The Reversal of the Green Bond Premium

Laura Wollny[a], Jeroen Derwall[a,b], Rients Galema[a], Kees Koedijk[a,c]

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Abstract

Anecdotal evidence suggests that the negative yield (positive price) difference between green and conventional bonds, the so-called greenium, has disappeared. In this paper, we first analyze whether this is the case. We are able to match a large sample of global, corporate green bonds to similar conventional bonds by the same issuer. Following Zerbib (2019), we extract the green bond premium as the fixed effect of regressions of differences in liquidity and volatility on yield difference for every year from 2020 to 2024. We are the first to show that the greenium not only has disappeared but that it has reversed suggesting declining green preferences of investors. In the second part of the paper, we explore whether broader sentiments on the market such as the ESG backlash (Baker et al., 2024) or doubts about the effectiveness of ESG investing (Hartzmark and Shue, 2022) can help explain why investors are no longer willing to pay more for green bonds. We only find evidence of ESG backlash. Using ESG scores in interaction with a post 2022 dummy and bond as well as macro-level controls, we show that high ESG scores lose importance after 2022 in our sample consistent with increasingly negative sentiment towards ESG investing. Meanwhile, investors in the market for green bonds seem not the exhibit the "counterproductive" behavior found in Hartzmark and Shue (2022): the greenium is lower for dirtier firms in term of emission intensity before 2023. Nevertheless, after 2022 we observe a reversal of green bond premia across clean and dirtier issuers. This implies that despite the efforts in regulation such as the European bond standard to limit greenwashing, it may be difficult to convince investors to pay for green, making financing decarbonization more difficult.

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E-mail: l.i.j.wollny@uu.nl (Laura Wollny, contact author), j.m.m.derwall@uu.nl (Jeroen Derwall), r.j.galema@uu.nl (Rients Galema), c.g.koedijk@uu.nl (Kees Koedijk)

1 Introduction

Over the last decade, financial markets have increasingly embraced sustainable investments[1]. On the fixed income side, the market for green bonds has expanded rapidly, reaching 3.65 trillion USD cumulative amount issued in 2025. Although there are other Environmental, Governance and Social (ESG) debt products such as social bonds or sustainability linked loans, green bonds remain the single largest category (Climate Bonds Initiative, 2025). With the market expansion, a discussion emerged among academics and practitioners on the existence of the so-called 'greenium.' Even though the evidence is mixed, there was evidence of a small greenium on the secondary market (e.g. MacAskill et al., 2021) suggesting that bond investors were willing to pay a premium for green bonds. This could be theoretically explained by green preferences (Pástor et al., 2021; Zerbib, 2019). Nevertheless, we know from both academic literature and recent anecdotal evidence that such preferences are changing or potentially even reversing. Financial news outlets reports that sentiments are moving away from ESG investing and that the greenium is disappearing[2]. Beyond these anecdotes, recent literature by Baker et al. (2024), for example, estimates that investors willingness to pay for ESG index funds was initially positive but turned negative post 2022 consistent with the negative sentiment dubbed ESG backlash. On top of this, the effectiveness of ESG investing is being questioned. For instance, Hartzmark and Shue (2022) suggest that investors invest "counter-productively", favoring already clean firms thereby reducing potential impact. A recent paper by Lam and Wurgler (2024) finds that green bonds indeed do not succeed in channeling additional finance to newly developed green projects.

These developments raise two questions we address in this paper. First, we ask whether there is significant time variation in the greenium. Building on Zerbib (2019), we retrieve the green bond premium as the fixed effect in a regression controlling for differences in liquidity and volatility of the matched bonds in every year. Next to matching on a large number of bond characteristics, we impose limits on the amount issued, issue date and maturity at issuance and construct a synthetic bond from two matched conventional bonds to exactly correspond the maturity of the green bond. We are able to match 1,349 corporate green bonds with similar conventional bonds by the same issuer. We show that the green bond premium has disappeared during our sample period from 2020 to 2024. In the end of our sample, we even observe a positive green bond premium suggesting a reversal in the green bond market. We are the first to show this reversal, suggesting that investors no longer prefer green bonds over similar conventional bonds and consistent with recent anecdotal evidence of ESG backlash.

These results motivate our second question. We explore whether investors differentiate between issuers' ESG and greenness profiles and whether this has changed over time. Green Bonds are simply defined as fixed income instruments which allocate their proceeds exclusively to green projects (ICMA, 2021) and are issued by both clean and dirty issuers. Investors caring about impact should focus on the issuers with the greatest impact potential, that is, with the highest emission intensity (Hartzmark and Shue, 2022). We believe, however, that this is not the case and that it is green bonds of the cleanest issuers that trade at a premium. Moreover, we expect investors to adjust their evaluation over time. Specifically, if investors

[1]Bloomberg Intelligence (2024, February 22). ESG AUM set to top $40 trillion by 2030, anchor capital markets. https://www.bloomberg.com/professional/insights/sustainable-finance/esg-aum-set-to-top-40-trillion-by-2030-anchor-capital-markets/

[2]Bloomberg (2023, January 13). Goldman says goodbye greenium as ESG is now priced like all debt. https://www.bloomberg.com/news/articles/2023-01-13/goldman-says-goodbye-greenium-as-esg-now-priced-like-all-debt. Financial Times (2023, December 4). The real impact of the ESG backlash. https://www.ft.com/content/a76c7feb-7fa5-43d6-8e20-b4e4967991e7

previously preferred cleaner issuers, one could expect that that these characteristics lose relevance in time of declining ESG sentiments. Hence, we predict a lower greenium for bonds from these issuers over time. This is what we find to some extent. Using ESG scores from LSEG Eikon, we include issuer ESG scores or emission intensity in interaction with a post-2022 dummy variable and a host of controls. Our estimates indicate that until 2022 higher ESG scores are associated with a lower bond premium, a greenium, whereas this effect disappears considering 2023 and 2024. While the results stay robust when including bond level and macroeconomic controls, the interaction term of ESG score and post 2022 dummy is only weakly significant at 10% across specifications. A similar picture emerges when considering issuers' greenness measured by emission intensity including upstream and downstream emissions of the firm. Issuers in the fifth quintile of issuers' emission intensity, that is, the dirtiest issuers, have a significantly higher greenium before 2023. Nonetheless, green bond premia after 2022 are positive across the first, second and fifth quintiles of issuers' emission intensity. Still, considering the previously negative coefficient, the increase is smallest for the dirtiest issuer. This implies that investors, at least, used to prefer green bonds by dirtier issuers providing some evidence against counterproductive investment in the green bond market.

In summary, our evidence indicates that (i) the average corporate green bond premium has changed from negative to positive in the period of 2020 to 2024, and (ii) during that period investors reassessed their preferences across green bonds. Since 2023, green bond investors do no longer care about the greenness of issuers. By doing so our paper makes several contributions to the literature.

First, the paper contributes to the literature on green bonds. Our paper contributes particularly to studies on the (in)existence of the greenium and its determinants. There is ample empirical literature discussing the existence of the greenium (Aswani and Rajgopal, 2025; Baker et al., 2022; Caramichael and Rapp, 2024; Cortellini and Panetta, 2021; Flammer, 2021; Gianfrate and Peri, 2019; Ghitti et al., 2025; Karpf and Mandel, 2018; Lam and Wurgler, 2024; Lehkonen et al., 2024; MacAskill et al., 2021; Pietsch and Salakhova, 2022; Renjie and Xia, 2023; Zerbib, 2019). We add more specifically to studies that have documented corporate green bond premiums on the secondary market. For instance, Zerbib (2019) interprets the presence of a greenium in the secondary market between 2013 and 2017 as the expression of non-pecuniary preference for green. Other authors indicate that that the greenium varies over time and is driven by investor demand (Boermans, 2023; Caramichael and Rapp, 2024; Karpf and Mandel, 2018; Pietsch and Salakhova, 2022; Sangiorgi and Schopohl, 2023). We contribute to this literature by providing evidence that the average corporate green bond premium has reversed, consistent with the idea that the demand for green bonds has declined due to weakening ESG preferences (Baker et al., 2024). Thereby, our paper also relates to the broader literature on the existence of investors' non-pecuniary preferences and their role for performance (for a discussion see e.g. Starks (2023)).

Secondly, we contribute to the literature on the determinants of the greenium across bonds. Green bonds were explicitly designed to close financing gaps for decarbonization efforts (OECD, 2017). Thus, following an approach where investors care about their impact (Hartzmark and Shue, 2022; Oehmke and Opp, 2025), we would expect a greenium on bonds (or bonds by issuers) that are financing meaningful transition. Developing a measure of greenness based on the use of proceeds, Benincasa et al. (2022) show that higher greenness implies lower yields in the primary market. Moreover, projects aiming at lasting and significant CO2 reductions, indicated by a so-called shade of green by an second party option provider, have greater greeniums

(Dorfleitner et al., 2022; Ghitti et al., 2025; Huynh et al., 2022). However, taking into account specific information on greenness is not easy for investors due to limited availability and difficulty to interpret available data (Dinh et al., 2023; Kapraun et al., 2021; Tuhkanen and Vulturius, 2022). For instance, investors do not seem to make use of information such as the additionality of the project; The green bond premium is not different depending on whether projects do or do not provide additional finance (Caramichael and Rapp, 2024; Lam and Wurgler, 2024). Another way to assess greenness is to focus on issuer characteristics. Aswani and Rajgopal (2025); Caramichael and Rapp (2024); Lehkonen et al. (2024); Pietsch and Salakhova (2022) and Zerbib (2019) find that the financial sectors has significantly higher greenium. This suggests that already clean firms are rewarded with a greenium. Authors taking into account ESG score reach different conclusions of whether only the lowest ESG scores or lower ESG scores are associated with lower greeniums (Immel et al., 2022; Huynh et al., 2022; Kapraun et al., 2021). We are interested in whether these assessments have changed over time. We show that high ESG score are associated with higher greeniums before 2023 suggesting an initial preference for these green bonds. This effect disappears after 2022, in line with ESG backlash observed by e.g. Baker et al. (2022). Most studies considering emissions, focus on whether issuers reduce emission after green bond issuance (Aswani and Rajgopal, 2025; ElBannan and Löffler, 2024; Ehlers et al., 2020; Fatica and Panzica, 2021; Flammer, 2021). Furthermore, Leung et al. (2023) find that greenwashing firms, that is firms whose emission intensity does not decrease after issuance, will have a lower greenium. We use emission intensity as a measure of greenness of the issuer and observe that even though bonds with the highest emission intensity have a positive green bond premium after 2023, the reversal from negative to positive premia is less pronounced for these issuers. Thus, we find evidence implying that green bond investors demand green bonds with impact potential more. Nonetheless, the overall reversal to a positive green bond premium seems more important.

The remainder of the paper is structured as follows. Section 2 describes the sample construction and the matching process in detail. Next, the fixed effect regression to recover the green bond premium and the regression to analyzes the distribution of the green bond premium across issuers are explained in the methodology (Section 3). Results are reported and discussed in Section 4. Section 5 concludes.

2 Data

2.1 Matching

In the literature, the green bond premium is defined as the yield difference between a green bond. and a similar conventional bond. When the green bond has lower yield (higher price), the difference is negative and we refer to it as a greenium. In order to estimate it, we match a sample of non-convertible, non-putable, plain vanilla fixed coupon, corporate green bonds from LSEG Eikon to conventional bonds by the same issuer. We start with 5,147 green bonds by 1,785 issuers that have non-missing identifiers (RIC) and maturity dates, and positive issue amounts. Next, we download daily ask yields[3], ask and bid prices in USD for both green and conventional bonds by the same issuers[4]. We winsorize ask yields, ask prices and bid prices at 1st and 99th percentile for all bonds. Similar to Zerbib (2019), we match green and conventional bonds based on

[3]Zerbib (2019) argues that since we are looking at the demand side the ask yield is the relevant metric. Moreover, ask yields are much more available then yield to maturity on LSEG Eikon.

[4]We consider conventional (non green), non-convertible, non-putable plain vanilla fixed coupon bonds by the same issuer as the green bonds

callability, currency, collateral, coupon frequency, instrument type, issuer, rating and seniority (Table 1). In addition, we require that the available data of potential matches need to overlap by at least 100 days.

Table 1: Matching Criteria

This table lists the criteria by which we match green to conventional bonds by the same issuer. We only consider conventional bonds whose price data overlaps with the green bond for at least 100 days. There are three limits placed on the conventional bonds. First, the amount issued must be within a range of one fourth to four times the amount issued of the green bond. Second, the issue date must be six years before or after the issue date of the green bond. Third, the maturity at issuance must be within two years shorter or longer than the maturity at issuance. Moreover, green and conventional bond must match on every criteria of the exact matching criteria and lastly, we select the two closest neighbors in terms of amount issued, coupon, issue date and maturity at issuance. For detailed variable descriptions refer to Table A.1 in the Appendix.

