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Sustainable Finance

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The European sustainable debt market – do issuers benefit from an ESG pricing effect?

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Summary

Issuance of sustainable-labelled debt has soared over the last years, benefitting from an increasing investor appetite for financial products that contain a sustainability element. At the same time, research suggests that sustainable-labelled debt issuers may benefit from a pricing advantage, the so-called 'greenium', which is often attributed to investor's willingness to forego returns in exchange for the sustainability element of the financial product they are investing in. However, existing evidence has not been conclusive so far regarding the existence of a definite pricing advantage, and it further focuses mainly on green bonds only. This article expands the analytical work to all environmental, social and governance (ESG) bond types and identifies a set of key factors potentially causing the greenium. The topic is thereby relevant to several of ESMA's mandates. It directly adds to the understanding of investor preferences for sustainable finance, it helps to investigate any pricing distortions between comparable debt instruments that might impact market stability if they unravel, and, finally, it contributes to ESMA's strategic priority of monitoring ESG market developments and assessing new financial instruments. In terms of findings, our analytical results cannot confirm the existence of a systematic and consistent pricing advantage for any ESG bond category. Furthermore, we find that in the past, issuers of ESG bonds benefitted from pricing premiums based on their issuer characteristics and that issuers' public sustainability commitments do not impact the pricing of their bonds.

Introduction

The **market size of sustainable debt** by issuers domiciled in the European Economic Area (EEA) has increased substantially over the past years, reaching EUR 1.7 tn in the first half of 2023, a growth of 130 % in only 2 years. The increase in size has been mirrored by a growing set of sustainable debt products being offered to investors.

The rapid growth of the sustainable debt market has sparked several questions, some regarding investor preferences and motivations (e.g. why would investors prefer sustainable vs. conventional debt instruments?), but also questions concerning the credibility of sustainability claims put forward.

In this article, we investigate the question of whether investors not only prefer sustainable debt instruments, but if they are willing to forego returns in the process and thus contribute to the existence of the **'greenium'**. The United Nations Development Program (2021) defines the greenium as 'pricing benefits based on the logic that investors are willing to pay extra or accept lower yields in exchange for sustainable impact.' Concretely, this means that sustainable debt instruments price inside their yield curve, i.e. they offer lower yields at equal or higher prices as opposed to their conventional debt counterparts, provided that all other instrument and issuer characteristics are (almost) equal (Climate Bonds Initiative, 2021).

While investor preferences may justify pricing differences due to individual financial and non-financial aspects, the systematic existence of a greenium can give rise to several concerns. First, from a regulatory and supervisory perspective, a systematic greenium for sustainable debt may signal price distortions in the market, especially if the sustainability aspect driving the pricing premium proves to be inaccurate. This could raise **financial stability concerns** in the form of high price volatility or rapidly decreasing liquidity for sustainable debt instruments. It can also raise **investor protection concerns**, e.g. if investors feel deceived about the sustainability performance of a sustainable debt instrument. This issue can additionally be aggravated by insufficient or unclear disclosure regarding the specific sustainability characteristics of the instrument. Second, the incentive for issuers to increase their sustainability spending and profile may be stronger using alternative mechanisms, including by developing comprehensive and long-term entity-level strategies to holistically transform business processes.

This analysis focuses on the financial stability angle and informs our regulatory and supervisory work by assessing **potential pricing distortions** in the environmental, social and governance (ESG) debt market and thus investigating whether the greenium phenomenon can trigger financial stability concerns. By doing this, we aim to identify the potential for financial stability concerns at an early stage and to contribute to the ESMA strategic priority of monitoring key market developments in the area of sustainable finance.

Greenium – rationale, and evidence so far

Recent analytical findings (Climate Bonds Initiative, 2021; Meyer and Henide, 2021) showing that green bonds tend to be issued at a higher price have triggered a growing amount of research on the greenium phenomenon.

However, the question remains as to why sustainable bonds should be priced differently from their conventional equivalents (Climate Bond Initiative, 2021). Indeed, **sustainable debt carries the same risks** to investors as conventional debt, i.e. investors are exposed to the same issuer credit risk, hence higher expected financial returns cannot explain the phenomenon.

Among the existing body of research, different explanations have been proposed: Preclaw and Bakshi (2015) suggest that the pricing benefit may stem from a 'mechanical supply and demand mismatch' or that 'impact-focused investors' typically hold on to debt until maturity, thus reducing trading activity and leading to greater price stability. Pietsch and Salakhova (2022) suggest that a pricing premium of sustainable debt may point towards **investors' confidence in and preference for these instruments**. One possible reason driving this confidence may lie in a lower perceived risk level of sustainability-related products. In terms of non-traditional risk factors, investors may believe that conventional debt carries higher financial risks, such as high volatility in valuations or assets becoming stranded due to, for example, climate-change-induced natural disasters, or they may consider sustainability-oriented issuers to be better placed to face any regulatory transition risk without significant disruptions. While these perceptions may not always reflect the instrument's actual riskiness, they can drive emotional responses and investment decision-making (Hoffmann et al., 2015; Raut et al., 2023). Alternatively, some investors may consider sustainable investment

vehicles to align closer with their personal preferences (Pastor et al., 2021).

