Norwegian School of Economics

Bergen, Fall 2022

Do Borrowers Benefit from Sustainability-Linked Loans?

An analysis of explicit ESG information in loan contracts and borrowers' incentives to enter sustainability-linked loans

Eira Torsteinsen and Sofia Englund

Supervisor: José A. Albuquerque de Sousa

Master of Science in Economics and Business Administration

Major in Financial Economics

NORWEGIAN SCHOOL OF ECONOMICS

Acknowledgments

This thesis completes our Master of Science in Economics and Business Administration at the Norwegian School of Economics (NHH), with a specialization in Financial Economics. In this thesis, we research the sustainability-linked loan market. The topic was introduced to us through the course FIE459 Sustainable Finance at NHH and quickly caught our interest as we are genuinely interested in how financial markets can contribute to mitigating climate change.

Throughout this process, we have acquired valuable knowledge in the field of sustainability-linked finance by applying econometric analyses and financial theory. We attempt to approach the topic holistically, thus, including both regulatory and economic perspectives when interpreting the sustainability-linked loan market and our results.

Writing a master's thesis has been challenging, but also highly educational and rewarding due to the interesting topic and excellent guidance. We express our sincere gratitude to our supervisor, Assistant Professor José A. Albuquerque de Sousa, for his valuable insights and constructive criticism during the writing of our thesis. Finally, we would also like to thank the Norwegian School of Economics for providing access to literature and databases that have been vital to the completion this thesis.

Norwegian School of Economics

Bergen, December 2022

Eira Torsteinsen

Sofia Englund

Abstract

This thesis examines the explicit use of ESG information in loan contracts and borrowers' incentives to enter sustainability-linked loans (SLLs). We explore whether shareholders respond to announcements of sustainability-linked loan issuances and whether companies with sustainability-linked loans experience a higher ESG score and performance on contractual KPIs after entering the loan contract. We also investigate if there is a sustainability-linked premium around loan issuance. We perform this analysis by comparing a sample of sustainability-linked loans from 2017 to 2019 to a matched sample of comparable traditional loans from Bloomberg Terminal.

We find that shareholders respond positively to announcements of sustainability-linked loan issuances. Borrowers with better disclosure quality contracts receive a more significant response than borrowers with poor disclosure quality contracts, implying that investors value transparency and are vigilant about greenwashing concerns. We conclude that loan spreads are higher for SLLs at issuance; hence, financial discounts are unlikely to drive the observed stock market reaction. There are no significant indications of improved ESG performance between the borrowers of sustainability-linked and traditional loans. Thus, using explicit ESG information in loan contracts does not seem to affect sustainability performance. However, borrowers with good ESG profiles seem to self-select into sustainability-linked loans. Our findings suggest that the borrowers enter sustainability-linked loan contracts to signal ESG commitment, and their shareholders seem to value this choice.

Contents

1. Introduction **1**

2. Background and Literature Review **5**

2.1 Sustainability-Linked Lending *5*

2.2 Determinants of Sustainability-Linked Loans *6*

2.2.1 Selection of Key Performance Indexes 6

2.2.2 Calibration of Sustainability Performance Targets 6

2.2.3 Loan Pricing 7

2.2.4 Reporting 7

2.2.5 Verification 8

2.3 Borrowers' Incentives to Enter SLLs *8*

2.4 Lenders' Incentives to Enter SLLs *10*

2.5 Literature Review *11*

2.6 Research Question *13*

3. Data **15**

3.1 Data Selection *15*

3.1.1 Selection of Sustainability-Linked Loans 15

3.1.2 Selection of Time Span 15

3.1.3 Selection of Group of Comparable Loans 16

3.1.4 Selection of Sustainability Performance Data 16

3.1.5 Selection of Stock Price Data 19

3.2 Matching Criteria *19*

3.3 Summary Statistics on the Matched Sample *20*

3.3.1 Descriptive Statistics on Matching Pairs 20

3.3.2 Borrower and Loan Characteristics 22

4. Methodology **23**

4.1 Event Study of Stock Market Reaction to SLL Announcements *23*

4.2 Construct a Control Group by Matching *24*

4.3 Fixed Effects Regression on Coupon Rates and ESG Scores *25*

4.3.1 Fixed Effects Regression on Coupon Rates 26

4.3.2 Fixed Effects Regression on ESG Scores 26

4.4 Difference in Differences Estimation *27*

5. Results **29**

5.1 Stock Market Reaction to SLL Announcements *29*

5.2 Sustainability-Linked Loans' Pricing *32*

5.2.1 Statistics on Contractual Details 32

5.2.2 Fixed Effects Regression of SLL on Coupon Rates 33

5.3 Sustainability-Linked Loans' Effect on ESG Scores *36*

5.3.1 Fixed Effects Regression of SLL on Borrower ESG Scores 36

5.3.2 Trends in ESG Scores 39

5.3.3 Difference-in-Differences Estimation of SLL on ESG Scores 40

5.4 The Effect of Explicit ESG Information in Loan Contracts 42

5.4.1 Characteristics of Sustainability-Linked Loan Terms 42

5.4.2 Difference-in-Differences Estimation on Environmental and Social Scores 44

5.4.3 Difference-in-Differences Estimation on Contractual KPIs 46

6. Conclusion 49

References 52

Appendix 55

A. Variable Definitions 55

B. Country Distribution of Growth in SLLs 57

Tables, Figures, and Formulas

Tables

Table 1. Summary Statistics from 2021 on Contractual KPIs 18
Table 2. Sustainability-Linked Lending by Country 20
Table 3. Sustainability-Linked Lending by Sector 21
Table 4. Summary Statistics for Borrower and Loan Characteristics 22
Table 5. Stock Market Reaction to the Announcements of SLL Issuances 29
Table 6. Cross-Sectional Heterogeneity on Stock Market Reaction 31
Table 7. Contractual Details 32
Table 8. Fixed Effects Regression of SLL on Coupon Rates 34
Table 9. Fixed Effects Regression on borrowers' ESG scores after SLL issuances 37
Table 10. Difference-in-Differences Estimation of SLL on ESG Scores 40
Table 11. Disclosure Quality of Sustainability-Linked Loan Terms 42
Table 12. Prevalence of Overlapping KPIs 44
Table 13. Difference-in-Differences Estimation on Environmental and Social Scores 45
Table 14. Difference-in-Differences Estimation on Sustainability-Linked KPIs 47

Figures

Figure 1. Annual Sustainability-Linked Loan Issuances from 2010 to October 2022 2
Figure 2. Event Study Timeline of Stock Market Reaction 23
Figure 3. Cumulative Abnormal Returns over Event Period 30
Figure 4. The Trend in ESG Scores Pre and Post Loan Issue 39
Figure 5. Global Evolution of Sustainability-Linked Loans Issue Size from 2010 to 2022 .. 57

Formulas

Formula 1. Coupon Rate Fixed Effects Regression Specification 26
Formula 2. ESG Score Fixed Effects Regression Specification 26
Formula 3. Difference-in-Difference Specification 28

1. Introduction

The central contribution of this paper is the investigation of the explicit use of environmental, social, and governmental (ESG) information in loan contracts and the examination of borrowers' incentives to enter sustainability-linked loans (SLLs). Following the increasing climate change and ESG concerns, there is a growing demand by stakeholders to take material ESG issues into account (Krueger et al., 2020). As a response to mitigating ESG concerns, the use of sustainability-linked financing has increased exponentially in recent years. We investigate the characteristics of sustainability-linked loans and study why borrowers enter these contracts.

In our thesis, the term "sustainability-linked loan" is in accordance with the Sustainability-Linked Loans Principles definition: "any types of loan instruments and/or contingent facilities (such as bonding lines, guarantee lines or letters of credit) which incentivize the borrower's achievement of ambitious, predetermined sustainability performance objectives" (APLMA et al., 2022). The design of sustainability-linked loans allows for regulation of the borrowers' performance by aligning loan terms with borrower ESG performance through chosen key performance indexes (KPIs). However, due to the SLLs being a relatively young debt instrument, standardized regulations to ensure contractual quality are still absent.

To portray the significance of sustainability-linked finance and its rapid growth in recent years, we include a figure of the issue size of sustainability-linked loans from 2010 to October 2022. We use Bloomberg Terminal to retrieve sustainability-linked loan issuances with no additional retrieval criteria. Figure 1 illustrates that sustainability-linked financing now makes up a significant part of global debt issuances, with almost 140 billion euros issued in 2022 up until October. The growth portrayed in the figure signals the increasing significance of sustainability-linked financing and why it is crucial to examine it.

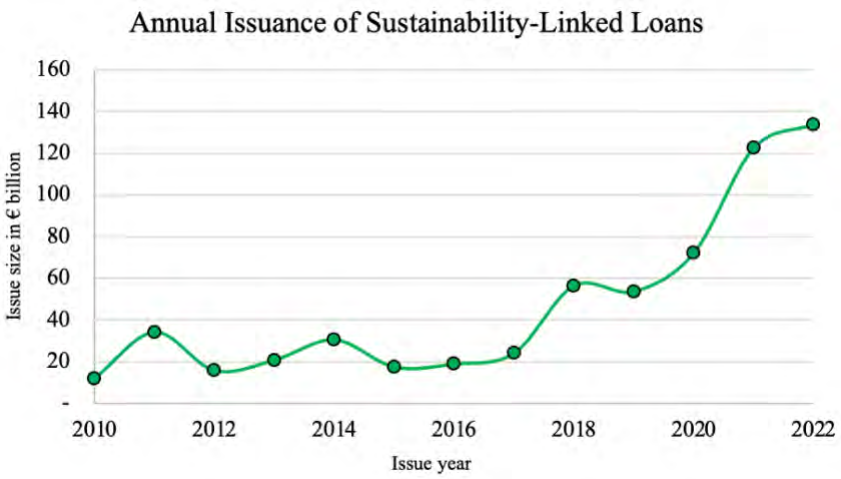

Figure 1. Annual Sustainability-Linked Loan Issuances from 2010 to October 2022

To perform our analysis, we compare a sample of sustainability-linked loans from 2017 to 2019 to a matched sample of comparable traditional loans from Bloomberg Terminal. We begin our research with an event study on stock market reaction to evaluate shareholders' responses to announcements of sustainability-linked loan issuances. To investigate if sustainability-linked borrowers receive financial benefits at issuance, we perform a regression of SLLs on coupon rates where we control for borrower and loan characteristics and country-, industry-, and time-fixed effects. We estimate the impact of explicit ESG information in loan contracts on ESG score by a fixed effects regression and difference-in-differences estimation of SLL on ESG score where we control for borrower and loan characteristics and country-, industry-, and time-fixed effects. To gain more specific results, we examine whether sustainability-linked borrowers report more improvements on their contractually bound key performance indexes (KPIs) than borrowers without this specific KPI.

We find a positive stock market response to announcements of sustainability-linked loan issuances through the event study of shareholders' reactions. In a sub-sample of good and poor disclosure quality contracts, we find that the response is more prominent for borrowers with good disclosure quality contracts, indicating that shareholders show some vigilance towards greenwashing actions. The analysis of coupon rates suggests that sustainability-linked loans are issued at a significantly higher rate than in the control group. However, the sustainability-linked loan design allows borrowers to be eligible for obtaining discounts via rate adjustments if they reach their contractual sustainability performance targets (SPTs) on KPIs over time. The magnitude and frequency of rate adjustments depend on the individual contract, as there are no standard regulations.

A trend analysis portrays similar positive trends in ESG scores for both borrowers of SLLs and traditional loans. However, it shows that sustainability-linked borrowers have significantly higher ESG scores at issuance. We find that sustainability-linked loans positively impact a company's ESG score and that it is more likely for borrowers with superior ESG profiles ex-ante to self-select into sustainability-linked loan contracts. However, we fail to find evidence that suggests that companies with explicit ESG information in their loan contracts experience more development in ESG scores post-loan issuance than borrowers with non-SLLs. Our studies regarding contractual details imply that borrowers tend to select sustainability-linked KPIs on measures where they underperform compared to other sustainability-linked borrowers.

Several studies investigate the effect of both implicit and explicit ESG information in loan contracts. ESG information may affect loan contracts explicitly by ESG criteria being included in loan contracts, or it may affect implicitly where ESG information is not explicitly contracted but is still a consideration for loan terms. Regarding the implicit use of ESG information in loan contracts, it has been found that borrowers with large environmental footprints paid higher rates than more responsible firms and that banks grant loans to borrowers with similar ESG profiles as themself (Goss & Roberts, 2011; Houston & Shan, 2022). Investigating the explicit use of ESG information in loan contracts, Kim et al. (2022), recently found that ESG performance ex-post is linked to contractual disclosure quality.

In a study of green bonds, Flammer (2021) researches the incentives to issue green bonds in a comparable study. She finds that companies that issue green bonds increase ESG performance ex-post and use these bonds to signal ESG commitment to shareholders and other stakeholders. She finds a positive stock market response, indicating that shareholders value this commitment. In similarity to Flammer, we approach the topic by explicitly examining the borrowers and their performance on sustainability following issuances. A key distinction of our research in relation to this literature is that we measure performance from the contractual-specific KPIs embedded in each SLL contract. By examining the details of sustainability-linked loan contracts, we can differentiate between elements leading to improvements or deterioration of environmental performance.

The structure of this thesis follows the order of our research. Firstly, we present background information on the topic and a more comprehensive literature review before we present our research question in detail. Further, we present the data sample and our data sources, and

explain how we retrieve the loans. In the methodology chapter, we clarify how we conduct our data sample analysis, before we present the results in the following chapter. Finally, we summarize and conclude our findings at the end of the thesis.

2. Background and Literature Review

This chapter presents the origin and concept of sustainable financing and sustainability-linked lending. Secondly, we define what a sustainability-linked loan should resemble by addressing the determinants of sustainability-linked loans. We will also investigate the borrowers' and lenders' incentives to enter a sustainability-linked loan agreement and look at today's challenges related to these loans. Finally, we review relevant literature for this topic and present our research question.

2.1 Sustainability-Linked Lending

In recent years, multiple initiatives have been introduced to slow global climate change. In 2015, the United Nations (UN) set up the sustainable development goals (SDGs), 17 global goals aiming at a sustainable and just future (United Nations, n.d.a). To legally bind countries to contribute to reaching the SDGs and making an effort against climate change and its negative impacts, the Paris agreement was created in 2015 (United Nations, n.d.b). By incentivizing borrowers who, for example, have signed the UN's SDGs to achieve their objectives, the sustainability-linked loans contribute towards a more sustainable future.

Although bank loans make up a large part of debt financing worldwide, there is limited research about their role in the rapidly advancing sustainable finance industry. In correspondence with rapid growth in the sustainable financing market, investors are increasingly focusing on the impact of their investment decisions regarding both the environment and their key stakeholders (Schoenmaker & Schramade, 2018). As a result, environmental, social, and governmental concerns have become essential in strategic investment decisions.

The function of SLLs is to facilitate lenders in incentivizing borrowers towards improving on sustainability measures by offering companies the opportunity to leverage their ESG performance and thus improve their bottom line (APLMA et al., 2022). Contractually bound KPIs measure the borrowers' performance on pre-defined Sustainability Performance Targets (SPTs). Unlike green loans, that are earmarked for green projects, SLLs can be obtained for general corporate purposes (Ministry of the Environment Government of Japan, n.d.). An advantage of this is that the purpose of the loan is not in itself a determining factor for being granted a loan. Consequently, SLLs contribute to democratizing green finance by making

sustainable financing available to industries and companies that did not previously qualify for green loans.

