Finance Research Letters 63 (2024) 105261

Contents lists available at ScienceDirect

Finance Research Letters

journal homepage: www.elsevier.com/locate/frl

Signaling sustainability: Differential reaction of the stock market following the announcement of sustainability-linked bonds☆

Beat Affolter [a], Elisa Ciarla [a], Julia Meyer [a,b,*], Sugandhita Sugandhita [a]

[a] ZHAW (Institute for Financial Management), Switzerland
[b] University of Zurich (Department of Banking and Finance), Switzerland

ARTICLE INFO

JEL classification:
G20
G32
Q51
Q56

Keywords:
Sustainable finance
Sustainability-linked bonds
Climate targets
Event study

ABSTRACT

This paper explores the suitability of sustainability-linked bonds (SLBs) for signaling sustainability intentions by analyzing the market reaction following their announcement and issuance. We find no significant share price reaction for SLBs targeting greenhouse gas emission reduction objectives. The lack of significant market reaction also applies to SLB-independent emission-reduction announcements. In contrast, for other types of SLB goals, such as those linked to sustainability ratings, renewable energy, or energy efficiency, we observe a significant positive market reaction. We argue that climate transition activities of companies are already priced by the market, while other sustainability goals are positively received.

1. Introduction

Motivated by the international sustainability agenda and the growing pressure from society, clients, and financing parties, companies are increasingly eager to make their own contributions to sustainability. They achieve this by investing in green or social projects, developing new products, adapting their business models, and aligning their production and logistics processes more closely with environmental, social, and governance (ESG) factors or the UN Sustainable Development Goals (SDGs). To accompany or finance the transition towards sustainability, various sustainability-related financing instruments have been established on both the bank and bond markets.

Sustainability-linked bonds (SLBs), as one example of such instruments, have experienced significant growth since their first issuance in 2018 and are emerging as an important sustainable financing instrument (Climate Bonds Initiative, 2022). According to the SLB Principles of the International Capital Market Association (ICMA), SLBs are bonds in which financial and/or structural characteristics vary depending on the achievement of predefined sustainability targets (ICMA, 2023). These targets or key performance indicators (KPIs) can include improvements to the overall ESG profile (ESG rating) or the enhancement of individual ESG metrics, such as reducing greenhouse gas emissions or increasing the proportion of women in the company. The target to be achieved and the target achievement horizon must be defined for each KPI. In practice, it is usually the interest coupon that varies depending on target achievement (ICMA, 2023). In most cases, the interest rate increases by a certain number of basis points (coupon step-up) if the sustainability performance target is not achieved within the defined time horizon.

☆ Julia Meyer acknowledges funding from Schwyzer-Winiker Stiftung. The authors declare that they have no relevant or material financial interests that relate to the research described in this paper.

* Corresponding author at: ZHAW (Institute for Financial Management), Switzerland.
E-mail address: julia.meyer@zhaw.ch (J. Meyer).

https://doi.org/10.1016/j.frl.2024.105261
Received 9 January 2024; Received in revised form 18 March 2024; Accepted 19 March 2024
Available online 22 March 2024
1544-6123/© 2024 The Author(s). Published by Elsevier Inc. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/).

The increasing relevance and the clear differentiation from other sustainable bond instruments constitute the motivation and the need to analyze this relatively new product in more detail. In comparison with green, social and sustainable bonds, SLBs are specific in that they are forward-looking and performance-based (Climate Bonds Initiative, 2022). SLBs therefore provide a clear financial and reputational commitment to achieve specified sustainability improvements. This suggests that the market views the issuance of an SLB as a credible signal of the issuer's sustainability commitments. This is particularly significant because signaling sustainability, along with other motives such as favorable pricing or greenwashing, can be one of the main reasons for companies to choose sustainability-related debt instruments over traditional ones (Koelbel and Lambillon, 2023; Flammer, 2021).

This paper investigates the effectiveness of SLBs in signaling sustainability intentions to the stock market by conducting event studies around the announcement and issuance of these bonds. We further test the significance of the market reaction based on different sustainability indicators at the issuer level, such as ESG and SDG ratings, CO_2 emissions, commitment towards net-zero, as well as relative to the predefined KPIs of the SLB.

