EUROPEAN CENTRAL BANK

EUROSYSTEM

# Working Paper Series

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## Environmental score and bond pricing: it better be good, it better be green

No 3176

**Abstract**

We provide empirical evidence that the pricing of green bonds tends to be highly sophisticated and based on a two-tiered approach. When buying a green bond, investors do not look only at the presence of a green label, but also consider additional characteristics of the bond that involve the environmental score of the issuer and the soundness of the underlying project. By comparing the yields at issuance of green bonds to those of a matched control sample of conventional bonds, our baseline specification identifies a premium of 16 basis points for the green label alone. Furthermore, when the environmental score of the issuer is in the top tercile of the cross-sectional distribution of such an indicator across the analyzed issuers, the greenium nearly doubles. Green certification and periods of heightened climate uncertainty also significantly affect the size of the greenium.

JEL Codes: G12, G15, C21, C58, Q56

Keywords: Sustainable finance; ESG scores; Green bonds; Greenium; Corporate bonds.

**Non-technical summary**

This paper investigates the presence of a significant yield differential at issuance, the so-called *greenium*, between a set of traditional bonds and one of green bonds, i.e. bonds whose proceeds are targeted to projects bearing a green footprint. The existence of a *greenium* between the two sets of bonds matters also because, over the last decade, green bonds have evolved from niche instruments into a widely adopted financing tool, with global placements rising from fewer than 200 securities in 2014 to a cumulative issuance of over 3 trillion US dollars in 2024. In our analysis we track around 9,500 green bonds issued in 73 countries and over 250,000 traditional bonds, used as a comparison, spanning 145 nationalities. Overall, we find that the size of the *greenium* is non-trivial and depends on a number of characteristics of both the bonds and the issuer. A *greenium* of approximately 16 basis points is attached to the green label of a bond, and when the issuers' environmental performance is strong (i.e. in the top third of the distribution of a green performance indicator, known as the $E - score$, across the analyzed firms) it increases up to doubling. Similarly, an increase in the *greenium* of around 15 basis points is found for certified green bonds. Furthermore, we find that this two-tiered pricing mechanism strengthens in periods of heightened climate change stress. Our findings helps reconcile the divergent estimates for the *greenium* obtained so far in the literature and highlight the importance of looking beyond the bonds' label. Investors reward both the use of proceeds and the climate identity of the borrower, and they do so more aggressively when climate risks are on the rise, as reflected by an increasing number of media articles. An important policy implication of our analysis is that even firms without a top environmental performance can obtain a price advantage when issuing a green bond, provided that the underlying green project to be financed is convincing, thereby creating incentives to undertake climate-friendly investments. This aspect is also relevant because imposing higher financing costs on high-emission firms may encourage them to maintain polluting technologies rather than transitioning to cleaner alternatives. As a result, a shift of global portfolios away from high emitters and towards low emitters alone may not lead to a fully-fledged decarbonization nor to effective mitigation of transition risk.

# 1 Introduction

Over the last decade, green bonds have evolved from niche instruments into a widely adopted financing tool, with global placements rising from fewer than 200 securities in 2014 to a cumulative issuance of over 3 trillion US dollars in 2024. Alongside growing awareness about climate change and an increasing recognition of a key role for financial markets in supporting the transition to a low-carbon economy, the pricing of green assets has received significant scholarly attention. The rapid growth in green issuance has also reignited interest in one of the most recurrent questions in the specialized literature: "do green bonds enjoy a systematic pricing advantage?" - a *greenium* - and if so, "what exactly are investors rewarding"? The existence of a negative yield spread for green bonds versus conventional issues would, by definition, imply a funding advantage to environmentally oriented projects, as indeed the main difference between a green bond and a traditional bond is that the proceeds of a green issuance are committed to be employed for selected projects supporting an environmental target. It is worth mentioning that the use-of-proceeds approach allows any company to issue green bonds, regardless of its main business activity.

However, this earmarking of the funds raised on the market via a green bond is not likely to induce a radical change relative to traditional bond investing, where investors typically focus on all available pieces of information, including broad company balance sheet characteristics and creditworthiness indicators, rather than the specific use of funds. While the bulk of the literature has focused on the yield spread between bonds with a green label and traditional bonds, with a broad range of estimates, we argue that investors do not price all green bonds in the same way. We show that, in addition to the green label, there are other characteristics concerning the issuer's sustainability that also matter. When the latter are taken into account, premia attached to green bonds turn out to exhibit a significant degree of variation, not only across bonds but also across issuers.

To preview our main results, we find that a greenium of approximately 16 basis points is attached to the green label of a bond. However, when the issuers' environmental performance is in the top tercile of the distribution of the $E - score$ across the issuers in our sample[1], the greenium nearly doubles. A similar increase, around 15 basis points, is found also for certified green bonds, a category for which the greenium typically stands at 25 basis points.