Criteria	Limit	Matching Method
Amount Issued	1/4 to 4x	Nearest Neighbor
Issue Date	+/- 6 Years	Nearest Neighbor
Maturity at Issuance	+/- 2 Years	Nearest Neighbor
Coupon	-	Nearest Neighbor
Callable	-	Exact Matching
Collateral	-	Exact Matching
Coupon Frequency	-	Exact Matching
Currency	-	Exact Matching
Instrument	-	Exact Matching
Rating	-	Exact Matching
Seniority	-	Exact Matching

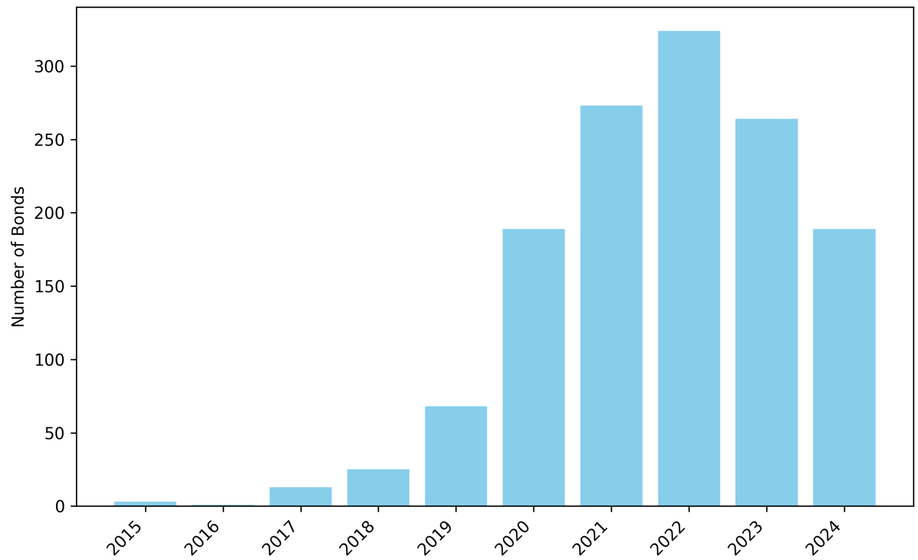
We select the two nearest neighbors based on amount issued, coupon, issue date and maturity. Having two matches allows us to control for potential maturity biases by constructing a synthetic bond. As in Zerbib (2019), we extra-/interpolate at the maturity at issuance to calculate as maturity matched yield of the (synthetic) conventional bond. This also implies that the two conventional bonds need to have different maturities from each other, otherwise the match is redundant in the inter/extrapolation. If only one conventional bond is found but the maturity is within a seven day window to the green bond, we treat the one matched conventional bond as a synthetic bond. This is the case for 268 of 1,349 bonds in the final sample.

The advantage of our conservative matching process over a cross-sectional regression is that it controls for potential confounders at the bond-pair level. Successfully matched bonds only differ by the variable of interest, the label as green bond. As observed by e.g. Kapraun et al. (2021); Lehkonen et al. (2024); Zerbib (2019), some differences between groups remain (Table A.2); green bonds tend to have smaller issue amounts on average pointing to remaining differences in liquidity. We will, however, control for the latter in the next stage. Moreover, coupons are slightly higher for green bonds while maturity at issuance shows a very similar distribution for both.

2.2 Green Bonds Sample

The green bonds in our sample are issued between 2015 and 2024. Issuance follows an upward trend, peaking in 2022 and decreasing slowly subsequently (Figure 1). The bond characteristics in Figure A.1, such as bond rating, are matched on, that is they hold for green bond as well as the two matched conventional bonds. It shows that the majority of bond pairs is non-callable, non-rated, senior unsecured bonds or notes without

Figure 1: Number of Green Bonds by Issue Year



collateral and that pay out coupons annually. Approximately 43 percent of green bonds in our sample are issued in the European Union (EU) (Figure A.2). Germany stands out with a high number of bonds issued. Two of the three largest issuers are German, namely Deutsche Bank (12,597.3 million (mn) USD) and E ON (10,637.2 mn USD). Meanwhile, the five largest single issues are from 2022 and 2023, all AAA-rated and by Chinese banks (3725.37 - 4193.4 mn USD). In line with the distribution in country groups (Figure A.2), bonds are mostly issued in Euro, Chinese Yuan and USD (Figure A.1). Moreover, the majority of bonds are issued by the financial sector (Figure A.3). This may seem counterintuitive at first because banks have very low direct emissions and energy usage, that is low Scope 1 and 2 emissions. Nonetheless, banks use these bonds to issue loans targeting to (re)financing of green projects (Caramichael and Rapp, 2024). For all green bonds, the type of projects which are financed are recorded as use of proceeds. Use of proceeds can be unspecific such as "eligible green projects" and bonds can fall into more than one category. Most bonds finance energy efficiency, renewable energy projects and green construction or buildings (Figure A.4a). External reviews in the form of a certification from the Climate Bonds Initiative (CBI) and/or a Second Party Opinion (SPO) provide additional credibility to a green bond label. While most bonds are CBI aligned, only a few in our sample are certified (Figure A.4b). However, the majority have a SPO (Figure A.4c).

Table 2: Yield Differences by Year

This table shows the average yield difference $\Delta y_{i,t} = y_{i,t}^{GB} - y_{i,t}^{SB}$ in percentage points (pp) by year. It suggests that the average yield difference has flipped from negative to positive, pointing to a vanishing greenium.

	count	mean	sd	min	p50	max
2020	19405	-0.0317	0.3178	-1.7952	-0.0003	2.2389
2021	68102	-0.0412	0.2662	-1.8053	-0.0026	2.4123
2022	125169	-0.0367	0.3477	-1.8054	-0.0094	2.4140
2023	189076	0.0150	0.3441	-1.8035	-0.0011	2.4163
2024	287845	0.0470	0.3735	-1.8045	-0.0002	2.4169
Total	689597	0.0121	0.3518	-1.8054	-0.0011	2.4169
Observations	689597					

The sample to estimate the greenium covers 689,597 unbalanced daily observations of 1,349 matched green bonds by 536 issuers from January 1, 2020, to December 31, 2024. Table 2 shows the simple yield difference $\Delta Yield$ by year. There is a remarkable change over the years indicating that an time-varying green bond premium. In particular, the average yield difference switches from negative to positive in 2023, suggesting a vanishing greenium. We will confirm this preliminary evidence in a matched regression described in Section 3.

2.3 Greenness Subsamples

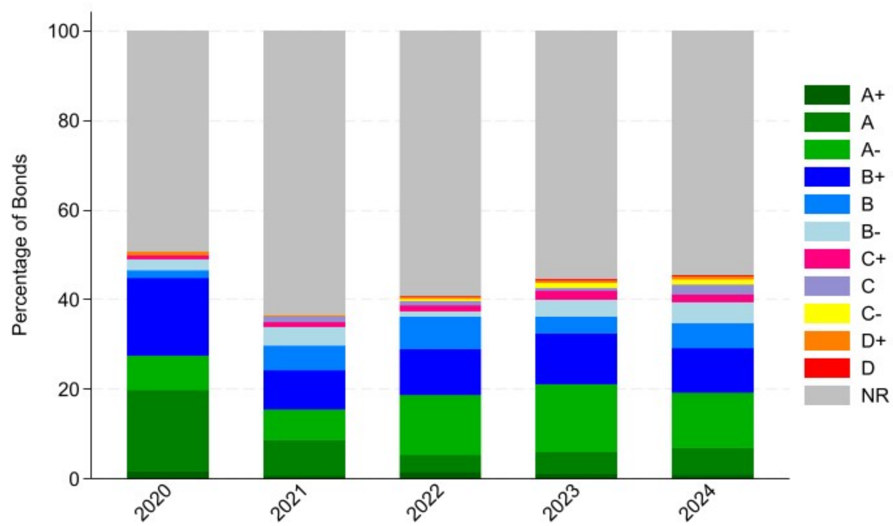
We hypothesize that investors value green bonds differently according to the bond issuers' "greenness" and that this assessment has changed over time. For this we set up a regression of the average annual green bond premia per bond on the issuers' greenness described in Section 3. By focusing on corporate bonds in the secondary market, we can explore whether investors value green bonds by issuers of different environmental track records differently. Moreover, it is in the secondary market where newly issued information such as the ESG score or emissions data are taken into account. We proxy issuer greenness by ESG scores and emission intensity covered by two distinct subsamples. ESG scores are the most readily available and used source of information for investors on sustainability performance (Berg et al., 2024). The ESG subsample, is an unbalanced annual sample of 619 bonds by 289 issuers with ESG data from LSEG Eikon. Emissions on the other hand, are often used to assess the real effect of green bonds (e.g. Flammer, 2021). This subsample is an unbalanced sample of 613 bonds of 203 issuers for Scope 1 to 3 emissions from S&P Trucost.

Environmental (E), Social (S) and Governance (G) Pillar scores make up the aggregate ESG Score. The scores range from zero to one where the one is the highest. They are be converted to letter grades from D- to A+ according to their percentile position (LSEG, 2024). In our sample, the annual ESG refers to the data available to investors by March 31st of the respective year. Figure 2 shows the distribution of ESG scores over our sample period. The majority of bonds remains non-rated. Among the group of ESG rated issuers, green bonds are issued across almost the entire range from A+ to D and issuers in the same sector are heterogeneous. For example, we have A-rated as well as D-rated electric utility companies in our sample. Both, average ESG and E scores decline slightly over time in our sample (Tables A.3 and A.4).

In absence of a common identifier, we match the bond issuers with S&P Trucost emission data by name[5].

[5]First, we clean issuer names in both datasets of abbreviations and special characters. Next, we search for exact string

Figure 2: Distribution of ESG scores



We can not always match on the issuer directly because bonds are often issued via special purpose vehicles. Thus, we match on the parent level[6] as well. In the final sample, we have 450 unique issuer matches, 52 in the immediate parent and five on ultimate parent level. Moreover, Trucost data exhibits large percentage changes within issuer. However, it is not specified which data may be closer to reality (S&P Global, 2020), therefore, we refrain from cleaning the data further. GHG emissions, hereafter emissions, can be broken down as direct (Scope 1), indirect via purchased energy (Scope 2)[7] and indirect in upstream and downstream activities (Scope 3). Scope 3 downstream data which measures the emissions of the products' use and disposal is less available than Scope 3 downstream activities which measures emissions along the supply chain (World Resources Institute, 2015). An advantage of S&P Trucost data is that it records Scope 3 emissions which make a substantial difference in the assessment of greenness (Table A.5). However, it decreases our sample size to 203 issuers. Greenhouse Gas (GHG) emissions are measured as carbon dioxide (CO_2) equivalents. We scale them scaled by economic activity to get emission intensity (tons of CO_2/ mn USD). These are heavily skewed and therefore log transformed.

3 Methodology

The methodology is split into two parts. First, we explain how we estimate the green bond premium. We adopt the methodology of Zerbib (2019) and recover the greenium as the bond-specific fixed effect in the matched sample. Second, we present the regression setup to analyze the impact of issuer greenness on the

matches in issuer name and domicile or country of incorporation. Then we check the matches on the ticker and domicile or country of incorporation. The fuzzy matching package can match issuers with small discrepancies in the name such as word order, typos, etc. Lastly, we manually check whether the issuer can not be matched or match it to its immediate or ultimate parent. All matches are double-checked. For example, we take into account additional data from Eikon and check whether the websites match. To remove duplicates, we prioritize the company status "operating" over "operating subsidy" over "acquired." Mergers and acquisitions are merged into the original company once they have been part for the full financial year (S&P Global, 2020).

[6]LSEG defines immediate parents as a parent, owner or owning more than 50% of voting stock and ultimate parent as the last immediate parent (variable definition by the Data Item Browser (DIB).

[7]For Scope 2 we use the location-based emissions where emissions factor comes from the overall grid rather than specific suppliers because the data is mostly missing.

distribution of green bond premia in the subsamples of bonds with ESG or emissions data.

