.31)	4.11 (0.41)	2.06 (0.37)	5.08* (1.72)	0.44 (0.09)
Firm FE	No	Yes	No	Yes	No	Yes	No	Yes
Country X Sector X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	910	910	910	910	910	910	910	910
Adj. R^2	0.22	0.86	0.38	0.88	0.09	0.53	0.27	0.78

The results' *SLB Issuer* variable's significant coefficients show SLB issuers to have on average 10.0, 11.2 and 7.6 points higher scores in environmental, social and combined ESG score categories compared to the matched bond issuers. The environmental and social scores more or less exhibit the same level of differences than the ex-ante year's scoring discussed previously. However, the differences in the combined ESG scores seem remarkable compared to the ex-ante

year when the two issuer groups' performance in the measure didn't significantly differ, likely caused by the previously discussed weak ex-ante controversy performance discounting the combined ESG scoring as well. Put together, it seems that the SLB issuers are overall higher ESG performers when observing a sample that captures several years of observations both before and after the issuance.

The interaction variable *SLB Issuer X Post Issuance* used to test the signaling argument's main hypothesis indicates SLB issuers' sustainability performance to have in fact deteriorated across the environmental, social and combined ESG categories following instrument issuances compared to conventional bond issuers. Such deterioration indicates that SLB issuances are not credible signals of sustainability commitments but rather raise serious greenwashing concerns, opposite to the signaling argument. Performance deterioration in the SLB issuers' social scoring is only significant when firm fixed effects are factored in. In this model specification 4, the SLB issuer specific deterioration is 3.6 points, less than half of the 7.5 point deterioration observed in a similar model specification 2 for the environmental score. As the scoring runs from 0 to 100 and the matched sample should consist of as similar issuer pairs as possible, I still consider both of the scores' deterioration to be also economically very significant.

Most SLB issuer specific post-issuance deterioration takes place within the environmental and the combined scores which deteriorate 7.5 and 5.7 points in the model specifications with firm fixed effects. The latter metric rather heavily weighs in the environmental aspects in its calculation to start with and can potentially be further driven down post-issuance also by the governance and controversy scores. Despite SLB issuances do not predict significant performance deterioration in these scores individually, when grouped together with other sustainability aspects to calculate the combined score they may well contribute to the observed strong deterioration. Overall qualitatively similar results are observed if the standard errors are clustered at firm level. Table A9 in the appendix reports these robustness check results.[9]

Part of the strong deterioration in sustainability performance could in theory be driven by the fact that SLB issuances may force issuers to disclose new pieces of information that may not have been disclosed before, thus giving Refinitiv's ESG analysts more data points to base their scoring on. If the new data points reveal information considered to be negative from sustainability perspective, this could lead to a drop in scoring. However, significant improvements in disclosure transparency should be captured by increases in ESG controversies score, unless mitigated by simultaneous growth in controversies, which seems highly unlikely to happen for enough issuers to be visible as a statistical difference. As SLB issuers' performance development in the ESG controversy score does not seem to differ from that of conventional bond issuers post-issuance, I

[9]SLB issuers' governance score development post issuance is also negative but insignificant. I consider this pillar's relevance in terms of issuers' signaling attempts to be less relevant as most SPTs are linked to environmental and/or social targets and therefore commitments in these pillars are even explicitly communicated. Additionally, unlike the controversy score, no unexpected ex-ante dynamics were observed for the governance pillar previously reducing its interestingness further. Table A10 in the appendix reports the results of the regression estimated against the governance scores.

deduct the observed deteriorating performance to be indeed caused by weaker performance and not (solely) by disclosure related factors.

In terms of the previously discussed unexpected ex-ante ESG controversy score dynamics, the model specification 5 provides interesting insights. The coefficient for the variable *SLB Issuer* remains insignificant, indicating that during the longer 9 year sample period there are no significant differences in the controversy performance between SLB and conventional bond issuers. Considering that the SLB issuers exhibited on average almost 18 points weaker ex-ante year controversy performance compared to the matched conventional bond issuers when no other factors were controlled for, this yields several interesting observations calling for future research. The preliminary findings suggest that firms issuing SLBs may experience drastic changes in their controversy development prior to the issuance, which however flatten out when observing the scoring during a longer sample and including in fixed effects to control for different factors. Interestingly however, the SLB issuers do not seem to improve their performance in the metric significantly post issuance compared to conventional bond issuers due to the *SLB Issuer X Post Issuance*'s insignificant coefficient. Without a more comprehensive study into the dynamics, it is difficult to comment on what could drive these counter-intuitive observations.

Put together, the observed weak controversy score performance SLB issuers experience in the ex-ante year can for example be driven by a factor I successfully controlled for through the regression's fixed effects. Alternatively and even more interestingly, the findings could indicate that firms experiencing certain events pre-issuance can be more likely to become SLB issuers in the first place. However, any weak controversy performance spiked by these events then statistically flattens out when expanding the observation period both before the ex-ante year as well as into the post-issuance years. Overall, a more comprehensive analysis of the topic is required to properly assess the dynamics and to provide any conclusive evidence.

Criticism over ESG scores' subjective nature and inconsistencies between the scoring providers have been addressed widely in the literature (e.g., Berg et al. (2022) & Kotsantonis and Serafeim (2019)). Thus, inspired by Kim et al. (2023), I estimate the model also against more objective measures of environmental sustainability, namely Refinitiv's emissions, resource use, and ESG innovation scores in an attempt to minimize the potential bias caused by Refinitiv's ESG analysts' subjectivity. I consider the emissions score measuring environmental emissions and waste generation as the most objective measure of the three. Resource use metric aims to capture the usage of water and energy as well as aspects such as sustainable packaging and supply chains. ESG innovation is more of a forward looking measure aiming to capture firms' potential future sustainability potential and weighs for example green revenue, R&D and capital expenditures as well as efforts to develop environmental products in its calculation. Although the R&D efforts considered in calculation of the metric are directed towards sustainability aspects, such developments are by no means guaranteed. Hence, I consider this metric to be less objective than the other two that aim to capture firms' current sustainability performance and not their

implied undertakings that may never realize.

In terms of the first two more objective measures, the regression results reported in Table 13 are comparable to the observed post-issuance development in the broader environmental score. The results exhibit significant deterioration in the SLB issuer specific emissions and resource use scores, while the coefficient in the most subjective measure of the three, ESG innovation remains insignificant albeit negative.

The findings provide comfort that the observed deterioration in the combined environmental performance is not due to simply discrepancies or subjectivity of sustainability scoring but that the scores calculated by Refinitiv analysts serve as good proxies also for the more objective performance measures. The deterioration observed in the objective measures thus also contradicts with the signaling argument and is suggestive of SLB issuances being greenwashing attempts. Kim et al. (2023) also find firms' more objective scores to be well aligned with the analysts' high level performance metrics by showing that borrowers experience significant deterioration also in the objective scores after obtaining an SLL.[10]

Overall, SLB issuances raise greenwashing concerns and are not supportive of the signaling hypothesis. The findings suggest that firms may simply issue SLBs in an attempt to exploit the potential sustainability premiums and consequently achieve lower cost of capital with little to none attempts at pursuing sustainable developments. Hence, market participants should not interpret the issuances as credible promises of sustainability commitments. However, it is worth noting that due to the market's infancy, longer term development trends are not possible to empirically address yet. With an average SPT observation date being 5.6 years away from the issuance and the instruments' average maturities even longer, SLBs can still possibly serve as longer term sustainability commitment signals beyond my maximum observation period of 4 post-issuance years for 2019 issuers. For more recent issuances and issuers the observation period understandably diminishes. As the market matures, a subsequent study into the topic addressing the longer term trends could identify different dynamics.