[1] In the term $E - score$, $E$ stands for Environmental.

In addition, we find that this two-tiered pricing mechanism significantly strengthens during periods of heightened climate change stress. The issuer-adjusted greenium widens to around 44 basis points and it is temporarily awarded to mid-tier issuers as well, indicating a transient "dash-for-green" phenomenon.

Taken together, these findings contribute to reconcile the apparently divergent estimates obtained so far in the literature and highlight the importance of looking beyond the label. Investors reward both the use of proceeds and the climate identity of the borrower, and they do so more aggressively when climate risks are on the rise (as reflected by an increasing number of media articles). Moreover, strengthening corporate disclosure and harmonizing $E-score$ methodologies could channel capital not only toward inherently green champions, but also toward committed transition phase emitters. Indeed, one interesting policy implication stemming from our analysis is that even firms without a top environmental performance can obtain a price advantage when issuing a green bond, provided that the underlying green project is convincing. We show that firms in the middle or lower tercile of the $E-score$ distribution still benefit from a portion of the greenium: the part of the overall premium that is uniquely associated with the bond green label. Thus, also companies without top environmental performance face an incentive in undertaking climate-friendly projects. This is even more important since, as highlighted by Hartzmark and Shue (2023) and Angelini (2024) – and confirmed in a macroeconomic setup by Bartocci et al. (2024) – imposing higher financing costs on high-emission firms might provide them with an incentive to maintain polluting technologies rather than undertaking a transition to cleaner alternatives. Thus, significantly shifting the portfolio composition away from high emitters and towards low emitters only may not lead to a fully-fledged decarbonization or to an effective transition risk mitigation.

The remainder of the paper is organized as follows: Section 2 reviews the related literature; Section 3 describes the data employed and the matching procedure that is at the core of the analysis. Section 4 presents the empirical model and the key findings. Section 5 provides some robustness checks and Section 6 concludes.

## 2 Related literature

A central question in the green bond literature is whether these instruments provide a direct incentive to corporations and financial institutions to invest in climate-friendly projects. Among the potential channels, the most direct one is a borrowing cost advantage, the so-called greenium, observed when green bonds offer lower yields than comparable conventional issues. However, issuing a green bond is far from a trivial decision, as it may involve additional costs relative to conventional financing. Committing the bond proceeds to green projects restricts firms' investment flexibility. Moreover, to have the bond formally recognized as green, issuers typically seek third-party verification to ensure that the proceeds fund projects consistent with one of the two most widely adopted taxonomies: the *Green Bond Principles* issued by ICMA (2021) or the *Climate Bond Standard* issued by Climate Bonds Initiative (2020). The process entails additional administrative and compliance costs (Flammer, 2021).

While extensive and growing, the literature is almost unanimous in confirming the existence of a greenium. However, it remains inconclusive regarding the characteristics that determine its size and dynamics (Zerbib, 2019, Tang and Zhang, 2020, Flammer, 2021, Baker et al., 2022, Bolton et al., 2021, Moro and Zaghini, 2025). Concerning corporate issuance, Zerbib (2019) focuses on a set of 110 green bonds issued globally between 2013 and 2017, finding a statistically significant, but small, greenium of around 2 basis points. Similarly, Baker et al. (2022) estimate a greenium of between 5 and 9 basis points. Fatica et al. (2021) report a larger negative premium of 22 basis points for non-financial corporations, while financial corporations are not found to experience a significant and negative yield differential. The greenium of supranational institutions, however, is significantly larger than for corporations, standing at 80 basis points.

Tang and Zhang (2020) find that stock markets respond positively to green bond issuance announcements, whereas Flammer (2021) documents a significant increase in firms' environmental performance after the issuance, indicating that green bonds effectively enhance corporate environmental footprints. However, both contributions do not find strong empirical evidence supporting the existence of a significant spread between green bonds and conventional bonds issued by the same firm. More recently, Caramichael and Rapp (2024) identify a greenium of 3-8 basis points linked to demand pressure at issuance. In addition, they find that the greenium emerged only after 2019, coinciding with the growth of the sustainable asset management industry following the EU Sustainable Finance Disclosure Regulation (SFDR). The greenium is observed predominantly among large, investment-grade issuers, particularly within the banking sector and in developed economies.