3.1 Estimating the Greenium

After matching, Zerbib (2019) adds controls for differences in liquidity, maturity and volatility between green and matched conventional bonds. To control for the maturity difference, a synthetic bond (SB) is constructed. Its yield is obtained by inter- or extrapolation from the two matched conventional bonds (CB1, CB2) on the maturity at issuance.

$$y_{i,d}^{SB} = y_{i,d}^{CB1} + b_{i,d} * (\text{Maturity}_i^{GB} - \text{Maturity}_i^{CB1})$$

where $y_{i,d}$ is the yield of bond i at day d and the slope is given by

$$b_{i,d} = \frac{y_{i,d}^{CB2} - y_{i,d}^{CB1}}{\text{Maturity}_i^{CB2} - \text{Maturity}_i^{CB1}}$$

Next, we address the potential remaining differences in liquidity. Green and conventional bonds may differ significantly in liquidity. Pástor et al. (2022) suggest that green bonds have lower liquidity due to their usually lower issue sizes as is the case in our sample even after matching on liquidity and within a limit on the liquidity difference (Table A.2). As in Zerbib (2019), we also control for the liquidity difference measured as the difference in daily bid-ask spreads computed as percent quoted spread[8].

$$\Delta Liquidity_{i,d} = Liquidity_{i,d}^{GB} - Liquidity_{i,d}^{SB}$$

where

$$\text{Liquidity}_{i,d}^{SB} = w1 \times \text{Liquidity}_{i,d}^{CB1} + w2 \times \text{Liquidity}_{i,d}^{CB2}$$

and the weights w1 and w2 are equal to

$$w1 = \frac{|\text{GB maturity} - \text{CB 2 maturity}|}{|\text{GB maturity} - \text{CB 1 maturity}| + |\text{GB maturity} - \text{CB 2 maturity}|}$$

and

$$w2 = \frac{|\text{GB maturity} - \text{CB 1 maturity}|}{|\text{GB maturity} - \text{CB 1 maturity}| + |\text{GB maturity} - \text{CB 2 maturity}|}$$

Another concern is a potential risk difference given by the differences in volatility[9]. Volatility is computed as the standard deviation of a 30-day rolling window of the daily returns of ask yields. The difference in volatility, $\Delta Volatility$, is calculated analogously to the difference in liquidity described above.

[8]

$$\text{Bid-Ask Spread} = \frac{\text{Ask Price - Bid Price}}{\frac{\text{Ask Price + Bid Price}}{2}}$$

[9] For instance, a report by the Dutch bank ABN Amro suggest that the lower volatility of green bonds may be driving the greenium. ABN AMRO (2025, 27 March). ESG - green bonds exhibit lower volatility and higher liquidity than non-green bonds. https://www.abnamro.com/research/en/our-research/esg-green-bonds-exhibit-lower-volatility-and-higher-liquidity-than-non-green.

Finally, the green bond premium p_i found in a fixed effect regression and reflects the difference in yield driven solely by the label as green bond.

$$\Delta y_{i,d} = p_i + \beta_1 \Delta Liquidity_{i,d} + \beta_2 \Delta Volatility_{i,d} + \epsilon_{i,d} \tag{1}$$

where $\Delta y_{i,d} = y_{i,d}^{GB} - y_{i,d}^{SB}$ and $\hat{p}_i$ is the estimated green bond premium[10]. A negative green bond premium is synonymous to greenium. Since we are particularly interested in its time-variation, we run the regression on yearly subsamples resulting in a green bond premium for each bond i and each year t ($\hat{p}_{i,t}$).

3.2 Distribution of the Greenium

A greenium reveals investors' non-pecuniary preferences (Zerbib, 2019). Therefore, the distribution of the greenium is also informative about the preferences of investors across green bonds by different issuers. This is interesting because green bonds are issued by firms with both high and low initial "greenness". While it could be argued that investor are most likely to reward the already cleanest issuers because it increases their utility (e.g. Pástor et al., 2021), Hartzmark and Shue (2022) suggest that investors with non-pecuniary preferences should invest in brown firms because these firms can decrease emissions by a substantially large amount. This would imply that green investors prefer green bonds of brown firms more and hence, bonds by these firms should have a lower green bond premium. To analyze whether investors value already environmentally friendly green bonds less and whether this changes over time, we set up the following regression.

$$\begin{aligned} \hat{p}_{it} = \alpha_{it} &+ \beta_1 \text{Greenness}_{ft} + \beta_2 \text{Post 2022}_t + \beta_3 \text{Post 2022}_t \times \text{Greenness}_{ft} \\ &+ \beta_4 \text{Bond Controls}_{i(,t)} + \beta_5 \text{Climate News}_t + \eta_{it} \end{aligned} \tag{2}$$

where $\hat{p}_{it}$ is the estimated annual green bond premium from Equation 1. $Greenness_{ft}$ refers to the firm f's ESG score or emissions. Post 2022_t is an indicator equal to one after 2022 and equal to zero otherwise. The coefficient β_3 of the interaction will be significant if investors re-evaluate the bonds' greenness after 2022. The turn of investors against ESG can be dated approximately to 2022 (Baker et al., 2024). Furthermore, Lehkonen et al. (2024) ascribe the disappearing greenium to the increase in supply. In our sample of global, corporate green bonds, the peak of bonds issued is reached in 2022 (Figure 1). We will show that this also fits with the reversal in the green bond premium in our sample (Figure 3). Across all specifications, standard errors are clustered at the issuer level.

In alternative specifications, we control for bond characteristics and some macroeconomic variables. The mostly time-invariant bond characteristics we control for are country, log issue amount, rating, remaining maturity (at the end of the respective year) and sector. Contrary to Zerbib (2019), we prefer country over currency because we believe that what drives the greenium is the difference in local investors' green preferences and regulations at country-level. In addition, the literature proposes that attention to climate change could drive investors' interest in green bonds (Pástor et al., 2021, 2022). Hacıömeroğlu et al. (2022) report higher returns for corporate green bonds in the secondary market during the COVID-19 pandemic which they attribute to increased demand for green assets in crisis times. Instead of climate news driving

[10] We run this regression without a constant (STATA code reghdfe ..., noconstant). That is, $\hat{p}_i$ reflects the absolute level of yield differences for each bond i.

the greenium, Shi and Zhang (2024) believe oil price shocks to be the driver of the differences in green and brown returns. Table A.9 shows the yearly averages of climate news and real oil price. The MCCC is a normalized aggregate of climate sentiments in eight US newspapers where a higher score represents higher concerns (Ardia et al., 2023). The oil price is the Brent Crude Oil Price discounted by the US Consumer Price Index both obtained from the Federal reserve Bank St. Louis. As expected, climate news and real oil prices are highly correlated (0.89).

4 Results

The first part of this section reports the results for the fixed effect regression estimating the green bond premium. In the second part, we investigate whether the distribution of green bond premia is shaped by bond issuers' greenness and whether this has changed over time.

4.1 The Reversal of the Green Bond Premium

Table 3: Regression of Liquidity Difference and Volatility Difference on Yield Difference

This table shows the results of the fixed effects regression $\Delta y_{i,d} = p_i + \beta_1 \Delta Liquidity_{i,d} + \beta_2 \Delta Volatility_{i,d} + \epsilon_{i,d}$ (Equation 1). The reference category for year is 2020. Standard errors are clustered at the issuer level.

	(1) Δ Yield	(2) Δ Yield	(3) Δ Yield
Δ Liquidity	-16.7844***	-17.3447***	-17.0484***
	(2.7371)	(2.8377)	(2.6996)
Δ Volatility		-1.2183	
		(1.4795)	
year=2021			-0.0083
			(0.0176)
year=2022			-0.0100
			(0.0203)
year=2023			0.0357
			(0.0252)
year=2024			0.0678***
			(0.0247)
Observations	689597	672080	689597

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table 3 reports the results of the fixed effect regression for all years combined. We cluster standard errors at the issuer level due to the existence of heteroskedasticity and serial correlation and test the appropriateness of the fixed effect regression with a Mundlak test. In all columns, negative liquidity differences leads to a lower yield differences. In line with Caramichael and Rapp (2024) ignoring the liquidity difference would lead to an underestimation of the greenium. The magnitude is large, a one basis point (bp) increase in the liquidity difference implies a 16.78 bps decrease in the yield difference. Zerbib (2019), for comparison, reports an 9.88

bps increase in reply to a one bp increase in the liquidity difference. Column 2 shows that the difference in volatility is not significant considering the entire period from 2020 to 2024. This is in line with Zerbib (2019).

The green bond premia for every bond i is given by the bond-fixed effect $\hat{p}_i$. We find a small, positive and significant[11] green bond premium of 3.84 basis points averaged over the period from 2020 to 2024 (Table A.10). This is in contrast with earlier papers which mostly assume a small, negative green bond premium in the secondary market (MacAskill et al., 2021). For example, Zerbib (2019) reports a greenium of -1.8 bps over the period from 2013 to 2017. Similarly, Pietsch and Salakhova (2022) report an average greenium of -4.3 bps averaged over 2016 to 2021. We argue that our findings fit into the literature because taking a time average masks an important development in our sample. That is, taking a simple average covers up a switch from negative to positive green bond premium. In Column 3 of Table 3, we add year fixed effects, which shows a statistically significant and positive coefficient for the year 2024. Together with the evidence of a previous greenium (Aswani and Rajgopal, 2025; Baker et al., 2022; Cortellini and Panetta, 2021; Gianfrate and Peri, 2019; Lehkonen et al., 2024; MacAskill et al., 2021; Pietsch and Salakhova, 2022; Zerbib, 2019), this points further towards time variation and namely to a diminishing greenium. Indeed, we find evidence for both.

Table 4: Regression of Liquidity Difference and Volatility Difference on Yield Difference by Year

This table shows the results of the fixed effects regression $\Delta y_{i,d} = p_i + \beta_1 \Delta Liquidity_{i,d} + \beta_2 \Delta Volatility_{i,d} + \epsilon_{i,d}$ (Equation 1) run separately for every year. Standard errors are clustered at the issuer level.

	2020 Δ Yield	2021 Δ Yield	2022 Δ Yield	2023 Δ Yield	2024 Δ Yield
Δ Liquidity	-6.3310**	-11.5782***	-12.2184***	-18.0441***	-23.8248***
	(2.7702)	(2.8306)	(2.0557)	(3.5203)	(4.5877)
Δ Volatility	5.2993	3.4379	-1.1649	-3.1488**	-3.0880
	(3.9288)	(3.0860)	(3.2654)	(1.5308)	(1.8806)
Observations	17930	62806	121324	185696	284319

Standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

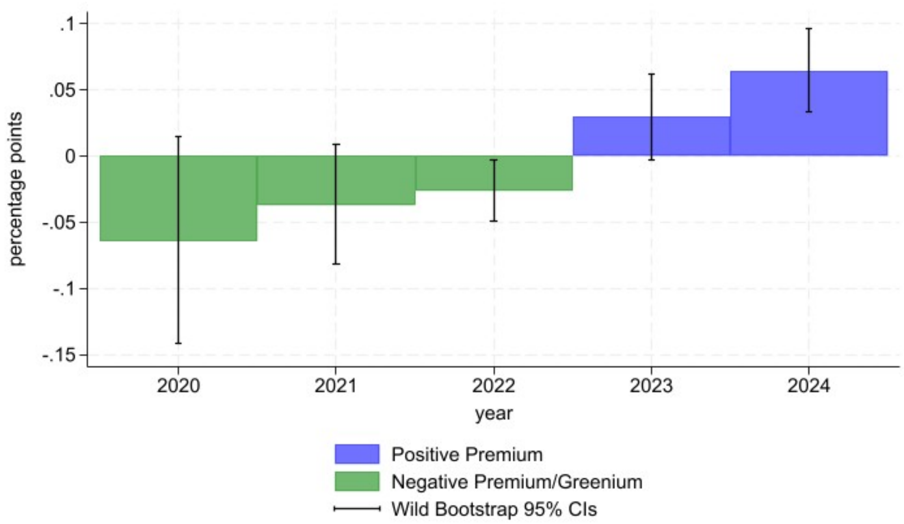
Table 4 reports the results for estimating Equation 1 for each year separately. Similar to Table 3, lower liquidity of green bonds compared to the synthetic one leads to a positive yield difference. Moreover, the coefficient increases over time. In contrast to the regression on the entire sample in Table 3, the difference in volatility is significant in 2023. That is, in 2023 investors take into account the (small) differences in volatility. A large increase of one basis point (Table A.7) in $\Delta Volatility$ decreases $\Delta Yield$ by 3.1 bps in 2023. Figure 3 shows the average green bond premium by year. Initially, we observe a negative yield difference, a greenium. However, the green bond premium disappears and even turns positive in 2023. Average green bond premia range from -6.42 bps in 2020 to 6.4 bps in 2024 controlling for both the difference in liquidity and in volatility (Table A.11). Table A.12 shows the results of a t-test and well as a wild bootstrapped test for the mean. We observe that 2022 and 2024 exhibit significant green bond premia. We conclude that the previously observed greenium, significant in our sample in 2022, has disappeared. Instead, the green bond

[11] We use a simple T-test as well as a bootstrapped test for the mean. While the sample size is sufficiently large, we have one premia for each 1,349 bond pairs, the bootstrapped test for the mean with re-sampling by cluster should alleviate concerns of non-normality and clustering issues. Both tests confirm the hypothesis of a significant positive green bond premium.

premium has become significantly positive. This finding extends the time frame of previous papers (e.g. Caramichael and Rapp, 2024; Lehkonen et al., 2024; Ghitti et al., 2025; Pietsch and Salakhova, 2022; Zerbib, 2019). It is in line with, for example, Lehkonen et al. (2024) who document a significant corporate greenium only before 2021. Nonetheless they do not find a reversal.