[10]Both the SLB and the matched bond issuers' strong performance improvements of 12.2 points in the ESG Innovation metric post issuance when including in firm fixed effects reflect the robust and consistent upward trend in the metric during the sample period. The large coefficient likely captures mostly the fact that the later years within the sample are more likely to be classified as *post-issuance* years for issuers than the earlier ones. Thus, bond issuances likely do not serve as significant turning points for issuances per se, although at the first glance this is what the large coefficient implies.

Table 13: Bond issuer performance development in objective environmental performance measures. The table reports regression estimates of different environmental sustainability performance components' development following bond issuances for an issuer-year panel data consisting of SLB issuers and their matched conventional bond issuers from 2014 to 2022. *SLB Issuer* is an indicator variable equal to one if the firm issues an SLB during the sample period. *Post Issuance* indicates whether the firm has issued an SLB or a control conventional bond during the current or previous years. The variable is subsumed when *Firm FE* are introduced to the model in specifications 2, 4 and 6. *SLB Issuer X Post Issuance* is an interaction variable between the other two variables equal to one if the firm has issued an SLB during the current or previous years and captures whether the SLB issuers experience differential changes in sustainability performance post issuance compared to the matched bond issuers. Standard errors are clustered at sector level (2-digit TRBC) and t-values are reported in parenthesis. *, **, *** represent significance levels of 10%, 5% and 1%, respectively.

Dependent variable	*Emissions*		*Resource use*		*ESG Innovation*	
	(1)	(2)	(3)	(4)	(5)	(6)
SLB Issuer *X* Post Issuance	−7.70* (−1.95)	−7.53*** (−4.08)	−8.58** (−2.41)	−7.92*** (−2.62)	−4.87 (−0.84)	−6.74 (−1.32)
SLB Issuer	11.10*** (2.93)		14.12*** (3.41)		1.93 (0.40)	
Post Issuance	4.17 (1.36)	−0.24 (−0.10)	−0.04 (−0.01)	−3.28 (−0.78)	1.98 (0.30)	12.20* (1.68)
Firm FE	No	Yes	No	Yes	No	Yes
Country X Sector X Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	910	910	910	910	910	910
Adj. R^2	0.35	0.84	0.25	0.84	0.12	0.75

6.2.3 The Role of SPOs as Credible Signals of Sustainability Commitments: Regression Model Results

This section expands the study on the signaling argument in which I showed SLB issuances to raise greenwashing concerns on average and tests whether SLBs issued with an SPO are credible sustainability commitment signals. Table 14 reports regression results of Equation 3 estimated against issuer-year panels of sustainability scores for two subsamples. The first subsample consists of firms that have issued SLBs with an SPO and these issuers' matched conventional bond issuers ("SPO SLBs"), whereas the second one consists of SLB issuers without SPOs and their matched pairs ("Non-SPO SLBs").

Table 14: Bond issuer sustainability performance development for SPO SLB subsample. The table reports regression estimates of different sustainability score developments following bond issuances for two subsamples of issuer-year panel data consisting of SLB issuers and their matched conventional bond issuers from 2014 to 2022. The first subsample consists of sustainability metrics of SLB issuers that have obtained an SPO for their issuance and those of these issuers' matched conventional bond issuers'. The second subsample consists of non-SPO SLB issuers and their matched pairs. *SLB Issuer* is an indicator variable equal to one if the firm issues an SLB during the sample period. *Post Issuance* indicates whether the firm has issued an SLB or a control conventional bond during the current or previous years. In the model specifications reported in this table, the variable is subsumed by introducing *Firm FE* to the model. *SLB Issuer X Post Issuance* is an interaction variable between the other two variables equal to one if the firm has issued an SLB during the current or previous years and captures whether the SLB issuers experience differential changes in sustainability performance post issuance compared to the matched bond issuers. Standard errors are clustered at sector level (2-digit TRBC) and t-values are reported in parenthesis. *, **, *** represent significance levels of 10%, 5% and 1%, respectively.

	SPO SLBs			Non-SPO SLBs		
Dependent variable	*Environmental score*	*Social score*	*Combined ESG score*	*Environmental score*	*Social score*	*Combined ESG score*
	(1)	(2)	(3)	(4)	(5)	(6)
SLB Issuer *X* Post Issuance	−7.45***	−3.96**	−5.93**	−3.50	0.30	−3.80
	(−3.42)	(−2.45)	(−2.34)	(−0.63)	(0.09)	(−0.96)
Post Issuance	6.98**	4.30	8.27***	−2.82	−3.59**	4.20**
	(2.05)	(0.86)	(3.64)	(−1.02)	(−2.14)	(2.13)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Country X Sector X Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	665	665	665	245	245	245
Adj. R^2	0.87	0.88	0.75	0.83	0.90	0.81

The results show SLBs issuances with an SPO to precede significant ESG score deterioration in the environmental, social and combined ESG categories. This finding is not supportive of the signaling argument and indicates that issuers' decisions to obtain SPOs are not incentivized by their attempts to send the market credible sustainability commitment signals and thus raise greenwashing concerns. Clustering at firm level yields qualitatively similar results. Table A11 in the appendix reports the differently clustered regression results.

At the first glance, comparing the subsample's significant and negative coefficients for the variable *SLB Issuer X Post Issuance* to the insignificant coefficients of the non-SPO SLB subsample could be considered to be strongly indicative of greater greenwashing concerns for the SPO SLBs. However, the very small number of observations within the non-SPO SLB sample likely drastically decrease the significance of the coefficients, reducing the reliability and extrapolatability of the results. Even with 245 total issuer-year observations, the subsample only consists of 20 post-issuance year observations for the SLB issuers (i.e., the observations captured by the variable *SLB Issuer X Post Issuance*). Thus unfortunately, a more comprehensive sample would be required to confidently distinguishing the differences in post-issuance performance development between the SPO SLBs and the non-SPO SLBs.

As described in subsubsection 5.2.3, I estimate an alternative approach in the footsteps of Flammer (2021) to robustness check the results of the subsample approach. Overall, the robustness check's results qualitatively align with those of the subsample approach and do not support the signaling argument for the SPO SLB issuances. Table A12 in the appendix reports this robustness check's regression results in detail.

Overall, despite facing some econometric challenges caused by the scarcity and limitations of available data, the results still provide insightful information. The findings highlight that the deteriorating sustainability performance post-issuance which was previously observed to exist on average is not driven (solely) by the non-SPO SLBs. In fact, the presence of an SPO which I hypothesized to have greater signaling capabilities due to being costly to obtain seems to also predict strong and significant deterioration in environmental, social and combined ESG scores, comparable to all SLBs on average, opposite to the signaling argument. My findings thus do not provide any evidence to support the notion that SLBs issued with SPOs serve as credible means of signaling sustainability commitments. In fact, these issuances raise serious concerns about greenwashing practices.