According to Bloomberg, 430 SLBs were issued worldwide between 2018 and 2022. Due to the availability of stock price data, a total of 273 SLBs from 196 different issuers could be included in our analysis. The results of our event study indicate that neither the announcement nor the actual issuance of the investigated SLBs resulted in a significant share price reaction. The cumulative abnormal return (CAR) aggregated for the sample shows no significant deviation from zero across various event time windows. We next examine the significance of the relationship between abnormal returns (CAR) and bond and company characteristics. We also find no significant market reactions when assessing abnormal returns based on subsamples reflecting issuers' sustainability profiles (ESG and SDG ratings), verified net-zero ambition, or carbon emission intensity.

Interestingly, we observe significantly positive abnormal returns for companies incorporating key performance indicators beyond greenhouse gas emissions in their sustainability-linked bond framework. This finding suggests that markets have already priced in emission reduction related goals, while other sustainability targets are positively received.

Our study contributes to two major streams of the literature. The first stream explores whether corporate sustainability significantly influences financial markets. Different studies present evidence for sustainable behavior to create value for shareholders (Flammer, 2021; Krueger, 2015; Flammer, 2013). Analogous to the general information asymmetry problem between company insiders and shareholders (Akerlof, 1970), investors cannot be sure whether communicated sustainability characteristics of companies are credible or not. Companies can reduce this information asymmetry by engaging in costly signals, that make the information credible. Such signals come with less marginal costs for better (in this case more sustainable) companies than for the others (Riley, 1979a,b). Moreover, the higher the costs or sanctions in the event of misinformation, the higher the credibility (Spence, 1973; Riley, 1979a). Credible signals consequently represent investments for companies that are only made if they are considered profitable (Spence, 1973). We contribute to this discussion by studying market reactions following the announcement and issuance of SLBs. These instruments have the potential to serve as a costly signal regarding the sustainability commitments of the companies, given their characteristics such as potential penalties, reputation risks, and higher issuance costs. However, our results indicate that the signaling mechanism does not seem to hold for certain types of sustainability goals, specifically those related to emission reduction.

The second stream focuses on the specifics of SLBs. Koelbel and Lambillon (2023) provide a comprehensive overview of the SLB market to date, it primarily addresses the question of who — whether investors or issuers — bears the cost of sustainability improvements in the case of SLBs. The authors identify statistically significant yield differences at the time of issuance. In 65% of the cases examined, it is the investors who pay for the sustainability improvements. The paper concludes that the motivation for issuing SLBs depends on the sustainability premium: if the pricing of the SLB includes a premium, the main motivation is the more favorable cost of capital. If, on the other hand, the SLB does not include a premium, it is the issuers themselves who bear the cost of sustainability improvement. In this second case, the condition of costly information in the context of signaling theory is fulfilled, and issuers could be motivated by potential signaling effects (Koelbel and Lambillon, 2023). While Koelbel and Lambillon (2023) discuss and analyze the cost of capital and signaling motivation they do not empirically test the stock price reaction. In addition, it is important not to disregard the motivational impact of the signaling effect on SLB issuances, even when a sustainability premium is present. The issuance of SLBs entails additional process costs and reputation risks for issuers that might outweigh the improvement in cost of capital.

Berrada et al. (2023) also attempt to shed light on the price and incentive structure of SLBs. They set up a theoretical model that takes into account, among other things, the credibility of the sustainability intention from the investors' perspective, the sustainability efforts of the management and the private investor benefit resulting from an improvement in sustainability. With this model, they show that SLBs are "incentive-compatible" (i.e. management is motivated to devote resources to achieving the target) if the total coupon penalty is higher than the costs associated with the sustainability improvement. Since the theoretical model is not directly suitable for testing hypotheses, the authors introduce a model-free, practically applicable indicator for measuring "mispricing". Based on this metric, they analyze a total of over 180 SLBs and find that "overpricing" leads to a price adjustment in the secondary market and to a significantly positive stock price reaction.

In contributing to this second stream of literature, we emphasize the sustainability-related characteristics of both companies and SLBs and utilize the event study methodology on a larger sample. Our results reveal heterogeneity among different sustainability goals, showing that markets do not react to the announcement of emission-reduction targets but positively receive other goals.