Figure 3: Average Green Bond Premium by Year

This figure shows the average annual green bond premia and confidence intervals (CIs) calculated via cluster-robust wild bootstrap. It suggests that the greenium, significant in 2022, has disappeared and that we now observe a positive green bond premium.



Our findings confirm that the green bond premium is time varying as predicted by Pástor et al. (2021). It also strengthens the mostly anecdotal evidence of a vanishing greenium. Previous papers attribute the time-varying nature of the greenium to excess demand by investors (Boermans, 2023; Caramichael and Rapp, 2024; Pietsch and Salakhova, 2022). Our results suggests that investors do no longer prefer green bonds over similar conventional bonds which coincides with the increasingly negative market perception of ESG (Baker et al., 2024). An alternative explanation could be that there also have been growing doubts whether green bonds can deliver on their investment objective. For instance, Aswani and Rajgopal (2025) find that there is no evidence that carbon emissions fall after four years and even when looking only at voluntary disclosed data. Ehlers et al. (2020) also find no association with lower emission intensity along the supply chain (Scope 1 to 3). Moreover, a recent study found that most green bonds in the United States by firms and municipalities simply fund existing projects or similar projects as already in place (Lam and Wurgler, 2024). This raises the question whether a sustainable investment strategy focused on green bonds achieves the intended outcome of greening the economy and how investors use additional information related to the environmental performance of the bond.

Next, we address some of the potential sample selection concerns and show that these do not drive the observed reversal of the green bond premium (Figure A.5). We show that i) the reversal is not driven by including bonds with single conventional bond matches, nor ii) the composition of the bonds in sample. In particular, we show that the reversal is not driven by different types of bonds being in the sample in different years by restricting the sample to the 122 bonds for which have data for all years. Moreover, iii) samples excluding bonds without a credit rating or iv) bonds with amount issued below 300 mn USD produces a similar switch from negative to positive green bond premia after 2021. If anything, Figure A.5 shows that the reversal for these smaller subsamples is more pronounced.

4.2 Do investors prefer green issuers?

Green bonds explicitly target green projects but they are issued by both clean and brown firms in our sample. Over the entire time span, we observe large heterogeneity in the green bond premia (Table A.11). Given this heterogeneity, we will test whether the greenness of issuers can explain the distribution across bonds and whether this plays a role in the reversal of the green bond premium.

4.2.1 ESG scores

Figure 4: Average Green Bond Premium by ESG Score

This figure shows the green bond premium averaged for 2020 to 2022 and for 2023 and 2024 by ESG score groups A, B C & D and Non-Rated (NR). ESG rating categories C and D are combined due to few bonds in these.

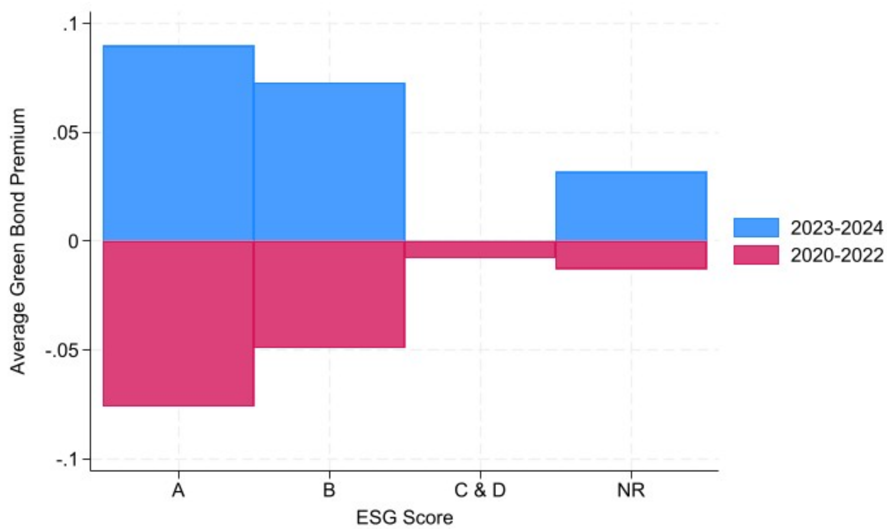


Figure 4 shows that the average annual green bond premium varies not only over time but also with the issuer's ESG score. Moreover, the average green bond premia increases noticeably for A, B and non-rated (NR) bonds after 2022. We confirm the preliminary evidence of ESG scores driving the distribution of green bond premia in a regression. Table 5 reports the results of Equation 2 with ESG scores as the greenness indicator. Standard errors are clustered at the issuer level. Columns 1 and 2 show that the post 2022 indicator by itself is significant without and with bond fixed effects. In column 3, we add continuous ESG scores as an explanatory variable. The coefficient on the post 2022 indicator remains significant, while the issuer ESG score does not seem to explain green bond premia. However, when we interact the ESG score and the Post 2022 dummy (Column 4), both the ESG score and its interaction with the post 2022 dummy are significant at 10%. Higher (better) ESG scores correspond to a lower green bond premium, a greenium, before 2023.

Column 4 suggests that the opposite is the case after, that is, higher ESG scores being associated to higher green bond premium. Nonetheless, this part of the results does not stay robust when including bond characteristics and climate news or real oil prices (Columns 5 to 7). The coefficients of the ESG score and the interaction add up to be close to zero. Meanwhile, the significance of the coefficient of ESG score increases from 10 to 5%. The interaction effect stays weakly significant at 10% across specifications. In conclusion, we find that a one standard deviation increase in ESG score of 0.15 in 2022 (Table A.3) is associated to a 0.03 to 0.04 bps higher greenium. While the magnitudes are rather small, our results show that investors no longer pay a more for green bonds with high ESG scores consistent with ESG backlash observed e.g. in a fund context (Baker et al., 2024).

In column 5, we add bond level controls[12]. The reference category is "non-rated" for the bond ratings, and "other" for all remaining categories. Neither bond rating nor sector seem to play an additional role in the distribution of the green bond premia. Previous authors found the sector, particular the financial sector, to be driving the greenium (Aswani and Rajgopal, 2025; Caramichael and Rapp, 2024; Lehkonen et al., 2024; Pietsch and Salakhova, 2022; Zerbib, 2019). In addition, the green bond premium is around 0.14 bps higher for bonds domiciled in the EU. This contradicts the assumption that stricter regulation (Ghitti et al., 2025; Pástor et al., 2021; Pietsch and Salakhova, 2022), here in particular the introduction of the green bond Standard in 2023 in the EU, should lead to a greenium. Moreover, European investors are believed to be more willing to pay for ESG (Baker et al., 2024). Column 5 reveals that longer remaining maturities increase green bond premia slightly. That is, green bonds with longer remaining maturities are more likely to have a higher green bond premium. In line with Zerbib (2019), liquidity measured as log amount issued has no effect. Including climate news (Column 6) or real oil prices (Column 7) also leaves the significance of the coefficients on ESG score and interaction term in Column 5 unchanged. As in Ardia et al. (2023) more climate news suggest to green outperforming brown leading to a lower greenium. Similar results are reported by Lehkonen et al. (2024) and Renjie and Xia (2023) for municipal bonds. The real oil price has the same but smaller effect; higher real oil prices lead to a higher greenium, while leaving the effect of ESG scores unchanged. Furthermore, we find no evidence that the ESG effect is driven by the E score of the ESG rating (Table A.14) even if the correlation of ESG and E score is high (0.81). The E score as well as its interaction with the Post 2022 indicator are insignificant for all specifications.

4.2.2 Emission Intensity

What matters most for decarbonization is the whether firms are able to considerably reduce their (level) emission intensity (Hartzmark and Shue, 2022). In our sample, neither ESG nor E scores are significantly correlated to emission intensity (Figures A.7). This could be partly due to the limited overlap between ESG and Emission subsamples. However, ESG scores combine environmental with social and governance measures and even Environmental (E) scores combine measures of emissions, innovation and resource use. Furthermore, E-scores are benchmarked against a the issuer's respective industry (LSEG, 2024). Therefore, a regression with emission intensity may lead to additional insights.

[12]We refrain from adding bond-level fixed effects because it would lead to the already limited variation in ESG scores by issuer to be further restricted.

Table 5: Regression of ESG Scores on Estimated Green Bond Premia

This table shows the results of the regression $\hat{p}_{it} = \alpha_{it} + \beta_1 \text{ESG Score}_{ft} + \beta_2 \text{Post 2022}_t + \beta_3 \text{Post 2022}_t \times \text{ESG Score}_{ft} + \beta_4 \text{Bond Controls}_{i(,t)} + \beta_5 \text{Climate News}_t + \eta_{it}$ (Equation 2) in the ESG subsample. $ESGScore_{ft}$ refers to the continuous ESG score of firm f in year t. The reference categories for country and sector is "Other" and for the rating is is non-rated (NR). Standard errors are clustered at the issuer level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	$\hat{p}$_it	$\hat{p}$_it	$\hat{p}$_it	$\hat{p}$_it	$\hat{p}$_it	$\hat{p}$_it	$\hat{p}$_it
Post 2022=1	0.1076***	0.0990***	0.1076***	-0.0803	-0.0466	-0.0641	-0.0660
	(0.0286)	(0.0278)	(0.0287)	(0.0859)	(0.0801)	(0.0792)	(0.0829)
ESG Score			0.0380	-0.1643*	-0.2447**	-0.2581**	-0.2572**
			(0.1003)	(0.0972)	(0.1137)	(0.1129)	(0.1141)
Post 2022=1 × ESG Score				0.2630*	0.2337*	0.2519*	0.2435*
				(0.1392)	(0.1318)	(0.1289)	(0.1317)
Investment Grade					-0.0849	-0.0866	-0.0839
					(0.0579)	(0.0577)	(0.0584)
Not Investment Grade					-0.1745	-0.1763	-0.1743
					(0.1465)	(0.1460)	(0.1466)
Financials					0.0499	0.0499	0.0487
					(0.0426)	(0.0429)	(0.0428)
Industrials					-0.0180	-0.0180	-0.0190
					(0.0760)	(0.0763)	(0.0761)
Real Estate					0.0443	0.0456	0.0420
					(0.0445)	(0.0443)	(0.0448)
Utilities					-0.0017	-0.0022	-0.0019
					(0.0370)	(0.0371)	(0.0371)
China					0.0151	0.0129	0.0121
					(0.0373)	(0.0377)	(0.0374)
EU					0.1403***	0.1397***	0.1402***
					(0.0388)	(0.0392)	(0.0390)
United States					-0.0129	-0.0131	-0.0098
					(0.0380)	(0.0382)	(0.0385)
Maturity					0.0051**	0.0051**	0.0046*
					(0.0023)	(0.0023)	(0.0024)
Log Amount Issued					0.0040	0.0051	0.0041
					(0.0107)	(0.0105)	(0.0107)
Climate News						-0.0908*	
						(0.0468)	
Real Oil Price							-0.0012*
							(0.0007)
Constant	-0.0295*	-0.0372*	-0.0557	0.0901	0.0034	0.1818	0.1038
	(0.0174)	(0.0190)	(0.0709)	(0.0711)	(0.2209)	(0.2687)	(0.2346)
Adjusted R^2	0.0325	0.0414	0.0330	0.0376	0.0741	0.0756	0.0738
Bond Fixed Effects	No	Yes	No	No	No	No	No
N	1478	1478	1478	1478	1478	1478	1478

Standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Figure 5: Average Green Bond Premium by Scope 1-3 Emission Intensity

This figure shows the green bond premium averaged for 2020 to 2022 and for 2023 and 2024 by the quintile of issuers' emission intensity where the 1st quintile is the issuers with the lowest emission intensity.