The fact that the presence of an SPO for an SLB can predict lower cost of capital for issuers on average as shown in subsection 6.1 can alone incentivize issuers enough to obtain one purely for financial reasons, although at the time of the issuance they cannot know for certain whether their instrument is rewarded with such a premium. Especially as SLB issuers' sustainability performance seems to deteriorate following the issuances in most of the observed metrics, this is largely suggestive of greenwashing behaviour and implies that many firms may tend to issue SLBs and obtain SPOs primarily for the financial reasons rather than to genuinely signal their

sustainability commitments.

6.2.4 Reputation of SPO Providers as a Predictor of Credible Sustainability Commitments: Regression Model Results

As neither SLB issuances on average nor SLB issuances with an SPO seemed to serve as credible sustainability commitment signals, I further filter the study to consist only of the SLBs for which an SPO has been obtained for from a top tier provider (i.e., Moody's, Sustainalytics or ISS). Additionally, tightening the subsample further allows me to work around the previously discussed small number of observations within the non-SPO SLB subsample. By combining the issuers of SLBs without SPOs and the issuers of SLBs with SPOs from less reputable providers, I can expand the "out-of-sample" observations allowing me to perform more robust comparisons between the two subsamples. The regression results are reported in Table 15.

The results strikingly show that also the SLB issuances with an SPO from a top tier provider predict significant sustainability performance deterioration in the environmental and the combined ESG performance metrics post-issuance. However, such issuances do not predict significant deterioration in the issuers' social scores. These findings survive a robustness check in which I cluster the regression at firm level instead of the sector level. Table A13 in the appendix reports this robustness check's results. Interestingly, the top tier SPO SLB subsample's SLB and the matched conventional bond issuers experience both statistically and economically significant improvements post-issuance in the social score as exhibited by the positive coefficient for the *Post Issuance* variable, regardless of the level of clustering. Estimating environmental and combined ESG scores on the variable produce coefficients whose levels of significance do not remain robust between different levels of clustering.

Similarly as before when addressing the cost of capital argument, the SLBs whose SPO has been publicly disclosed largely overlap with the SLBs whose SPO has been obtained from a top tier provider. Thus, the SLBs with disclosed SPOs similarly predict deteriorating environmental and combined ESG performance development post-issuance as reported in Table A14 in the appendix. Interestingly, this subsample significantly differs from the top tier SPO SLB subsample in that the *Post Issuance* variable indicates social and combined ESG performance to deteriorate post-issuance not only for the SLB but also for the matched conventional bond issuers.

As for the SLB issuances without an SPO or with an SPO obtained from a less reputable opinion provider, the main regression Table 15 and the differently clustered robustness check of Table A13 in the appendix yield mixed results. When clustering at sector level, these SLB issuances do not seem to precede significant changes in the issuers' environmental or combined ESG performance metrics compared to conventional bond issuances but do predict deterioration in the social score. On the other hand, clustering at firm level predicts significant deterioration in all of the three metrics. Thus, support for the deteriorating environmental and combined ESG performance following SLB issuances is surprisingly weaker within this sample compared to

Table 15: Bond issuer sustainability performance development for top tier SPO SLB subsample. The table reports regression estimates of different sustainability score developments following bond issuances for two subsamples of issuer-year panel data consisting of SLB issuers and their matched conventional bond issuers from 2014 to 2022. The first subsample consists of sustainability metrics of SLB issuers that have obtained an SPO from a top tier provider for their issuance and those of these issuers' matched conventional bond issuers. The second subsample consists of scores of both non-SPO SLB issuers and other than top tier SPO SLB issuers and these two SLB issuer types' matched pairs. *SLB Issuer* is an indicator variable equal to one if the firm issues an SLB during the sample period. *Post Issuance* indicates whether the firm has issued an SLB or a control conventional bond during the current or previous years. In the model specifications reported in this table, the variable is subsumed by introducing *Firm FE* to the model. *SLB Issuer X Post Issuance* is an interaction variable between the other two variables equal to one if the firm has issued an SLB during the current or previous years and captures whether the SLB issuers experience differential changes in sustainability performance post issuance compared to the matched bond issuers. Standard errors are clustered at sector level (2-digit TRBC) and t-values are reported in parenthesis. *, **, *** represent significance levels of 10%, 5% and 1%, respectively.

	Top tier SPO SLBs			Non-SPO & lower tier SPO SLBs		
Dependent variable	*Environmental score*	*Social score*	*Combined ESG score*	*Environmental score*	*Social score*	*Combined ESG score*
	(1)	(2)	(3)	(4)	(5)	(6)
SLB Issuer *X* Post Issuance	−8.91*** (−3.23)	−3.16 (−1.12)	−8.82** (−1.97)	−7.13 (−1.58)	−4.64* (−1.84)	−3.98 (−1.35)
Post Issuance	2.09** (2.02)	11.31*** (2.67)	−4.40 (−1.37)	7.57** (2.40)	9.17** (2.08)	8.71** (2.04)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Country X Sector X Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	441	441	441	469	469	469
Adj. R^2	0.89	0.82	0.69	0.82	0.88	0.83

the top tier SPO SLB subsample. Even more, the coefficients measuring the deterioration are greater (in absolute terms) within the top tier SPO SLB subsample, indicating that such issuances surprisingly predict greater deterioration in these scores than the rest of the SLB issuances. However, the opposite holds true for the SLB issuers' performance development in the social pillar. Specifically, issuers of top tier SPO SLBs exhibit no significant changes in their social performance following issuances when compared to their matched bond issuers, regardless of the level of clustering. In contrast, the remaining SLB issuances without an SPO or with an SPO from a less reputable provider predict significant decreases in the scores compared to the control group's development.

The scarcity of data does not unfortunately allow me to perform feasible robustness checks on whether the classification of the top tier SPO providers impacts the study outcome. Tightening the classification by dropping ISS from being considered a top tier provider would reduce the subsample's size excessively, reducing the reliability of the results. On the other hand, loosening the classification to consist of also some lower tier opinion providers would defeat the purpose of studying only the top tier opinion providers.

To still somehow robustness check the results, I again perform a secondary analysis to supplement the subsample analysis using the approach of Flammer (2021) as described in subsubsection 5.2.3. As before with the SPO SLBs, the robustness check's results again qualitatively align with the top tier SPO SLB subsample analysis' results and do not provide any support for the signaling argument. The supportive analysis predicts significant deterioration also within the social score following SLB issuances with top tier SPOs. Table A12 in the appendix reports this robustness check's regression results in detail.

Firstly, the discussed findings indicate that SLBs with an SPO from a reputable top tier provider have no greater signaling capabilities than all SLBs on average or all SLBs with an SPO do. Secondly, the fact that SLB issuances with an SPO obtained from a top tier provider predict greater environmental and combined ESG performance deterioration than the remaining SLB issuances raises serious greenwashing concerns over issuers' decisions to obtain such SPOs. First of all, obtaining an SPO from a highly reputable opinion provider is likely costlier for issuers than obtaining one from a less reputable provider. In this context, costs refer to not only the possibly higher price tags but also the potentially tighter requirements for instrument designs, as the reputable providers try to maintain their high quality standards, which is their key differentiating factor in the industry. This is the theoretical framework based on which I hypothesized the top tier SPOs to be more credible signaling tools than all SPOs on average. As the selection of an SPO provider is likely not random for issuers and as issuers have no financial incentives to obtain an SPO from a reputable provider (as shown in subsection 6.1), something else must incentivize them for doing so.