So far, most research has focused on the greenium, i.e. a potential pricing benefit for issuers of **bonds with an environmental objective**. These research efforts have increased over the past 3 years, but the **findings are inconclusive so far**, both regarding the pricing benefit and its potential drivers. In its 1H21 pricing study, the Climate Bond Initiative (2021) found a greenium at issuance for 79 % of corporate green bonds, albeit within a relatively small sample of 24 bonds globally. Another study by Meyer and Henide (2020) find a greenium in the secondary market, in particular for issuers active in sectors with a high greenhouse gas (GHG) emission intensity[1], pointing to a supply–demand mismatch. Grishunin et al. (2023) find a relatively small greenium of 3 bps for corporate climate bonds[2] in Europe overall, but also show that this finding cannot be confirmed for each individual country.

Additionally, Pietsch and Salakhova (2022) have investigated the drivers of the greenium, showing its **dependence on the level of credibility** associated with the bond itself and the issuer, i.e. if the bond is externally reviewed or if the issuing firm operates in a green sector or forms part of environmental initiatives. Their findings also illustrate that the greenium has become more statistically and economically significant over time, suggesting that increased climate concerns drive investor demand for green bonds. Fatica et al. (2021) provide similar findings, showing that the greenium strongly depends on the issuer's characteristics and the credibility of the instrument: externally verified sustainability bonds exhibit a significantly higher greenium than non-verified ones.

While recent research has begun to expand the scope to other sustainable debt instruments (e.g. Slimane et al., 2023), this remains a highly nascent field. In our work, we are looking at a sample of outstanding EEA-issued ESG debt instruments and comparing their prices and yields to those of their conventional counterparts, while controlling for a set of variables at both the issuer and instrument level. We thus contribute to the existing research by significantly **expanding the scope beyond green bonds**, which is appropriate against the background of the growing and diversifying nature of the ESG debt market.[3]

This is also in line with ESMA's financial stability objective and its strategic focus on monitoring and assessing ESG market developments and associated risks. Indeed, a pricing divergence between sustainable and conventional debt instruments could be the result of different issues. First, the market might already price existing climate risks in, thus leading to sustainable debt becoming pricier as these are expected to hedge against the risks. Second, increased prices for ESG bonds could result from excess demand for those instruments due to non-traditional investor preferences, such as ethically driven investment considerations. Third, diverging prices may stem from greenwashing practices, if issuers mislead the public about the instruments' sustainability objectives and apply selective disclosure. In all cases, a sudden **unravelling of pricing differences could affect** the stability of the **overall bond market**, and thus the phenomenon demands further investigation.

The paper is structured as follows. First we will provide an overview of market developments in the sustainable debt sphere; then, we will give an outline of our methodological approach and key descriptive statistics. This will be followed by an explanation of the findings of our regression analysis. The last section concludes the paper, providing a summary of the findings, their implications and potential avenues for further research.

ESG debt instruments

The rapid market growth of sustainable debt instruments has prompted the development of a vast set of **different kinds of bonds with a sustainability element**, which can broadly be distinguished into two categories: use of proceed bonds (UoP) and sustainability-linked bonds (SLBs).

UoP bonds have their proceeds earmarked for a specific sustainability project or activity, with the aim of raising financing for a pre-defined sustainability purpose. While no official labels such as those stipulated by law exist[4], these

[1] GHG emissions intensity is measured as the volume of carbon emissions per million dollars of revenue (carbon efficiency of a portfolio), expressed in tons CO2e/USD revenue. For further details please see *Task Force on Climate-Related Financial Disclosures* (2017).

[2] Climate bonds are bonds that aim to raise financing for climate change solutions such as mitigation- or adaptation-related projects. For further details, please view the Climate Bonds Initiative definition.

[3] Due to the broader scope of the research we use the term 'ESG premium' rather than greenium, to account for the inclusion of all types of ESG debt instruments.

[4] The forthcoming EU Green Bonds Standard introduces an official definition for green bonds, provided they fall

bonds are typically further distinguished by the sustainability character of the financed project and are typically split into green bonds (for those where the proceeds are earmarked for an environmental purpose, such as reduction of CO_2 emissions or the restauration of biodiversity), social bonds (for social purposes such as healthcare or social housing) and sustainability bonds, which contain both environmental and social elements[5]. However, along with increasing efforts to better grasp different sustainability issues, the availability of UoP bonds with a specific thematic focus has grown, ranging from blue bonds to transition bonds or rhino bonds (Table 1).

However, UoP bonds require **transparency around the proceed allocation**, and while several market initiatives (e.g. International Capital Markets Association (ICMA) principles) are promoting mechanisms to achieve this goal, challenges remain due to the absence of standardised, uniform disclosure rules.

While UoP bonds are project centred, **SLBs** are forward-looking instruments with an entity focus, i.e. aimed at supporting an entities' sustainability transformation. Contrary to UoP bonds, the proceeds are allocated to general purposes or refinancing activities, but the issuer makes a commitment to deliver a specific and defined sustainability outcome in the future, typically expressed in the form of company-level key performance indicators (KPIs) and measured against Sustainability Performance Targets (SPTs). While KPIs are usually defined in broad terms (e.g. 'Scope 1 GHG emissions'), SPTs should provide for a concrete baseline against which the issuer's performance can be assessed, for example 'X % reduction in scope 1 and Y % reduction in scope 2 GHG emissions against the baseline of year Z'.