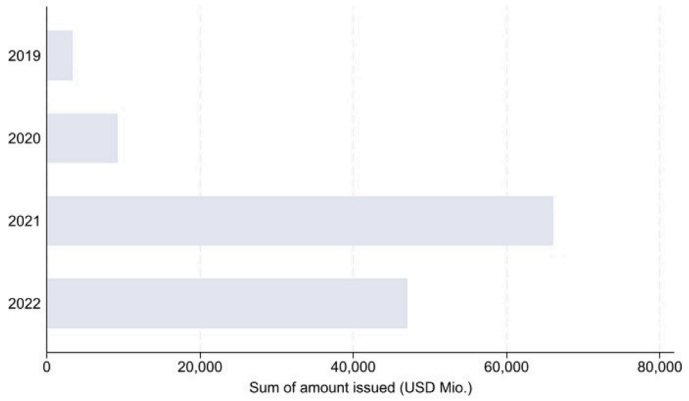

Fig. 1. Issued amounts of SLBs.

2. Data

The database of the information service providers Bloomberg and Refinitiv were used for this study. According to Bloomberg, the first sustainability-linked bond was issued in 2018 by the Chinese rail transport company Beijing Infrastructure Investment Corporation Limited. Our sample constitutes of 273 distinct SLBs issued by 196 companies. This sample is constructed after extraction of "Sustainability-linked" labeled bonds from the Bloomberg's fixed income database with issuance period between 2018 and 2022. The corresponding company and share return data was obtained via Refinitiv. The data was allocated using the international securities identification number (ISIN) of the SLBs.

SLBs could only be considered if stock price data was available for their issuers in the relevant period. Bonds are often issued by unlisted special purpose entities. If share return data was missing, it was therefore checked whether it was available for the direct or ultimate parent company instead. If this was the case, the corresponding SLBs were included in the sample. The total amount issued by the sample is summarized in Fig. 1.

We furthermore collect yearly ESG ratings, total carbon emissions, market valuation, and institutional ownership shares from Refinitiv. SDG scores were obtained from Robeco SAM and commitments towards net-zero were collected from the website of the science-based targets initiative (SBTi)[1].

3. Methodology

To estimate each firm's alpha and betas, we run regressions based on daily price returns (in USD) in excess of (1) the market return (proxied by the MSCI ACWI respectively MSCI World Index) and (2) the 5 Fama–French risk factors (Fama and French, 2015) for 200 business days. The estimation window ends 20 trading days before the respective event dates (announcement, respectively issuance of the SLBs). To ensure the predictive power of our estimates, we compute abnormal returns only for stocks with at least 150 daily observations in the estimation period. We compute market, respectively Fama French-adjusted abnormal returns as the daily excess return on the stock minus the stock's alpha minus beta times the factor(s) (see Eq. (1)). We define different event windows around the respective event days.

For each company i and each day t in the event window, we calculate the daily abnormal return $AR_{i,t}$ as the difference of the actual return of the company $R_{i,t}$ and its expected return that we estimate in regressions with the market and Fama–French risk factor model, respectively. Daily abnormal returns are thus defined by

$$AR_{i,t} = R_{i,t} - \alpha_i - \sum_{n=1}^{N} \beta_{n,i}\text{Factor}_{n,t} \ . \tag{1}$$

We accumulate abnormal returns $CAR_i[\theta_0, \theta_1]$ for a given period $[\theta_0, \theta_1]$ as the sum of the company-specific abnormal returns estimated above, that is

$$CAR_i[\theta_0, \theta_1] = \sum_{t=\theta_0}^{\theta_1} AR_{i,t} \ . \tag{2}$$

[1] https://sciencebasedtargets.org/

Table 1
Summary statistics at the issuer level.

	Item	SLB issuer	MSCI ACWI constituents	Difference
ESG Rating	Mean	63.85	58.41	5.44***
	St.err.	(0.91)	(0.19)	
	N.	259		
SDG Rating	Mean	1.37	−0.52	1.89***
	St.err.	(0.25)	(0.04)	
	N.	212		
Institutional Ownership	Mean	54.28	46.19	8.09***
	St.err.	(1.45)	(0.31)	
	N.	273		
ln_Marketcap	Mean	22.75	23.50	−0.74***
	St.err.	(0.09)	(0.01)	
	N.	273		
Emission_Intensity	Mean	.0075	.0003	0.007***
	St.err.	(0.007)	(0.000)	
	N.	234		

This table provides summary statistics for SLB issuers in the year of the issuance in comparison to the mean values of the constituents of the MSCI ACWI index. Column 3 provides the difference in means, *, **, and *** denote significance at the 10%, 5%, and 1% level based on robust standard errors.

Table 2
Stock market reaction to the announcement of SLB issuance.