Albeit not supportive of the signaling argument, the insignificant coefficient for the *SLB Issuer X Post Issuance* variable for the social score in the main subsample analysis could still be indicative of larger weight being placed on social dimension's considerations by the top tier SPO SLB issuers than the remaining SLB issuers who experience deteriorating social performance post-issuance. Within the ESG pillars, reputational aspects would typically fall under the social pillar which is generally considered to encompass for example aspects such as how an entity is perceived by different stakeholders and society, reflecting its social standing and for example the role of trust. Thus, firms acknowledging the potential role and worth of trust that the market can place on SPO providers' reputation may be more likely to obtain an opinion from a top tier provider. Such issuers may for example count on investors to place value on SPO providers' reputational characteristics as a way to reduce uncertainties and information

asymmetries as they do when considering the reputational aspects in the underwriter market as discussed previously. Thus, although the presence of an SPO from a top tier provider does not predict that investors would reward SLBs with such opinions with greater sustainability premiums as shown in subsection 6.1, it can still potentially impact different market participants' perception of the issuers in other ways.

Future research in the area should for example aim to distinguish between the stock market reactions of SLB issuances with and without a top tier SPO in place. As prior research has shown stock market investors to be vigilant for greenwashing attempts in the first place (e.g., Kim et al. (2023)), this analysis could provide interesting insights into whether an SPO from a highly reputable provider could veil or conceal the subsequent sustainability performance deterioration and have investors falsely assess the issuers' future sustainability commitments. Similarly, studies into how for example the ownership of "green" and long-term investors (as done by Flammer (2021) for green bond issuances in general) develops post issuance could provide new insights into whether the market falsely assesses the issuers' sustainability commitments as credible.

Another potentially valuable future research topic in terms of the SPO providers' reputation could be the potential impact an SPO provider's reputation can have on ESG analysts' work and their sustainability rating outcomes. In theory, the reputation of an opinion provider that confirms an SLB's alignment with the ICMA's Sustainability-linked Bond Principles can provide additional confidence also for the analysts when they are trying to assess the issuing firm's sustainability performance. This is especially the case if the SLB's contractual details have not been publicly disclosed or the disclosure has not been transparent enough, which may have the analysts place more weight on the confirmatory role of an opinion provider. In theory, the more reputable a provider, the stronger its confirmatory power should be. Any future literature addressing the topic should also consider whether the reputation of an SPO provider should not in fact be measured simply by their market share or presence in large issuances but rather for example by the success of how well the SPOs incentivize or discipline SLB issuers to drive for sustainable developments by addressing the real effects.

To my knowledge, all of the potential future research directions over SPO providers' reputational aspects discussed can be further expanded to cover not only the SLB market but the whole sustainable finance spectrum. As discussed previously, the reputational characteristics of all sustainable finance certifications and verifications remain mostly unaddressed in the literature.

To summarize, even the presence of an SPO provided by a top tier provider does not support the signaling argument, indicating that the reputation of SPO providers is irrelevant in this context. Specifically, the SLB issuances with an SPO from a top-tier provider predict significant deterioration in at least environmental and combined ESG metrics. The main subsample analysis does not predict significant changes in the social score, despite a negative coefficient. However, although the lack of significance does not necessarily imply greenwashing for the given metric, it still contradicts with the signaling argument. Interestingly, the post-issuance deterioration in

the environmental and combined ESG performance categories is even more pronounced for the top-tier SPO SLBs compared to not only the average deterioration observed across all SLBs but also across the SLBs with an SPO. Consequently, decisions to obtain an SPO from a top tier provider thus are suggestive of greenwashing attempts, especially in terms of environmental and combined ESG sustainability performance.

7 Conclusions

Stronger ex-ante ESG performing companies tend to be more likely to issue SLBs. Interestingly however, the SLB issuers are more likely to have either experienced some sustainability controversies or followed weaker sustainability disclosure standards prior to the issuance. Thus, the issuances may for example be issuers' attempts to (falsely) communicate the markets of improved focus on sustainability aspects to save the issuers' face after a controversy or simply attempts to tap into lower cost of capital. However, the issuances do not seem to be credible signals of sustainability commitments as they do not precede improvements in any of the observed sustainability performance metrics. Combined with the potential for sustainability premiums giving issuers financial incentives to issue SLBs, this raises serious greenwashing concerns.

Investors seem to place value on the sustainability commitments communicated to the market by SLB issuances and reward the issuers by accepting lower yields for SLBs compared to otherwise similar conventional bonds from the same issuers. These sustainability premiums are further predicted to be greater if an SPO verifying the SLB's design is present. I find the presence of an SPO to predict SLBs to be rewarded with lower yields on average with the estimates ranging from approx. 47 bps up to 70 bps. Conservative estimates for the yield differences the presence of an SPO can predict range from 28 bps to 50 bps, remaining both statistically and economically significant. The findings indicate that investors consider these external opinions to either (i) be valuable ways to reduce uncertainty about SLBs' contractual details and the issuers' sustainability commitments, or (ii) to better discipline SLB issuers to properly pursue sustainable developments. Interestingly, the reputation of the entity providing the SPO or whether the SLB issuer publicly discloses the details of the SPO do not seem to predict differing investor perception as investors reward all SPOs similarly with sustainability premiums.

Despite investors' implicit expectations of sustainable developments indicated by the sustainability premiums, it seems that SLB issuances are not truly credible signals of sustainability commitments but rather precede ESG performance deterioration in environmental, social and combined ESG performance categories, indicative of greenwashing. SLBs with an SPO do not change the predicted direction of sustainability performance development post issuance, regardless of whether the SPO has been obtained from a reputable opinion provider or publicly disclosed. However, obtaining an SPO from a reputable provider may not necessarily predict

deterioration in the social score. Assuming that investors properly assess the issuers' sustainability commitments they either (i) trust that such developments will take place in the future beyond my 1-4 year observation period post issuance, (ii) have for example regulatory requirements to invest some pool of capital to sustainability instruments, thus creating a sustainability premium due to high demand for products with still relatively small supply, or (iii) truly are happy to pay for small sustainability developments either indeed signaled or even caused by the funds raised through SLBs or by issuers' attempts to reach the SPTs but that are not visible in company-wide sustainability performance metrics.[11]

Due to the nascent SLB market and empirical approach relying on matching which forces me to omit many observations for which matching is impossible, my thesis' findings in terms of both the sustainability premiums and signaling arguments are based on a relatively small number of observations. Although the matching approaches for both of the addressed aspects differ, both of them still require good disclosure of several financial metrics and other key characteristics. Hence, the study's results' should be considered extrapolatable mainly to public firms with high quality disclosure over not only sustainability characteristics but also other aspects. A larger sample can be obtained in the coming years as the market matures and for example new legislations requiring better disclosure over sustainability aspects are imposed, hopefully increasing the availability of sustainability information.