2.2 Determinants of Sustainability-Linked Loans

Disregarding the growth of sustainability-linked loans in recent years, regulations for loan design are absent. However, to preserve the integrity of the sustainability-linked loan product, the “Sustainability Linked Loan Principles” (SLLP) was developed as a collective effort by the Asian Pacific Loan Market Association (APLMA), the Loan Market Association (LMA), and the Loan Syndications and Trading Association (LSTA) (APLMA et al., 2022). The goal of the SLLP is to promote the development of SLLs and provide guidelines that capture the fundamental characteristics of these loans. This standard was first developed in 2019 and later updated in 2022. To better understand the determinants of a sustainability-linked loan, we present the five core components of the framework.

2.2.1 Selection of Key Performance Indexes

SLLs aim to improve the borrower’s sustainability over the loan term by aligning loan terms with the borrower's performance, measured by internal or external sustainability KPIs (APLMA et al., 2022). The KPIs and calculation methods should be defined clearly in the contract and include the applicable parameters or scope. The KPIs should, if possible, be benchmarked against an industry standard. For each borrower, the KPIs should be highly strategic in relation to current or future operations and be material, core, and relevant to the borrower's business. They should address relevant ESG challenges in the industry. It is essential that these targets can be measured and quantified consistently and that it is possible to benchmark them against external definitions or references. The sustainability-linked loan market's credibility relies on selecting prime targets.

2.2.2 Calibration of Sustainability Performance Targets

The calibration of sustainability performance targets per KPI expresses the borrower's ambition to commit (APLMA et al., 2022). The borrower and lender define these targets together, and the targets must communicate clearly how the borrower intends to reach the chosen SPTs. The SPTs are ambitious if they are relevant throughout the loan's lifetime, represent a material improvement on the respective KPIs, can be compared to external

references or benchmarks, and align with the company's overall sustainability strategy. They should be calibrated with the borrower's performance over time, the borrower's peer's performance, science-based scenarios, or official targets like the Paris Agreement or the Sustainable Development Goals. Hence, when the borrower and lender are determining appropriate KPIs and SPTs, they should preferably obtain input from an external party to assess the ambition level of the SPTs and the reliability, robustness, and relevance of the chosen KPIs.

2.2.3 Loan Pricing

One of the key characteristics of sustainability-linked loans is the rate adjustments throughout the loans' lifetime that can present a potential discount if the borrower meets the predefined SPTs (APLMA et al., 2022). The pricing agreements of sustainability-linked loans incentivize borrowers to meet their sustainability targets by reducing the rates when goals are met. However, if the targets are not met, some borrowers face penalties that increase the margin (Bloomberg, n.d.a). If the shift in margin is substantial, the step-up and step-down in price create an effective reward-punishment mechanism. If there are no defined penalties in the loan contract, the price stays at its issue price if the borrower fails to meet its predefined SPTs. De la Orden and de Calonje (2022) state that when targets are met, the margin reduction is usually set to 5 to 10 percent of the initial margin. However, when borrowers fail to meet their targets, they experience a step-up of around 25 basis points. The magnitude and frequency of rate adjustments depend on the individual contract, as there are no standard regulations. Ideally, the discount should correlate with the ambitions of the targets and the borrowers' financial characteristics (de la Orden & de Calonje, 2022).

2.2.4 Reporting

Due to the characteristics of sustainability-linked loans, transparency is valuable in the SLL market. Hence, borrowers should as a minimum be encouraged to report their annual performance on the SPTs to lenders participating in the loan (APLMA et al., 2022). This information is often a part of the borrower's public integrated annual or sustainability report. However, when such information is not integrated into public statements, it is a requirement to provide the lender with details behind closed doors.

2.2.5 Verification

The borrowers must obtain independent and external verification on how they perform on each SPT for each KPI (APLMA et al., 2022). A qualified reviewer like an auditor, rating agency, or environmental consultant should complete the external verification. As post-signing verification, a second-party opinion will help gain confidence in the borrower-lender relationship and act as an assurance for the lender (Sustainalytics, 2022). When the borrower's performance is verified, the lenders evaluate the borrower's achievements based on this information. A margin reduction will occur if the reviewers verify that borrowers satisfy the pre-determined measures and have met their targets (APLMA et al., 2022). When the sustainability-linked loan principles were updated, it became mandatory to have an external independent reviewer to evaluate the borrower's performance on their KPIs (Milligan, 2022).

2.3 Borrowers' Incentives to Enter SLLs

To analyze the effect of explicit ESG information in loan contracts, it is vital to understand the borrower's motivation for entering a sustainability-linked loan agreement. The borrowers' motives are linked to the determinants of sustainability-linked loans and the signals implicit in the contract.

Investors often lack perfect information on a company's sustainability commitment, causing information asymmetry (Lyon & Montgomery, 2015). This asymmetry induces a transaction cost of identifying companies with beneficial characteristics. Due to this, it is beneficial for the companies to credibly convey information and reduce information asymmetry to shareholders and other stakeholders. The signaling theory states that a credible signal should be costly to mimic for companies of less desirable characteristics (Riley, 1979). Hence, companies can credibly signal their commitment to investors and shareholders by entering sustainability-linked loan contracts. It allows companies to outline the most material sustainability issues for themselves and their stakeholders, such that they can capitalize on new opportunities and discover potential risks (Schoenmaker & Schramade, 2018).

By entering SLLs to signal ESG commitment to stakeholders, borrowers can also reap a clientele effect from becoming more attractive to certain investors due to the expected improvements in environmental performance associated with the SLL (Friedman & Heinle, 2015). This effect can be visualized as a positive stock market response to the SLL

announcement. Sustainability investments may also decrease borrowers' risk by reducing the risk of adverse environmental outcomes, e.g., environmental regulatory actions. However, if the company enters a sustainability-linked loan for ESG signaling purposes with no real ESG commitment, the SLL only works as a vehicle for greenwashing purposes.

Despite the praiseworthy motives behind sustainability-linked loans, there are still unresolved dilemmas within the loan design. These issues unfold in credibility- and greenwashing concerns partly due to the lack of standardized methods for measuring ESG performance and are also connected to the effectiveness and motivation for entering into such an agreement. If the SLLs do not impact ESG performance more than regular loans, then the function and purpose of such loans are limited. We will refer to this as the omission of the additionality principle.

Greenwashing is defined as distributing misleading or false information about a company's environmental impact on its activities or products (Peterdy, 2022). If a company greenwashes intentionally, it unfolds through marketing efforts to improve its public image or reputation, being more environmentally friendly than they are. If the chosen KPIs in SLL contracts are low-hanging fruit for the borrower, there is a fair chance that the borrower has other motivations for entering the SLL than the purpose of these loans. When a borrower signals ESG commitment to stakeholders in this way without demanding responsible action, it aligns with greenwashing. This issue can be linked to an adverse selection problem as the borrower's incentives before entering the loan contract are unknown. Greenwashing problems can be mitigated by improving transparency and contractual disclosure, aiming for complete informational symmetry. However, if the market is efficient, it detects greenwashing at some point. Hence, greenwashing will be discovered and not pay off over time.

Another rationale for issuing a sustainability-linked loan is reducing the cost of capital. If SLLs are priced at a premium compared to regular loans, borrowers can potentially obtain financing at a lower spread. Hence, the sustainability-linked loan design attracts borrowers with economic incentives. Borrowers with good ESG profiles can also obtain protection against downside risk (Albuquerque et al., 2020), yielding lower spreads at issuance. Consequently, cheaper debt financing can generate a positive stock market response by benefitting equity holders. However, to acquire discounts from reaching KPIs, the borrowers must commit to improving sustainability performance and contribute to mitigating ESG concerns.

2.4 Lenders' Incentives to Enter SLLs

To further understand the borrowers' position in sustainability-linked lending, we shed light on the lenders' motivations to contract on sustainability performance. The lenders' motives are related to the borrowers' and linked to signaling ESG commitment and the determinants of the sustainability-linked loan design.

In the same way as for borrowers, the lenders can benefit from signaling their ESG commitment to their shareholders to reduce information asymmetry. By providing sustainability-linked loans, lenders can signal their sustainability commitment to the public and their stakeholders. The demand for companies to make an effort towards becoming more sustainable is increasing, and to retain old and attract new ESG-conscious customers, it is also essential for lenders to signal ESG commitment. By sustainability-linked lending, lenders can limit reputational costs associated with other loans to borrowers with poor ESG profiles. Investing in companies committing to improving material sustainability issues can create a portfolio that lowers the banks' exposure risk. Through the sustainability-linked loan design, they can thus mitigate their reputational and financial concerns by directly influencing borrowers' sustainability performance through the sustainability-performance-pricing mechanism (Houston & Shan, 2022).

Lenders may, however, also use sustainability-linked loans to greenwash their actions and reputation. The lenders' purpose of explicit ESG information in sustainability-linked contracts may only be to showcase an empty emphasis on sustainability to stakeholders. Through relationship banking, greenwashing can be mutually fostered by both lenders and borrowers. At the expense of stakeholders, the borrower and lender can arrange mutually favorable greenwashing arrangements through tailored contracts. However, the lender can also foster greenwashing at the expense of borrowers. For instance, lenders can decide not to provide sufficiently large pricing differentials to promote the borrower's sustainability-linked activities.

The sustainability-linked loan design can incentivize lenders to enter such contracts. Demanding ambitious sustainability performance targets of KPIs and introducing financial penalties may provide lenders with a financial motive. When borrowers fail to improve their sustainability performance and reach their contractual KPIs in time, the lenders will receive financial benefits through penalties. This misalignment of lenders' incentives introduces a

morally hazardous problem. The problem arises when investors or bankers claim to do good by offering sustainability-linked loans and then make money off failing loans.

2.5 Literature Review

As sustainability-linked finance has become more established in the debt landscape, more studies have been conducted. Our study is related to the growing topic of the relevance of ESG information in banking and borrowers' incentives to enter sustainability-linked contracts. ESG information may affect loan contracts explicitly by ESG criteria being included in loan contracts, or it may affect contracts implicitly when ESG information is not explicitly contracted but remains significant for loan terms. This literature review provides the basis for our analysis and will include studies regarding both the implicit and explicit use of ESG information.

Over the years, several studies have been conducted on the implicit use of ESG information and the relationship between borrower ESG profiles and loan terms. Goss and Roberts (2011) find that borrowers that contribute negatively to climate change concerns pay higher rates than responsible firms. This study was supported by Chava (2014), who finds that lenders charge borrowers with environmental concerns a higher interest rate. His research suggests that environmentally sensitive lending may have a material impact on debt capital and the cost of equity of affected firms.

Another line of literature investigates the implicit use of ESG information in the loan origination between a borrower and a lender. In a recent study, Houston and Shan (2022) emphasize that banks have both reputational and financial incentives to focus on ESG performance. The study shows that banks grant loans to borrowers with similar ESG profiles as themself. In addition, Houston and Shan find that if a borrower has lower ESG performance than the lending bank, the banks are more likely to influence the borrower’s subsequent ESG profile positively.

Another line of recent research investigates how the explicit use of ESG information for lenders indirectly impacts borrowers. Amiram et al. (2021) finds that US banks who adopted an environmental and social risk framework called the Equator Principles experienced increased provisions regarding environmental protection in borrowers’ loan contracts. In addition, the study was able to document lower loan spreads and reduced cost of equity for

borrowers who actively switched to banks that had adopted this framework. They also show that these borrowers improved ESG performance overall. This framework is comparable to the framework of sustainability-linked loan contracting. However, sustainability-linked contracts focus on the borrower by improving specific ESG measures. By studying SLL contracts, we can investigate the direct impact of explicit ESG information in contracts for borrowers.

In another study, Kim et al. (2022) research the sustainability-linked market directly and characterizes the growth of green and sustainability-linked loans. They find that borrowers and lenders with superior ESG profiles ex-ante are most likely to enter a SLL agreement and that ESG performance deteriorates after loan issuance, especially for contracts with poor disclosure quality. The research also investigates loan pricing, where they find no difference in SLL pricing compared to other loans.

Our research joins and supplements Amiram et al. (2021) and Kim et al. (2022) in the study of sustainability-linked loan contracts and the explicit use of ESG information. Our paper differentiates from existing literature by measuring ESG performance connected to contractual details. A key distinction of our research in relation to this literature is that we measure performance from the contractual-specific KPI embedded in each SLL loan contract. By examining the details of sustainability-linked loan contracts, we can differentiate between elements leading to improvements or deterioration of environmental performance.

Our study also complements Flammer's (2021) recent study on the green bonds market, where she finds that the incentives to issue green bonds are consistent with the signaling argument. She finds that the stock market reacts positively to green bond announcements and that companies improve their environmental performance after issuing. Hence, she discards concerns about greenwashing. Furthermore, she finds no pricing differences between green and brown quasi-identical bonds by the same issuer, which is inconsistent with the cost of capital argument. We use a similar approach to study the borrowers' incentives to issue sustainability-linked loans.

2.6 Research Question

In this section, we present the main research question for our analysis. We study a sample of sustainability-linked loans and the ESG impact of this group in comparison with traditional loans. This thesis aims to analyze whether explicit ESG information in loan contracts contributes to additional ESG performance and which incentives the borrower has to enter such loan contracts.

If explicit ESG information in loan contracts contributes to additional ESG performance, then we should see more improvements for the sustainability-linked loans than the traditional loans post-loan issuance. Thus, we should also see improvements in the outlined contractual KPIs in the sustainability-linked loan sample. If this is the case, the loan design incentivizes firms across industries to improve their sustainability profiles, and SLLs hold companies accountable for their sustainability-related promises. However, if SLLs do not reap improved ESG performance, then SLLs might be a vehicle for greenwashing. Both lenders and investors may be attracted by the prospect of a tangible positive sustainability component in their loan portfolio to look "greener" and reduce ESG risk. Using SLLs for greenwashing purposes is simplified by the absence of disclosure requirements or regulations, as lenders and borrowers voluntarily and selectively disclose this information.

On the other hand, if the borrowers have good ESG profiles before entering SLLs, they may use SLLs to signal their ESG commitment to shareholders. SLLs can be used as a credible signal to convey information and reduce information asymmetry between shareholders and company credibly. If this is true, we expect a positive stock market reaction from the borrowers' shareholders. However, shareholders might be vigilant to greenwashing if the contracts have poor disclosure quality. If their shareholders value it, it can still be a substantial incentive for borrowers even if the SLLs are more expensive than traditional ones. If the SLLs are cheaper, companies may be incentivized to enter to reduce their cost of capital.

Our research complements previous studies; hence, similar results on the part of the analysis that has previously been conducted in other studies will help to validate our results. However, as previous studies did not find improvements in ESG scores, we are curious to extensively analyze the impact of the contractual details and why borrowers enter these loans. Consequently, we will focus on the following research question in our thesis:

Does explicit ESG information in loan contracts contribute to ESG performance, and what incentivizes a borrower to enter a sustainability-linked loan contract?

We explore this question by estimating the effect of different characteristics of SLL contracts through difference-in-differences estimations, fixed effects regressions, and an event study of shareholders' responses. We will assess the shareholders' reactions to SLL issuances in the stock market, investigate loan pricing, and examine the performance on contractual KPI metrics and ESG score. Hence, we conduct the following hypotheses:

1) *Shareholders of sustainability-linked borrowers value ESG commitment.*
2) *Sustainability-linked borrowers acquire financing at a discount.*
3) *Sustainability-linked borrowers improve their ESG performance more than traditional lenders after issuing loans*.

The following chapter describes how we retrieve the relevant data and sample of sustainability-linked- and traditional loans to conduct tests of these hypotheses to answer our research question.