SLBs also contain **penalty mechanisms**, commonly in the form of a coupon step-up, in cases when sustainability targets are missed.[6] SLBs are a relatively new sustainable debt form, with the first one issued in 2019, and surged in market growth in 2020 as they provided an attractive sustainable financing option in particular for issuers that do not qualify for UoP bonds.[7] They however also draw increasing scrutiny in particular for what concerns the effectiveness of the penalty mechanism and the materiality of the issuer's sustainability commitment.[8]

Table 1
Use of proceed bonds
Growing variety of use of proceed bonds

Bond type	Description
Green bond	Bond instruments where the proceeds or an equivalent amount will be exclusively applied to finance or re-finance, in part of in full, new and/or existing eligible green projects, for example projects related to the restauration of biodiversity, pollution prevention and control, and energy efficiency.
Social bond	Bond instruments where the proceeds or an equivalent amount will be exclusively applied to finance or re-finance, in part of in full, new and/or existing eligible social projects, for example projects related to affordable basic infrastructure, access to essential services, affordable housing, employment generation, socioeconomic advancement and empowerment, food security.
Sustainability bond	Bond instruments where the proceeds or an equivalent amount will be exclusively applied to finance or re-finance a combination of both green and social projects.
Climate bond	Raise financing for climate change solutions, for example mitigation or adaptation-related projects including renewable energy plants or climate mitigation programs. Not all climate bonds need to be UoP bonds, but most of them are.
Blue bond	Raise financing for ocean-related assets and projects, for example related to marine conservation and restauration, and water-related infrastructure.
Rhino bond	Raise financing for wildlife conservation, including endangered species such as the Black Rhino.

Note: Overview of different sustainability-related uses of proceed bonds and their objectives. Several of these categories can also be applied as part of sustainability-linked bond issuances, albeit considering the different bond structure.
Source: Climate Bonds Initiative, ICMA, United Nations Global Compact, Green Finance Institute, ESMA.

within scope of the regulation. For further information please see the proposed regulation on European green bonds.

5 For further details see ICMA use of proceed bond principles.

6 For further analysis on SLBs please view ESMA's Trends Risks and Vulnerabilities Report 1.23, Sustainable Finance section.

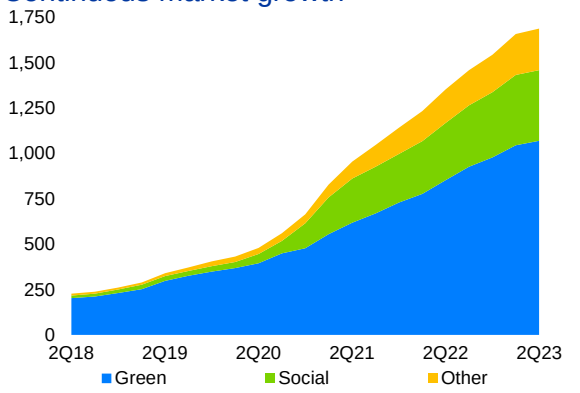
7 Issuers operating in typically 'brown' sectors or those in service sectors where little to no activities or projects are available to map green proceeds to.

8 For further details on risks associated to SLBs please refer to Koelbel and Lambillon (2022).

The EU sustainable debt market

Over the recent years, the market for EEA-issued sustainable debt has grown at a rapid and continuous pace. **Outstanding ESG bonds reached EUR 1.7 tn** in 1H23, an increase of 28 % in 1 year and 663 % since 1H18, with green bonds dominating the market (63 %) (Chart 1).

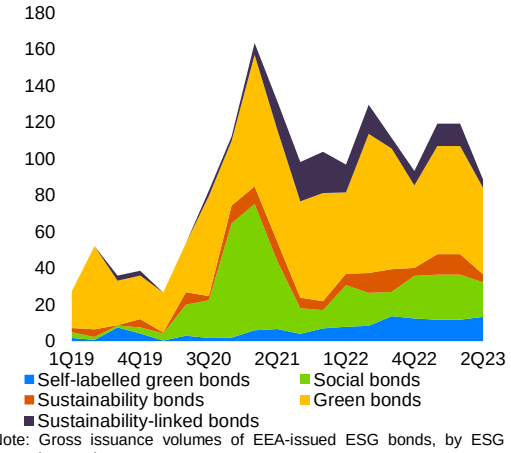
Chart 1
EEA-issued ESG bonds outstanding
Continuous market growth



Note: Total amount of ESG bonds outstanding issued by EEA30-domiciled issuers, EUR bn. Other refers to all other ESG bond types, including sustainability bonds and sustainability-linked bonds.
Sources: Refinitiv EIKON, ESMA.

While issuance volumes, mirroring developments in the overall debt markets and following seasonal trends, have seen variations triggered by market stress over the last years, they have also increased at a stable pace on an annual basis (Chart 2), signalling a **continuous interest from both issuers and investors** in these instruments.

Chart 2
EEA-issued ESG bonds gross issuance volumes
Issuance volumes remain stable



Note: Gross issuance volumes of EEA-issued ESG bonds, by ESG bond types, in EUR bn.
Sources: Refinitiv EIKON, ESMA.

Each sustainable debt instrument may align with a **vast set of industry standards**, including but not limited to the Climate Bonds Initiative (CBI) or the ICMA principles. For example, green bonds may be CBI certified (labelled green bonds), meaning they undergo a labelling scheme based on science-based criteria. [9] The different sustainable debt instruments can also be aligned with the ICMA principles. They can also not be aligned with any official standard and/or be verified as such, and thus carry lower degrees of credibility. Indeed, to boost credibility, issuers of sustainable bonds may undergo third-party verification to provide certainty to investors that the proceeds are allocated to sustainability purposes, or that a firm has implemented concrete plans to achieve sustainability objectives.