Overall, my thesis makes numerous novel contributions to the literature not only within the SLB market but also on broader sustainable finance field by observing for example the reputational aspects of sustainable finance opinion providers. Additionally, I raise several interesting new research questions to be addressed in future literature. I consider the observed unexpected dynamics of issuers' controversy performance around SLB issuances to be one of the most interesting ones. Whether the weak controversy performance leads firms to issue the instruments in an attempt to save face or whether the timing is a pure coincidence is an interesting question. Other interesting topics for future research which the scarcity of data made difficult to address at this stage are dynamics between SPOs and different industries and/or regions. Especially the question of whether more ESG "sensitive" industries or regions with room for a lot of for example environmental development such as energy and utilities or Africa and Asia behave differently compared to industries or regions with less obvious sustainability links. For example, are issuers within these industries or regions more prone to obtain an SPO and more interestingly, whether the SLBs with SPOs in these industries or regions signal of credible sustainability commitments or predict greater sustainability premiums compared to others. Put together, my thesis serves as comprehensive groundwork and first contribution to several aspects of the SLB market upon which future research can expand on while addressing the discussed and also other new arising research questions within this quickly growing market.

[11] Additionally, some institutional investors' investment quotas may require sustainability products to be independently verified to get acceptance from the investment board, thus driving these instruments' demand and therefore the SPO predicted sustainability premiums up.

8 References

Akerlof, G. A. (1970). The market for "lemons": Quality uncertainty and the market mechanism. *Quarterly Journal of Economics*, 84(3):488–500.

Bachelet, M. J., Becchetti, L., and Manfredonia, S. (2019). The green bonds premium puzzle: The role of issuer characteristics and third-party verification. *Sustainability*, 11(4):1098.

Baker, M., Bergstresser, D., Serafeim, G., and Wurgler, J. (2018). Financing the response to climate change: The pricing and ownership of us green bonds. Technical report, National Bureau of Economic Research.

Barry, C. B., Muscarella, C. J., Peavy Iii, J. W., and Vetsuypens, M. R. (1990). The role of venture capital in the creation of public companies: Evidence from the going-public process. *Journal of Financial Economics*, 27(2):447–471.

Berg, F., Koelbel, J. F., and Rigobon, R. (2022). Aggregate confusion: The divergence of esg ratings. *Review of Finance*, 26(6):1315–1344.

Berrada, T., Engelhardt, L., Gibson, R., and Krueger, P. (2022). The economics of sustainability linked bonds. *Swiss Finance Institute Research Paper*, (22-26).

Carter, R. and Manaster, S. (1990). Initial public offerings and underwriter reputation. *Journal of Finance*, 45(4):1045–1067.

Dursun-de Neef, Ö., Ongena, S., and Tsonkova, G. (2022). Green versus sustainable loans: The impact on firms' esg performance. *Swiss Finance Institute Research Paper*, (22-42).

Flammer, C. (2021). Corporate green bonds. *Journal of Financial Economics*, 142(2):499–516.

Frésard, L. and Valta, P. (2016). How does corporate investment respond to increased entry threat? *Review of Corporate Finance Studies*, 5(1):1–35.

Friede, G., Busch, T., and Bassen, A. (2015). Esg and financial performance: aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance & Investment*, 5(4):210–233.

Hyun, S., Park, D., and Tian, S. (2020). The price of going green: the role of greenness in green bond markets. *Accounting & Finance*, 60(1):73–95.

ICMA (2020). Sustainability-linked bond principles. *ICMA International Capital Markets Association*.

Karpf, A. and Mandel, A. (2017). Does it pay to be green? *Unpublished working paper. Pantheon-Sorbonne University*.

Kim, S., Kumar, N., Lee, J., and Oh, J. (2023). Esg lending. *European Corporate Governance Institute - Finance Working Paper*, (817/2022).

Kölbel, J. F. and Lambillon, A.-P. (2023). Who pays for sustainability? an analysis of sustainability-linked bonds. *Swiss Finance Institute Research Paper*, (23-07).

Kotsantonis, S. and Serafeim, G. (2019). Four things no one will tell you about esg data. *Journal of Applied Corporate Finance*, 31(2):50–58.

Larcker, D. F. and Watts, E. M. (2020). Where's the greenium? *Journal of Accounting and Economics*, 69(2-3):101312.

Li, Z., Tang, Y., Wu, J., Zhang, J., and Lv, Q. (2020). The interest costs of green bonds: Credit ratings, corporate social responsibility, and certification. *Emerging Markets Finance and Trade*, 56(12):2679–2692.

Liberadzki, M., Jaworski, P., and Liberadzki, K. (2021). Spread analysis of the sustainability-linked bonds tied to an issuer's greenhouse gases emissions reduction target. *Energies*, 14(23):7918.

Mahalanobis, P. C. (1936). On the generalised distance in statistics. *National Institute of Sciences of India*, 2:49–55.

Megginson, W. L. and Weiss, K. A. (1991). Venture capitalist certification in initial public offerings. *Journal of Finance*, 46(3):879–903.

Pohl, C., Schüler, G., and Schiereck, D. (2023). Borrower-and lender-specific determinants in the pricing of sustainability-linked loans. *Journal of Cleaner Production*, 385:135652.

Rennison, J. (2021). Investors scrutinise green claims in $80bn sustainability bond market. *Financial Times*.

Riley, J. G. (1979). Informational equilibrium. *Econometrica: Journal of the Econometric Society*, pages 331–359.

Rocha, P. A. (2022). Empty esg pledges ensure bonds benefit companies, not the planet. *Bloomberg*.

Zerbib, O. D. (2019). The effect of pro-environmental preferences on bond prices: Evidence from green bonds. *Journal of Banking & Finance*, 98:39–60.

9 Appendix

Table A1: Winsorized (90%) yield difference regression results. The table reports regression estimates for yield differences between SLBs and matched conventional bonds from the same issuer. Robust t-values are reported in parenthesis and *, **, *** represent significance levels of 10%, 5% and 1%, respectively.

		Dependent variable: Winsorised ΔYield			
		Whole sample		*ESG score sample*	
Independent variables	Exp. sign	(1)	(2)	(3)	(4)
SLB Characteristics					
SPO	-	−28.15*	−17.41	−50.06**	−63.08**
		(−1.80)	(−0.78)	(−2.50)	(−2.46)
Reputable SPO provider	-		−12.52		13.86
			(−0.59)		(0.62)
Time-weighted step-up	-	−0.13***	−0.12***	0.09	0.08
		(−2.71)	(−2.64)	(0.66)	(0.58)
At maturity *X* step-up	?/-	−0.12	−0.11	−1.42	−1.84
		(−0.35)	(−0.32)	(−0.30)	(−0.40)
At maturity	+	−38.08	−38.13	7.79	10.82
		(−1.42)	(−1.45)	(0.08)	(0.11)
First SLB issuance	-	5.76	5.00	3.22	3.79
		(0.43)	(0.37)	(0.20)	(0.31)
EU taxonomy aligned SPT	-	16.03	16.77	−27.91	−27.98
		(0.88)	(0.93)	(−1.19)	(−1.57)
Issuer Characteristics					
ESG score	?			−0.33	−0.28
				(−0.46)	(−0.41)
Credit rating change	+	−77.09**	−74.66**	−126.30**	−130.09**
		(−2.32)	(−2.21)	(−2.47)	(−2.56)
Matching Differences		Yes	Yes	Yes	Yes
Common Bond Pair Characteristics		Yes	Yes	Yes	Yes
Credit Environment		Yes	Yes	Yes	Yes
Sector FE		Yes	Yes	Yes	Yes
Region FE		Yes	Yes	Yes	Yes
Year FE		Yes	Yes	Yes	Yes
Observations		153	153	96	96
Adj. R^2		0.80	0.80	0.86	0.86

Table A2: Yield difference regression result robustness check excluding issuers with credit rating changes. The table reports regression estimates for yield differences between SLBs and matched conventional bonds from the same issuer for the callable subsample. Robust t-values are reported in parenthesis and *, **, *** represent significance levels of 10%, 5% and 1%, respectively.