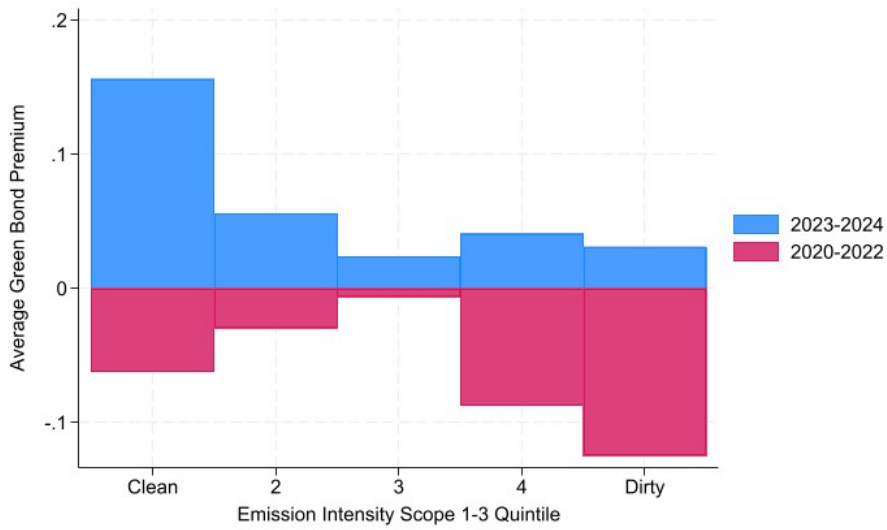


Figure 5 shows the average green bond premium for quintiles of issuers emission intensity for 2020 to 2022 and 2023 and 2024. Similarly to above, green bond premia across all quintiles on average are positive after 2022. Moreover, the issuers with the highest emission intensity (dirtiest issuers) seem to have the lowest green bond premium before 2023, while the issuers with the lowest emission intensity (cleanest issuers) seem to have the highest green bond premium after 2022. We capture this nonlinearity in a regression by using quintiles of issuers' annual emission intensity. Table 6 shows the results. As observed in Figure 5, across specifications issuers in the dirtiest quintile are associated to a higher greenium (Columns 3). Nonetheless, this reverses after 2022 (Column 4). Compared to the middle quintile, issuers in the first, second and fifth quintile have higher green bond premia after 2022. The effect is strongest for the cleanest issuers (0.14 bps). Again, the results stay robust when adding bond and macroeconomic controls (Columns 5 to 7). Similarly to before, only EU domiciled bonds are associated with higher green bond premia. When controlling for emission intensity, only more climate news (Column 6) but not higher real oil prices (Column 7) have a significantly negative effect. Nonetheless, we can not confirm our results with Scope 1 and 2 emissions only, which are more accessible to investors (Table A.15. There we find that green bond premia are significantly higher post 2022 and this effect is less pronounced for the cleanest issuers across specification. Thus, we find some evidence that investors in the green bond market invest "productively" preferring bonds by dirtier issuers. However, the reversal is present for all types of issuers suggesting that this effect dominates and investors no longer are willing to pay a premium for green bonds irrelevant of its impact potential.

Table 6: Regression of Scope 1-3 Emission Intensity on Estimated Green Bond Premia

This table shows the results of the regression $\hat{p}_{it} = \alpha_{it} + \beta_1 \text{Emission Intensity}_{ft} + \beta_2 \text{Post 2022}_t + \beta_3 \text{Post 2022}_t \times \text{Emission Intensity}_{ft} + \beta_4 \text{Bond Controls}_{i(,t)} + \beta_5 \text{Climate News}_t + \eta_{it}$ (Equation 2) in the Emissions subsample. Emission Intensity$_{ft}$ refers to the quintile of issuer f's Scope 1-3 emission intensity in year t. The reference categories for country and sector is "Other" and for the rating is is non-rated (NR). Standard errors are clustered at the issuer level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	$\hat{p}$_it	$\hat{p}$_it	$\hat{p}$_it	$\hat{p}$_it	$\hat{p}$_it	$\hat{p}$_it	$\hat{p}$_it
Post 2022=1	0.0885***	0.0788***	0.0946***	0.0145	0.0317	0.0189	0.0137
	(0.0292)	(0.0267)	(0.0206)	(0.0306)	(0.0327)	(0.0352)	(0.0393)
Emissions Quintile=1			0.0766	0.0095	0.0352	0.0244	0.0256
			(0.0699)	(0.0481)	(0.0577)	(0.0625)	(0.0609)
Emissions Quintile=2			0.0135	-0.0128	-0.0156	-0.0248	-0.0294
			(0.0217)	(0.0127)	(0.0138)	(0.0157)	(0.0220)
Emissions Quintile=4			-0.0327	-0.0160	0.0023	-0.0021	-0.0043
			(0.0223)	(0.0535)	(0.0560)	(0.0557)	(0.0564)
Emissions Quintile=5			-0.0743**	-0.1418***	-0.1157***	-0.1266***	-0.1246***
			(0.0344)	(0.0405)	(0.0383)	(0.0370)	(0.0381)
Post 2022=1 × Emissions Quintile=1				0.1289**	0.1229**	0.1324**	0.1316**
				(0.0649)	(0.0567)	(0.0565)	(0.0569)
Post 2022=1 × Emissions Quintile=2				0.0891**	0.1053**	0.1166**	0.1209**
				(0.0423)	(0.0448)	(0.0460)	(0.0493)
Post 2022=1 × Emissions Quintile=4				0.0363	0.0057	0.0118	0.0135
				(0.0661)	(0.0724)	(0.0729)	(0.0735)
Post 2022=1 × Emissions Quintile=5				0.1537***	0.1560***	0.1673***	0.1652***
				(0.0550)	(0.0568)	(0.0562)	(0.0573)
Investment Grade					-0.0054	-0.0071	-0.0043
					(0.0314)	(0.0312)	(0.0319)
Not Investment Grade					-0.0701	-0.0708	-0.0693
					(0.1451)	(0.1447)	(0.1450)
Financials					0.0599	0.0616	0.0586
					(0.0465)	(0.0462)	(0.0471)
Industrials					-0.0537	-0.0562	-0.0557
					(0.0855)	(0.0863)	(0.0859)
Real Estate					0.0289	0.0285	0.0259
					(0.0526)	(0.0521)	(0.0531)
Utilities					0.0218	0.0198	0.0200
					(0.0427)	(0.0432)	(0.0430)
China					0.0279	0.0261	0.0236
					(0.0418)	(0.0423)	(0.0434)
EU					0.0818**	0.0820**	0.0810**
					(0.0322)	(0.0323)	(0.0325)
United States					-0.0144	-0.0159	-0.0145
					(0.0469)	(0.0476)	(0.0468)
Maturity					0.0046	0.0052*	0.0041
					(0.0032)	(0.0029)	(0.0034)
Climate News						-0.0994*	
						(0.0584)	
Real Oil Price							-0.0009
							(0.0008)
Constant	-0.0164	-0.0249	-0.0196	0.0057	-0.1278**	0.0826	-0.0498
	(0.0188)	(0.0172)	(0.0241)	(0.0164)	(0.0568)	(0.1663)	(0.1083)
Adjusted R^2	0.0294	0.0310	0.0418	0.0469	0.0658	0.0673	0.0651
Bond Fixed Effects	No	Yes	No	No	No	No	No
N	1637	1637	1637	1637	1637	1637	1637

Standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

5 Conclusion

In our paper, we present evidence that the greenium has not only disappeared but that it has reversed. Instead of a negative green bond premium, or greenium, we now observe a significant positive premium in 2024. We believe that the positive premium at the end of our sample period could be a reflection of the trend of ESG backlash. We show that higher ESG scores correspond to higher greeniums only before 2023. Afterwards, investors no longer seem to be willing to pay more for high ESG bonds compatible with ESG backlash observed over the same time span. While we find support of ESG backlash, we do not find evidence of the idea that ESG investing is focused on already clean issuers. Instead, we find that issuers with the highest emission intensity are associated with the highest greeniums before 2023 and that the change to a positive green bond premium after 2022 is less pronounced for these bonds. Nonetheless, the reversal overshadows this implying that green bonds are no longer preferred over their conventional counterparts irrespective of their issuer characteristics.

The strongest limitation in our paper is dictated by data availability. We only cover 2020 to 2024. Nevertheless, we are able to construct a relatively large sample of matched bonds. Furthermore, we leave the puzzle of a higher green bond premia for EU-domiciled bonds for further research. Given that the greenium has been shown to be demand driven, an increasing supply of green bonds in the EU could explain this effect. Another explanation could be that stricter regulation helps investor re-assess the credibility of green bonds leading to a cleaning up on the market.

If there is no longer a greenium, it not only reflects the changing preferences of investors but also has important implications for the financial markets role in financing decarbonization. Higher prices (lower yields) for green bonds also imply a potentially lower cost of capital for the issuer thereby rewarding credible green projects. Moreover, green bonds are believed to allocate capital effectively in case of no carbon tax (Baker et al., 2022). Given the large potential of green bonds, our paper suggests that large improvements may be needed to convince investors of their importance. Tighter standards such as the EU Green Bond Standard should help alleviating concerns of their efficacy. It may be more difficult in the current political climate, however, to persuade investors to pay attention to ESG at all.

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A Appendix

List of Figures

List of Tables

A.1 Data

Table A.1: Variable Descriptions

Variable	Unit	Notes
Amount Issued	mn USD	All bonds have a positive amount issued.
Callable	Category	All bonds are either callable (true) or non-callable (false).
Certification	Category	green bonds are either Climate Bonds Initiative (CBI) certified, aligned or self-labeled bonds. We assign “self-labeled” if missing. Refers to Eikon variable “ESG Bond Type.”
Currency	Category	
Collateral	Category	All bonds either have collateral (true) or none (false). We do not differentiate collateral type.
Coupon	Percent	
Coupon Frequency	Category	All bonds pay out coupons either annually, quarterly or semi-annually.
Country	Category	green bonds’ issuer domicile in four country groups: China, European Union (EU), United States or Other.
Instrument		We aggregate different countries’ covered bonds such as Belgian Mortgage Pandbrieven (Covered Bond), Cedula de Internacionalizacion (Covered Bond) or Fundierte Schuldverschreibungen (Covered Bond), to one category.
Issue Date	Date	All bond have a date on which they are issued.
Liquidity	Percent	Bid- Ask Spread calculated as the percent quoted spread.
Maturity	Date	All bonds have a maturity date.
Maturity at Issuance	Years	Difference between maturity and issue date.
Rating	Category	All bond have a bond rating in 22 categories. Non-rated and missing are combined into “NR” Category. Refers to Eikon variable “S&P Equivalent Rating.”
Second Party Opinion	Category	green bonds either have (true) or do not have (false) a second party opinion (SPO). We do not differentiate on which agency gives the SPO. Refers to Eikon variable “Second Party Opinion Provider.”
Sector	Category	TRBC Sector aggregated to 5 sectors: Financials, Industrials, Real Estate, Utilities or Other.
Use of Proceeds		green bonds’ record on how amount issued is used.
Volatility	Percent	Calculated as the 30-day standard deviation in the daily return of ask prices.
Yield	Percent	Ask yield.

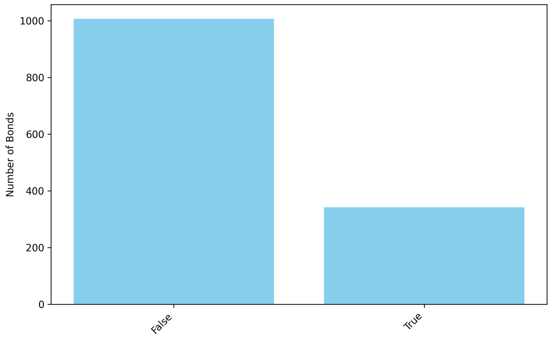
Table A.2: Green and Conventional Bond Characteristics

This table shows the summary statistics of amount issued (in USD), coupon (in percent), issue date (date) and maturity at issuance (in years) of green bonds (GB) and Conventional Bonds (CB) in the final (matched) sample.

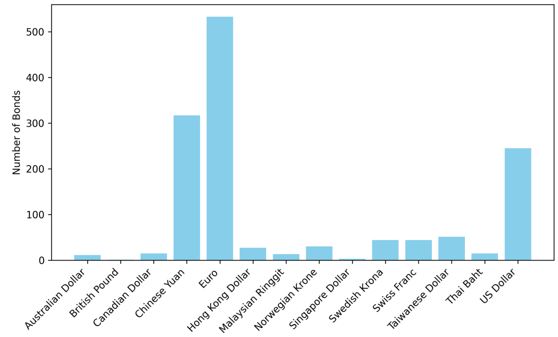
	Amount Issued		Coupon		Issue Date		Maturity at Issuance	
	GB	CB	GB	CB	GB	CB	GB	CB
count	1349	2430	1349	2430	1349	2430	1349	2430
mean	382.32	424.59	2.54	2.26	2022-03-17	2021-02-07	7.78	7.87
std	462.63	601.47	1.70	1.67	NaN	NaN	5.58	5.56
min	1.10	2.90	0	0	2015-04-15	2013-09-19	2	2
25%	68.99	66.34	0.88	0.74	2021-03-10	2019-12-06	4.98	5
50%	206.97	221.43	2.65	2.25	2022-04-14	2021-01-15	7	7
75%	523.30	518.75	3.70	3.38	2023-06-06	2022-11-06	10	10
max	4139.30	5492.39	7.88	9.62	2024-10-17	2024-10-03	31.01	31

Figure A.1: Green and Conventional Bond Characteristics

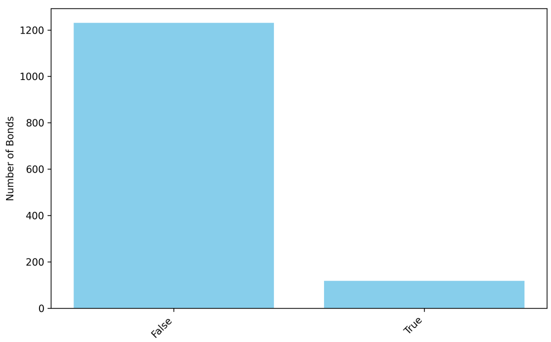
These figures show the bond characteristics of the matched pairs of green and conventional bonds in the final (matched) sample. Each characteristic is exactly matched on (see Table 1).