At the issuer level, firms increasingly sign up to public initiatives such as the Principles for Responsible Investors or the UN Global Compact [10] to signal their sustainability commitment to the public. While these initiatives provide certain levels of credibility due to feedback loops (i.e. thanks to independent third parties acting as reviewing entities) and public disclosures, their **voluntary nature does not hold space for penalty or enforcement actions** but can rather cause reputational risks. The forthcoming EU Green Bond Standard [11] is expected to tackle some of the challenges by enhancing transparency and credibility of the EU

[9] For further information please view Climate Bonds Standard: Certification.
[10] For further information please view the Principles for Responsible Investment and the UN Global Compact.
[11] European Commission: European green bond standard. In particular, the framework offers a definition referring to 'bonds marketed as environmentally sustainable' and will also cover sustainability-linked bonds.

green bond market. Furthermore, the Corporate Sustainability Reporting Directive (CSRD) will increase entity-level sustainability disclosures by expanding the requirements and the scope of reporting entities.[12]

The ESG bond premium

In the following section we investigate to what extent and under which conditions a greenium exists for the different types of ESG bonds. In doing so, we rely on the definition outlined in the first section and help investigate the regulatory and supervisory concerns detailed above. We begin by detailing our methodology, starting with the construction of our dataset, and descriptive statistics. We further outline our empirical approach to estimate a potential greenium and finally we present the results of this exercise, including their interpretation.

Dataset construction and descriptive analysis

Our raw dataset comprises approximately 330 000 bonds from issuers domiciled in the EEA and the United Kingdom, available in Refinitiv Eikon as of March 2023. [13] Refinitiv Eikon provides both a quoted yield and the credit rating at issuance for about 23 000 of them. After further exclusions [14] and data cleaning, we obtain our **final dataset of 8 696 bonds** corresponding to a combined outstanding face value of EUR 3.7 tn.

According to ESMA calculations based on regulatory data reported under the markets in financial instruments directive (MiFID), the European bond market (EEA + the United Kingdom) comprised around 80 000 bonds with an outstanding total nominal value of around EUR 27 tn, as of 2023.[15] Comparing the size of our cleaned dataset with this figure, we estimate that our sample represents about **10 % of the total bond market**.

Our dataset covers **1 103 issuers domiciled across 30 countries** (Table 2), which we have clustered according to their sector into: (a) sovereigns[16] and three corporate categories: (b) financials; (c) industry and services; and (d) utilities, mining and energy firms. Moreover, we have identified the following bond types: (i) conventional bonds, (ii) labelled green bonds, (iii) self-labelled green bonds, (iv) social bonds, (v) sustainability bonds, (vi) sustainability-linked bonds.

Columns 1 to 3 of Table 3 (Annex) show that 14 % of the issuers are sovereigns, 42 % are financials, 44 % are from other industries with a respective outstanding face value distribution of 27 %, 37 % and 36 %. Keeping these distributions in mind is important for the interpretation of our analysis, as the results may be driven by dominant issuer characteristics in our sample.

Across all sectors, 90 % of bonds are conventional bonds, which is equivalent to 81 % of the sample's combined face value. **Most ESG bonds are labelled green bonds and social bonds**, representing around 6 % and 1 % of all bonds and 9 % and 5 % of face value respectively.

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12 European Commission: corporate sustainability reporting directive.

13 We obtained our list of instruments through Refinitiv Eikon's advanced search on government and corporate bonds (GOVSRCH). All issuer and bond types were included and filtered for issuer domicile being a country of the EEA and the United Kingdom, and issuance amount being greater than zero. The raw data included inactive bonds and a filter was applied to exclude matured bonds as of the extraction date.

14 The final sample was constructed by filtering the original data to include only euro-denominated plain vanilla bonds with a full set of pre-defined variables available. We excluded all bonds (a) without an ISIN, (b) without a quoted yield-to-maturity, (c) without an issuance credit rating, (d) that were not denominated in euros, (e) that were covered or securitised, (f) that did not have their issued face value outstanding as of the extraction date (i.e. were called, put or converted), (g) with an issuance date before 1990 and a maturity date after 2200, (h) hybrid bonds. Furthermore, we have winsorized our data by excluding the top and bottom 2.5 percentiles of bond yields.

15 MiFID reporting only covers bonds that are available for trading at European market infrastructures. It does not cover fully private issuances and thus only represents a lower-bound estimate of the actual market size.

16 Sovereign issuers comprise, national governments, municipals, agencies, and supranational institutions including the European Union and development banks.