3. Data

3.1 Data Selection

We retrieve data for the analysis from Bloomberg Terminal and Refinitiv Eikon. The Bloomberg Terminal is a global platform and database with news, analytics, and real-time and historical data (Bloomberg, n.d.b). Eikon by Refinitiv is a digital platform that covers financial markets with multiple data sources and Reuters news for the financial market (Refinitiv, n.d.). We retrieve a sample of sustainability-linked and traditional loans from the Bloomberg Fixed Income database and manually collect sustainability performance data and published company news from Eikon.

3.1.1 Selection of Sustainability-Linked Loans

To compile a sample of sustainability-linked loans, we extract loans in Bloomberg's fixed income database that are labeled as "sustainability-linked loans" (more precisely, loans for which the field "Sustainability-linked" is "Yes"). To be confident in the classification quality, we perform manual searches to confirm the classification and find no misfits. However, due to little or no data on the characteristics of several loans and borrowers, we supplement the retrieval with two criteria: there had to be data reported on borrowers' total assets, and the borrowers had to have a credit rating, either Moody's long-term rating or S&P Issuer rating. We later convert the credit ratings numerically and use the outcome as a combined credit rating for the companies. For each loan, we retrieve the company name, borrower country and industry, issue date, announcement date, maturity date, credit rating, total assets, market capitalization, loan size, coupon rate, and information about contractual sustainability-linked key performance indexes. To facilitate comparisons, we convert all amounts into euros.

3.1.2 Selection of Time Span

We retrieve loans issued from January 1, 2017 until December 31, 2019. The selected time span and the above criteria yield 119 sustainability-linked loans. Bloomberg Terminal does not provide data that satisfies our retrieval criteria before 2017, hence the chosen start of the period. We limit the period to 2019 issues because we require data from at least two years post-issue to conduct our analysis and insulate the findings. The rationale behind the period's

end is that we need at least two years post-loan issuance to measure the impact of more recent loans.

3.1.3 Selection of Group of Comparable Loans

To study the impact of sustainability-linked loans, we retrieve a sample of comparable traditional loans with identical retrieval criteria to the SLLs sample. We further use these loans to construct a control group later in the analysis. The same retrieval criteria yield 4988 traditional loans from January 1, 2017, until December 31, 2019.

3.1.4 Selection of Sustainability Performance Data

To collect ESG scores on the retrieved loan samples, we study each borrower manually in Refinitiv Eikon. To select which KPIs to analyze, we chose a variety of the most prevalent KPIs from the retrieved information about the loans' contractual sustainability-linked KPIs, and we require historically reported data for the KPIs. From Refinitiv Eikon, we retrieve the borrowers' reported data on ESG score, environmental score, social score, total renewable energy, and total greenhouse gas emissions. We do not find a good measure for gender equality in Refinitiv; hence, we use the gender pay gap for middle and other management from Bloomberg Terminal and study each company to collect data. We will explore each score and KPI to infer whether detailed explicit ESG information yields different performances on the ESG measures. To study the scores' and KPIs' trends ex-ante and ex-post loan issuance, we retrieve annual ESG data from 2015 until 2021.

To develop a comprehensive and rounded evaluation of the companies' ESG performance, we use the Refinitiv ESG combined score. Refinitiv Eikon defines this score as an evaluation of ESG performance based on reported environmental, social, and governmental data with an overlay of ESG controversies retrieved from global media sources (Refinitiv Eikon, n.d.). The purpose of the controversies overlay is to discount negative media stories on ESG performance. The ESG score of a company is based on reported data across three pillars and ten different ESG topics in the public domain. The environmental pillar contains resource use, emissions, and innovation. The social pillar reports workforce, human rights, community, and product responsibility, while the governance pillar includes management, shareholders, and corporate social responsibility strategy. As our sample of SLLs contains KPIs in the environmental and social pillar, we also collect these individual scores. The measures in these

categories are based on data availability, considerations around materiality, and industry relevance. The ESG ratings are reported as a score from 1 to 100.

Although the use of ESG scores is widespread, it is challenging to interpret ESG scores as merely a metric of environmental performance. As there are no legal requirements for conducting ESG scores, several providers of ESG ratings use varying metrics and methodologies, resulting in inconsistent scores and a lack of robust data. In addition, several companies self-report data on non-financial KPIs, making manipulated ESG scores a rising concern. Consequently, assessing the informational quality of ESG scores is difficult, which is a risk about which shareholders should be vigilant.

To analyze whether sustainability-linked borrowers report more improvements on their contractually bound KPIs than borrowers without this KPI, we retrieve information on four sustainability-linked key performance indexes. The data on greenhouse gas emissions is the Refinitiv reported total CO2 equivalent emissions, which includes CO2 emissions and CO2 emissions equivalents in tons (Refinitiv Eikon, 2021). Refinitiv follows the greenhouse gas protocol on all their emission classifications, a global accounting standard for managing and measuring greenhouse gas emissions (Greenhouse gas protocol, n.d.). Total renewable energy is the total produced and purchased primary renewable energy in gigajoules (Refinitiv Eikon, 2021). We retrieve gender pay gap data from Bloomberg Terminal on middle and other company management in a percentage representing female earnings relative to its male equivalents. In addition, multiple companies have a third-party ESG score KPI. Since Refinitiv is an external source, we use the Refinitiv ESG combined score to measure this KPI.

Table 1. Summary Statistics from 2021 on Contractual KPIs

Notes: This table presents the mean and standard deviation of sustainability-linked KPIs. # Facility counts how many SLLs with the particular KPI. Contractual KPI represents performance statistics of the companies with the particular KPI in their loan contract. GHG emissions are greenhouse gas emissions in thousands of tons. Third-party ESG rating is Refinitiv Eikon combined ESG score measured on a scale from 1-100. The gender pay gap represents the gender equality KPI and measures how large a percentage of males pay women are paid in middle management. Renewable energy is measured in 1000 Gigajoules. Borrower attributes measure the mean total assets and credit rating for borrowers with each KPI. Variable definitions are included in Appendix A.

	GHG Emissions (1000 tonnes)		Third party ESG-rating		Gender Pay Gap (%)		Renewable Energy (1000 GJ)	
# Facility	46		12		12		22	
	Mean	*Std. Dev.*	*Mean*	*Std. Dev.*	*Mean*	*Std. Dev.*	*Mean*	*Std. Dev.*
Contractual KPI								
GHG Emissions	10,643.76	*19,905.75*	70.81	*11.84*	69.15	*34.76*	10,486.82	*21,427.68*
Third party ESG-rating	2,565.24	*3,467.88*	70.67	*13.92*	99.40	*9.24*	12,851.89	*31,829.14*
Gender Pay Gap	7,440.90	*12,830.31*	68.42	*10.86*	98.00	*1.41*	2,826.35	*4,994.40*
Renewable Energy	7,020.38	*12,342.24*	66.51	*10.41*	52.73	*34.90*	8,287.92	*14,371.24*
Borrower attributes								
Total assets (€ billion)	106,879.39		123,742.58		29,714.30		59,608.49	
Credit rating	60.11		59.58		60.83		59.85	

Table 1 presents summary statistics on our selected KPIs. There are 46 loans with greenhouse gas emissions as KPI, 12 with third-party ESG rating, 12 with gender equality, and 22 with renewable energy. The specific KPIs present the mean and the sample standard deviation of KPIs for companies with the particular KPI. We find that there are large standard errors and differences between KPI means in the sample. The credit ratings are similar across the KPIs, while there are differences in total assets. Third-party ESG rating has the largest total assets, while the gender pay gap has the minor total assets. These observations imply that there may be differences in the selection of KPIs based on firm sizes.

We express concern about our findings of limited ESG data for some borrowers. We find that not all companies disclose data on the different ESG measures. Some companies only disclose information on ESG performance in recent years, while others disclose no ESG information. The consequence is a smaller sample available for the analyses related to contractual KPIs, causing potentially biased and untrustworthy results.

3.1.5 Selection of Stock Price Data

To study how the stock market reacts to sustainability-linked loan issuances, we obtain daily stock market data from January 1, 2016 until December 31, 2020 from Refinitiv Eikon. We retrieve daily stock market data on the 70 public companies in the sustainability-linked loan sample and the MSCI All Country World Price Index. Furthermore, we pair stock returns and MSCI ACWI Index returns based on the individual stock's announcement date.

3.2 Matching Criteria

We perform nearest-neighbor matching to construct a control group to compare to the sample of sustainability-linked loans. To ensure that the control group is equivalent to the group of sustainability-linked loans, we apply five matching criteria: loan issue date, borrower industry, borrower country, borrower's total assets, and loan size. By including more matching criteria, we will exclude many observations but also achieve closer and more similar matches. Based on these characteristics, the nearest neighbor to each sustainability-linked loan is chosen within the retrieved group of comparable loans. We decide not to perform exact matching, as our loan sample decreases significantly, making it difficult to interpret our findings. Allowing for some slack by not performing exact matching to obtain larger loan samples, introduces a degree of bias to our model.

We would also like to address a concern regarding matching quality. Optimally, we want to include the ESG score as a matching criterion. However, it is difficult to do so as there is no exportable common identifier for firms in Bloomberg, and we are not able to manually collect ESG scores for 4988 companies over seven years. It becomes clear later in the analysis that we should have performed matching credit ratings. If we were to perform matching on ESG score and credit rating, the matched control borrowers would be in the same development state regarding sustainability and risk. Hence, they would have had the same starting point for the analysis, contributing to more robust and reliable results. Consequently, the two groups have some different characteristics. We will further address this limitation later in the analysis.

3.3 Summary Statistics on the Matched Sample

In this section of the thesis, we present descriptive statistics of the data. First, we will focus on issue size distributed by country and industry. Secondly, we provide a visual overview of the borrower and loan characteristics of the SLL borrowers and the matched non-SLL borrowers.

3.3.1 Descriptive Statistics on Matching Pairs

Tables 2 and 3 present the number of loan facilities for sustainability-linked- and regular loans and the total issuance amount by country of incorporation and sector.

Table 2. Sustainability-Linked Lending by Country

Notes: This table presents the number of sustainability-linked loan facilities and the total issuance amount by country of incorporation. The data consists of 108 sustainability-linked loans and 108 matched comparable loans issued from January 2017 to December 2019. Data is obtained from Bloomberg Terminal.

Sustainability-Linked + Comparable Loans			Sustainability-Linked Loans			Comparable Loans		
Country	*# facility*	*€ billion*	*Country*	*# facility*	*€ billion*	*Country*	*# facility*	*€ billion*
Australia	4	2,34	Australia	3	1,27	Australia	1	1,08
Austria	2	0,67	Austria	2	0,67	Austria		
Belgium	1	2,00	Belgium	1	2,00	Belgium		
Bermuda	1	0,40	Bermuda			Bermuda	1	0,40
Brazil	1	0,11	Brazil			Brazil	1	0,11
Britain	13	15,72	Britain	8	12,79	Britain	5	2,93
Canada	5	4,54	Canada	2	1,97	Canada	3	2,57
Chile	3	4,73	Chile			Chile	3	4,73
China	2	3,78	China			China	2	3,78
Finland	4	2,85	Finland	4	2,85	Finland		
France	13	13,85	France	11	11,65	France	2	2,20
Germany	6	12,75	Germany	6	12,75	Germany		
Hong Kong	1	0,05	Hong Kong	1	0,05	Hong Kong		
Iceland	2	0,30	Iceland	1	0,13	Iceland	1	0,16
India	2	0,85	India			India	2	0,85
Ireland	3	4,05	Ireland	3	4,05	Ireland		
Italy	19	54,03	Italy	11	28,00	Italy	8	26,03
Japan	3	1,93	Japan	2	0,57	Japan	1	1,36
Luxembourg	2	5,56	Luxembourg	2	5,56	Luxembourg		
Netherlands	6	7,70	Netherlands	6	7,70	Netherlands		
Norway	1	0,98	Norway	1	0,98	Norway		
Poland	1	0,46	Poland	1	0,46	Poland		
Singapore	1	0,19	Singapore	1	0,19	Singapore		
South Africa	1	0,45	South Africa			South Africa	1	0,45
Spain	18	163,18	Spain	14	151,50	Spain	4	11,68
Sweden	1	2,31	Sweden	1	2,31	Sweden	0	0,00
Switzerland	3	9,06	Switzerland	2	2,56	Switzerland	1	6,50
Turkey	2	0,55	Turkey	1	0,05	Turkey	1	0,50
United States	95	152,02	United States	24	34,50	United States	71	117,52
Total	216	467,41	Total	108	284,57	Total	108	182,84

In table 2, we observe differences in country distribution between the sustainability-linked- and the matched control group, which confirms that country matching is not exact. We find

that the United States has the largest share regarding the number of loan facilities and the total loan issuance, which aligns with our observations from figure 5 in Appendix B. We observe an overweight of European countries and some engaged countries from each continent. These observations imply that the results may be colored globally by a skewed country distribution. Local regulations, culture, and other characteristics of the US and European countries may affect the results. We note that the number of issuances and issue size varies in each country. These variations make it important to identify close matches by comparing firms that operate in the same sector and country.

Table 3. Sustainability-Linked Lending by Sector

Notes: This table presents the number of sustainability-linked loan facilities and the total issuance amount by borrower sector, defined using the Bloomberg Industry Classification Standard (BICS) level 1. % to total is the ratio of each sector issuance amount to the total issuance across samples. The data consists of 108 sustainability-linked loans and 108 matched comparable loans issued from January 2017 to December 2019. Data is obtained from Bloomberg Terminal.

	Sustainability-Linked + Comparable Loans			Sustainability-Linked Loans			Comparable Loans		
Sector	*€ billion*	*% to total*	*# facility*	*€ billion*	*% to total*	*# facility*	*€ billion*	*% to total*	*# facility*
Communications	17,16	3,67	7	11,51	4,05	4	5,65	3,09	3
Consumer Discretionary	27,61	5,91	24	13,24	4,65	10	14,37	7,86	14
Consumer Staples	17,11	3,66	8	4,18	1,47	3	12,93	7,07	5
Energy	33,28	7,12	18	21,21	7,45	7	12,07	6,6	11
Financials	77,96	16,68	51	19,84	6,97	19	58,12	31,78	32
Government	1,40	0,30	4	0,13	0,05	1	1,26	0,69	3
Health Care	47,84	10,24	8	1,00	0,35	1	46,84	25,62	7
Industrials	157,35	33,66	25	148,54	52,2	16	8,80	4,82	9
Materials	36,97	7,91	30	28,52	10,02	21	8,45	4,62	9
Technology	6,01	1,29	6	1,50	0,53	1	4,51	2,47	5
Utilities	44,72	9,57	35	34,89	12,26	25	9,83	5,38	10
Total	467,41	100	216	284,57	100	108	182,84	100	108

Table 3 reports the distribution of the sustainability-linked- and comparable borrowers over Bloomberg's BICS codes. The sector distribution of sustainability-linked loan issuance is broad. However, sustainability-linked loans are more common in industries such as industrials and utilities, where sustainability is likely core to the firms' operations. In contrast, the matched comparable loans only issue 4,82% to the industrials sector, but have an overweight of issuances in the financial- and healthcare industries. The broad sector distribution for sustainability-linked loans aligns with the characteristics of SLL as proceeds from SLLs are available for general-purpose use and not for specific projects making sustainable financing available for all sectors.

3.3.2 Borrower and Loan Characteristics

In this segment, we study the matching characteristics of borrowers of sustainability-linked and control loans. Table 4 exhibits the final matched sample of loans used in the analyses. We note that there are quite similar results for both samples.