Kapraun et al. (2019) analyze over 1,500 green bonds and 20,000 conventional bonds, finding similar yields on average in the secondary market. However, they also note that investors accept lower yields, between 5 and 18 basis points, on (i) bonds issued by governments, local governments or supranational entities, and (ii) bonds denominated in euro. In addition, external certification of the bond's greenness proves to be a key driver of the size of the greenium.[2] Loeffler et al. (2021), using a large cross section of green and conventional bonds issued between 2007 and late 2019, employ a matching method to align relevant characteristics of the two sets. They find a greenium of 18 basis points, a result consistent with Ehlers and Packer (2017), who examined a shorter period of time.

Moro and Zaghini (2025) develop a partial-equilibrium model in which foreign investors have mean-variance preferences and face a convex disutility from holding brown assets. The model predicts a smaller greenium in economies with more closed financial systems and volatile exchange rates, as foreign investors allocate less to such markets and attach lower weight to ethical considerations. Empirically, they find that the greenium decreases with exchange-rate volatility and increases with financial openness, estimating an average premium of about 30 basis points in advanced economies and close to zero in emerging markets, which are generally perceived as riskier by international investors.

Few studies have analyzed the impact of a company's environmental performance on green bond pricing. Focusing on a limited sample that includes 466 green bonds issued globally up to 2019, Immel et al. (2021) find a premium of 12 basis points attached to green bonds, as well as a premium of 22 basis points related to the availability of an $ESG-score$.[3] When focusing on the yield on green bonds only, they show that the negative correlation with the $ESG-score$ (ranging from 12 to 19 basis points) is entirely due to the "Governance" component of the index. Along this line, Eskildsen et al. (2024) analyze 23 measures of greenness for selected companies along with corresponding forward-looking expected returns, comparing bonds issued by green versus brown firms. In their preferred estimation, they find a spread of 13 basis points. However, the negative correlation between returns and environmental performance holds for both green and non-green bonds, as it is linked to the issuer. Finally, focusing on 561 Chinese green bonds, Tang et al. (2023) find a negative correlation between the bond yield and an environmental information disclosure index that was constructed *ad hoc* for their study. The estimated premium ranges from 8 to 12 basis points.[4]

[2] For *ad hoc* analyses on the role of the external certification on green bond yields see also Dorfleitner et al. (2022) and Ghitti et al. (2023).

[3] $ESG$ stands for Environmental, Social and Governance.

[4] A related issue, i.e. the relationship between exposure to climate changes and the issuance of green bonds, is

With regard to research methodology, the empirical contributions to greenium can be broadly classified into two strands. The first relies on the standard regression approach (Ehlers and Packer, 2017, Kapraun et al., 2019, Tang and Zhang, 2020, Fatica et al., 2021, Baker et al., 2022, Zaghini, 2025), in which bond yields are regressed on a green dummy that captures the average yield differential between green and conventional bonds, controlling for issuer- and bond-specific characteristics. Although intuitive, this approach may still be subject to selection and omitted variable biases, as green and conventional issuers are not randomly distributed across key characteristics.

A second strand employs matching-based identification, which aims to improve comparability between the two groups of issuers before estimating the greenium (Gianfrate and Peri, 2019, Zerbib, 2019, Larcker and Watts, 2020, Loeffler et al., 2021, Flammer, 2021). Within this literature, different matching procedures have been adopted. Several studies, including Gianfrate and Peri (2019) and Loeffler et al. (2021), employ Propensity Score Matching (PSM) to improve comparability between green and conventional bonds, typically finding a moderate greenium of about 10 - 20 basis points. Loeffler et al. (2021) further test the robustness of their results by re-estimating the greenium using Coarsened Exact Matching (CEM), obtaining consistent estimates. Other studies, such as Zerbib (2019), Larcker and Watts (2020), and Flammer (2021), rely on exact or nearest-neighbour matching, either at the bond or firm level, to ensure comparability across key characteristics. Overall, matching techniques represent a substantial improvement over simple regression frameworks by explicitly balancing observable covariates and thus mitigating selection bias due to non-random issuer characteristics.

Recent contributions such as Boermans (2023), Boermans et al. (2024) and Fricke and Meinerding (2025), shift the focus to the investor perspective, analysing euro-area securities holdings to uncover a “green bias” in institutional portfolios consistent with preferred-habitat demand for sustainable assets. Fricke and Meinerding (2025), in particular, employ a within-issuer “twin-bonds” design comparing green and conventional bonds issued by the same firm. They estimate an average greenium of about 3 basis points for the euro area and show that it is mainly borne by specific investor categories, such as investment funds, banks, and insurance companies. This approach offers a clean identification of the pure label effect by controlling for all time-invariant issuer characteristics, but it necessarily limits the scope for analysing how the greenium varies

examined in Guesmi et al. (2025). They find that firms exposed to climate change are more likely to issue green bonds to hedge against physical and regulatory risks. These bonds generate lower proceeds, have higher coupon rates and longer maturities, and are associated with higher ESG scores, but not with lower carbon emissions.

across issuers with different ESG profiles, disclosure levels, or certification practices.