	Market model		5 Factors model	
$CAR[-5, 10]$	0.010*	0.007	0.840	0.552
	(1.82)	(1.35)	(1.40)	(1.06)
$CAR[-20, -6]$	0.007	0.005	0.486	0.284
	(1.20)	(0.93)	(0.84)	(0.57)
$CAR[0, 30]$	−0.002	−0.003	−0.792	−0.727
	(−0.19)	(−0.38)	(−0.93)	(−1.00)
$CAR[11, 20]$	−0.005	−0.004	−0.659	−0.564
	(−1.10)	(−1.04)	(−1.56)	(−1.54
$CAR[21, 60]$	0.000	−0.003	−0.149	−0.606
	(0.02)	(−0.38)	(−0.19)	(−0.87)
Number of obs.	196	273	196	273
First Issuance	Yes	All	Yes	All

t statistics in parentheses.
This table reports the average cumulative abnormal return using the market model (MSCI ACWI index, based on logarithmic stock and market returns) and the Fama French 5 factors model around the announcement of SLB issuances for different event windows. The sample consists of 273 SLB issuance events. *, **, and *** denote significance at the 10%, 5%, and 1% level based on robust standard errors.

4. Results

4.1. Issuers of sustainability-linked bonds

We start with comparing our sample of SLB issuers with the constituents of the market index MSCI ACWI in terms of sustainability performance (ESG and SDG), institutional ownership and market capitalization.

Results in Table 1 reveal that the sample is significantly different in all these dimensions. Issuers of SLBs are significantly more sustainably rated in terms of both ESG and SDG, compared to the constituents of the market index on average in the respective year of the issuance. At the same time, concerning total carbon emissions, the issuers are slightly more carbon intensive (in relation to the market capitalization) in comparison to the market index. Furthermore, SLB issuers have larger shares of institutional ownership, while in turn being smaller in terms of market capitalization.

4.2. Event study around SLB announcement and issuance

We continue with discussing the significance of the abnormal returns around the announcement of SLBs. In Table 2 we differentiate between first issuance events (columns 1 and 3) and the overall sample (columns 2 and 4). Our analysis reveals that

the cumulative abnormal returns (CAR) in different event windows are not significantly different from zero, except for the window [−5, 10] using the market model, which shows significance at the 10% level for first issuers. It can therefore be concluded that the announcement of the SLB issuances did not generate any new or additional information value from the shareholders' perspective and shareholders' expectations for the future remained unchanged.[2] This finding indicates that either the information was already available before or that the information has no signal value. The later case would imply that investors either do not care about sustainability targets, or do not perceive these KPIs as credible and in turn rather link them to greenwashing. From the perspective of companies, the result indicates that the only reason to issue SLBs involves the cost of capital advantages that compensate for additional costs.

4.3. Cross-sectional heterogeneity

To further evaluate the signaling power of the release of sustainability-related financing instruments, we continue with analyzing the significance of the abnormal returns concerning the event window [−5, 10] with respect to sustainability characteristics of the issuing companies. We take into consideration the ESG and SDG ratings as well as verified commitments towards net zero targets and carbon emission intensities. We focus on announcements of first issuances of SLBs in order to avoid diluted results due to potentially already known information out of prior issuances of the same company.

Table 3 presents results for the analysis of first issuance SLBs by comparing high versus low sustainability performance in the ESG (Panel A) and SDG domain (Panel B), companies with respectively without commitments towards net zero (Panel C) and companies with high and low carbon emission intensity (Panel D). Concerning carbon emissions, we define $Emission\_Intensity$ as total carbon emissions divided by market value (Panel D). We thereby define high (low) ESG/SDG performance and high (low) $Emission\_Intensity$ as above (below) the median in the respective year.

For the ESG, SDG and the net zero criteria, we observe only slightly significant (at the 10% level) cumulative abnormal returns for the low sustainability performers, but only for the model based on the MSCI ACWI and not the 5 factors model. We do not find any effect for $Emission\_Intensity$. In conclusion, this implies that the information content of an SLB announcement is generally not driven by the sustainability profile of the issuer.

In addition, we study differences according to the specific key performance indicators (KPIs) defined as part of the sustainability-linked bonds in Panel E. The following KPIs can be differentiated considering all bonds in our sample (while for 18 bonds the information is not available):

- Greenhouse gas (GHG) emissions ($n = 154$)
- ESG scores ($n = 29$)
- Energy efficiency ($n = 15$)
- Renewable energy ($n = 15$)
- Other ($n = 42$)

We subsume these indicators into two distinct categories: GHG emissions and Other. Our results in Panel E as part of Table 3 (columns 2 and 4) reveal that the abnormal returns were significant at the 5% level and positive for companies with KPIs other than greenhouse gas emissions. We also present the results for our total sample (first and subsequent issuances) in the Appendix in Table A.3, while the significance is slightly stronger for first issuances.