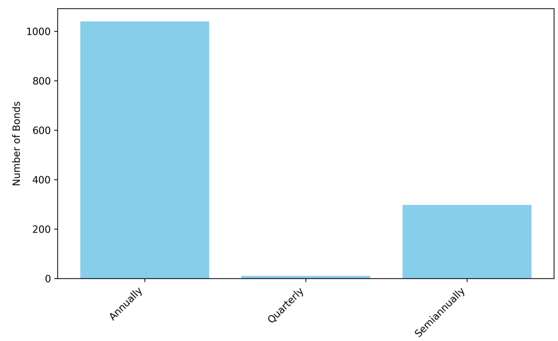
(a) Number of Bond Pairs by Callability



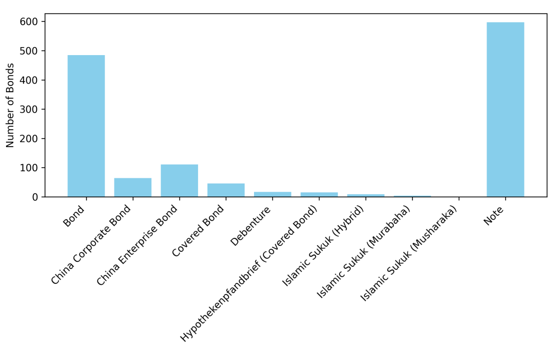
(b) Number of Bond Pairs by Currency



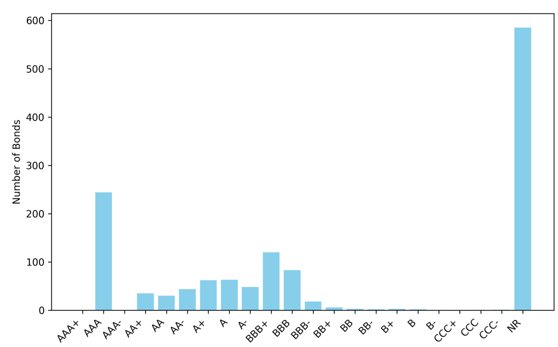
(c) Number of Bond Pairs by Collateral



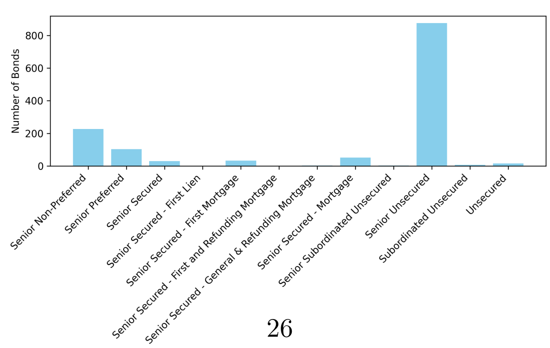
(d) Number of Bond Pairs by Coupon Frequency



(e) Number of Bond Pairs by Instrument

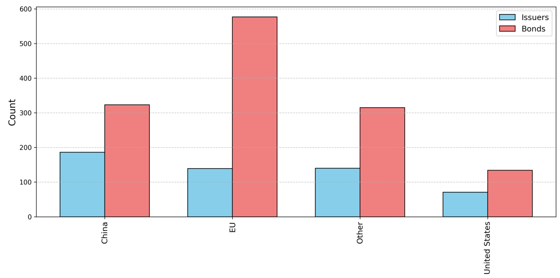


(f) Number of Bond Pairs by Rating

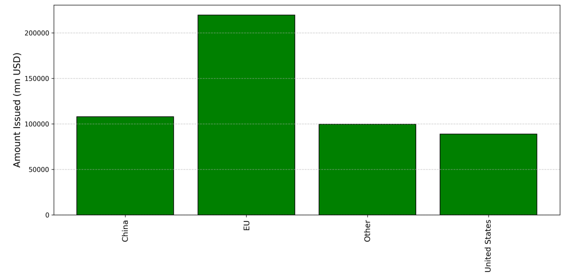


(g) Number of Bond Pairs by Seniority

Figure A.2: Distribution by Country

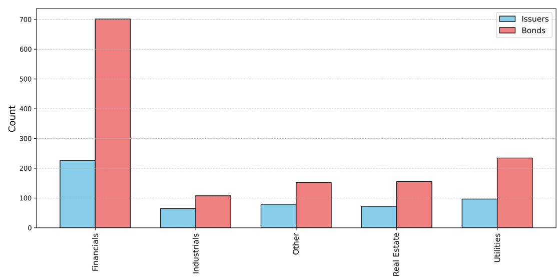


(a) Number of Bonds and Issuers by Country Group

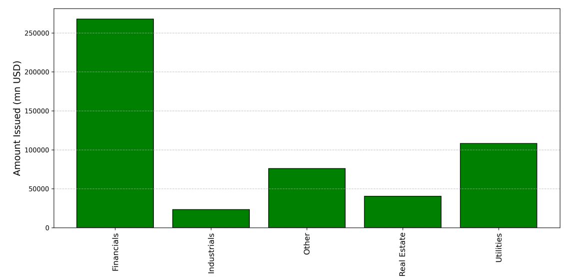


(b) Total Amount Issued (mn USD) by Country Group

Figure A.3: Distribution by Sector



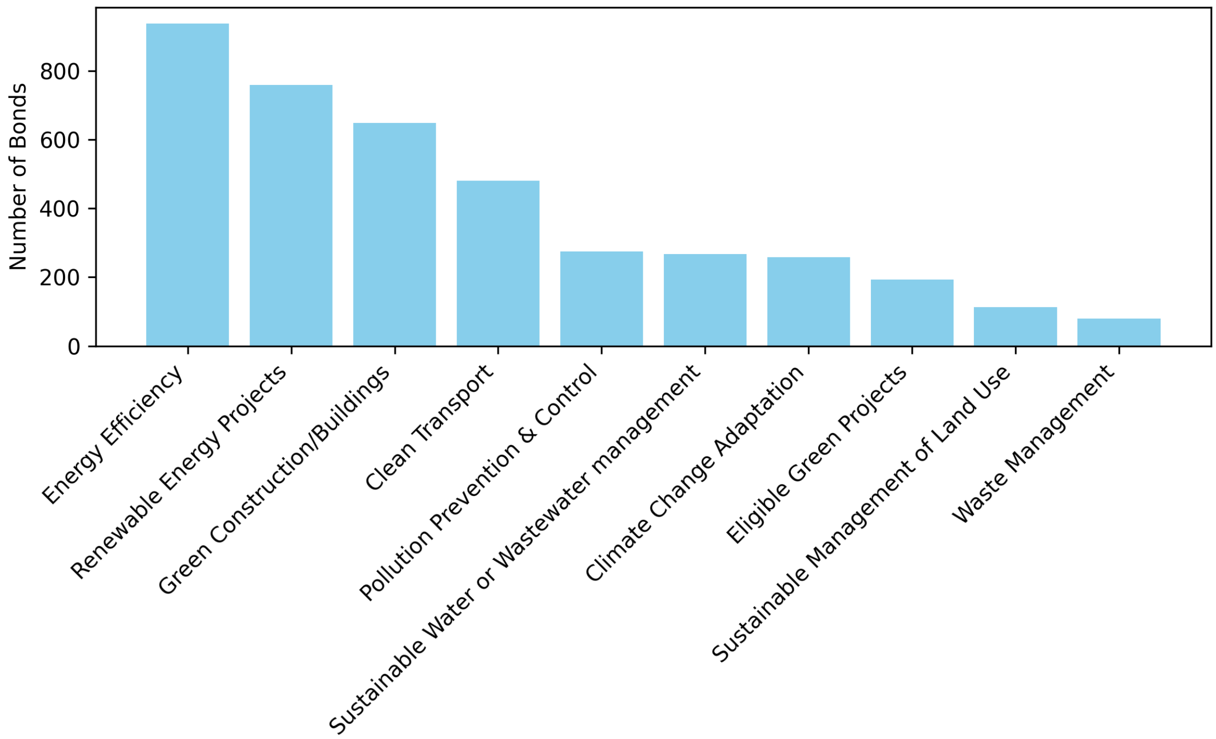
(a) Number of Bonds and Issuers by Sector



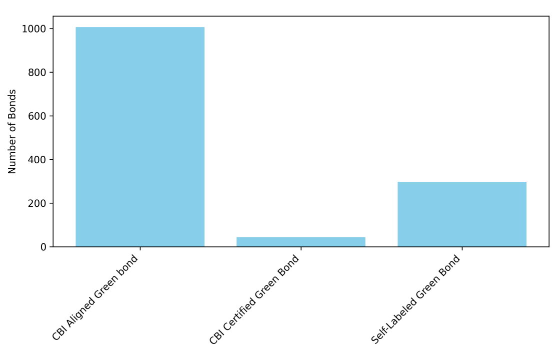
(b) Total Amount Issued (mn USD) by Sector

Figure A.4: Green Bond Characteristics

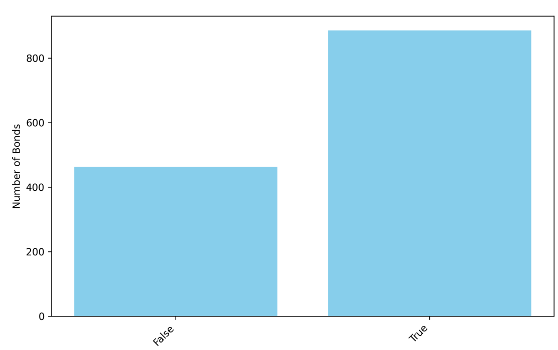
These figures show characteristics specific to the green bond. Note that a green bond can have multiple use of proceeds listed.



(a) Top 10 Number of Bonds by Use of Proceeds



(b) Number of Bonds with Certification



(c) Number of Bonds with Second Party Opinion

Table A.3: Summary Statistics ESG scores

This table shows the summary statistics of the ESG score by year ranging from lowest (0) to highest (1). The ESG score is a aggregate of **E**nvironmental, **G**overnance and **S**ocial score

	count	mean	sd	min	p50	max
2020	42	0.75	0.14	0.21	0.76	0.93
2021	97	0.70	0.14	0.18	0.71	0.94
2022	146	0.70	0.15	0.14	0.72	0.94
2023	218	0.68	0.16	0.14	0.72	0.95
2024	283	0.66	0.16	0.15	0.71	0.95
Observations	786					

Table A.4: Summary Statistics Environmental Pillar (E) scores

This table shows the summary statistics of the Environmental Pillar (E) score by year ranging from lowest (0) to highest (1). The E score is one building block of the ESG Score.

	count	mean	sd	min	p50	max
2020	42	0.78	0.17	0.12	0.84	0.98
2021	97	0.72	0.20	0.03	0.76	0.97
2022	146	0.72	0.19	0.03	0.76	0.98
2023	218	0.71	0.20	0.06	0.74	0.98
2024	283	0.69	0.20	0.08	0.73	0.98
Observations	786					

Table A.5: Summary Statistics Emission Intensity

This table shows the summary statistics of Scope 1-2 and Scope 1-3 emission intensity (in log (tons CO2 / mn USD)) per year.

	count	mean	sd	min	p50	max
2020						
Log Intensity Scope 1-2	51	4.80	2.53	0.80	4.85	8.71
Log Intensity Scope 1-3	31	5.91	1.25	3.64	5.70	8.48
2021						
Log Intensity Scope 1-2	116	4.37	2.46	0.82	4.03	8.59
Log Intensity Scope 1-3	66	6.35	1.17	3.51	6.29	8.95
2022						
Log Intensity Scope 1-2	191	3.87	2.38	0.61	3.49	8.64
Log Intensity Scope 1-3	99	6.56	1.10	3.59	6.33	9.34
2023						
Log Intensity Scope 1-2	318	3.53	2.25	0.06	3.27	8.87
Log Intensity Scope 1-3	154	6.61	1.01	3.23	6.91	9.61
2024						
Log Intensity Scope 1-2	449	3.45	2.28	0.06	3.18	9.57
Log Intensity Scope 1-3	197	6.61	1.10	3.18	6.93	9.64
Observations	1125					

A.2 Methodology

Table A.6: Summary Statistics Ask Yields

This table shows summary statistics of ask yields (in %) for green bonds (GB) and matched conventional bonds (CB1, CB2), as well as of the synthetic bond (SB), and the dependent variable: $\Delta Yield = Yield^{GB} - Yield^{SB}$ (in percentage points). Any extreme variation in differences can stem from the fact that we work with three sets of daily yields (GB, CB1, CB2) which are prone to error rather than the matching process. Thus, we winsorized the yield difference at 1st and 99th percentile.