		Dependent variable: ΔYield			
		Whole sample		*ESG score sample*	
Independent variables	Exp. sign	(1)	(2)	(3)	(4)
SLB Characteristics					
SPO	-	−50.67***	−19.29	−82.59***	−86.10**
		(−2.71)	(−0.74)	(−3.42)	(−2.10)
Reputable SPO provider	-		−37.09		3.70
			(−1.51)		(0.10)
Time-weighted step-up	-	−0.03	−0.02	0.02	0.02
		(−0.47)	(−0.35)	(0.09)	(0.08)
At maturity X step-up	-	−0.89**	−0.83**	14.56***	14.89***
		(−2.08)	(−2.01)	(2.62)	(2.58)
At maturity	+	−12.18	−13.58	−362.68***	−362.33***
		(−0.35)	(−0.39)	(−3.56)	(−3.56)
First SLB issuance	-	−0.87	−3.23	3.73	3.84
		(−0.05)	(−0.20)	(0.21)	(0.22)
EU taxonomy aligned SPT	-	−1.48	1.69	−48.07*	−48.07*
		(−0.07)	(0.09)	(−1.76)	(−1.76)
Issuer Characteristics					
ESG score	?			1.62*	1.63*
				(1.89)	(1.84)
Matching Differences		Yes	Yes	Yes	Yes
Common Bond Pair Characteristics		Yes	Yes	Yes	Yes
Credit Environment		Yes	Yes	Yes	Yes
Sector FE		Yes	Yes	Yes	Yes
Region FE		Yes	Yes	Yes	Yes
Year FE		Yes	Yes	Yes	Yes
Observations		144	144	90	90
Adj. R^2		0.84	0.84	0.87	0.87

Table A3: Yield difference regression result robustness check for callable bond pairs subsample. The table reports regression estimates for yield differences between SLBs and matched conventional bonds from the same issuer for the callable subsample. Robust t-values are reported in parenthesis and *, **, *** represent significance levels of 10%, 5% and 1%, respectively.

		Dependent variable: ΔYield			
		Whole sample		*ESG score sample*	
Independent variables	Exp. sign	(1)	(2)	(3)	(4)
SLB Characteristics					
SPO	-	−95.33***	−68.09*	−110.88***	−99.78***
		(−3.13)	(−1.94)	(−4.25)	(−3.74)
Reputable SPO provider	-		−47.08		−29.01
			(−1.47)		(−0.84)
Time-weighted step-up	+	−0.08	−0.05	0.15	0.14
		(−0.84)	(−0.54)	(0.40)	(0.39)
First SLB issuance	-	6.93	6.59	24.19	25.85
		(0.28)	(0.27)	(1.03)	(1.14)
EU taxonomy aligned	-	−49.35*	−46.96*	−79.07*	−83.64**
		(−1.74)	(−1.74)	(−1.88)	(−2.03)
Issuer Characteristics					
ESG score	?			−0.12	−0.53
				(−0.09)	(−0.38)
Credit rating change	+	−86.89	−51.94	−168.50*	−139.75
		(−1.47)	(−0.79)	(−1.68)	(−1.37)
Matching Differences		Yes	Yes	Yes	Yes
Common Bond Pair Characteristics		Yes	Yes	Yes	Yes
Credit Environment		Yes	Yes	Yes	Yes
Sector FE		Yes	Yes	Yes	Yes
Region FE		Yes	Yes	Yes	Yes
Year FE		Yes	Yes	Yes	Yes
Observations		127	127	79	79
Adj. R^2		0.60	0.61	0.75	0.74

Table A4: Yield difference regression result robustness check to test for tighter SPO reputation classifications. The table reports regression estimates for yield differences between SLBs and matched conventional bonds from the same issuer. Robust t-values are reported in parenthesis and *, **, *** represent significance levels of 10%, 5% and 1%, respectively.

		Dependent variable: ΔYield			
		Whole sample		*ESG score sample*	
Independent variables	Exp. sign	(1)	(2)	(3)	(4)
SLB Characteristics					
SPO	-	−22.60	−48.12**	−69.09***	−85.45***
		(−1.05)	(−2.50)	(−2.89)	(−3.53)
SPO from Moody's or Sustainalytics	-	−43.09**		−1.79	
		(−2.08)		(−0.07)	
SPO from Moody's	-		4.81		91.19**
			(0.16)		(2.39)
Time-weighted step-up	-	−0.02	−0.04	0.05	0.16
		(−0.23)	(−0.51)	(0.20)	(0.66)
At maturity *X* step-up	?/-	−0.73*	−0.73*	−6.92	3.87
		(−1.81)	(−1.71)	(−1.09)	(0.59)
At maturity	+	16.51	3.24	−149.02	−111.56
		(0.51)	(0.10)	(−1.27)	(−1.03)
First SLB issuance	-	4.73	5.75	10.78	6.55
		(0.31)	(0.37)	(0.62)	(0.21)
EU taxonomy aligned SPT	-	−0.98	−4.64	−63.05**	−54.37
		(−0.05)	(−0.23)	(−2.57)	(−1.14)
Issuer Characteristics					
ESG score	?			0.86	1.42
				(0.98)	(1.29)
Credit rating change	+	−18.22	−49.12	−162.00**	−135.71**
		(−0.46)	(−1.38)	(−2.37)	(−2.40)
Matching Differences		Yes	Yes	Yes	Yes
Common Bond Pair Characteristics		Yes	Yes	Yes	Yes
Credit Environment		Yes	Yes	Yes	Yes
Sector FE		Yes	Yes	Yes	Yes
Region FE		Yes	Yes	Yes	Yes
Year FE		Yes	Yes	Yes	Yes
Observations		153	153	96	96
Adj. R^2		0.82	0.82	0.84	0.86

Table A5: Yield difference regression result robustness check excluding issuers with credit rating changes to test for tighter SPO reputation classifications. The table reports regression estimates for yield differences between SLBs and matched conventional bonds from the same issuer for the callable subsample. Robust t-values are reported in parenthesis and *, **, *** represent significance levels of 10%, 5% and 1%, respectively.