Table 4. Summary Statistics for Borrower and Loan Characteristics

Notes: This table reports unconditional univariate comparisons of sustainability-linked and non-sustainability-linked loans. Column 3 displays the results of a difference in the means test. Log assets represent the total assets book value in the company's pre-issue year. Log market cap represents a company's market capitalization, the market value of the company's outstanding shares. Log loan portrays companies' loan size. Credit rating is a numerical conversion of the S&P issuer rating and Moody's long-term rating. Variable definitions are included in Appendix A.

	(1)		(2)		(3)	
	Sustainability-Linked		Control Group		Diff. in Means	
	N	Mean	N	Mean	Abs.	P-value
Log(Assets)	108	4.32	108	4.34	0.01	0.92
Log(Market Cap)	108	10.02	108	10.09	0.07	0.64
Log(Loan)	108	8.91	108	8.88	-0.03	0.67
Credit Rating	108	58.81	108	53.31	-5.50***	0.00

Table 4 indicates no significant differences in characteristics between the two groups on the matched criteria. This observation implies that the matching was successful and that the loan couples could be a good sample for drawing inferences. However, we find significant differences in credit rating between the groups, which is worrisome. This observation is the consequence of not matching on credit rating. Not matching on credit rating is a significant shortcoming for the analysis as the central thought is to compare two firms of the same quality, the only difference being whether they have entered a sustainability-linked loan. Consequently, we receive less reliable and robust results from our analysis.

We note that the credit rating is significantly higher for the sustainability-linked borrowers by 5.5 points. Due to ESG risk, we know that ESG performance is priced into most credit ratings nowadays. Hence, having a sustainability-linked loan may positively impact a company's credit score. Although there are shortcomings to the control sample, we believe, with some skepticism that the sample is a relatively reliable contrafactual for observing how the sustainability-linked loans would behave without being ESG-linked. We note that market capitalization is a measure of firm size; thus, outstanding shares are a measure that may change over time.

4. Methodology

This chapter describes the different empirical methods we have applied to conduct our research. First, we conduct an event study of the stock market reaction to the announcements of sustainability-linked loans. Further, we perform nearest-neighbor matching to create a control group of comparable loans. To examine if lower loan spreads are a proper incentive for borrowers to enter sustainability-linked loans, we perform a fixed effects regression of SLL on the coupon rate. We then estimate the effect of the loan being sustainability-linked on ESG score by fixed effects regression and later perform a difference-in-differences estimation to examine if the ESG score improved more post-loan issue for sustainability-linked borrowers than for the control group. To explore explicit ESG details in the contracts, we examine if borrowers with different contractually bound sustainability-linked KPIs perform better on the specific KPI than borrowers without the particular KPI.

4.1 Event Study of Stock Market Reaction to SLL Announcements

We use event study methodology to examine the response in the stock market around the announcement of SLLs. In our event study, we use the loan issuance announcement date as the event of interest (day 0), as this date captures the day information is shared with the market. By including the five previous- and the ten following trading days in the baseline event window, we account for the possibility that some information may be known to the public before the announcement and the possibility of a staggered response. We include two time intervals before and after the baseline event window, [–20, –11], [–10, –6], [11, 20], and [21, 60], to capture if there is any run-up in stock prices before or after the event windows. To estimate the normal return in this study without conditioning on the event in the event window, we use the 200 trading days before the first event window, [–220, –21], as our estimation window. Figure 2 visualizes the timeline of our event study, where the event date is defined as t = 0.

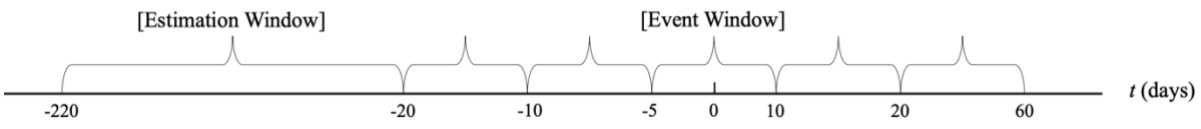

Figure 2. Event Study Timeline of Stock Market Reaction

We compute abnormal returns using the Single Index Model (SIM), also called the market model, for each firm *i*. In the market model, we estimate the coefficients α_i and β_i by ordinary least squares (OLS) based on daily returns in the estimation window. Officially, we estimate the market model by formula 4.1, where R_{it} is the return on the stock of firm *i* on day *t*, and R_{mt} is the daily return on the market. ε_{it} is the residual. We estimate the return on the stock of company *i* on day *t* by formula 4.2 and then estimate the abnormal daily return (AR) on company *i* on day t by formula 4.3.

$$R_{it} = \alpha_i + \beta_i \times R_{mt} + \varepsilon_{it}. \tag{4.1}$$

$$\hat{R}_{it} = \hat{\alpha}_i + \hat{\beta}_i \times R_{mt}. \tag{4.2}$$

$$AR_{it} = R_{it} - \hat{R}_{it} \tag{4.3}$$

Finally, we compute the cumulative average returns (CARs) by adding up the abnormal returns for each interval within the specific time windows; [–20, –11], [–10, –6], [-5, 10], [11, 20], and [21, 60]. To validate the results, we test whether CAR differs from zero by applying the conventional parametric t-test, assuming that we have normally distributed abnormal returns (MacKinlay, 1997).

In the event study methodology, a common assumption is the constant variance assumption (Brown & Warner, 1985). In this context, the assumption implies that the event might not be significantly different from earlier levels if the securities' returns are volatile prior to the announcement. When this assumption is violated, statistical tests may understate or overstate abnormal returns and provide less reliable results. However, we can verify low volatility in the stock market reaction analysis results.

4.2 Construct a Control Group by Matching

To investigate whether sustainability-linked loans have an additional sustainability impact compared to traditional loans, we compute a control group of regular loans by matching the sustainability-linked loans to regular loans. Optimally, the matches should have similar loan- and borrower characteristics. The reasoning is that the control group simulates the performance of sustainability-linked loans.

To avoid sustainability-linked loans from being matched with regular loans by the same issuer, we start the process by removing rows from the traditional loans data set. Rows duplicated in terms of company, loan size, and issue year were removed in RStudio to gain unique matches. This process downsizes the comparable loans group to 3257 regular loans. Followingly, to obtain a control group with no reused units, we use matching without replacement, so that each matched control unit cannot be reused as a match for other sustainability-linked loans (Greifer, 2022).

We chose to perform matching with the nearest neighbor method, as we found this to be most suitable to our data and in addition one of the most extensively studied matching methods (Kim & Thoemmes, 2011). This matching method runs through the list of traditional loans and selects the closest eligible loan as a control unit to pair with each sustainability-linked loan (Greifer, 2022). In the matching process, we chose a range of criteria we wanted the loans to match. We match on the issue date, loan size, company's total assets, borrower industry, and country. As a result, we gain 108 unique matches from the 119 sustainability-linked loans in the data set.

Conducting an ideal matching where match observations are as near in parameters as possible requires a large or homogeneous sample. Due to limited observations, this is an issue that affects the quality of the matching. As already stated, the matched loans are less comparable in the loan- and borrower characteristics than we optimally would want.

4.3 Fixed Effects Regression on Coupon Rates and ESG Scores

For our initial analysis, we use fixed effects regression to estimate the impact of loans being sustainability-linked first on coupon rate and later in the ESG scores. An advantage of the fixed-effects regression model is that it adjusts for endogeneity and unobserved heterogeneity problems between groups by measuring variation over time within each group (Verbeek, 2021). We control for country-, industry-, and time-fixed effects to capture systematic differences in sustainability-linked lending in countries, industries, and issue years. Country-fixed effects capture the country-specific mean across all years, industry-fixed effects capture the industry-specific mean across all years, and time-fixed effects take out the effect of unobservable variables that vary with issue year. We found this model appropriate as we have collected sustainability-linked loans from the whole world across all industries over three

years. However, as sustainability-linked loans are not randomly assigned, it is difficult to hedge completely against endogeneity.

We cluster standard errors to avoid biased standard errors caused by dependencies in the residuals. We chose to cluster at the country level because there are common conditions for loan issuance within countries that may vary between countries, especially because we use loan issuances from all continents. These may be factors associated with regulations, culture, industrialization, degree of technology, etc.

4.3.1 Fixed Effects Regression on Coupon Rates

Formula 1. Coupon Rate Fixed Effects Regression Specification

$$CPN_{i,j,t} = \alpha + \beta \cdot SLL_{i,j,t} + \zeta_b + \mathrm{I}_{Ind} + \theta_t + \mathrm{Z}_{i,j,t} + \varepsilon_{i,j,t} \quad (4.4)$$

In the first regression, the dependent variable CPN is the annual interest rate for loan facility *j* issued by borrower *i* in year *t*. The explanatory variable in this regression is $\mathrm{SLL}_{i,j,t}$. $\mathrm{Z}_{i,j,t}$ is a vector of control variables for borrower and loan characteristics. The control variables remove the variables' effect on the outcome variable and allow us to obtain inference on the effect of the loan being sustainability linked on the coupon rate. The vector includes log of the issue size, credit rating, log of total assets, a dummy for whether the loan is secured and a dummy for whether the loan was publicly announced, dummy variables for whether the loan is a revolving loan, term loan or another type of loan, dummy variables for whether the loan has a maturity of 3 - 6 years or greater than 6, and a dummy for whether the loan was publicly announced. The control variables remove the variables' effect on the outcome variable and allow us to obtain inference on the effect of the loan being sustainability linked to the coupon rate. ζ_b, I_{Ind}, and θ_t refer to country-, industry, and -year fixed effects.

4.3.2 Fixed Effects Regression on ESG Scores

Formula 2. ESG Score Fixed Effects Regression Specification

$$ESG_{i,j,t} = \alpha + \beta \cdot SLL_{i,j,t} + \zeta_b + \mathrm{I}_{Ind} + \theta_t + \mathrm{Z}_{i,j,t} + \varepsilon_{i,j,t} \quad (4.5)$$

In the second regression, the annual ESG score is the outcome variable for loan facility *j* issued by borrower *i* in year *t*. The explanatory variable $\mathrm{SLL}_{i,j,t}$ is a dummy variable with a value of one if the loan is sustainability-linked and zero otherwise. $\mathrm{Z}_{i,j,t}$ is a vector consisting of control variables for the borrower and loan characteristics. The vector includes log of total assets, log

of market capitalization, log of the issue size, credit rating, dummy variables for whether the loan has a maturity of 3 - 6 years or greater than 6, dummy variables for whether the loan is a revolving loan, term loan or another type of loan and dummies for whether the loan is secured or publicly announced. The control variables remove the variables' effect on the outcome variable and allow us to obtain inference on the effect of the loan being sustainability linked on ESG score. ζ_b, I_{Ind}, and θ_t refer to country-, industry, and -year fixed effects.

4.4 Difference in Differences Estimation

In our analysis, we use difference-in-differences estimation to examine if sustainability-linked borrowers improve more on different ESG measures after loan issuance than the matched control group. It is a suitable method to measure causal impacts in non-experimental settings. It involves comparing two groups, treatment, and control, in two time periods, pre- and post-loan issues (Stock & Watson, 2019). Hence, we investigate the treatment effect of sustainability-linked loans and the differences between the two groups before and after the issue. Due to the relatively young sustainability-linked loan market, there is an absence of regulations for what to include and how detailed a contract for a sustainability-linked issue should be. We investigate whether the contractual quality of explicit ESG information matters for ESG performance and examine the impact of sustainability-linked contractual KPIs.

By diff-in-diff, we examine if the borrowers' ESG scores improve more in the post-loan issue years for companies with sustainability-linked loans than for the control loans. The treatment group is the borrowers with sustainability-linked loans, while the control group is the matched borrowers with comparable loans. To detail the explicit ESG information in loan contracts, we use the same method to investigate if borrowers with specific contractual KPIs improve more than borrowers without the particular KPI after loan issuance. This analysis examines the sample of sustainability-linked borrowers, where borrowers with a particular contractual KPI are the treatment group, and the borrowers without this KPI are the control group. We analyze four selected KPIs; greenhouse gas emissions, third-party ESG score, gender pay gap, and renewable energy.

To analyze the impact on ESG score and KPIs, we first create a dummy called treatment to indicate who got treatment and then a dummy called post issue to mark the treatment start. Subsequently, we make an interaction term between treatment-dummy and treatment-start-dummy. For the analysis of the ESG score, the interaction term of the two dummies, called

DiD, estimates the effect of SLL on the ESG score by comparing the changes in outcomes over time between sustainability-linked borrowers and regular borrowers. For KPIs, DiD estimates the impact of a borrower's contractual KPIs on the particular KPIs. The following regression specification is the general model used in the different estimations:

Formula 3. Difference-in-Difference Specification

$$Y_{i,j,t} = \beta_0 + \beta_1 Treat + \beta_2 Post_{i,j,t} + \beta_3 (Treat \times Post_{i,j,t}) + \zeta_b + \mathrm{I}_{Ind} + \theta_t + \mathrm{Z}_{i,j,t} + \varepsilon_{i,j,t}$$

$Y_{i,j,t}$ is the outcome variable representing the company ESG score or a particular KPI for loan facility *j* issued by borrower *i* in year *t*. β_0 is the baseline average. Treat is a dummy variable with a value of one if the loan is sustainability-linked and zero otherwise. Post is a dummy variable equal to 0 in pre-loan issue years and 1 in treatment start and post-issue years. Treat x Post is the interaction term between time and treatment, also called the DiD estimate. ζ_b, I_{Ind}, and θ_t refer to country-, industry, and -year fixed effects. ε is the error term.

All ordinary least square (OLS) assumptions apply equally to DiD; however, DiD also requires the parallel trend assumption. In other words, to measure the causal effect of the analysis, we must assume that the trends in both groups move similarly. Otherwise, we cannot know if the results were generated by the difference in trends or the treatment (Stock & Watson, 2019). We will examine this requirement in a trend analysis that visualizes the movement in ESG scores for sustainability-linked and non-SLL borrowers pre- and post-loan issuance.

5. Results

In this section, we present the results of our analysis. We conduct the analysis with consideration for answering our research question; *Does explicit ESG information in loan contracts contribute to ESG performance, and what incentivizes a borrower to enter sustainability-linked loans?* We present how the stock market reacts to sustainability-linked loan issuances. Then, we introduce our findings on whether sustainability-linked loans are priced at a premium at issuance. Furthermore, we thoroughly study how sustainability-linked loans affect borrower ESG performance by ESG scores. Finally, we detail explicit ESG information in loan contracts by examining the disclosure quality of the sustainability-linked loan contracts and investigating the effect of different contractually bound sustainability-linked KPIs on ESG performance.

5.1 Stock Market Reaction to SLL Announcements

To study the signaling rationale of borrowers' incentives, we perform an event study of shareholders' responses to announcements of sustainability-linked loan issuances. We find out whether shareholders value the ESG initiatives of firms by calculating the cumulative abnormal return for different event windows. We report the event study results in table 10.

Table 5. Stock Market Reaction to the Announcements of SLL Issuances

Notes: This table reports the cumulative abnormal return (CAR) for multiple time windows around the announcement of sustainability-linked loan issues. The sample consists of N = 70 sustainability-linked loan issuance events. The data is collected from Refinitiv Eikon. Variable definitions are included in Appendix A.