	GB	CB 1	CB 2	SB	Δ Yield
count	689597	689597	564863	689597	689597
mean	2.82	2.79	2.90	2.80	0.01
std	1.98	1.98	1.93	1.99	0.35
min	-0.30	-0.30	-0.30	-1.95	-1.81
1%	0.02	0.02	0.03	0.02	-1.05
5%	0.11	0.09	0.14	0.10	-0.44
50%	3.29	3.26	3.40	3.20	-0
95%	5.63	5.62	5.60	5.69	0.55
99%	6.65	6.38	6.49	6.75	1.44
max	16.42	16.58	15.38	16.53	2.42

Table A.7: Summary Statistics Bid Ask Spread

This table shows summary statistics of bid ask spreads (in %) for green bonds (GB) and matched conventional bonds (CB1, CB2), as well as of the synthetic bond (SB) and the independent variable: $\Delta Liquidity = Liquidity^{GB} - Liqudity^{SB}$ (in percentage points). Bid-Ask Spreads are computed as percentage quoted spread. Any extreme variation in differences can stem from the fact that we work with six sets of bid and ask prices and their combinations (synthetic bond variables and yield differences) which are prone to error rather than the matching process. Thus, we winsorized the difference in bid ask spreads at 1st and 99th percentile.

	GB	CB 1	CB 2	SB	Δ Liquidity
count	689597	689597	564863	689597	689597
mean	0.01	0	0	0	0
std	0	0	0	0	0
min	-0.02	-0.01	-0.01	-0.01	-0.03
1%	0	0	0	-0	-0.01
5%	0	0	0	0	-0
50%	0	0	0	0	0
95%	0.01	0.01	0.01	0.01	0.01
99%	0.01	0.01	0.01	0.02	0.01
max	0.08	0.07	0.06	0.07	0.01

Table A.8: Summary Statistics Volatility

This table shows summary statistics of volatility (in %) for green bonds (GB) and matched conventional bonds (CB1, CB2), as well as of the synthetic bond (SB) and the independent variable: $\Delta Volatility = Volatility^{GB} - Volatility^{SB}$ (in percentage points).Volatility is computed as the standard deviation of a 30-day rolling window of the daily returns of ask yields. Any extreme variation in differences can stem from the fact that we work with three sets of ask prices (GB, CB1, CB2) and their associated volatility and their combinations (synthetic bond variables and yield differences) which are prone to error rather than the matching process. Thus, we winsorized the difference in volatility at 1st and 99th percentile.

	GB	CB 1	CB 2	SB	Δ Volatility
count	683835	689597	564863	689597	672082
mean	0.01	0.01	0.01	0	0
std	0.02	0.01	0.01	0.23	0
min	0	0	0	-17.32	-0.01
1%	0	0	0	0	-0.01
5%	0	0	0	0	-0
50%	0	0	0	0	0
95%	0.01	0.01	0.01	0.01	0
99%	0.03	0.01	0.02	0.02	0.01
max	2.13	1.98	1.26	43.89	0.02

Table A.9: Summary Statistics Climate News and Real Oil Price

This table shows annual averages for climate news measured as the Media Climate Change Concerns (MCCC) index by (Ardia et al., 2023) where a higher value indicates more attentions to climate change and real oil prices (in USD) are the Europe Brent Spot prices discounted by the US Consumer price Index.

	Climate News	Real Oil Price
	mean	mean
2020	1.50	38.40
2021	2.10	61.85
2022	2.19	81.76
2023	2.20	64.15
2024	1.91	60.85

A.3 Results

Table A.10: Summary Statistics Green Bond Premia $\hat{p}_i$

This table shows the summary statistics of the green bond premia $\hat{p}_i$ (in percentage points) extracted as the fixed effect from a regression of Δ Yield on Δ Liquidity (Equation 1).

	mean	sd	min	p50	max
$\hat{p}\_i$	0.0384	0.2461	-1.1868	0.0018	2.0913
Observations	1349				

Table A.11: Summary Statistics Green Bond Premia $\hat{p}_{i,t}$ by Year

This table shows the summary statistics of the green bond premia $\hat{p}_{i,t}$ (in percentage points) extracted as the fixed effect from a annual regression of Δ Yield on Δ Liquidity and Δ Volatility (Equation 1).

	count	mean	sd	min	p50	max
2020						
$\hat{p}\_it$ controlling for $\Delta Liquidity$	134	-0.0430	0.2928	-1.1152	-0.0077	1.3228
$\hat{p}\_it$ controlling for $\Delta Liquidity$ and $\Delta Volatility$	68	-0.0642	0.2461	-0.8428	0.0020	0.3791
2021						
$\hat{p}\_it$ controlling for $\Delta Liquidity$	405	-0.0392	0.2093	-1.6087	-0.0147	0.6430
$\hat{p}\_it$ controlling for $\Delta Liquidity$ and $\Delta Volatility$	168	-0.0373	0.2358	-1.0795	-0.0045	0.5871
2022						
$\hat{p}\_it$ controlling for $\Delta Liquidity$	643	-0.0300	0.2904	-1.1701	-0.0060	1.8360
$\hat{p}\_it$ controlling for $\Delta Liquidity$ and $\Delta Volatility$	523	-0.0264	0.3067	-1.3018	-0.0050	1.8395
2023						
$\hat{p}\_it$ controlling for $\Delta Liquidity$	926	0.0312	0.2584	-1.3682	0.0033	1.5933
$\hat{p}\_it$ controlling for $\Delta Liquidity$ and $\Delta Volatility$	809	0.0295	0.2615	-1.3669	0.0021	1.6211
2024						
$\hat{p}\_it$ controlling for $\Delta Liquidity$	1332	0.0605	0.3048	-1.2054	0.0058	2.2637
$\hat{p}\_it$ controlling for $\Delta Liquidity$ and $\Delta Volatility$	1230	0.0640	0.3077	-1.0728	0.0058	2.2655

Table A.12: Test for the Average Green Bond Premium by Year

This table shows the results of a t-test and bootstrapped test for the mean $H_0 : \sum_{i=1}^{N} \hat{p}_{i,t} = 0$ for every year. The observed mean refers to the estimate fixed effect from Equation 1 controlling for the differences in liquidity and volatility. We use wild bootstrapping with Rademacher weights to account for different cluster sizes and re-sample by issuer.

Year	Method	Mean	SE	p-value	Count	Clusters
2020	T-test	-0.0642	0.0298	0.0349**	68	49
	Wild Bootstrap	-0.0642	0.0465	0.1080	68	49
2021	T-test	-0.0373	0.0182	0.0420**	168	93
	Wild Bootstrap	-0.0373	0.0308	0.1170	168	93
2022	T-test	-0.0264	0.0134	0.0495**	523	208
	Wild Bootstrap	-0.0264	0.0193	0.0270**	523	208
2023	T-test	0.0295	0.0092	0.0014***	809	321
	Wild Bootstrap	0.0295	0.0333	0.1090	809	321
2024	T-test	0.0640	0.0088	0.0000***	1230	486
	Wild Bootstrap	0.0640	0.0255	0.0000***	1230	486

* p<0.10, ** p<0.05, *** p<0.01

Figure A.5: Average Green Bond Premium by Year: Subsamples

This figure shows the average annual green bond premia for the full sample (blue), excluding bonds with only one conventional bond match (red), excluding bonds without data for all years (green), excluding bonds without credit rating (yellow) and excluding bonds with amount issued < 300 mn USD (purple). It shows that the reversal can be observed in all subsamples.

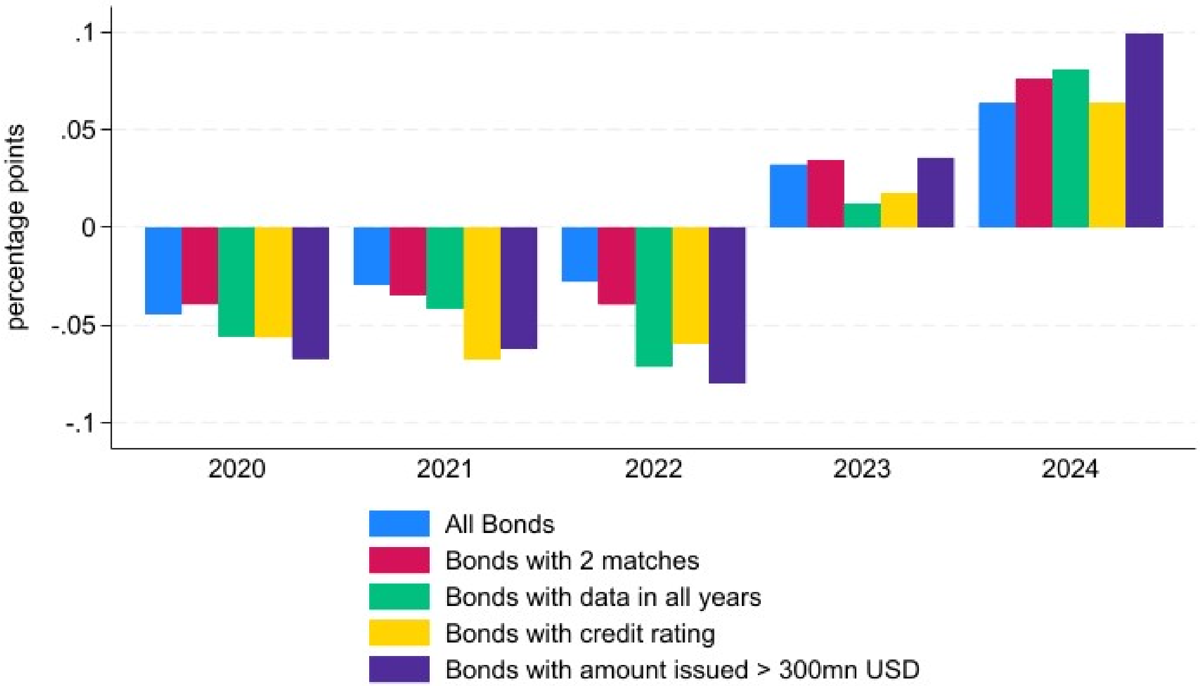


Figure A.6: Average Green Bond Premium by Year: ESG Subsample

This figure shows the average annual green bond premia for the full sample (blue) and subsample of bond with ESG scores (red). It shows that the reversal can be observed in both subsamples.