These effects are also visualized in Fig. 2 for both first issuers only and all issuers. The cumulative abnormal return amounts to roughly 2.4% based on the 5 factor model (respectively 2.5% – $exp(0.025)$, based on the market model).

We further test the prevalence of the significance of the KPI to explain abnormal return by controlling for market capitalization, institutional ownership, amount issued and sector. Results in Table 4 show that the 5% significance largely prevails for the two event windows under consideration. Interestingly, the longer term effect CAR [0,30] is stronger if we include all observations, while the CAR in the shorter window are only significant for the first time issuances.

The positive stock price reaction for KPIs other than greenhouse gas emissions does not automatically mean that the issuance of the respective SLB worked as a signal. A number of other reasons could prevail: First, it could be that any bond issuance worked as a signal for financial strength overall. However, empirical studies have shown that the stock market does not significantly react to the issuance of bonds (Leary and Roberts, 2010). Therefore, we do not expect the financial strength signal to play an important role in our findings. The fact that the effect is stronger for first issuance reinforces that the market reaction reflects sustainability information and signaling rather than the capital increases. Second, it could be that SLBs come with a cost of capital advantage for companies compared to a normal bond issuance (Koelbel and Lambillon, 2023; Berrada et al., 2023). This would lead to a wealth transfer from bondholders to shareholders which should lead to a positive share price reaction. Berrada et al. (2023) find evidence for such a wealth transfer. Because we do not find a positive share price reaction in general, we do not expect this argument to be a major driver of our results. Third, it could be that the reaction is not due to the (costly) signaling but due to the sustainability information itself that is new to the market, if not communicated before.

We cannot distinguish between the pure signaling aspect and the information aspect since often sustainability commitments in an SLB include both the cost of a signal and a sustainability target information that is new to the market. Nevertheless, the positive

[2] We additionally tested for significance at the date of the issuance of the bond and did also not find significant abnormal returns. The results are presented in the Appendix in Table A.2. Furthermore, our results remain stable if we use the MSCI World as market index instead.

Table 3
Cross-sectional analyses.

	Market model		5 Factors model	
Panel A	High ESG	Low ESG	High ESG	Low ESG
Mean	0.007 (0.98)	0.015* (1.67)	0.375 (0.47)	1.351 (1.42)
Observations	90	96	90	96
Panel B	High SDG	Low SDG	High SDG	Low SDG
Mean	0.007 (0.96)	0.018* (1.69)	0.441 (0.56)	1.925* (1.69)
Observations	107	68	107	68
Panel C	Net Zero	No Net Zero	Net Zero	No Net Zero
Mean	0.004 (0.49)	0.012* (1.78)	−0.223 (−0.23)	1.214 (1.64)
Observations	51	145	51	145
Panel D	High Emiss_Int	Low Emiss_Int	High Emiss_Int	Low Emiss_Int
Mean	0.013 (1.33)	0.004 (0.64)	1.179 (1.07)	0.272 (0.38)
Observations	75	93	75	93
Panel E	GHG KPI	Other KPI	GHG KPI	Other KPI
Mean	0.003 (0.38)	0.025** (2.51)	−0.031 (−0.04)	2.361** (2.24)
Observations	111	75	111	75
Panel F	Callable	At Maturity	Callable	At Maturity
Mean	0.014 (1.55)	0.008 (1.04)	1.053 (1.06)	0.703 (0.95)
Observations	94	95	94	95

t statistics in parentheses.
This table reports the average $CAR[-5, 10]$ from Table 2 for different subsamples using first issuances of SLBs. Cumulative returns are calculated based on the market model (MSCI ACWI index, based on logarithmic stock and market returns) and the Fama French 5 factors model. Panel A distinguishes according to ESG performance into high (above median) and low (below median). Panel B distinguishes according to SDG performance into high (above median) and low (below median). Panel C distinguishes according to SBTi verified Net Zero target (1: set, 0: not set). Panel D distinguishes according to carbon emission intensity into high (above median) and low (below median). Panel E distinguishes according to the KPI defined as part of the SBTi issuance (1: GHG emissions, 0: other). Panel F distinguishes according to the type of maturity in callable or at maturity. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

stock price reaction identified for SLBs involving "other" KPIs indicates the information made available to the market is relevant and credible.