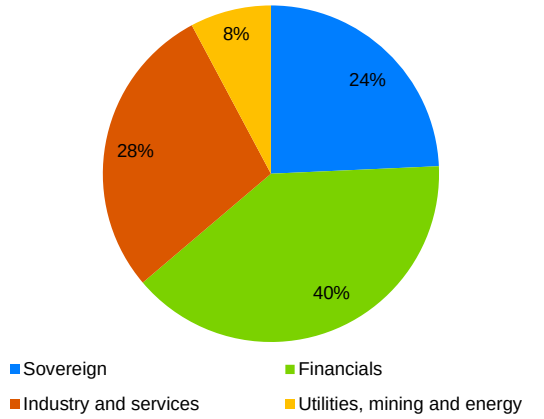
Table 2
Bond dataset – Panel I
French and German issuers most prominent

	Face value (EUR bn)	Unique bonds	Unique issuers
France	763	1 252	173
Germany	646	3 325	143
Netherlands	517	911	155
Luxembourg	289	326	78
Italy	288	478	96
United Kingdom	249	468	120
Spain	204	382	66
Belgium	160	235	33
Sweden	102	213	46
Austria	66	366	33
Ireland	62	126	40
Finland	56	188	27
Romania	52	43	3
Denmark	45	86	15
Norway	39	73	17
Poland	32	34	8
Greece	16	15	7
Hungary	16	18	6
Portugal	14	32	15
Croatia	12	10	2
Bulgaria	11	10	1
Cyprus	9	11	2
Czech Republic	9	24	10
Lithuania	7	8	2
Slovakia	6	10	6
Estonia	4	8	4
Malta	3	31	2
Iceland	2	5	3
Slovenia	2	5	3
Latvia	2	3	2
Total	**3 682**	**8 696**	**1 103**

Note: Bond dataset split by issuer domicile.
Source: Refinitiv, ESMA.

By comparing the **sectoral distributions** between the ESG and the conventional bond markets, we find a higher share of sovereigns and utilities, mining and energy firms within ESG bonds, especially in terms of outstanding face value (Charts 3 and 4).

Chart 3
Bond dataset – Sector distribution conventional bonds
Conventional bond market dominated by financials and industry and services firms



Note: Sample distribution of bond face value by economic sector for conventional bonds.
Sources: Refinitive, ESMA.

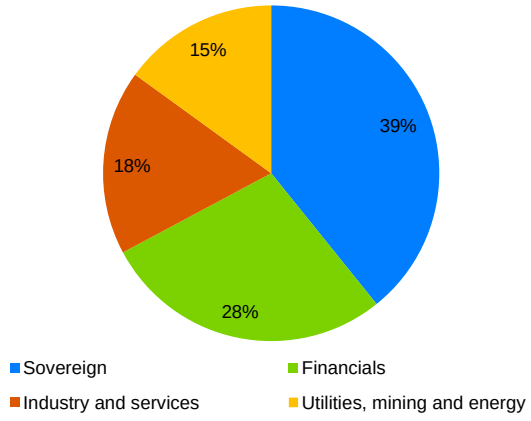
For the average **issuance size** in our sample (Table 3; column 4), we find that financials have markedly smaller issuances than sovereigns and other sectors.[17] Moreover, sovereign labelled green bonds appear on average larger than conventional sovereign bonds – driven, for example, by the NextGenerationEU[18] program or large issuances of development banks. Social bond issuances are comparably larger in general – driven for example by the EU's 'Support to mitigate Unemployment Risks in an Emergency' bonds, which reached record volumes of up to 10 bn per issuance, or the financing of large-scale infrastructure projects.

Regarding the distribution of **issuance ratings** (Table 3; column 5), the sample confirms that sovereign bonds are on average rated higher than financial firms and utilities, mining and energy firms, which in turn have superior ratings when compared with other industry and service firms. On a purely descriptive basis, we do not spot material rating differences between ESG and conventional bonds.

[17] The French independent association 'Union nationale interprofessionnelle pour l'emploi dans l'industrie et le commerce' (UNEDIC) is classified as an industry and service firm and slightly skews the average issuance size for industry and service firms upwards.

[18] European Union: NextGenerationEU.

Chart 4
Bond dataset – Sector distribution ESG bonds
Sovereigns and utility, mining and energy firms are over proportionately active in the ESG bond market



Note: Sample distribution of bond face value by economic sector for ESG bonds.
Sources: Refinitive, ESMA.

The average remaining time-to-maturity per sector (Table 3; column 6) is longest for sovereigns and shortest for financials. We do not observe any noticeable differences between bond types regardless of the sector.

Similarly, **average yields-to-maturity** (Table 3; column 7) are lower for sovereign-issued bonds compared to corporate bonds reflecting their higher credit ratings. We do not find any meaningful deviations neither between the three corporate sectors nor between ESG and conventional bonds.

Regression analysis: ESG vs conventional bond yields

We ran **multiple linear regressions** to analyse whether the different ESG bond types exhibit a structurally different bond yield compared with conventional bonds, while controlling for several bond and issuer-specific characteristics. Equation 1 describes our baseline specification.

For each bond *i* included in our **cross-sectional dataset** we regress its quoted yield on a constant, the bond's credit rating, the logarithm of its issued amount in euros[19], the logarithm of its remaining maturity in years, the logarithm of its relative bid-ask spread in basis points[20], the issuer's broad economic sector[21], the bond's ESG type as detailed above, a dummy variable indicating if the issuer has issued at least one ESG bond, a dummy variable indicating if the issuer has publicly committed to a sustainability objective[22], as well as controlling for issuer domicile and bond issuance year. We allow residuals to be correlated at a bond issuer level and thus report cluster-robust standard errors throughout our results. A significantly negative coefficient for the ESG bond types would signal the existence of a greenium.