Event Time	CAR	Std. Err.
[-20, -11]	0.512	0.597
[-10, 6]	0.449	0.541
[-5, 10]	0.758**	0.572
[11, 20]	-0.124	0.658
[21, 60]	-0.653	0.798
Note:		**p<0.1; **p<0.05; ***p<0.01*

We report the cumulative average return as percentages with the corresponding standard error. At the event window, the average CAR is 0.758% and significant at the 5% level. The positive coefficient implies that the market reacts positively to sustainability-linked loan issuances. The other CARs before and after the event window yield insignificant and smaller returns, indicating that no unrelated trends around the event date drive the results. These findings are

consistent with Flammer's (2021) research on stock market reaction to the issuance of green bonds, where she finds that the market responds positively to the issuance in the event window.

Compared to regular debt announcements, sustainability-linked debt announcements blend two parts of information, debt issuance, and a signal of the company's environmental commitment. Since previous literature suggests that the market is unresponsive to debt issuances (Maskara & Mullineaux, 2011), the observed positive stock reaction is likely to reflect the latter of sustainability. This is also consistent with other event studies of CAR on environmental actions that show a positive stock market response (Flammer, 2013). Hence, we interpret it as a reasonable incentive for companies to enter sustainability-linked loans to signal ESG commitment.

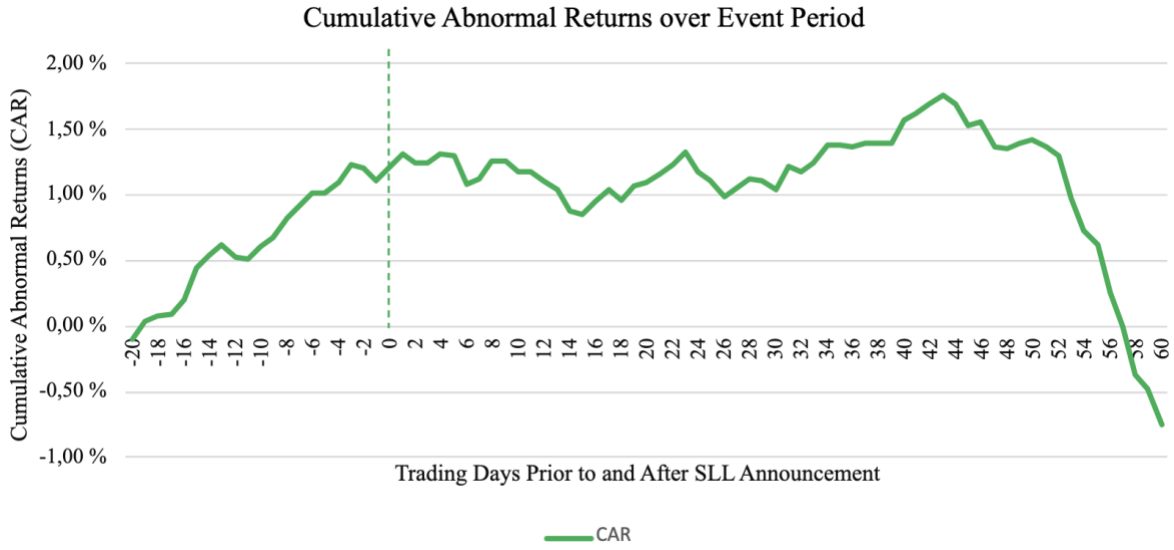

Figure 3. Cumulative Abnormal Returns over Event Period

Figure 3 visualizes the cumulative abnormal returns over the total event period. The CAR starts growing at the beginning of the event period and continues to grow in the main event window. Furthermore, the CAR fluctuates around 1% before it deteriorates at the end of the event period.

To examine which characteristics drive the returns from the announcement, we present the CARs of different sub-samples in table 6. Panel A distinguishes between SLLs with environmental, social, and third-party ESG ratings as KPIs. Panel B distinguishes between sustainability-linked loans with good or poor disclosure quality contracts. We define sustainability-linked loan contracts to have good disclosure quality when sustainability-linked KPIs are available in Bloomberg and can be confirmed with a manual search of media releases

and corporate sustainability reports. Consequently, we define borrowers as having poor disclosure quality contracts when they do not have sustainability-linked KPIs available in Bloomberg, and we in addition find no publicly verifiable information about their sustainability-linked KPI metrics elsewhere.

Table 6. Cross-Sectional Heterogeneity on Stock Market Reaction

Notes: This table reports the average cumulative abnormal return (CAR) from table 10 for different sub-samples. Panel A distinguishes between SLLs with environmental, social, and 3rd party ESG ratings as KPIs. Panel B distinguishes between sustainability-linked loans that we have classified as good or poor disclosure quality. Variable definitions are included in Appendix A.

	CAR [-5, 10]	Std. Err.
Panel A. Contractual KPIs		
Environmental KPI (N = 48)	0.951**	0.567
Social KPI (N = 10)	1.497***	0.508
3rd Party ESG Rating (N = 12)	0.256	0.627
Panel B. Good vs. Bad Disclosure Quality in Contracts		
Good Disclosure (N = 57)	0.816**	0.586
Poor Disclosure (N = 13)	0.661*	0.524
Note:	**p<0.1; **p<0.05; ***p<0.01*	

First, in Panel A, we find that the stock market reaction is large and significant for borrowers with environmental and social KPIs in loan contracts and small and insignificant for borrowers with 3rd party ESG rating KPIs. As most environmental and social KPIs are quantifiable goals with standardized measures, they may also come with administrative and organizational burdens. Consequently, it can be interpreted as a larger commitment to choose quantifiable environmental and social KPIs over third-party ESG scores as a KPI. The company can improve on whatever measure calculated into the score when having a third-party ESG score as a KPI. Thus, the borrowers can choose to improve on low-hanging fruit or continue with improvements that are already processing. Direct and concrete KPIs, such as environmental and social KPIs, may therefore seem like a more credible signal of a firm's commitment towards sustainability. Also, the strong response for social KPIs may result from few companies choosing them; therefore, the market values it higher as it seems like a more substantial commitment. Hence, the strong stock market response aligns with the signalization argument.

In Panel B, we find that the borrowers with good disclosure contracts yield a slightly higher and more significant return than borrowers with poor disclosure contracts. This is consistent with the signaling argument, as transparent and good quality information provided to the public reaps better stock performance. There are positive abnormal returns regardless of

disclosure quality, consistent with studies showing that environmental-friendly actions yield a positive response. However, the slightly larger response to loan announcements of contracts with good disclosure quality may highlight some stock market vigilance toward potential greenwashing actions.

5.2 Sustainability-Linked Loans' Pricing

To investigate the cost of capital argument, we examine if borrowers with SLLs receive lower loan spreads than borrowers with non-SLLs. First, we look at the characteristics and contractual details of the loans and then perform a fixed effects regression to examine whether not banks price ESG-linked loans differently.

5.2.1 Statistics on Contractual Details

First, we present statistics on the contractual details of the sample. We examine differences between sustainability-linked loans and the matched control group in the type of loan, maturity, and loan details.

Table 7. Contractual Details

Notes: This table presents statistics on contractual details on sustainability-linked loans and the matched control group. Loans are either term loans, revolving loans, or other. We report maturities between 3-6 years and more than six years, and if loans are secured or publicly announced. Variable definitions are included in Appendix A.

	Sustainability-Linked	Matched Control
# Facility	108	108
Type of Loan		
Term loan	18	71
Revolving loan	85	20
Other loan	5	18
Maturity		
3-6 Years	57	53
More than 6 years	43	14
Loan details		
Secured	22	52
Publicly announced	8	31

Table 7 indicates a clear overweight of revolving loans for the sustainability-linked borrowers, while there is an overweight of term loans in the matched control group. The sustainability-linked loans are likely to be structured as revolving credit facilities more often due to the need

for frequent monitoring and the contractual complexities related to such loans. There is a comparable amount of loans between the two groups with a maturity of three to six years, while an overweight of sustainability-linked loans have a maturity longer than six years. This may indicate that sustainability-linked loans, on average, have a longer maturity than traditional loans. Regarding loan details, we find that the matched control group has more secured and publicly announced loans than the sustainability-linked ones.

5.2.2 Fixed Effects Regression of SLL on Coupon Rates

To empirically examine the pricing of sustainability-linked loans, we investigate coupon rate differences at issuance between sustainability-linked loans and non-sustainability-linked loans by estimating a fixed effects regression. We report the results in table 8.

Table 8. Fixed Effects Regression of SLL on Coupon Rates

Notes: In this table, we report results from fixed effects regressions of SLL on the coupon rate at issuance. SLL is a dummy taking the value of 1 if the borrower is entering a sustainability-linked loan and 0 if entering a regular loan. We include control variables for borrower and contractual characteristics. Maturity 3-6 years is a dummy taking the value of 1 if maturity is between 3-6 years and 0 if not, and maturity > 6 years is a dummy taking the value of 1 if maturity is longer than six years and 0 if not. Term loan, revolving loan, and other loan are dummies taking the value of 1 for the correct loan type and 0 if it's not the right loan type. The secured dummy takes the value of 1 if the loan is secured and 0 if not, and publicly announced is a dummy taking the value of 1 if the loan is publicly announced and 0 if not. We control for borrower country-, industry(BICS)- and time (Issue month) fixed effects. Standard errors are clustered by country and reported in paratheses. Variable definitions are included in Appendix A.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable:	CPN, %	CPN, %	CPN, %	CPN, %	CPN, %	CPN, %	CPN, %	CPN, %
SLL	0.05	1.51***	0.47	1.57***	1.46	2.74***	2.77***	2.55**
	(0.46)	(0.20)	(0.44)	(0.15)	(1.13)	(0.22)	(0.50)	(0.98)
Log(Loan)			-0.09	0.68***	-0.69	-0.53***	-0.37	-0.24
			(0.54)	(0.18)	(0.81)	(0.14)	(0.26)	(0.21)
Credit score			-0.08***	-0.08***	-0.02	-0.02	0.02**	0.00
			(0.02)	(0.01)	(0.04)	(0.01)	(0.01)	(0.01)
Log(Assets)			-0.19	-0.71***	-0.08	0.38***	-0.62	-0.40
			(0.38)	(0.10)	(0.44)	(0.10)	(0.56)	(0.47)
Secured					1.76	2.41***	2.44***	2.86***
					(1.10)	(0.41)	(0.47)	(0.38)
Term loan					-0.16	-0.03	0.15	-0.98**
					(2.07)	(0.15)	(0.26)	(0.36)
Revolving loan					0.79	0.13	0.29	-0.39
					(1.92)	(0.32)	(0.34)	(0.56)
Other loan					-0.27	-0.59	0.00	-1.03
					(2.23)	(0.47)	(0.55)	(0.99)
Publicly announced					5.18***	5.02***	4.39***	4.00***
					(1.12)	(0.08)	(0.10)	(0.23)
Maturity 3-6					-1.03	-0.86**	-0.74***	-0.48
					(1.02)	(0.28)	(0.24)	(0.41)
Maturity>6					-0.41	0.00	-0.12**	-0.02
					(1.15)	(0.42)	(0.78)	(0.69)
Borrower Country FE	N	Y	N	Y	N	Y	Y	Y
Industry FE	N	Y	N	Y	N	N	Y	Y
Issue Month FE	N	Y	N	Y	N	N	N	Y
Observations	76	76	67	67	67	67	67	67
R^2	1.391	0.741	0.259	0.796	0.624	0.823	0.873	0.905
Adjusted R^2	-0.13	0.252	0.211	0.290	0.450	0.647	0.562	0.599
Note:								*p<0.1; **p<0.05; ***p<0.01

Table 8 suggests that sustainability-linked loans seem to be priced differently from non-sustainability-linked loans at issuance. While the results indicate that SLLs only pay five basis points more than non-SLLs, sustainability-linked loans experience an increase in rate when we also control for loan- and borrower characteristics and country- and industry-fixed effects. We find that across all model specifications, SLLs seem to be paying a higher rate at issuance.

Regression 8 suggests that sustainability-linked loans from the same country and industry issued in the same month in the same year pay 2.55 percentage points more in coupon rate than the matched non-SLLs at issue.

When we include more specifications, the results vary slightly across all model specifications, indicating relatively robust results. In regression 8, where we control for both borrower and loan characteristics and country-, industry- and time-fixed effects, the R-squared increases to 0.905, reducing much unexplained variation. We observe the largest increase in R-squared when we control for country-fixed effects. This may indicate that the coefficients are driven by omitted variables that vary within the borrowers' countries. When we add industry-fixed and time-fixed effects, we get a slight increase in R-squared. This implies that the coefficients are likely independent of omitted variables that vary over time or industry. Undocumented in the table, we obtain similar results when we run the different model specifications without US loans. This confirms that the results are likely to be consistent across countries.

Although these results suggest that sustainability-linked borrowers do not enjoy pricing benefits at issuance, the results still align with SLL's future pricing being performance-linked to meet contractual KPI targets. Hence, the suggested coupon rate difference at issuance is still consistent with future lower coupon rates if the borrowers of sustainability-linked loans reach their contractual targets. The positive coefficient for SLL may imply that the additional costs related to monitoring and regulating the sustainability-linked loans outweigh lower ESG risk, which could present a discount. These results contradict Flammer's (2021) findings, suggesting no spread difference between green and non-green bonds. Due to the lack of data on rate adjustments, it is difficult to conclude whether pricing is a sufficient incentive for borrowers without analyzing whether borrowers receive substantial discounts. Lastly, we note that there are few observations of coupon rates, some of which may cause inconsistent and biased estimates that are less trustworthy. Although the R-squared is quite high, we cannot presume that the results from this model are unbiased and reliable.

5.3 Sustainability-Linked Loans' Effect on ESG Scores

We continue the analysis by thoroughly studying how sustainability-linked loans affect borrower ESG performance by ESG scores. First, we examine ESG scores post-loan issue to see if sustainability-linked loan issuance impacts company ESG score; then, we examine the trends in ESG scores before the issue, and lastly, we examine the additionality principle by identifying whether or not sustainability-linked borrowers experience a higher development in ESG scores following the loan issue than matched regular borrowers.

5.3.1 Fixed Effects Regression of SLL on Borrower ESG Scores

We perform several regressions with different model specifications to analyze whether SLLs impact ESG scores after loan issuance. These specifications include borrower and loan characteristics, country-clustered standard errors, country-, industry-, and time-fixed effects. We regress SLL on post-loan issue ESG score and present the results of the regressions in table 9.