4.4. Event study around the commitment towards verified climate targets

To further evaluate the market reaction towards climate targets in general, we estimate abnormal returns around the announcement of SBTi-verified climate targets. We build on the sample of companies provided online by SBTi which includes the type of target set as well as the respective date when this target was communicated as being verified by SBTi.

Setting a science-based target is a five-step process. First, a company commits by sending a letter to express its intent to set a target. Second, it develops an emissions reduction target that aligns with the SBTi's criteria. Third, the target is submitted to the SBTi for an official validation. Once validated, the target is announced to let stakeholders know about the target. And lastly, the company discloses and reports company-wide emissions and tracks target progress annually.[3]

The Science-Based Targets Initiative (SBTi) forms a collaboration of CDP, UN Global Compact, World Resources Institute, and World Wide Fund for Nature (WWF). As of December 2023, we were able to retrieve a total of 2176 companies with commitments or targets set and identifiers available (ISIN). Based on stock market data availability, we were able to consider 1669 companies in our analysis. Results in Table 5 reveal that markets do not significantly react to the announcement of SBTi verified climate targets. This finding is consistent with our observations from the SLB analysis.

[3] https://sciencebasedtargets.org/how-it-works

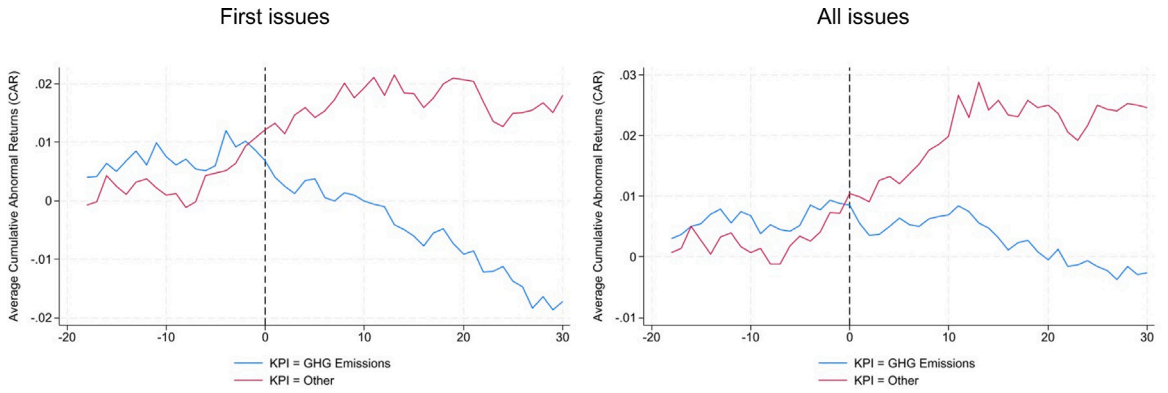

Fig. 2. Cumulative abnormal returns around the announcement date
This figure displays the cumulative abnormal returns around the announcement date for first issuances and all issuances respectively in our sample, based on the market model. The sample is divided according to the type of KPI (GHG Emissions versus other).

Table 4
Cross-sectional regression to explain CAR based on market model.

	CAR[−5, 10]				CAR [0, 30]			
SLB KPI	−0.022*	−0.016	−0.024**	−0.017	−0.035*	−0.032**	−0.033*	−0.031**
	(−1.86)	(−1.59)	(−1.99)	(−1.62)	(−1.94)	(−2.22)	(−1.87)	(−2.13)
Inst_Own			0.000				−0.000	−0.000
			(0.43)				(−0.09)	(−0.12)
lnMarketcap			0.001	0.000			−0.001	0.002
			(0.44)	(0.12)			(−0.16)	(0.51)
Amountissued			0.007	0.037			0.041	0.011
			(0.09)	(0.53)			(0.43)	(0.14)
Sector			−0.001	−0.000			0.002	0.004
			(−0.31)	(−0.05)			(0.62)	(1.57)
Constant	0.025**	0.018	−0.010	0.009	0.018	0.018	0.025	−0.054
	(2.51)	(2.08)	(−0.14)	(0.15)	(1.27)	(1.52)	(0.21)	(−0.54)
Observations	186	255	186	255	186	255	186	255
First issuance	Yes	All	Yes	All	Yes	All	Yes	All

t statistics in parentheses.
This table shows the results of standard ordinary least squares regressions using CAR as dependent variable. Variables are defined in Table A.1. SLB KPI reflects a variable taking the value 1 if the KPI reflects greenhouse gas emissions and 0 for other types of KPIs. *, **, and *** denote significance at the 10%, 5%, and 1% level based on robust standard errors.