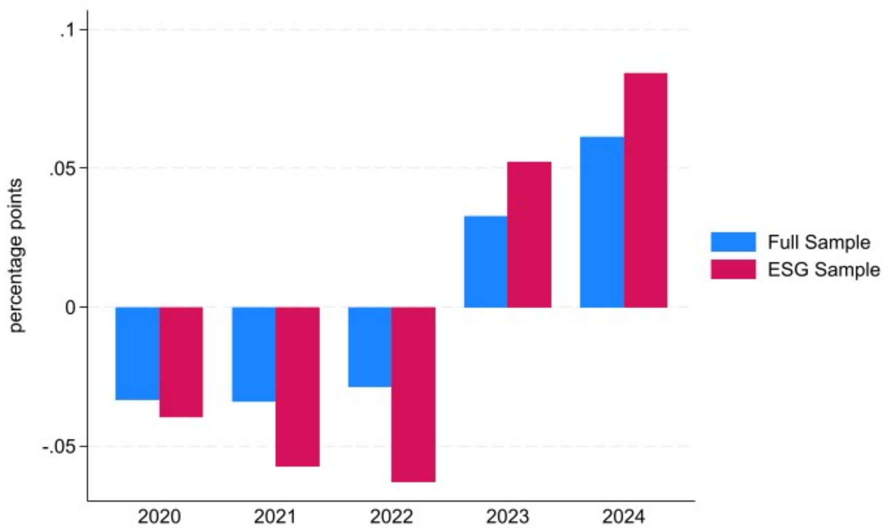


Table A.13: Regression of ESG Score Dummy on Estimated Green Bond Premia

This table shows the results of the regression $\hat{p}_{it} = \alpha_{it} + \beta_1 \text{ESG Score}_{ft} + \beta_2 \text{Post 2022}_t + \beta_3 \text{Post 2022}_t \times \text{ESG Score}_{ft} + \beta_4 \text{Bond Controls}_{i(,t)} + \beta_5 \text{Climate News}_t + \eta_{it}$ (Equation 2) in the ESG subsample. $ESGScore_{ft}$ refers a dummy equal to 1 if firm f has an ESG score in year t. The reference categories for country and sector is "Other" and for the rating is is non-rated (NR). Standard errors are clustered at the issuer level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	$\hat{p}\_it$	$\hat{p}\_it$	$\hat{p}\_it$	$\hat{p}\_it$	$\hat{p}\_it$	$\hat{p}\_it$	$\hat{p}\_it$
Post 2022=1	0.0713***	0.0663***	0.0708***	0.0447***	0.0571***	0.0532***	0.0551***
	(0.0167)	(0.0165)	(0.0166)	(0.0143)	(0.0147)	(0.0156)	(0.0172)
ESG Score=1			0.0291	-0.0187	-0.0045	-0.0052	-0.0045
			(0.0223)	(0.0214)	(0.0239)	(0.0241)	(0.0239)
Post 2022=1 × ESG Score=1				0.0647**	0.0606*	0.0615*	0.0606*
				(0.0324)	(0.0316)	(0.0315)	(0.0316)
Investment Grade					-0.0190	-0.0198	-0.0190
					(0.0343)	(0.0342)	(0.0343)
Not Investment Grade					-0.1564	-0.1564	-0.1563
					(0.1033)	(0.1030)	(0.1033)
Financials					0.0211	0.0218	0.0211
					(0.0257)	(0.0257)	(0.0257)
Industrials					0.0111	0.0117	0.0111
					(0.0294)	(0.0295)	(0.0295)
Real Estate					0.0437	0.0433	0.0433
					(0.0276)	(0.0275)	(0.0277)
Utilities					0.0156	0.0145	0.0156
					(0.0253)	(0.0254)	(0.0253)
China					-0.0062	-0.0073	-0.0064
					(0.0203)	(0.0204)	(0.0203)
EU					0.0536**	0.0549**	0.0537**
					(0.0241)	(0.0239)	(0.0241)
United States					-0.0494*	-0.0498*	-0.0490
					(0.0298)	(0.0298)	(0.0299)
Maturity					0.0033**	0.0034**	0.0033**
					(0.0014)	(0.0014)	(0.0015)
Log Amount Issued					0.0043	0.0043	0.0043
					(0.0092)	(0.0092)	(0.0092)
Climate News						-0.0612**	
						(0.0280)	
Real Oil Price							-0.0002
							(0.0005)
Constant	-0.0194*	-0.0214**	-0.0321**	-0.0135	-0.1565	-0.0307	-0.1420
	(0.0117)	(0.0109)	(0.0161)	(0.0128)	(0.1737)	(0.1924)	(0.1745)
Adjusted R^2	0.0183	0.0253	0.0175	0.0228	0.0377	0.0390	0.0376
Bond Fixed Effects	No	Yes	No	No	No	No	No
N	3398	3398	3398	3398	3398	3398	3398

Standard errors in parentheses

* $p < .10$, ** $p < .05$, *** $p < .01$

Table A.14: Regression of E Scores on Estimated Green Bond Premia

This table shows the results of the regression $\hat{p}_{it} = \alpha_{it} + \beta_1 \text{E Score}_{ft} + \beta_2 \text{Post 2022}_t + \beta_3 \text{Post 2022}_t \times \text{E Score}_{ft} + \beta_4 \text{Bond Controls}_{i(,t)} + \beta_5 \text{Climate News}_t + \eta_{it}$ (Equation 2) in the ESG subsample. $ESGScore_{ft}$ refers to the continuous E score of firm f in year t. The reference categories for country and sector is "Other" and for the rating is is non-rated (NR). Standard errors are clustered at the issuer level.

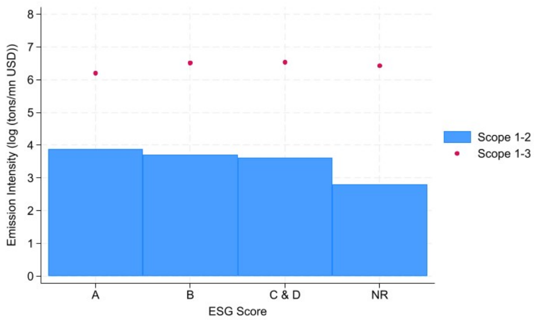
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	$\hat{p}$_it	$\hat{p}$_it	$\hat{p}$_it	$\hat{p}$_it	$\hat{p}$_it	$\hat{p}$_it	$\hat{p}$_it
Post 2022=1	0.1076***	0.0990***	0.1074***	-0.0465	-0.0228	-0.0351	-0.0379
	(0.0286)	(0.0278)	(0.0285)	(0.0910)	(0.0868)	(0.0836)	(0.0870)
E Score			0.0757	-0.0764	-0.1640	-0.1720	-0.1701
			(0.0899)	(0.0856)	(0.1107)	(0.1083)	(0.1096)
Post 2022=1 × E Score				0.2064	0.1928	0.2034	0.1972
				(0.1432)	(0.1399)	(0.1353)	(0.1377)
Investment Grade					-0.0886	-0.0905	-0.0878
					(0.0579)	(0.0576)	(0.0583)
Not Investment Grade					-0.1713	-0.1733	-0.1708
					(0.1472)	(0.1466)	(0.1472)
Financials					0.0559	0.0558	0.0552
					(0.0383)	(0.0387)	(0.0386)
Industrials					-0.0131	-0.0131	-0.0138
					(0.0759)	(0.0761)	(0.0760)
Real Estate					0.0512	0.0526	0.0495
					(0.0424)	(0.0422)	(0.0426)
Utilities					0.0045	0.0040	0.0046
					(0.0381)	(0.0382)	(0.0382)
China					0.0231	0.0207	0.0204
					(0.0356)	(0.0361)	(0.0358)
EU					0.1366***	0.1360***	0.1364***
					(0.0391)	(0.0396)	(0.0393)
United States					-0.0169	-0.0172	-0.0141
					(0.0383)	(0.0385)	(0.0387)
Maturity					0.0054**	0.0054**	0.0049**
					(0.0023)	(0.0023)	(0.0023)
Log Amount Issued					0.0047	0.0058	0.0048
					(0.0108)	(0.0105)	(0.0108)
Climate News						-0.0897*	
						(0.0466)	
Real Oil Price							-0.0012*
							(0.0007)
Constant	-0.0295*	-0.0372*	-0.0842	0.0303	-0.0659	0.1059	0.0253
	(0.0174)	(0.0190)	(0.0652)	(0.0630)	(0.2087)	(0.2517)	(0.2218)
Adjusted R^2	0.0325	0.0414	0.0358	0.0403	0.0742	0.0757	0.0739
Bond Fixed Effects	No	Yes	No	No	No	No	No
N	1478	1478	1478	1478	1478	1478	1478

Standard errors in parentheses

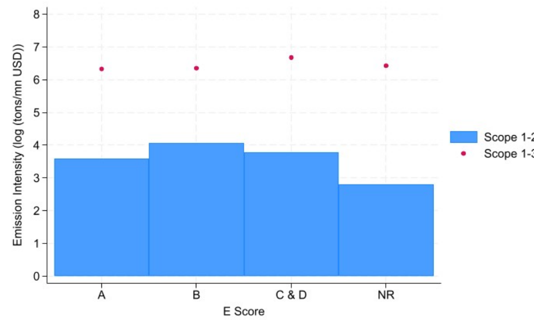
* $p < .10$, ** $p < .05$, *** $p < .01$

Figure A.7: Emission Intensity by ESG and E Scores

These figures show the average Scope 1-2 (blue bars) and Scope 1-3 (red dots) emission intensity by ESG and E score categories.



(a) by ESG Score



(b) by E Score

Figure A.8: Average Green Bond Premium by Year: Emissions Subsample

This figure shows the average annual green bond premia for the full sample (blue) and subsample of bond with Scope 1-3 emission intensity (red). It shows that the reversal can be observed in both subsamples.

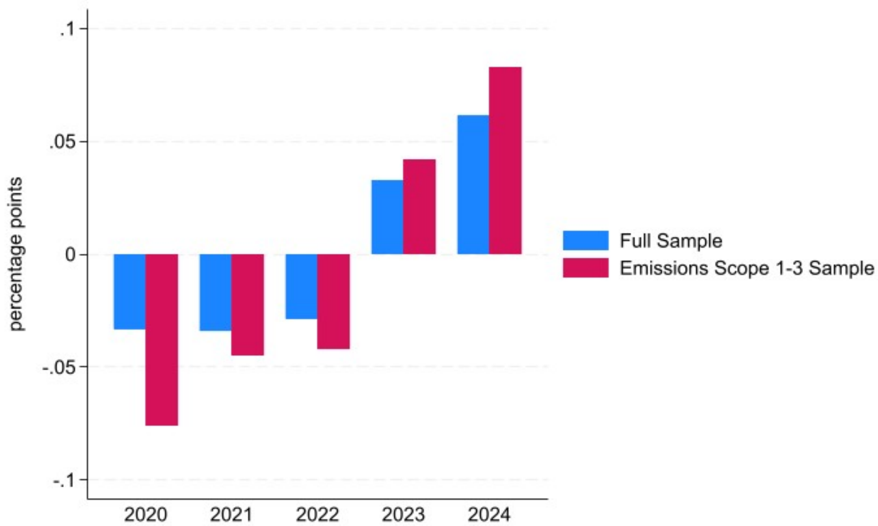


Table A.15: Regression of Scope 1-2 Emission Intensity on Estimated Green Bond Premia

This table shows the results of the regression $\hat{p}_{it} = \alpha_{it} + \beta_1 \text{Emission Intensity}_{ft} + \beta_2 \text{Post 2022}_t + \beta_3 \text{Post 2022}_t \times \text{Emission Intensity}_{ft} + \beta_4 \text{Bond Controls}_{i(,t)} + \beta_5 \text{Climate News}_t + \eta_{it}$ (Equation 2) in the Emissions subsample. Emission Intensity$_{ft}$ refers to the quintile of issuer f's Scope 1-2 emission intensity in year t. The reference categories for country and sector is "Other" and for the rating is is non-rated (NR). Standard errors are clustered at the issuer level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	$\hat{p}$_it	$\hat{p}$_it	$\hat{p}$_it	$\hat{p}$_it	$\hat{p}$_it	$\hat{p}$_it	$\hat{p}$_it
Post 2022=1	0.0642***	0.0583***	0.0609***	0.0738**	0.0876**	0.0876**	0.0881**
	(0.0170)	(0.0164)	(0.0172)	(0.0362)	(0.0360)	(0.0359)	(0.0359)
Emissions Quintile=1			-0.0017	0.0355	0.0098	0.0108	0.0099
			(0.0234)	(0.0302)	(0.0283)	(0.0281)	(0.0286)
Emissions Quintile=2			0.0333	0.0208	-0.0016	0.0014	-0.0021
			(0.0278)	(0.0335)	(0.0327)	(0.0343)	(0.0330)
Emissions Quintile=4			0.0031	-0.0250	-0.0325	-0.0307	-0.0326
			(0.0198)	(0.0332)	(0.0333)	(0.0336)	(0.0336)
Emissions Quintile=5			-0.0042	0.0184	0.0184	0.0202	0.0181
			(0.0234)	(0.0345)	(0.0345)	(0.0340)	(0.0345)
Post 2022=1 × Emissions Quintile=1				-0.0695*	-0.0721*	-0.0747*	-0.0721*
				(0.0393)	(0.0384)	(0.0385)	(0.0385)
Post 2022=1 × Emissions Quintile=2				0.0236	0.0171	0.0127	0.0176
				(0.0629)	(0.0616)	(0.0646)	(0.0623)
Post 2022=1 × Emissions Quintile=4				0.0354	0.0274	0.0243	0.0276
				(0.0499)	(0.0494)	(0.0496)	(0.0499)
Post 2022=1 × Emissions Quintile=5				-0.0363	-0.0418	-0.0434	-0.0417
				(0.0448)	(0.0440)	(0.0439)	(0.0441)
Investment Grade					0.0051	0.0043	0.0051
					(0.0233)	(0.0228)	(0.0233)
Not Investment Grade					-0.1189	-0.1192	-0.1189
					(0.1080)	(0.1077)	(0.1080)
China					-0.0252	-0.0260	-0.0251
					(0.0179)	(0.0178)	(0.0180)
EU					0.0469**	0.0479**	0.0468**
					(0.0226)	(0.0222)	(0.0226)
United States					-0.0509	-0.0528	-0.0509
					(0.0368)	(0.0372)	(0.0368)
Maturity					0.0029*	0.0030*	0.0029*
					(0.0016)	(0.0016)	(0.0016)
Climate News						-0.0422	
						(0.0357)	
Real Oil Price							0.0001
							(0.0005)
Constant	-0.0133	-0.0165	-0.0207	-0.0293	-0.0545*	0.0314	-0.0587
	(0.0113)	(0.0111)	(0.0216)	(0.0267)	(0.0308)	(0.0772)	(0.0490)
Adjusted R^2	0.0170	0.0209	0.0216	0.0264	0.0360	0.0362	0.0360
Bond Fixed Effects	No	Yes	No	No	No	No	No
N	2954	2954	2954	2954	2954	2954	2954

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$