Equation 1:

$$
\begin{aligned}
Bond\ yield_i = {} & \beta_0 \\
& + \beta_1 * Issuance\ rating_i \\
& + \beta_2 * \log(Issued\ amount_i) \\
& + \beta_3 * \log(Remaining\ maturity_i) \\
& + \beta_4 * \log(Relative\ bid-ask\ spread_i) \\
& + \beta_5 * Issuer\ sector_i \\
& + \beta_6 * ESG\ bond\ type_i \\
& + \beta_7 * ESG\ bond\ issuer_i \\
& + \beta_8 * Issuer\ ESG\ signatory_i \\
& + \beta_9 * Issuer\ domicile_i \\
& + \beta_{10} * Issuance\ year_i \\
& + \varepsilon_i
\end{aligned}
$$

In addition to running our baseline regression on the complete bond sample, we also perform the analysis on **multiple subsamples**, to further assess our results' robustness to any structural differences between bond or issuer characteristics that may drive a pricing difference.

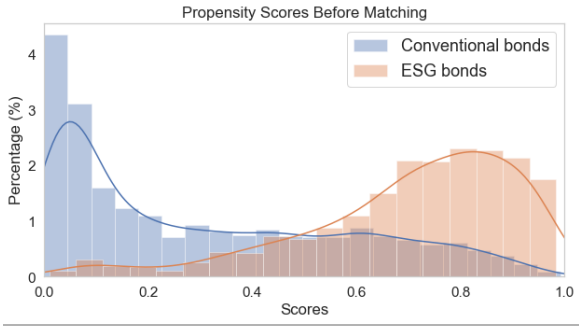
First, we restrict our data to **issuers that have both at least one ESG and at least one conventional bond outstanding**. By doing so, we aim to reduce any bias in issuer characteristics that could drive our baseline results.

Second, we use a **propensity score matching** approach to allocate one conventional bond to each of the 888 ESG bonds in the dataset, ensuring the closest possible similarity in bond attributes.[23] This allows us to account for differences at both the issuer and the bond level and to fully balance the number of observations. The estimated propensity scores (Chart 5) confirm significant differences in characteristics between both groups of bonds and would allow to

19 Due to our cleaning procedure, the dataset only comprises bonds whose issued amounts are equal to their outstanding amounts.
20 The relative bid-ask spread is constructed by dividing the absolute bid-ask spread by the implied mid-price and is denominated in basis points.
21 Based on information available in Refinitiv Eikon.
22 We extracted three variables from Refinitiv Eikon: (i) ESG Compliance Code, (ii) Verification and (iii) UNPRI Signatory, i.e. if the company signed the United Nations Principles for Responsible Investment.
23 To perform the sample matching, we have used all independent variables from our regression but the ESG bond type.

correctly predict the ESG or conventional bond type for 79 % of the total observations.

Chart 5
Propensity scores for ESG and conventional bonds
Distinctiveness in bond characteristics



Third, we perform the regression on the subset of bonds in our sample that were already **outstanding in March 2022 and March 2021**, which helps us understand if time differences are driving our results, i.e. if a greenium had originally existed but vanished over the recent years.

We have performed **multiple other robustness checks** [24] and regression specifications with differing variables, sample compositions and timeframes, which led to largely consistent results, with the outcomes which are presented here.

Evidence: No systematic greenium

Table 4 (Annex) summarises the results of our baseline regression according to Equation 1 and the other variations as described in the section above. Several of our independent variables are dummy variables, hence the estimate for the intercept includes the effects of i) issuance rating 'AAA', ii) issuer sector 'Sovereign', iii) bond type 'Conventional', iv) ESG bond issuer 'No', v) ESG signatory 'No', vi) issuer country 'Germany', and vii) issuance year 2023. Thus, all coefficients should be understood as add-on effects relative to this starting point.

Our **baseline results** (Table 4, column 1) show **statistically and economically insignificant** coefficients for each of the ESG bond types and, also, do not confirm any statistically significant relationship between bond yields and an issuer's ESG credentials. As expected, we observe that lower credit ratings, lower issuance volumes and larger bid-ask spreads are associated with higher yields.[25]

The results are **highly similar in our second regression** for the subset of issuers that have at least one ESG and at least one conventional bond outstanding (Table 4, column 2). While the indicator for sustainability bonds becomes slightly significant (at a 10 % level) with a coefficient of − 0.13, the comparably low sample size for sustainability bonds and the proportionally high representation of sovereigns issuing them likely drives the result.

In removing both issuer and bond-level differences, the results of our **third regression** (Table 4, column 3) may be the most accurate in investigating the price difference. Still, the **results do not confirm a statistically significant pricing difference** for any ESG bond type. In contrast to the baseline scenario, however, we observe that almost all ESG bond types, except self-labelled green bonds, suggest a positive effect on bond yields albeit with comparably low magnitudes.

When restricting our sample to only those **bonds outstanding in March 2022** (Table 4, column 4) **and March 2021** (Table 4, column 5), our results change slightly, both for what concerns ESG factors and general characteristics. We now observe that **ESG issuers benefitted from a statistically significant pricing advantage** compared to non ESG issuers of – 9 bps in 2021 and – 15 bps in 2022. In line with the findings by Fatica et al. (2021), this may suggest that investors considered those issuers that have previously issued ESG bonds to be more credible than those newly entering the ESG debt market.

Several factors could serve as an explanation to this observation. First, investors may consider **previous ESG issuers to have increased levels of experience in issuing ESG bonds** and thus be more likely to allocate the funds raised from these appropriately. Second, with the growing number of issuers entering the ESG debt market, concerns around greenwashing increased, and issuers may consider the 'first movers' as more credible in their sustainability commitment. The assumption that issuer characteristics drove the pricing benefit of sustainable debt rather than the ESG bond status is supported by the fact that the coefficients for most of the ESG bond type variables remain small in magnitude and insignificant, with the exception of SLBs that show a significant and

[24] Most notably we have investigated variable interactions between ESG bond type, ESG bond issuer, and issuer ESG signatory, and conducted our analysis for a range of different points in time.