5. Conclusion

This paper evaluates the suitability of sustainability-linked bonds for signaling sustainability intentions of issuers. Our event study results around SLB announcements indicate that markets do not perceive instruments linked to greenhouse gas emission reduction targets as signals for new information. At the same time, we establish significant evidence for the signaling power of KPIs linked to other measures such as ESG ratings, renewable energy, or energy efficiency. The stock market responds positively to these signals, confirming prior evidence that establishes a positive link between sustainable behavior and stock market performance (Flammer, 2021, 2013; Krueger, 2015). These differential findings for emission reduction targets, in comparison to other sustainability goals, thus indicate that the market either (i) has already priced in net-zero targets before or takes these targets for granted, or (ii) perceives targets related to emission reduction as greenwashing and thus attributes no signaling power to the SLB announcements. We find initial confirming evidence for the first channel by highlighting that the stock market does also not react to the announcement of climate targets (not in connection with the issuance of SLBs) that are officially verified by SBTi (and thus less prone to the risk of greenwashing). This suggests that the lack of reaction should not be interpreted as a lack of signaling power of the SLBs themselves, but rather that the net-zero targets do not provide additional relevant information.

The conclusion that climate transformation is already factored into stock markets suggests that companies failing to make progress toward net-zero as they approach key climate target years (e.g., 2030 or 2050) might face strongly negative market reactions. On the other hand, our results indicate that markets currently do not anticipate and price in sustainability targets

Table 5
Abnormal returns around the announcement of verified climate targets (SBTi).

	Market model	5 Factors model
CAR [−5, 10]	−0.000	−0.013
	(−0.24)	(−0.06)
CAR [11, 20]	−0.006	−0.166
	(−1.13)	(−1.23)
CAR [21, 60]	−0.001	23.972
	(−0.56)	(1.00)
CAR [−20, -6]	−0.001	0.459
	(−0.61)	(0.80)
Observations	1669	1669

t statistics in parentheses.
This table reports the average cumulative abnormal returns (CAR) using the market model (MSCI ACWI index) and the Fama French 5 factors model around the announcement of SBTi verified climate targets for different event windows. *, **, and *** denote significance at the 10%, 5%, and 1% level based on robust standard errors.

Table A.1
Variable descriptions and data sources used.

Variable	Retreived from	Description
ln*Marketcap*	Refinitiv	Natural logarithm of the market capitalization, calculated based on price data and shares outstanding
Amountissued	Refinitiv/Bloomberg	SLB amount issued divided by total liabilities in the respective year
Institutional Ownership	Refinitiv Eikon	Share of institutional ownership (%)
Emission Intensity	Refinitiv	Total carbon emissions divided by market capitalization
Price	CRSP/Compustat Capital IQ	Closing Price
ESG Rating	Refinitiv	Refinitiv ESG Score
SDG Rating	Robeco SAM	SDG Score
Net Zero	SBTi Website	Verified commitment towards climate targets
SLB KPIs	Refinitiv	Predefined key performance indicators
Maturity	Refinitiv	Callable versus "at maturity"
Sector	Refinitiv	Basic Materials, Consumer Cyclicals, Consumer Non-Cyclicals, Energy, Financials, Healthcare, Industrials, Real Estate, Technology , Utilities

other than emission reduction. However, considering the positive market reaction observed for these other targets in our SLB analysis, it suggests that firms and investors should pay more attention to such targets. Future research should delve further into the characteristics and differentiation of these targets.

CRediT authorship contribution statement

Beat Affolter: Writing – review & editing, Writing – original draft, Supervision, Methodology, Conceptualization. **Elisa Ciarla:** Writing – review & editing, Software, Methodology, Formal analysis, Data curation. **Julia Meyer:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Methodology, Funding acquisition, Formal analysis, Conceptualization. **Sugandhita Sugandhita:** Writing – review & editing, Visualization, Software, Formal analysis, Data curation.

Data availability

Data will be made available on request.

Appendix

See Tables A.1–A.3.

Table A.2
Market reaction at the date of the SLB issuances.