Table 9. Fixed Effects Regression on borrowers' ESG scores after SLL issuances

Note: This table reports results from fixed effects regressions of SLL on ESG scores 1 year post-loan issue. SLL is a dummy taking the value of 1 after entering a sustainability-linked loan and 0 if entering a regular loan. ESG scores are from one year after loan issue. We include control variables for borrower and contractual characteristics. Maturity 3-6 years is a dummy taking the value of 1 if maturity is between 3-6 years and 0 if not. Maturity > 6 years is a dummy taking the value of 1 if maturity is longer than six years and 0 if not. Term loan, revolving loan, and other loan are dummies taking the value of 1 for the correct loan type and 0 if it's not the right loan type. The secured dummy takes the value of 1 if the loan is secured and 0 if not, and publicly announced takes the dummy of 1 if the loan is publicly announced and 0 if not. We control for borrower country-, industry(BICS)- and time (Issue month) fixed effects. Standard errors are clustered by country and reported in paratheses. Variable definitions are included in Appendix A.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent Variable:	ESG Score	ESG Score	ESG Score	ESG Score	ESG Score	ESG Score	ESG Score	ESG Score	ESG Score	ESG Score
SLL	12.55***	13.21*	12.10***	9.85*	11.52**	15.22***	16.33***	14.38**	16.11**	26.93***
	(2.69)	(6.61)	(2.92)	(4.76)	(4.74)	(5.22)	(4.03)	(5.52)	(6.83)	(7.96)
Log(Assets)			-2.33	-1.36	-1.17	1.28	-0.72	0.19	-0.38	0.10
			(2.98)	(3.73)	(3.84)	(4.19)	(2.95)	(3.10)	(3.16)	(3.64)
Log(Market Cap)			1.05	-4.90	-2.46	-3.97	-0.14	-4.69	-1.59	0.32
			(3.17)	(3.84)	(4.22)	(5.17)	(3.11)	(3.12)	(3.86)	(3.66)
Log(Loan)			2.20	3.42	1.62	-1.79	1.07	2.83	2.50	-3.34
			(2.81)	(3.25)	(2.27)	(2.41)	(3.06)	(2.01)	(2.31)	(2.43)
Credit Score			0.35**	0.70***	0.69**	0.78**	0.36**	0.55***	0.54*	0.57
			(0.14)	(0.18)	(0.28)	(0.21)	(0.14)	(0.14)	(0.29)	(0.38)
Maturity 3 - 6 Years							0.57	0.74	0.54	-5.51
							(4.52)	(3.11)	(4.42)	(3.69)
Maturity > 6 Years							-2.94	-2.15	-1.94	-4.60
							(4.92)	(4.57)	(5.31)	(5.69)
Term Loan							27.14*	34.33***	36.47***	51.94***
							(15.33)	(4.17)	(4.24)	(10.89)
Revolving Loan							22.30	28.20***	28.36***	40.38***
							(15.23)	(2.35)	(2.17)	(13.74)
Other Loan							38.14*	40.83***	37.72***	51.76***
							(16.19)	(4.71)	(5.34)	(14.82)
Secured							-3.03	-3.44	-4.04	1.56
							(4.12)	(4.90)	(5.43)	(5.18)
Publicly Announced							-2.12	-5.61	-2.34	0.33
							(5.37)	(3.83)	(3.43)	(5.33)
Borrower Country FE	N	Y	N	Y	Y	Y	N	Y	Y	Y
Industry FE	N	Y	N	N	Y	Y	N	N	Y	Y
Issue Month FE	N	Y	N	N	N	Y	N	N	N	Y
Observations	128	128	117	117	117	117	113	113	113	113
R^2	0.147	0.585	0.190	0.423	0.491	0.648	0.286	0.494	0.547	0.714
Adjusted R^2	0.140	0.225	0.153	0.248	0.262	0.229	0.200	0.273	0.264	0.237
Note:										**p<0.1; **p<0.05; ***p<0.01*

In table 9, we find that coefficients on SLL are significantly positive across all model specifications. The regressions suggest that the borrowers with sustainability-linked loans have significantly higher ESG scores one year post-loan issuance than the control group. This could be caused by lenders selecting borrowers with specifically good ESG profiles for sustainability-linked loans. It could also result from borrowers with good ESG profiles choosing specifically to enter SLLs. We will further address this in the difference-in-differences estimation.

Almost all model specifications also have significant and positive coefficients on credit score. These results imply that credit score positively impacts ESG score, meaning that a rise in credit score is associated with an increase in ESG score. This is compatible with credit rating companies considering sustainability performance in a credit rating assessment. Hence, the better credit scores a company has, the smaller the sustainability risk they are exposed to; thus, they have a better ESG score. Undocumented in table 9, we conduct regressions without US loans as a test of robustness. We discover that the SLL coefficient is smaller and less significant as we add specifications. This may imply that the results are driven by US loans and might be biased.

From the simple regression in column 1 to the regression in column 10, we include more control variables and fixed effects to reduce omitted variable bias. The simple regression in column 1 has a low R-squared, indicating much unexplained variation in the model and that the bias in the SLL coefficient is severe. When we add country-industry-and-time fixed effects and borrower control variables, the R-squared increases, which indicates that the model explains more of the variation and reduces omitted variable bias. As we control for borrower country fixed effects with all control variables in column 8, the R-squared increases from 0.286 to 0.494, reducing much unexplained variation. This may indicate that the coefficients are driven by omitted variables that vary within the country. We obtain similar results when we add industry- and time-fixed effects to the regression. The R-squared increases significantly, which implies that the coefficients are likely driven by omitted variables that vary over industries and months of issuance. Undocumented in table 9, we conduct regressions with yearly time effects. However, we obtain a lower R-squared than with monthly time effects, implying that there are larger variations from month to month.

Even though fixed effects regressions significantly reduce the threat of omitted variable bias problems, the problem is not eliminated. In table 9, we find that the coefficients for SLL are not completely consistent across model specifications which may imply that omitted variable bias is not negligible. Endogeneity is one of the main challenges with this regression because the company's ESG score may affect granting of sustainability-linked loans. It may also be the other way around, as a sustainability-linked loan issue will likely affect the company’s ESG score. Such issues may result in inconsistent and biased estimates that cannot be trusted. To address the endogeneity issue, we will proceed with a difference-in-differences estimation.

5.3.2 Trends in ESG Scores

We test if the parallel trend assumption holds before we perform a difference-in-differences estimation. The outcome variable should change equally in both groups without receiving the treatment. We visualize the pre- and post-issue trend in figure 4 for companies with sustainability-linked loans and the control group with comparable loans.

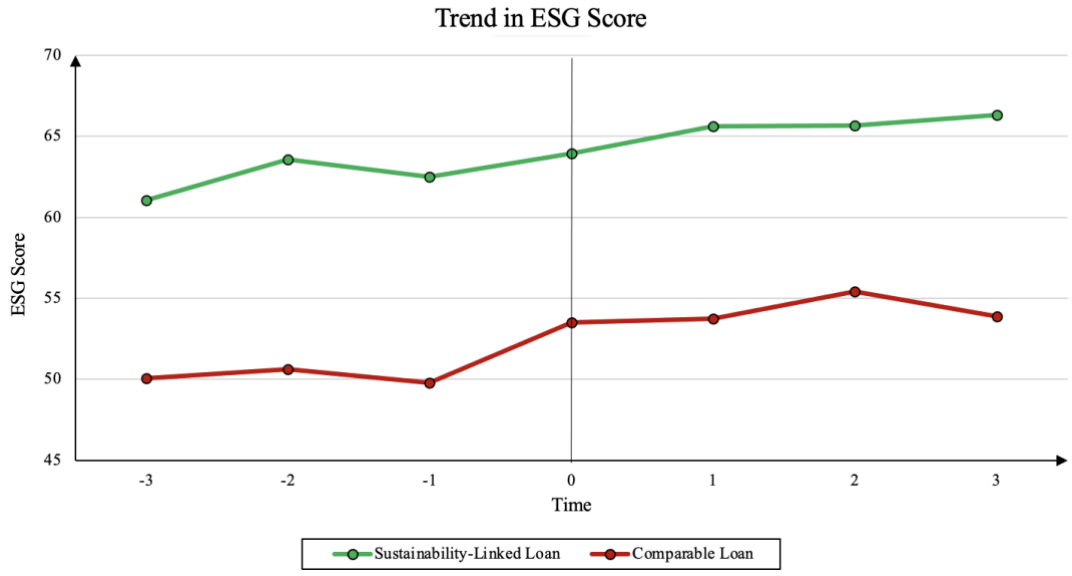

Figure 4. The Trend in ESG Scores Pre and Post Loan Issue

The vertical line at time 0 represents the issue year of all loans. Figure 4 demonstrates that companies with sustainability-linked loans have a higher ESG score continuously than those of comparable loans. This aligns with our findings in the fixed effects regression, confirming that SLL borrowers have higher ESG scores than the control group post-loan issuance. However, the figure also confirms our observations from the fixed effects regression of SLL on ESG score. It suggests that the sustainability-linked borrowers already have good ESG profiles before loan issuance. Following both trends, they move quite similarly with some variation and a parallel increase in ESG score. We have fewer observations further from the issue year, which implies that the observations closest to time zero are the most trustworthy. The figure suggests that the common trend assumption holds, but the small sample size makes it difficult to say that it holds confidently.

5.3.3 Difference-in-Differences Estimation of SLL on ESG Scores

Learning that the common trend assumption holds, we perform a difference-in-differences estimation of SLL on ESG score. The purpose is to identify whether sustainability-linked borrowers have higher ESG scores following the loan issue than matched regular borrowers. In table 10, we present the results of the difference-in-differences estimation.

Table 10. Difference-in-Differences Estimation of SLL on ESG Scores

Notes: This table presents the results from diff-in-diff estimations of SLL on the ESG score. Treatment is a dummy taking the value of 1 if the borrower has SLL and 0 if not. Post-Issue is a dummy taking the value of 1 if the observation is after loan issuance and 0 if not. We include control variables for the borrower and contractual characteristics, log(assets), and log(loan). DiD is the interaction term that estimates the effect of the treatment. We control for country-, industry- and time-fixed effects. Standard errors are clustered by country and reported in parentheses. Variable definitions are included in Appendix A.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable:	ESG Score	ESG Score	ESG Score	ESG Score	ESG Score	ESG Score
DiD	-0.88	-0.01	-1.09	-0.12	0.13	-0.02
	(2.27)	(1.62)	(2.23)	(1.46)	(1.72)	(1.71)
Treatment	12.90***	9.28**	13.69***	8.39**	8.90**	8.86**
	(1.65)	(3.48)	(1.63)	(3.47)	(3.21)	(3.18)
Post-Treatment	5.37***	0.07	5.78***	4.54***	4.30**	0.07
	(1.74)	(1.59)	(1.71)	(1.14)	(1.65)	(1.46)
Log(Assets)			2.37***	4.38	3.76	3.80
			(0.66)	(4.15)	(4.35)	(4.33)
Log(Loan)			3.54***	1.82	2.94*	3.03*
			(1.04)	(1.50)	(1.57)	(1.52)
Constant	49.68***		6.89			
	(1.28)		(9.30)			
Borrower Country FE	N	Y	N	Y	Y	Y
Industry FE	N	Y	N	N	Y	Y
Issue Year FE	N	Y	N	N	N	Y
Observations	849	849	849	849	849	849
R^2	0.139	0.299	0.170	0.290	0.317	0.325
Adjusted R^2	0.137	0.263	0.165	0.266	0.286	0.289
Note:						**p<0.1; **p<0.05; ***p<0.01*

In table 10, the interaction term, DiD, expresses how much the average outcome of the treatment group changes in the post-treatment period compared to what would have happened to the same group had the treatment not been introduced. We find that SLL issuance has no positive impact on ex-post-borrower ESG performance. The results in table 10 show negative and insignificant DiD estimates across all model specifications, indicating a negative relationship between SLL issuances and borrower ESG performance, where ESG scores deteriorate after issuance. Since the results are insignificant, we fail to find evidence to suggest

that the ESG score changed more after loan issuance for sustainability-linked borrowers, and we cannot answer to the additionality principle.

The treatment dummy represents the average difference between the treatment group and the control group before treatment starts. The dummy is positive and significant across all model specifications. Consistent with the trend analysis and the fixed effects regression on ESG score, this finding implies that the companies that are about to issue sustainability-linked loans have a significantly higher ESG score than the control group. If we use the regression in column 6 with the highest R-squared, we read that sustainability-linked borrowers within the same industry and country issued in the same year is associated with a higher ESG score by 8.86 points. These pre-issuance level differences between the two groups seem to explain much of the difference in ESG performance. As the two groups are not matched on ESG scores, it seems likely that the selectivity from either lender or borrower causes differences in ESG scores. This finding aligns with the signaling argument, as borrowers with good ESG profiles want to signal their commitment through SLLs and therefore self-select into them. In an undocumented robustness test of regressions without US loans, we find that the treatment dummy is smaller throughout the model specifications implying that the magnitude of the coefficient is driven by US loans.

The post-treatment dummy represents how much the average outcome of the control group has changes during the post-treatment period, meaning the gains in ESG score that occur over time for the control group independent of the treatment. We find positive and significant coefficients across all models except for the models with time-fixed effects. Out of these regressions, regression 5 has the highest R-squared and suggests that for borrowers in the control group within the same industry, the average ESG scores increased by 4.30 points after loan issuance.

From the simple regression in column 1 to the regression in column 6, we include more control variables and fixed effects to reduce omitted variable bias and explore the robustness of the model. The results show small variations across the model specifications, indicating relatively robust results. The simple regression in column 1 has a low R-squared, indicating much unexplained variation in the model and that the bias in the SLL coefficient is severe. As we control for borrower country-fixed effects with all control variables in column 4, the R-squared increases from 0.170 to 0.290, reducing much unexplained variation. This may indicate that the coefficients are in part driven by omitted variables that vary within the borrower country.

When we add industry-fixed and time-fixed effects in columns 5 and 6, we obtain almost no increase in R-squared, which indicates that the coefficients are likely independent of omitted variables that vary over time and within industry.

5.4 The Effect of Explicit ESG Information in Loan Contracts

In this chapter, we analyze the sustainability-linked loan contracts in-depth to explore the impact of the explicit use of ESG information in loan contracts. Due to the relatively young sustainability-linked loan market, there is an absence of regulations for what to include and how detailed a contract for a sustainability-linked issue should be. We investigate if the contractual quality of explicit ESG information matters for ESG performance and examine the impact of sustainability-linked contractual KPIs.

5.4.1 Characteristics of Sustainability-Linked Loan Terms

To study whether or not there are differences within the sample of SLLs, we investigate the sample by sectioning the contracts into good and poor disclosure quality. This segmentation is the same that we use in the stock market analysis. Table 11 exhibits the distribution of good and poor disclosure companies and the characteristics of the two groups within the sample.

Table 11. Disclosure Quality of Sustainability-Linked Loan Terms

Notes: This table reports the disclosure quality of contractual loan terms in sustainability-linked loans. Good and bad disclosure segmentation is based on market information available in the segment and sustainability-linked KPI remark fields in Bloomberg Terminal, supplemented with manual search in corporate sustainability reports and media releases. For each group, we report the number of loan facilities, borrowers' total assets, credit score, and ex-ante ESG score. We also report the fraction of loans used for environmental KPIs, environmental and social KPIs, and third-party ESG ratings among the group of good disclosure companies. Variable definitions are included in Appendix A.

	Good disclosure	Poor disclosure	Difference (p-value)
# Facility	88	20	
Borrower attributes			
Total assets (€ billion)	111.78	47.46	0.06
Credit score	59.56	55.42	0.66
Ex ante ESG score	65.26	64.35	0.79
Disclosed contract features			
Environmental KPI	0.70	-	
E/S KPI	0.19	-	
Third party ESG rating	0.38	-	

Our analysis in table 11 suggests that we have an overweight of good disclosure companies. Between good and poor disclosure quality loans, we find no significant difference in the characteristics of borrowers. This indicates no implied difference regarding total assets, credit score, or ex-ante ESG score between good and poor disclosure companies. However, we find the distribution between good and poor disclosure quality contracts unlikely to reflect the reality of the sustainability-loan market today. We consider the overweight of good disclosure companies to be a consequence of the method we use to retrieve the data sample of sustainability-linked loans. We pull borrowers with more general data on different borrower and loan characteristics in our data retrieval. Thus, these companies will more likely have better disclosure quality on sustainability. Consequently, we have reason to believe that the sample would include more poor disclosure quality contracts if we retrieve all sustainability-linked issues from Bloomberg with less strict retrieval criteria.