		Dependent variable: ΔYield			
		Whole sample		*ESG score sample*	
Independent variables	Exp. sign	(1)	(2)	(3)	(4)
SLB Characteristics					
SPO	-	−18.47	−49.30***	−45.21**	−64.60***
		(−1.10)	(−3.16)	(−2.37)	(−3.40)
SPO from Moody's or Sustainalytics	-	−23.94		−24.01	
		(−1.37)		(−1.23)	
SPO from Moody's	-		55.54**		65.98***
			(2.52)		(3.06)
Time-weighted step-up	-	−0.12***	−0.12***	0.09	0.17
		(−2.70)	(−2.79)	(0.69)	(1.31)
At maturity X step-up	-	−0.12	−0.14	4.75	0.79
		(−0.37)	(−0.40)	(1.19)	(0.24)
At maturity	+	−47.57*	−59.28**	−141.71*	−83.44
		(−1.76)	(−2.20)	(−1.69)	(−1.25)
First SLB issuance	-	3.17	3.40	−4.06	−6.10
		(0.24)	(0.25)	(−0.34)	(−0.54)
EU taxonomy aligned SPT	-	21.47	12.04	−24.16	−16.61
		(1.19)	(0.65)	(−1.32)	(−0.94)
Issuer Characteristics					
ESG score	?			−0.07	0.48
				(−0.10)	(0.78)
Matching Differences		Yes	Yes	Yes	Yes
Common Bond Pair Characteristics		Yes	Yes	Yes	Yes
Credit Environment		Yes	Yes	Yes	Yes
Sector FE		Yes	Yes	Yes	Yes
Region FE		Yes	Yes	Yes	Yes
Year FE		Yes	Yes	Yes	Yes
Observations		144	144	90	90
Adj. R^2		0.82	0.82	0.89	0.90

Table A6: Winsorized (90%) yield difference regression result robustness check to test for tighter SPO reputation classifications. The table reports regression estimates for yield differences between SLBs and matched conventional bonds from the same issuer. Robust t-values are reported in parenthesis and *, **, *** represent significance levels of 10%, 5% and 1%, respectively.

		Dependent variable: ΔYield			
		Whole sample		*ESG score sample*	
Independent variables	Exp. sign	(1)	(2)	(3)	(4)
SLB Characteristics					
SPO	-	−14.98	−38.35**	−46.45**	−64.90***
		(−0.87)	(−2.41)	(−2.31)	(−3.48)
SPO from Moody's or Sustainalytics	-	−23.63		−8.16	
		(−1.33)		(−0.37)	
SPO from Moody's	-		34.50		86.92***
			(1.53)		(3.82)
Time-weighted step-up	-	−0.12**	−0.13***	0.09	0.20
		(−2.50)	(−2.67)	(0.65)	(1.47)
At maturity *X* step-up	-	−0.12	−0.09	−1.42	−4.33
		(−0.35)	(−0.26)	(−0.28)	(−1.16)
At maturity	+	−31.02	−40.88	14.54	44.90
		(−1.17)	(−1.57)	(0.14)	(0.61)
First SLB issuance	-	5.28	6.66	3.95	−0.65
		(0.40)	(0.49)	(0.17)	(−0.05)
EU taxonomy aligned SPT	-	17.68	11.34	−29.48	−19.96
		(0.99)	(0.61)	(−0.82)	(−1.04)
Issuer Characteristics					
ESG score	?			−0.44	0.18
				(−0.48)	(0.29)
Credit rating change	+	−59.93	−74.24**	−119.95**	−99.91**
		(−1.63)	(−2.27)	(−2.14)	(−2.51)
Matching Differences		Yes	Yes	Yes	Yes
Common Bond Pair Characteristics		Yes	Yes	Yes	Yes
Credit Environment		Yes	Yes	Yes	Yes
Sector FE		Yes	Yes	Yes	Yes
Region FE		Yes	Yes	Yes	Yes
Year FE		Yes	Yes	Yes	Yes
Observations		153	153	96	96
Adj. R^2		0.80	0.80	0.86	0.88

Table A7: Disclosed SPOs' predictiveness of sustainability premiums. The table reports regression estimates for yield differences between SLBs and matched conventional bonds from the same issuer. Robust t-values are reported in parenthesis and *, **, *** represent significance levels of 10%, 5% and 1%, respectively.

		Dependent variable: ΔYield	
		Whole sample	*ESG score sample*
Independent variables	Exp. sign	(1)	(2)
SLB Characteristics			
SPO	-	−36.45	−53.98
		(−1.62)	(−1.63)
SPO publicly disclosed	-	−13.50	−18.09
		(−0.69)	(−0.37)
Time-weighted step-up	-	−0.04	0.03
		(−0.62)	(0.10)
At maturity *X* step-up	-	−0.66	6.05
		(−1.46)	(0.65)
At maturity	+	−0.75	−140.07
		(−0.02)	(−1.06)
First SLB issuance	-	3.87	10.10
		(0.25)	(0.20)
EU taxonomy aligned	-	−0.53	−57.06
		(−0.03)	(−0.64)
Issuer Characteristics			
ESG score	?		1.01
			(0.53)
Credit rating change	+	−46.41	−163.04**
		(−1.26)	(−2.36)
Matching Differences		Yes	Yes
Common Bond Pair Characteristics		Yes	Yes
Credit Environment		Yes	Yes
Sector FE		Yes	Yes
Region FE		Yes	Yes
Year FE		Yes	Yes
Observations		153	96
Adj. R^2		0.82	0.84

Table A8: Construction of the yield difference regression model with all variables' coefficients reported. The table reports regression estimates for yield differences between SLBs and matched conventional bonds from the same issuer. Robust t-values are reported in parenthesis and *, **, *** represent significance levels of 10%, 5% and 1%, respectively.

	Dependent variable: ΔYield				
Independent variables	(1)	(2)	(3)	(4)	(5)
SLB Characteristics					
SPO		−116.30***	−40.54**	−46.70**	−69.88***
		(−3.38)	(−2.01)	(−2.45)	(−3.04)
Time-weighted step-up	0.30***	0.38***	−0.05	−0.04	0.05
	(2.86)	(3.40)	(−0.70)	(−0.51)	(0.20)
At maturity *X* step-up	−1.47**	−1.11*	−0.31	−0.74*	6.92
	(−2.55)	(−1.80)	(−0.71)	(−1.71)	(1.10)
At maturity	104.22**	103.37**	−5.21	3.63	−150.50
	(2.19)	(2.01)	(−0.14)	(0.11)	(−1.27)
First SLB issuance	25.25	31.06	8.23	5.62	10.62
	(0.73)	(0.94)	(0.52)	(0.36)	(0.61)
EU taxonomy aligned SPT	−125.06***	−118.31***	−3.00	−3.99	−62.71**
	(−3.44)	(−3.53)	(−0.14)	(−0.20)	(−2.57)
Issuer Characteristics					
ESG score					0.89
					(1.09)
Credit rating change			−60.90*	−49.52	−163.39**
			(−1.73)	(−1.38)	(−2.52)
Matching Differences					
Issuance date diff.				2.23	9.96
				(0.36)	(1.04)
Maturity diff.				0.81	6.43*
				(0.46)	(1.88)
Issue size ratio				29.61***	90.84***
				(3.00)	(2.97)
Common Bond Pair Characteristics					
Senior				−26.28	−145.11***
				(−0.83)	(−4.65)
Short maturity				37.37	134.30**
				(1.41)	(2.33)
Credit Environment					
Risk-free rate change			−0.17***	−0.21***	0.00
			(−3.21)	(−3.82)	(0.02)
Credit spread change			1.39***	1.45***	1.13***
			(14.91)	(16.35)	(8.30)
Sector FE	Yes	Yes	Yes	Yes	Yes
Region FE	No	No	No	Yes	Yes
Year FE	No	No	No	Yes	Yes
Observations	153	153	153	153	96
Adj. R^2	0.19	0.25	0.81	0.82	0.85

Table A9: Bond issuer sustainability performance development clustered at firm level. The table reports regression estimates of different environmental sustainability performance components' development following bond issuances for an issuer-year panel data consisting of SLB issuers and their matched conventional bond issuers from 2014 to 2022. Standard errors are clustered at firm level and t-values are reported in parenthesis. *, **, *** represent significance levels of 10%, 5% and 1%, respectively.