	Market model		5 Factors model	
$CAR[-5, 10]$	0.004	0.002	0.149	0.001
	(0.64)	(0.36)	(0.25)	(0.00)
$CAR[-20, -6]$	0.005	0.002	0.294	0.140
	(0.87)	(0.140)	(0.52)	(0.28)
$CAR[21, 60]$	−0.006	−0.008	−0.820	−1.274*
	(−0.75)	(−1.16)	(−1.05)	(−1.83)
$CAR[11, 20]$	−0.005	−0.004	−0.816**	−0.641*
	(−1.17)	(−1.07)	(−2.03)	(−1.86)
Observations	196	273	196	273
First Issuance	Yes	All	Yes	All

t statistics in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$.
This table reports the average cumulative abnormal returns using the market model (MSCI ACWI index, based on logarithmic stock and market returns) and the Fama French 5 factors model around the issuance of SLB for different event windows. The sample consists of 273 SLB issuance events. *, **, and *** denote significance at the 10%, 5%, and 1% level based on robust standard errors.

Table A.3
Cross-sectional analyses.

	Market model		5 Factors model	
Panel A	High ESG	Low ESG	High ESG	Low ESG
Mean	0.000	0.013*	−0.230	1.350
	(0.07)	(1.73)	(−0.33)	(1.63)
Observations	130	129	130	129
Panel B	High SDG	Low SDG	High SDG	Low SDG
Mean	0.005	0.009	0.421	1.012
	(0.86)	(1.03)	(0.60)	(1.06)
Observations	153	93	153	93
Panel C	Net Zero	No Net Zero	Net Zero	No Net Zero
Mean	0.001	0.009	−0.212	0.921
	(0.07)	(1.56)	(−0.25)	(1.42)
Observations	89	184	89	184
Panel D	High Emiss_Int	Low Emiss_Int	High Emiss_Int	Low Emiss_Int
Mean	0.005	0.005	0.366	0.524
	(0.65)	(0.76)	(0.43)	(0.77)
Observations	118	116	118	116
Panel E	GHG KPI	Other KPI	GHG KPI	Other KPI
Mean	0.002	0.018**	0.023	1.838*
	(0.31)	(2.08)	(0.04)	(1.90)
Observations	154	101	154	101
Panel F	Callable	At Maturity	Callable	At Maturity
Mean	0.010	0.005	0.844	0.495
	(1.47)	(0.71)	(1.18)	(0.64)
Observations	140	122	140	122

t statistics in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$.
This table reports the average $CAR[-5, 10]$ from Table 2 for different subsamples using all issuances of SLBs. Panel A distinguishes according to ESG performance into high (above median) and low (below median). Panel B distinguishes according to SDG performance into high (above median) and low (below median). Panel E distinguishes according to the KPI defined as part of the SBTi issuance (1: GHG emissions, 0: other). Panel D distinguishes according to SBTi verified Net Zero target (1: set, 0: not set). *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.

References

Akerlof, George A., 1970. The market for "lemons": Quality uncertainty and the market mechanism*. Q. J. Econ. 84 (3), 488–500.
Berrada, Tony, Engelhardt, Leonie, Gibson, Rajna, Krueger, Philipp, 2023. The economics of sustainability linked bonds. SSRN Working Paper.

Climate Bonds Initiative, 2022. Sustainable Debt Market Summary Q3 2022. Climate Bonds Initiative.
Fama, E.F., French, K.R., 2015. A five-factor asset pricing model. J. Financ. Econ. 116 (1), 1–22.
Flammer, Caroline, 2013. Corporate social responsibility and shareholder reaction: The environmental awareness of investors. Acad. Manag. J. 56 (3), 758–781.
Flammer, Caroline, 2021. Corporate green bonds. J. Financ. Econ. 142 (2), 499–516.
ICMA, 2023. Sustainability-linked bond principles voluntary process guidelines.
Koelbel, Julian F., Lambillon, Adrien-Paul, 2023. Who pays for sustainability? An analysis of sustainability-linked bonds. SSRN Working Paper.
Krueger, Philipp, 2015. Corporate goodness and shareholder wealth. J. Financ. Econ. 115 (2), 304–329.
Leary, Mark T., Roberts, Michael R., 2010. The pecking order, debt capacity, and information asymmetry. J. Financ. Econ. 95 (3), 332–355.
Riley, John G., 1979a. Informational equilibrium. Econometrica 47 (2), 331–359.
Riley, John G., 1979b. Noncooperative equilibrium and market signalling. Am. Econ. Rev. 69 (2), 303–307.
Spence, Michael, 1973. Job market signaling. Q. J. Econ. 87 (3), 355–374.