In table 11 at disclosed contractual features, we observe that 70% of the sustainability-linked borrowers have an environmental KPI. This implies that in most borrowers' sustainability-linked contracts, there is an environmental KPI such as greenhouse gas emissions or renewable energy. 19% of the good disclosure companies have both an environmental and a social contractual KPI. A social sustainability-linked KPI can be related to gender equality measures such as the gender pay gap. 38% of the companies have a third-party ESG rating as a contractual KPI and sustainability performance measurement. In sum, we have no borrowers with governmental KPIs and few companies choosing only social KPIs. As most borrowers decide to improve on environmental measures, we question if their contractual KPIs correspond with the companies' most material issues.

To examine how correlated the scores of the different contractual KPIs are, we conduct a matrix to visualize the prevalence of overlapping KPIs. Here we define overlapping KPIs as contracts with more than one sustainability-linked KPI.

Table 12. Prevalence of Overlapping KPIs

Notes: This table presents a matrix of KPIs that overlap in contracts. Each number counts for how many contracts the combination of KPIs are included in. Variable definitions are included in Appendix A.

KPIs	Greenhouse Gas Emissions	Renewable Energy	Energy Efficiency	Transport	Water Consumption	Sustainable Sourcing	Circular Economy	Gender Equality	Labor	Education	3rd party ESG score
Greenhouse Gas Emissions	1	8	9	2	2	1	4	7	8	1	3
Renewable Energy	8	1	4	1	0	0	2	1	3	0	2
Energy Efficiency	9	4	1	2	1	0	1	0	3	1	3
Transport	2	1	2	1	0	0	1	0	0	0	0
Water Consumption	2	0	1	0	1	0	1	0	1	0	1
Sustainable Sourcing	1	0	0	0	0	1	0	0	0	0	0
Circular Economy	4	2	1	1	1	0	1	1	1	0	1
Gender Equality	7	1	0	0	0	0	1	1	1	0	1
Labor	8	3	3	0	1	0	1	1	1	0	0
Education	1	0	1	0	0	0	0	0	0	1	0
3rd party ESG score	3	2	3	0	1	0	2	1	0	0	1
Total	**46**	**22**	**25**	**7**	**7**	**2**	**14**	**12**	**18**	**3**	**12**

In table 12, we find a high prevalence of overlapping KPIs. Especially greenhouse gas emissions, renewable energy, and energy efficiency overlap with many other KPIs. These are observations that should be taken into consideration when interpreting the results from the following analyses.

5.4.2 Difference-in-Differences Estimation on Environmental and Social Scores

To investigate whether explicit ESG information in loan contracts contributes to ESG performance, we analyze whether sustainability-linked borrowers report more improvements on the pillars they have contractually bound KPIs linked to than borrowers without KPIs linked to the same in their contract. We present the results of difference-in-differences estimations of the environmental and social scores in table 13.

Table 13. Difference-in-Differences Estimation on Environmental and Social Scores

Notes: The table summarizes the results from four difference-in-difference estimations of environmental and social scores. Treatment is a dummy taking the value of 1 if the borrower has a KPI linked to the dependent variable and 0 if not. Post-Issue is a dummy taking the value of 1 if the observation is after loan issuance and 0 if not. DiD is the interaction term that estimates the effect of the treatment. Standard errors are clustered by country and reported in parentheses. Variable definitions are included in Appendix A.

Dependent Variable:	Environmental Score					Social Score				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
DiD	-2.05	-1.37	-0.71	0.37	0.40	-1.66	0.03	3.36	3.69	3.45
	(3.52)	(3.32)	(3.63)	(3.43)	(3.45)	(3.95)	(3.54)	(2.99)	(3.09)	(3.11)
Treatment	7.00***	6.93***	4.30	2.93	2.90	0.98	0.49	-5.40	-4.70	-4.70
	(2.53)	(2.37)	(5.19)	(4.40)	(4.42)	(2.84)	(2.56)	(4.61)	(4.25)	(4.30)
Post-Treatment	7.50***	6.39**	5.36	4.36	2.08	7.45***	6.46***	5.48***	4.96***	3.01
	(2.76)	(2.57)	(3.34)	(3.06)	(4.30)	(1.81)	(1.63)	(1.19)	(1.11)	(2.92)
Log(Assets)		8.27***	6.27**	2.77	2.78		7.74***	4.99	2.14	2.19
		(1.40)	(2.71)	(3.43)	(3.43)		(1.26)	(2.98)	(2.75)	(2.74)
Log(Loan)		-0.39	3.91	2.37	2.36		7.93***	9.99***	9.11*	9.05*
		(1.62)	(6.47)	(7.64)	(7.72)		(1.50)	(2.30)	(4.94)	(5.03)
Credit score		0.48***	0.78***	0.93**	0.94**		0.38***	0.46***	0.63**	0.63**
		(0.08)	(0.23)	(3.43)	(0.36)		(0.07)	(0.12)	(0.24)	(0.25)
Constant	64.14***	3.94				67.90***	-58.23***			
	(1.99)	(15.38)				(1.29)	(13.64)			
Borrower Country FE	N	N	Y	Y	Y	N	N	Y	Y	Y
Industry FE	N	N	N	Y	Y	N	N	N	Y	Y
Issue Year FE	N	N	N	N	Y	N	N	N	N	Y
Observations	488	453	453	453	453	488	453	453	453	453
R^2	0.049	0.222	0.520	0.602	0.604	0.04	0.264	0.551	0.631	0.637
Adjusted R^2	0.042	0.211	0.491	0.569	0.565	0.03	0.254	0.524	0.601	0.602
Note:										**p<0.1; **p<0.05; ***p<0.01*

In the regressions of the environmental pillar in table 13, we fail to find evidence to suggest that reported results on environmental scores change more after loan issuance for the borrowers with environmental contractually bound KPIs than the borrowers without. We find that treatment and post-treatment dummies are positive and significant for the models without fixed effects at 1%. The treatment dummy indicates that the companies that are about to issue sustainability-linked loans with environmental KPIs have higher environmental scores than those with other KPIs. The post-treatment dummy indicates that the average environmental scores increase by 6.39 points after loan issuance for borrowers in the control group. Since the results are insignificant in the more specified models with higher R-squared, we cannot presume that the results are robust. With low R-squared, other factors could affect the difference in trends between the two groups. Hence, we consider the estimation to be biased.

The results on social scores also indicate that we fail to find evidence to suggest that reported effects on social scores changed more after loan issuance for the borrowers with social contractually bound KPIs than the borrowers without. However, the interaction term is

positive for the regressions with control variables, suggesting that the treatment group has a positive development in social score in the post-treatment period. The post-treatment dummy is significant at 1%. This finding indicates that borrowers in the control group within the same country and industry experience an increase in the social score by 4.96 points after loan issuance. The treatment dummy is insignificant and negative across model specifications.

For the complete sample of sustainability-linked borrowers, we cannot confirm that specific ESG information in loan contracts contributes to ESG performance. We do not find more improvements on the pillars they have contractually bound KPIs linked to than borrowers without KPIs linked to the same in their contracts.

5.4.3 Difference-in-Differences Estimation on Contractual KPIs

To go into further detail of whether or not explicit ESG information in loan contracts contributes to ESG performance, we analyze if sustainability-linked borrowers report more improvements on their contractually bound KPIs than borrowers without this KPI in their contract. In this way, we can analyze if specific KPIs drive the inconclusive results on ESG score and the environmental and social pillar and if specific KPIs yield improvements in ESG performance. We present the results of our difference-in-differences estimation on four contractual KPIs from our sample of sustainability-linked loans in table 14.

Table 14. Difference-in-Differences Estimation on Sustainability-Linked KPIs

Notes: The table summarizes the results from eight difference-in-difference estimations of contractual KPIs. We have estimated DiD on third-party ESG score (3ESG), greenhouse gas emissions, gender pay gap, and renewable energy. Treatment is a dummy taking the value of 1 if the borrower has the dependent variable as a KPI and 0 if not. Post-Issue is a dummy taking the value of 1 if the observation is after loan issuance and 0 if not. DiD is the interaction term that estimates the effect of the treatment. Standard errors are clustered by country and reported in parentheses. Variable definitions are included in Appendix A.

	3ESG		Log(GHG)		Gender Pay Gap		Log(Renewable Energy)	
Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DiD	2.38	2.38	-0.19	-0.07*	-39.44**	-58.55**	0.58	-0.10
	(4.45)	(3.87)	(0.18)	(0.03)	(16.84)	(25.02)	(0.42)	(0.32)
Treatment	-1.98	-1.04	0.73***	0.22	54.80***	6.82	-0.92***	0.52
	(2.23)	(4.35)	(0.13)	(0.13)	(12.12)	(0.00)	(0.33)	(0.37)
Post-Treatment	2.73*	2.80	-0.02	0.12	13.54**	-0.76	-0.10	0.35*
	(1.61)	(2.60)	(0.13)	(0.09)	(6.10)	(0.00)	(0.20)	(0.18)
Log(Assets)	-1.44	-7.06***	0.51***	0.58***	-9.85	-82.16	0.35**	0.05
	(1.17)	(2.23)	(0.08)	(0.16)	(7.65)	(0.00)	(0.16)	(0.18)
Log(Loan)	2.30	3.98	0.20**	0.35	-28.62***	0.18	-0.33*	0.49
	(1.42)	(2.69)	(0.09)	(0.22)	(5.22)	(0.02)	(0.17)	(0.44)
Credit score	0.38***	0.78**	-0.01***	-0.02***	-2.06***	3.88	0.03***	0.02
	(0.07)	(0.29)	(0.01)	(0.00)	(0.34)	(0.00)	(0.01)	(0.01)
Constant	28.11**		2.40***		483.43***		5.92***	
	(13.01)		(0.83)		(53.56)		(1.64)	
Borrower Country FE	N	Y	N	Y	N	Y	N	Y
Industry FE	N	Y	N	Y	N	Y	N	Y
Issue Year FE	N	Y	N	Y	N	Y	N	Y
Observations	460	460	438	438	49	49	257	257
R^2	0.291	0.343	0.216	0.838	0.702	0.996	0.116	0.827
Adjusted R^2	0.232	0.402	0.205	0.821	0.660	0.997	0.095	0.796
Note:							**p<0.1; **p<0.05; ***p<0.01*	

In table 14, regressions one and two report ESG scores for borrowers with third-party ESG scores as a contractually bound KPI. The interaction term and the treatment dummy are insignificant and positive for both models. Hence, we fail to find evidence to suggest that reported results on ESG scores changed more after loan issuance for the borrowers with the third-party ESG score as a contractually bound KPI. The treatment dummy is negative and insignificant, indicating that the treatment group about to issue sustainability-linked loans might have a slightly lower ESG score than the control group. The post-treatment dummy is significant at the 10% level in regression 1, which implies that the average ESG scores increased by 2.73 points after loan issuance for borrowers in the control group.

Regressions 3 and 4 report estimations on greenhouse gas emissions for borrowers with GHG emissions as a contractually bound KPI. The interaction term is negative and significant at 10% in regression 4, suggesting that borrowers with a GHG emission KPI within the same country and industry who issued loans in the same year reduce their emissions more after loan

issuance than the control group. The treatment dummy in regression 3 indicates that the borrowers with GHG KPIs had larger emissions than the control group before the loan issuance. The post-treatment dummy is insignificant across both regressions.

For the borrowers with a gender pay gap KPI, we observe large coefficients and standard errors, which imply biased results. These are likely caused by the limited sample of observations which we consider too small to allow the results to be interpreted empirically. The interaction term for borrowers with renewable energy as a KPI is insignificant. The treatment dummy in regression 3 indicates that the borrowers with renewable energy KPIs used less renewable energy than the control group before the loan issuance. The post-treatment dummy suggests that borrowers of the control group within the same country and industry that issued loans in the same year and had renewable energy as a contractually bound KPI used 35% more renewable energy in the post-treatment period.

As we did not match on credit score, we observe that credit score as a control variable is significant and positive across all model specifications. Including this as a control variable allows us to separate this additional effect on the outcome, which is not due to SLLs. Including these controls should not affect the coefficient on the interaction term since all pre-determined characteristics should be statistically independent of the assignment. Indeed, for greenhouse gas emissions- KPI and third-party ESG score KPI, the interaction term coefficients are similar to each other with and without control variables. However, this is not the case for the two dependent variables with significantly fewer observations, gender pay gap, and renewable energy.

6. Conclusion

This paper thoroughly analyzes the sustainability-linked lending market, which has proliferated in recent years. We attempt to gain inference about the effect of explicit ESG information in sustainability-linked loan contracts and what incentivizes a borrower to enter SLL contracts. We more specifically ask if sustainability-linked lending provides an additional impact in terms of ESG performance, if the explicit information on contractual KPIs has an impact and why borrowers are entering SLLs. As sustainability-linked loans separate from green loans by being general use-of-proceed loans, most of the loans are revolving credit facilities. We show that sustainability-linked loans are widespread across industries and countries and are specifically most common in Europe and the US. Our data foundation reveals that sustainability-linked financing is at an early stage. Hence, we are working with a limited number of observations, which should be taken into consideration when interpreting the results.

We find a positive stock market response to announcements of sustainability-linked loan issuances by performing an event study of shareholders' reactions. Since previous literature suggests that the market is unresponsive to debt issuances, the positive result is likely to reflect the company's environmental commitment signal. We find that the stock market reaction is large and significant for borrowers with environmental and social KPIs in loan contracts and small and insignificant for borrowers with 3rd party ESG rating KPIs. Concrete and quantifiable KPIs, such as environmental and social KPIs, may seem like a more credible signal of a firm's commitment to sustainability. Borrowers with 3rd party ESG rating KPIs can choose to improve on low-hanging fruit or continue with improvements that are already processing. Hence, the strong stock market response aligns with the signaling argument as better information provided to the public reaps better stock performance. We observe a slightly larger positive response to good disclosure quality contracts, which may highlight some stock market vigilance toward potential greenwashing actions. These findings suggest that SLLs have the potential to become a credible and effective financing tool.

By examining the coupon rate at issuance, we find that sustainability-linked loans are seemingly issued at a significantly higher rate than the control group. Hence, it seems unlikely that borrowers enter SLLs based on the cost of capital argument. However, sustainability-linked borrowers can still obtain discounts via rate adjustments if they reach their contractual SPTs on KPIs over time. If borrowers achieve the discounts eventually, this could still be a

sufficient incentive. However, as SLLs are more expensive than traditional loans around the announcement date, the cost of capital argument is unlikely to drive the observed stock market reaction. As borrowers enter sustainability-linked loans in spite of cost, we suspect that sustainability-oriented borrowers are willing to trade off financial returns for societal benefits. This may also explain the incentives of entering SLLs if upcoming coupon rate adjustments are not substantial to discount the higher coupon rate at issuance for SLLs.

The trend analysis portrays similar positive trends in ESG scores for borrowers of both SLLs and traditional loans, but that sustainability-linked borrowers have significantly higher ESG scores at issuance. We find that sustainability-linked loans positively impact a company's ESG score and that it is more likely for borrowers with superior ESG profiles ex-ante to self-select into sustainability-linked loan contracts. These observations align with the signaling rationale, as it may imply that borrowers with good ESG profiles enter SLLs to signal their commitment. Therefore, good sustainability performance may explain the positive stock market reaction to sustainability-linked loan issuances. However, we cannot determine that companies with explicit ESG information in their loan contracts experience more development in ESG scores from loan issuance than borrowers with non-SLLs. Therefore, we cannot claim that the issuance of sustainability-linked loans aligns with greenwashing.