Dependent variable	*Environmental score*		*Social score*		*Controversy score*		*Combined ESG score*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SLB Issuer *X* Post Issuance	−7.42**	−7.51***	−3.45	−3.63**	−4.97	−2.57	−7.32**	−5.71***
	(−2.41)	(−3.75)	(−1.33)	(−2.27)	(−0.92)	(−0.71)	(−2.56)	(−2.67)
SLB Issuer	10.02**		11.15***		−3.72		7.61***	
	(2.47)		(3.40)		(−1.02)		(2.68)	
Post Issuance	3.48	2.92	8.35*	1.28	4.11	2.06	5.08	0.44
	(0.62)	(1.16)	(1.70)	(0.44)	(0.37)	(0.32)	(0.99)	(0.12)
Firm FE	No	Yes	No	Yes	No	Yes	No	Yes
Country X Sector X Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	910	910	910	910	910	910	910	910
Adj. R^2	0.22	0.86	0.38	0.88	0.09	0.53	0.27	0.78

Table A10: Bond issuer governance performance development. The table reports regression estimates of issuers' governance score performance development following bond issuances for an issuer-year panel data consisting of SLB issuers and their matched conventional bond issuers from 2014 to 2022. Standard errors are clustered at sector level (2-digit TRBC) and t-values are reported in parenthesis. *, **, *** represent significance levels of 10%, 5% and 1%, respectively.

Dependent Variable	*Governance score*	
	(1)	(2)
SLB Issuer *X* Post Issuance	−2.42	−0.81
	(−0.69)	(−0.25)
SLB Issuer	3.59	
	(1.06)	
Post Issuance	3.80	−2.97
	(1.26)	(−0.71)
Firm FE	No	Yes
Country X Sector X Year FE	Yes	Yes
Observations	910	910
Adj. R^2	0.13	0.79

Table A11: Bond issuer sustainability performance development for SPO SLB subsample clustered at firm level. The table reports regression estimates of different sustainability score developments following bond issuances for two subsamples of issuer-year panel data consisting of SLB issuers and their matched conventional bond issuers from 2014 to 2022. Standard errors are clustered at firm level and t-values are reported in parenthesis. *, **, *** represent significance levels of 10%, 5% and 1%, respectively.

	SPO SLBs			Non-SPO SLBs		
Dependent variable	*Environmental score*	*Social score*	*Combined ESG score*	*Environmental score*	*Social score*	*Combined ESG score*
	(1)	(2)	(3)	(4)	(5)	(6)
SLB Issuer *X* Post Issuance	−7.45***	−3.96**	−5.93***	−3.50	0.30	−3.80
	(−3.96)	(−2.44)	(−2.96)	(−0.97)	(0.13)	(−1.32)
Post Issuance	6.98*	4.30	8.27*	−2.82	−3.59	4.20
	(1.69)	(1.15)	(1.82)	(−0.71)	(−0.91)	(1.00)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Country X Sector X Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	665	665	665	245	245	245
Adj. R^2	0.87	0.88	0.75	0.83	0.90	0.81

Table A12: Results of an alternative regression approach to address SPOs' signaling capabilities. The table reports regression estimates of sustainability score development against an issuer-year panel data consisting of SLB issuers and their matched conventional bond issuers from 2014 to 2022. Indicator variable *SLB* equal to one when the issuer has issued an SLB during or before the current year is interacted with dummies to distinguish signaling capabilities between the SPO and the non-SPO SLBs. Similarly, *Tier 1 SPO* and *Other SPOs* are indicators separating SLBs with an SPO from a top or a lower tier providers from the rest of the SLBs. Standard errors are clustered at sector (2-digit TRBC) and firm level. T-values are reported in parenthesis and *, **, *** represent significance levels of 10%, 5% and 1%, respectively

Dependent variable	*Environmental score*		*Social score*		*Combined ESG score*	
	(1)	(2)	(3)	(4)	(5)	(6)
SLB x SPO	−7.75***		−4.30***		−7.68***	
	(−4.67)		(−3.10)		(−2.69)	
SLB x Non-SPO	−4.86		−0.79		0.41	
	(−0.89)		(−0.36)		(0.13)	
SLB x Tier 1 SPO		−8.47***		−3.96**		−11.45***
		(−3.95)		(−2.09)		(−3.11)
SLB x Other SPOs		−5.80		−2.95**		−0.72
		(−1.63)		(−2.22)		(−0.31)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Country X Sector X Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	910	910	910	910	910	910
Adj. R^2	0.86	0.88	0.78	0.86	0.88	0.78

Table A13: Bond issuer sustainability performance development for top tier SPO SLB subsample clustered at firm level. The table reports regression estimates of different sustainability score developments following bond issuances for two subsamples of issuer-year panel data consisting of SLB issuers and their matched conventional bond issuers from 2014 to 2022. Standard errors are clustered at firm level and t-values are reported in parenthesis. *, **, *** represent significance levels of 10%, 5% and 1%, respectively.

	Top tier SPO SLBs			Non-SPO & lower tier SPO SLBs		
Dependent variable	*Environmental score*	*Social score*	*Combined ESG score*	*Environmental score*	*Social score*	*Combined ESG score*
	(1)	(2)	(3)	(4)	(5)	(6)
SLB Issuer *X* Post Issuance	−8.91***	−3.16	−8.82***	−7.13**	−4.64**	−3.98**
	(−4.33)	(−1.59)	(−2.69)	(−2.34)	(−2.20)	(−1.97)
Post Issuance	2.09	11.31*	−4.40*	7.57	9.17**	8.71**
	(0.57)	(1.92)	(−1.96)	(1.43)	(2.16)	(2.38)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Country X Sector X Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	441	441	441	469	469	469
Adj. R^2	0.89	0.82	0.69	0.82	0.88	0.83

Table A14: Bond issuer sustainability performance development for disclosed SPO SLB subsample. The table reports regression estimates of different sustainability score developments following bond issuances for a subsample consisting of SLB issuers whose SPO has been publicly disclosed and their matched conventional bond issuers from 2014 to 2022. Standard errors are clustered at sector level (2-digit TRBC) and t-values are reported in parenthesis. *, **, *** represent significance levels of 10%, 5% and 1%, respectively.

Dependent variable	*Environmental score*	*Social score*	*Combined ESG score*
	(1)	(2)	(3)
SLB Issuer *X*	−7.79***	−2.42	−9.98***
	(−3.63)	(−1.27)	(−2.79)
Post Issuance	1.66	−8.28**	−11.71*
	(0.45)	(−1.99)	(−1.96)
Firm FE	Yes	Yes	Yes
Country X Sector X Year FE	Yes	Yes	Yes
Observations	342	342	342
Adj. R^2	0.87	0.86	0.72