[25] The coefficient of determination (r-squared) lies at 0.6, indicating that our linear model fits the data well and can be considered as exhibiting explanatory power.

sizable 20 bps yield discount. This result may however be explained by the considerably small sample size of outstanding SLBs in 2021 and the high levels of investor enthusiasm driving the demand for this instrument type at this point.

Interestingly for those **bonds outstanding in March 2022**, we find (as in column 3) **positive, yet non-significant, effects for all ESG bond types**, however now in combination with a negative statistically significant coefficient for the ESG-issuer variable. In contrasting this observation with the predominantly negative coefficients obtained when restricting the sample to only ESG issuers (Table 4, column 2), one may argue in favour of a natural entanglement between the ESG issuer and ESG issuance variables, which opens up avenues for further research. The notably lower intercept may be explained by the negative interest rate environment in the Eurozone between March 2021 and 2022. Furthermore, any pricing advantage for issuers operating in the utilities, mining and energy sector disappeared, with these bonds now showing significantly higher yields (compared to sovereign bonds). Implications from the energy crisis that only started in early 2022 and resulted in meaningful windfall profits for those firms may explain this result. Furthermore, any pricing advantage for issuers operating in the utilities, mining and energy sector disappeared, with these bonds now showing significantly higher yields (compared to sovereign bonds). Implications from the energy crisis that only started in early 2022 and resulted in meaningful windfall profits for those firms may explain this result.

Across all models, our results confirm that **issuer's public commitments to sustainability initiatives do not have a significant impact** on their sustainable debt pricing. This may suggest low credibility levels of these commitments, or that investors do not consider themselves to have any impact at the financial level.

Conclusion

In this article we **have analysed the existence of a pricing benefit for sustainable debt** by constructing a unique dataset of outstanding ESG and conventional bonds from EEA issuers based on commercial data from Refinitiv Eikon and by conducting regression analyses across multiple model and sample specifications. We also provided an overview of the sustainable debt market, including the different instruments and market developments over the recent years.

Our empirical results confirm our expectations regarding the standard factors that drive bond prices and yields – i.e. credit risk, maturity and liquidity risk – and the explanatory power of our models is encouraging. However, **our results do not confirm the systematic existence of a greenium** for neither sustainable bond category, regardless of the model and supported by a satisfactory r-squared across our entire model.

We do however find that **ESG bond issuers benefitted from yield discounts in the past** due to their issuer characteristics, and consider different possible reasons for this observation, ranging from first-mover advantage to increased levels of greenwashing concerns. We also find that this trend does not continue into the present. Furthermore, issuer-based public ESG commitments do not have any effect on bond prices overall.

The results are **encouraging from a financial stability perspective** as price divergences between sustainable and conventional debt instruments seem to stem from the same fundamental risk factors, for example an issuer's credit worthiness, and are not purely driven by a bond's ESG status. Yet, in consideration of the vast need to support the transition towards a more sustainable economy, the results also indicate a limited appetite in the market to forego returns in support of this objective. This opens up further avenues for research, for example to investigate under which conditions investors may be more willing to opt for sustainable investment instruments and forego returns or to assess the margin of missed profits investors would be willing to accept to support the sustainable transition.

However, as the sustainable debt market continues to evolve steadily, and considering that our analysis looks at a specific sample of outstanding bonds, these **results should not be interpreted as a general rejection regarding the possibility of pricing advantages** related to sustainable debt instruments. We will continue to monitor these and any related market developments in the future.

Annex

Table 3

Bond dataset – Panel II

Conventional and ESG bonds predominantly issued by financials and sovereigns

	Face value (EUR bn)	Unique bonds	Unique issuers	Average face value (EUR mn)	Average issuance credit rating	Average time-to-maturity (years)	Average yield-to-maturity (%)
Sovereign							
Conventional bond	721	1 764	145	409	AA	12	3.54
Labelled GB	73	83	28	875	AA	10	3.37
Self-labelled GB	7	9	7	811	AA	9	3.43
Social bond	136	63	14	2 161	AA	10	3.39
Sustainability bond	64	69	21	926	AA	8	3.34
SLB	–	–	–	–	–	–	–
Subtotal	**1 001**	**1 988**	**150**	**503**	**AA**	**12**	**3.52**
Financial							
Conventional bond	1 173	4 287	426	274	A	5	4.47
Labelled GB	137	238	107	574	A	5	4.60
Self-labelled GB	17	28	21	593	A	5	4.80
Social bond	32	45	28	702	A	5	4.52
Sustainability bond	5	9	9	500	BBB	8	5.43
SLB	10	18	13	579	BB	5	6.61
Subtotal	**1 372**	**4 625**	**469**	**297**	**A**	**5**	**4.49**
Industry and services							
Conventional bond	843	1 329	339	634	BBB	5	4.25
Labelled GB	51	85	38	604	BBB	7	4.72
Self-labelled GB	12	20	9	588	BBB	6	4.10
Social bond	24	12	3	2 017	A	7	3.63
Sustainability bond	12	15	9	803	A	9	3.82
SLB	28	39	29	713	BBB	7	4.68
Subtotal	**970**	**1 500**	**363**	**647**	**BBB**	**5**	**4.28**
Utilities, mining and energy							
Conventional bond	232	428	111	541	A	6	3.99
Labelled GB	69	100	33	692	BBB	7	3.63
Self-labelled GB	12	23	11	541	BBB	6	3.87
Social bond	–	–	–	–	–	–	–
Sustainability bond	–	–	–	–	–	–	–
SLB	26	32	12	797	BBB	8	4.16
Subtotal	**339**	**583**	**121**	**581**	**A**	**6**	**3.93**
Total	**3 682**	**8 696**	**1 103**	**423**	**A**	**7**	**4.20**