Regarding sustainability-linked KPIs, we cannot determine that explicit ESG information in loan contracts contributes additionally to sustainability performance compared to the ESG development in the control group. However, the selection of KPIs in sustainability-linked contracts seems to be based on sustainable areas where the borrowers are poor performers and should improve. For greenhouse gas emissions, the most prevalent KPI in our sample, we find that the sustainability-linked borrowers within the same country and industry who issue loans in the same year seem to reduce emissions more than the control group after the loan issue. For the other KPIs, we fail to find evidence to suggest that reported results on KPIs changed more after loan issuance for the borrowers with the specific KPIs contractually bound. As GHG emissions are a standardized measure following the greenhouse gas protocol, the significant effect on GHG emissions may imply that standardized and quantifiable KPIs like GHG emissions are the most likely to affect the borrowers' performance on the matter. If these results are representative, then the lack of regulations for disclosure, standardization, and specification in sustainability-linked contracts may cause inconsistent and insignificant results for the other KPIs.

We note that most loans have maturities longer than the post-issue observation period, which may imply that we need observations over a more extended period of time to observe the specific KPI- and ESG score results. This opens for further future analyses when the sustainability-linked loan market is more mature and more data is available. There is, unfortunately, a major limitation to our findings, as there are significant differences in credit rating between the sustainability-linked borrowers and the control group. Consequently, this shortcoming may cause less reliable findings with inconsistent and biased estimates, which should be taken into consideration when interpreting the results.

Finally, our paper contributes to the literature on a constantly developing loan market where stakeholder views are increasingly considered. Our findings call for future research as the data basis is rapidly increasing, and more observations over an extended period can provide the basis for analyzing long-term effects. In the future, we look forward to reading studies examining the rate adjustments for SPTs on KPIs and the prevalence of borrowers reaching these quantified targets. We would also like to obtain a better understanding of the lenders' incentives to offer sustainability-linked loans.

References

Albuquerque, R., Koskinen, Y., Yang, S,. & Zhang. (2020). Resiliency of Environmental and Social Stocks: An Analysis of the Exogenous COVID-19 Market Crash. *The Review of Corporate Finance Studies 9 (3),* 593-621. https://doi.org/10.1093/rcfs/cfaa011

Amiram, D., Gavious, I., Jin, C., & Li, X. (2021). The Economic Consequences of Firms' Commitment to ESG policies. *HKUST Business School Research Paper 2021(29).* https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3838462

Asia Pacific Loan Market Association, Loan Market Association & Loan Syndications & Trading Association. (2022). *Sustainability Linked Loan Principles* [Brochure]. https://www.lsta.org/content/sustainability-linked-loan-principles-sllp/

Bloomberg Media Studios. (n.d.a). *Incentivizing Change with Sustainability-Linked Loans.* Bloomberg. https://sponsored.bloomberg.com/article/scb/incentivizing-change-with-sustainability-linked-loans

Bloomberg Professional Services. (n.d.b). *Bloomberg Terminal.* Bloomberg. https://www.bloomberg.com/professional/solution/bloomberg-terminal/

Brown, S. J., & Warner, J. B. (1985). Using Daily Stock Returns: The case of event studies. *Journal of Financial Economics 14(1),* 3-31. https://doi.org/10.1016/0304-405X(85)90042-X

Chava, S. (2014). *Environmental externalities and cost of capital. Management Science, 60(9),* 2223– 2247. https://doi.org/10.1287/mnsc.2013.1863

De la Orden, R. & de Calonje, I. (2022). *Sustainability-Linked Finance – Mobilizing Capital for Sustainability in Emerging Markets.* [Brochure]. International Finance Corporation. https://www.ifc.org/wps/wcm/connect/306c321d-ea77-448d-85c6-7ce3899136a5/EMCompass_Note+110_Sustainability-Linked+Finance_web.pdf?MOD=AJPERES&CVID=nVKABZX

Flammer, C. (2012). Corporate social responsibility and shareholder reaction: The environmental awareness of investors. *Academy of Management Journal*, *56*(3), 758-781. https://doi.org/10.5465/amj.2011.0744

Flammer, C. (2021). Corporate green bonds. *Journal of Financial Economics*, *142*(2), 499-516. https://doi.org/10.1016/j.jfineco.2021.01.010

Friedman, H. L., & Heinle, M. S. (2015). Taste, information, and asset prices: Implications for the valuation of CSR. *Review of Accounting Studies*, *21*(3), 740-767. http://dx.doi.org/10.2139/ssrn.2635057

Goss, A. & Roberts, G. S. (2011). The impact of corporate social responsibility on the cost of bank loans. *Journal of Banking & Finance, 35(7),* 1794-1810. https://doi.org/10.1016/j.jbankfin.2010.12.002

Greenhouse Gas Protocol. (n.d). *What is GHG Protocol?* https://ghgprotocol.org/about-us

Greifer, N. (2022, May 18). *Matching methods*. https://cran.r-project.org/web/packages/MatchIt/vignettes/matching-methods.html#nearest-neighbor-matching-method-nearest

Hasan, I., Hoi, C. K., Wu, Q., & Zhang, H. (2017). Social Capital and Debt Contracting: Evidence from Bank Loans and Public Bonds. *Journal of Financial & Quantitative Analysis, 52(3),* 1017-1047. https://doi.org/10.1017/S0022109017000205

Houston, J. F., & Shan, H. (2022). Corporate ESG Profiles and Banking Relationships. *The Review of Financial Studies, 35(7),* 3373-3417. https://doi.org/10.1093/rfs/hhab125

Kim, E. S. & Thoemmes, F. J., (2011). A Systematic Review of Propensity Score Methods in the Social Sciences. *Multivariate Behavioral Research 46(1),* 90-118. https://doi.org/10.1080/00273171.2011.540475

Kim, S., Kumar, N., Lee, J., & Oh, J. (2022). ESG Lending. *Social Science Research Network, 2022(817).* https://papers.ssrn.com/sol3/Papers.cfm?abstract_id=3865147

Krueger, P., Sautner Z., & Starks L. T. (2020). The importance of climate risks for institutional investors. *The Review of Financial Studies 33(3)*, 1067–1111. https://doi.org/10.1093/rfs/hhz137

Lyon, T. P., & Montgomery, A. W. (2015). The means and end of greenwash. *Organization & Environment*, *28*(2), 223-249. https://doi.org/10.1177/10860266155753

MacKinlay, C. (1997). Event Studies in Economics and Finance. *Journal of Economic Literature 35(1)*, 13-39. https://www.jstor.org/stable/2729691

Maskara, P. K., & Mullineaux, D. J. (2011). Information asymmetry and self-selection bias in bank loan announcement studies. *Journal of Financial Economics*, *101*(3), 684-694. https://doi.org/10.1016/j.jfineco.2011.03.019

Milligan, D. (2022, September). *The Rise of Sustainability-Linked Loans.* Norton Rose Fulbright. https://www.nortonrosefulbright.com/en-nl/knowledge/publications/3ff84c08/the-rise-of-sustainability-linked-loans

Ministry of the Environment Government of Japan (n.d.). *What Are Sustainability-Linked Loans?* Green Finance Portal. https://greenfinanceportal.env.go.jp/en/loan/sll_overview/about.html

Peterdy, K. (2022, October). *Greenwashing.* Corporate Finance Institute. https://corporatefinanceinstitute.com/resources/esg/greenwashing/

Refinitiv (n.d.). *Refinitiv Eikon.* Retrieved 28.10.2022 from: https://www.refinitiv.com/en/products/eikon-trading-software

Refinitiv Eikon (n.d.) *Refinitiv ESG Scores.* [Brochure]. https://www.refinitiv.com/content/dam/marketing/en_us/documents/fact-sheets/esg-scores-fact-sheet.pdf

Refinitiv Eikon (2021). *ESG Data in Eikon.* [Brochure]. https://www.refinitiv.com/content/dam/marketing/en_us/documents/quick-reference-guides/esg-data-in-eikon-march-2021.pdf

Riley, J. G. (1979). Informational equilibrium. *Econometrica: Journal of the Econometric Society 47(2)*, 331-359. https://doi.org/10.2307/1914187

Schoenmarker, D., & Schramade, W. (2018). *Principles of Sustainable Finance.* Oxford University Press.

Stock, J. H., & Watson, W. W. (2019). *Introduction to Econometrics* (4th edition). Pearson Education Limited.

Sustainalytics. (2022). *Sustainable Finance Solutions.* [Brochure]. https://connect.sustainalytics.com/hubfs/SCS/Banking/Brochures/2022/Sustainalytics%20-%20Sustainability%20Linked%20Loans%20Brochure.pdf

United Nations. (n.d.a). *17 Goals to Transform Our World.* https://www.un.org/en/climatechange/17-goals-to-transform-our-world

United Nations. (n.d.b). *The Paris Agreement.* https://www.un.org/en/climatechange/paris-agreement

Verbeek, M. (2021). *Panel Methods for Finance.* De Gruyter. https://doi.org/10.1515/9783110660739-003

Appendix

A. Variable Definitions

Variable	Definition	Data Source
Log(Assets)	The natural logarithm of the total assets book value in € billion.	Bloomberg
Log(Loan)	Log loan is the natural logarithm of the companies' loan size in in €.	Bloomberg
Log(Market Cap)	The natural logarithm of a company's market capitalization, the market value of the company's outstanding shares in €.	Bloomberg
Credit rating	Credit rating is a numerical conversion of the S&P issuer rating and Moody's long-term rating measured on a scale from 1-100.	Bloomberg
GHG Emissions	The borrower's total CO2 equivalent emissions in tons.	Refinitiv Eikon
Log(GHG)	The natural logarithm of a company's greenhouse gas emissions.	Refinitiv Eikon
Third-party ESG rating / 3ESG	Refinitiv Eikon combined ESG score measured on a scale from 1-100.	Refinitiv Eikon
Gender Pay Gap	A percentage representing female earnings relative to its male equivalents.	Bloomberg
Renewable Energy	The total produced and purchased primary renewable energy in gigajoules.	Refinitiv Eikon
Log(Renewable Energy)	The natural logarithm on a company's total renewable energy.	Refinitiv Eikon
SLL	A dummy variable with a value of one if the loan is sustainability-linked and zero otherwise.	Bloomberg
ESG	Refinitiv Eikon combined ESG score measured on a scale from 1-100.	Bloomberg
Environmental Score	A score that measures the company's environmental performance from 1-100.	Refinitiv Eikon
Social Score	A score that measures the company's social performance from 1-100.	Refinitv Eikon
CPN	CPN is the annual interest rate for loan facility.	Bloomberg
CAR	Cumulative abnormal return for a time window around the announcement of sustainability-linked loan issues.	Refinitiv Eikon

Term Loan	A dummy taking the value of 1 if the loan is a term loan and 0 if it's not.	Bloomberg
Revolving Loan	A dummy taking the value of 1 if the loan is a revolving loan and 0 if it's not.	Bloomberg
Other Loan	A dummy taking the value of 1 if the loan is not a term- or revolving loan and 0 if it is a term- or revolving loan.	Bloomberg
Maturity 3-6	A dummy taking the value of 1 if maturity is between 3-6 years and 0 if not.	Bloomberg
Maturity > 6	A dummy taking the value of 1 if maturity is longer than six years and 0 if not.	Bloomberg
Publicly Announced	A dummy taking the value of 1 if the loan is publicly announced and 0 if not.	Bloomberg
Secured	A dummy takes the value of 1 if the loan is secured and 0 if not.	Bloomberg
Post-Issue	A dummy taking the value of 1 if the observation is after loan issuance and 0 if not.	Bloomberg
Treatment	A dummy taking the value of 1 if the borrower has SLL/specific KPI and 0 if not.	Bloomberg
DiD	The interaction term that estimates the effect of the treatment.	Bloomberg

B. Country Distribution of Growth in SLLs

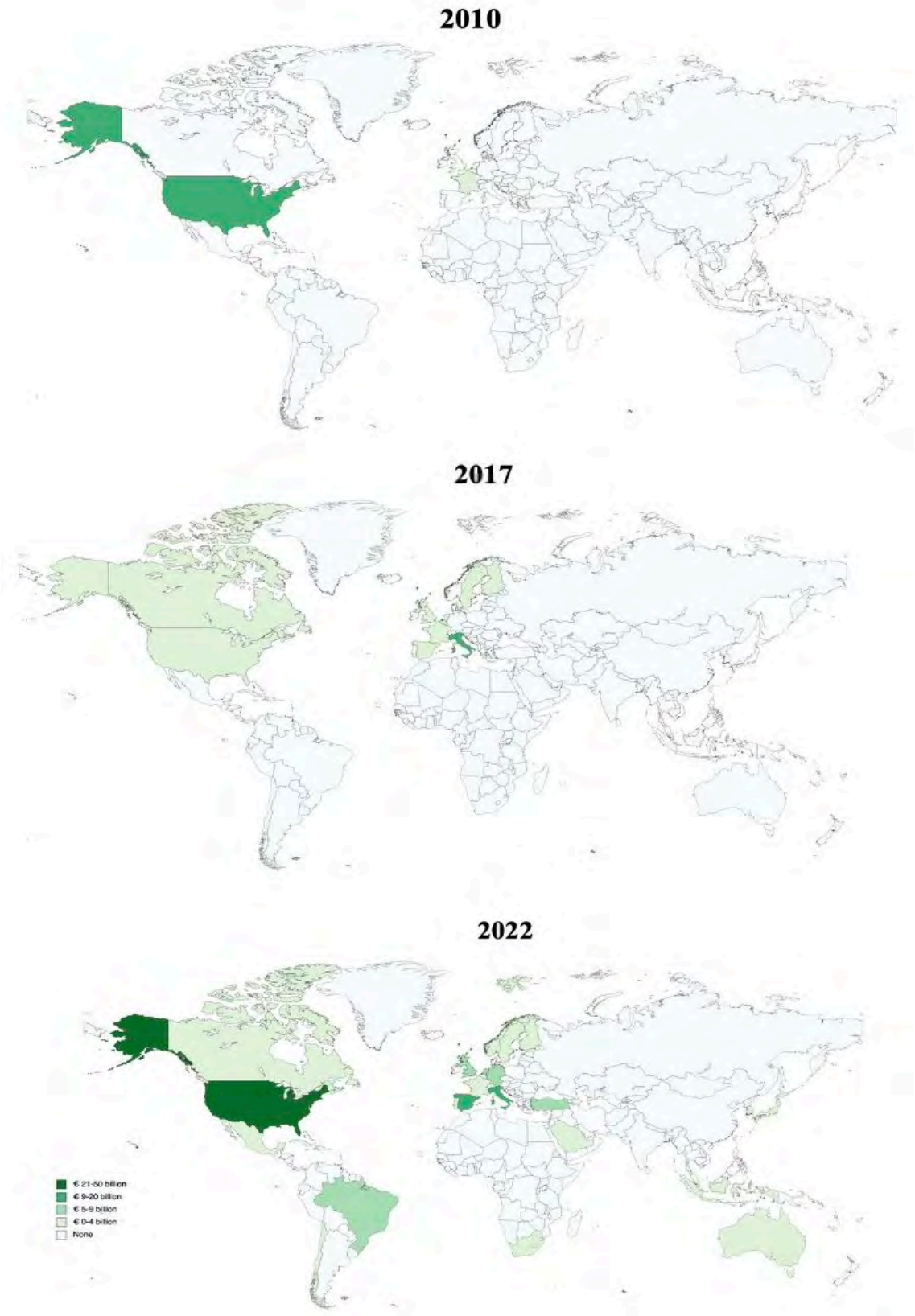

Figure 5. Global Evolution of Sustainability-Linked Loans Issue Size from 2010 to 2022