Note: Bond dataset split by issuer sector and bond type. Sovereign includes national governments, municipalities, agencies and supranational institutions. Conventional bond: plain vanilla bond without a sustainability objective; labelled GB: certified greenbond that meets the criteria of the CBI climate bond standard; self-labelled GB: uncertified greenbond that does not meet the CBI climate bond standard; social bond: bond with a social objective; SLB: sustainability-linked bond whose characteristics depend on corporate sustainability performance; sustainability bond: bond that combines both green and social objectives.

Source: Refinitiv, ESMA.

Table 4

Regression results

No evidence of a systematic greenium for neither ESG bond type

		(1)	(2)	(3)	(4)	(5)
		Baseline	**ESG Bond Issuers**	**Matched Data**	**As of Mar 2022**	**As of Mar 2021**
Intercept		3.01***	2.95***	2.95***	0.21	-0.27
		(-0.11)	(-0.1)	(-0.18)	(-0.4)	(-0.24)
Issuance rating (dummy, ref: AAA)	AA	0.15***	0.22***	0.04	0.05	0.10*
		(-0.05)	(-0.07)	(-0.08)	(-0.05)	(-0.05)
	A	0.55***	0.66***	0.30***	0.32***	0.35***
		(-0.07)	(-0.1)	(-0.1)	(-0.06)	(-0.06)
	BBB	1.01***	1.02***	0.79***	0.68***	0.54***
		(-0.08)	(-0.09)	(-0.11)	(-0.06)	(-0.06)
	BB	2.44***	2.40***	2.35***	2.06***	1.72***
		(-0.14)	(-0.24)	(-0.22)	(-0.14)	(-0.15)
	B	3.49***	2.79***	3.06***	3.24***	2.13***
		(-0.16)	(-0.42)	(-0.37)	(-0.15)	(-0.27)
	CCC	4.60***		3.44***	5.00***	4.60***
		(-0.27)		(-0.27)	(-0.27)	(-0.45)
Issued amount (log Euro)		-0.04***	-0.02	-0.07***	-0.02	-0.06***
		(-0.01)	(-0.02)	(-0.02)	(-0.01)	(-0.01)
Remaining maturity (log years)		0.01	0.08**	-0.13*	0.38***	0.25***
		(-0.03)	(-0.03)	(-0.07)	(-0.02)	(-0.02)
Relative bid-ask spread (log basis points)		0.15***	0.09***	0.32***	0.16***	0.14***
		(-0.02)	(-0.02)	(-0.06)	(-0.03)	(-0.03)
Issuer sector (dummy, ref: Sovereign)	Financials	0.60***	0.55***	0.72***	0.49***	0.20***
		(-0.06)	(-0.08)	(-0.08)	(-0.05)	(-0.06)
	Industry and services	0.05	-0.04	0.15	0.35***	0.13*
		(-0.08)	(-0.12)	(-0.1)	(-0.07)	(-0.07)
	Utilities, mining, energy	-0.15**	-0.26**	-0.18**	0.32***	0.05
		(-0.08)	(-0.1)	(-0.09)	(-0.06)	(-0.06)
ESG bond type (dummy, ref: Conventional)	Labelled green bond	0.05	-0.01	0.07	0.07	-0.09
		(-0.06)	(-0.04)	(-0.06)	(-0.04)	(-0.06)
	Self-labelled green bond	-0.07	-0.05	-0.04	0	-0.1
		(-0.07)	(-0.06)	(-0.07)	(-0.09)	(-0.12)
	Social bond	-0.03	-0.07	0.05	0.03	-0.10*
		(-0.07)	(-0.07)	(-0.07)	(-0.06)	(-0.06)
	Sustainability bond	-0.03	-0.13*	0.05	0.10*	-0.04
		(-0.06)	(-0.07)	(-0.07)	(-0.06)	(-0.09)
	Sustainability-linked bond	0.04	0.14	0.07	0.16	-0.20***
		(-0.13)	(-0.11)	(-0.13)	(-0.14)	(-0.08)
ESG bond issuer (dummy, ref: No)		-0.03		-0.05	-0.15***	-0.09***
		(-0.04)		(-0.07)	(-0.04)	(-0.03)
Issuer ESG signatory (dummy, ref: No)		-0.08	0.01	0.02	-0.09	-0.06
		(-0.06)	(-0.08)	(-0.08)	(-0.08)	(-0.05)
Controlled for issuance country		Yes	Yes	Yes	Yes	Yes
Controlled for issuance year		Yes	Yes	Yes	Yes	Yes
Observations		8696	5403	1776	7437	6137
R-squared		0.60	0.54	0.63	0.66	0.45
R-squared adj.		0.60	0.54	0.62	0.66	0.44

Standard errors are provided in brackets and are clustered at an issuer level.
Stars indicate significance at the 99%, 95% and 90% confidence level.

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