Our approach is complementary. By adopting a matching framework that compares green and non-green bonds across comparable issuers, we exploit cross-sectional variation in ESG profiles, disclosure, and certification practices to identify when and why the greenium materialises, rather than who pays it. In addition, by interacting the green label with measures of climate-related uncertainty, we capture market conditions under which the pricing advantage is likely to strengthen. Consistent with findings in the literature showing that greenium estimates are highly sensitive to sample selection, our design improves comparability ex-ante via a non-parametric matching approach. We employ Coarsened Exact Matching (Iacus et al., 2012), which directly balances key bond and issuer characteristics, thereby reducing specification dependence relative to traditional matching scores. Within a broad robustness exercise, we replicate our analysis using PSM and also employ an entropic weighting scheme (Hainmueller, 2012). In both cases, we obtain comparable results. More details on our methodology are provided in the next section.

# 3 Data

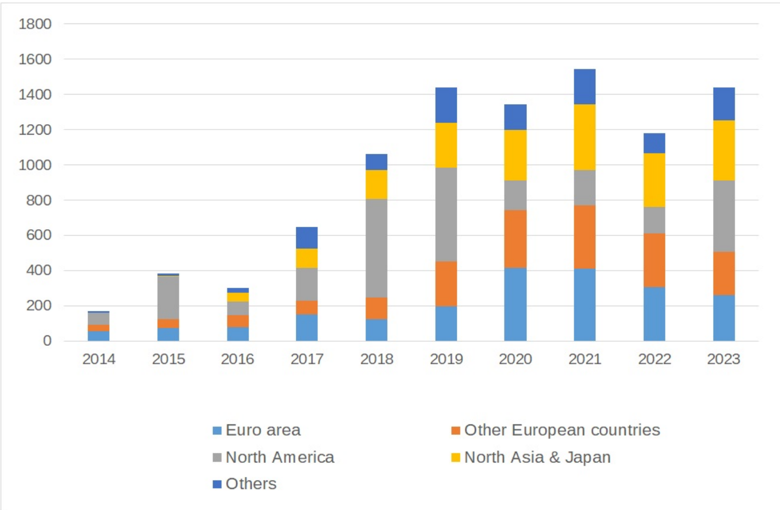
## 3.1 Green bond issuance

The issuance of green bonds has surged over time, reflecting growing investor interest in sustainable finance and environmentally responsible projects. Sourced from Dealogic DCM Analytics and LSEG Data Analytics, between January 2014 and October 2023, we tracked a total of 9,507 green bonds issued across 73 countries. Over the same period, the total number of bonds issued amounted to 258,421, spanning 145 nationalities. Among green bond issuers, the financial sector is the most represented at around 27%, followed by government entities and energy and utilities companies (both at 16%), development and multilateral agencies (11%), and transportation (5%). The LSEG database is also utilized as a source of information on the green footprint of issuers. Specifically, we downloaded the ESG scores and their three sub-components—Environmental (E), Social (S), and Governance (G)—for all available firms/issuers. These scores, computed at the firm level by LSEG based on a predefined set of indicators, range from zero (poor score) to 100.

Figures 1 and 2 illustrate the geographical distribution and total value of green bond issues between 2014 and 2023. The issuance of green bonds has significantly increased over this period, rising from 170 in 2014 to 1,441 in the first 10 months of 2023. In 2014-19, North American issuers led the market. However, after 2020, European and Asian issuers, particularly from China, have increased their activity, offsetting a reduction in North American issuance. In other regions, activity has remained subdued (Figure 1). Figure 2 displays the total value of green bond issues by region and year. Between 2014 and 2016 the value of green bond proceeds ranged below 100 billion euros. Afterward, the value surged, peaking at almost 500 billions euros in 2021 and stabilizing at around 400 billion euros in subsequent years. Europe has significantly contributed to the development of the green bond market, with nearly 50% of the global value of green bonds issued in the first 10 months of 2023 originating from the euro area alone.

**Figure 1:** Number of green bonds issued by geographical area and year

Note: Data for the year 2023 are limited to the January-October period due to data availability. Sources: Dealogic and LSEG.




Globally, there has been a progressive diversification of issuers over time, as illustrated in Figure 3. While the financial sector, primarily represented by banks, has maintained a key role, there has been a notable increase in issuance activity by governments and companies in carbon-intensive sectors such as energy, utilities, and transportation. Additionally, after 2020, other non-financial corporations have significantly increased their issuance of green bonds.

The return on the bonds across our sample has varied over time, reflecting factors such as global monetary policy and global risk-taking attitudes. Figure 4 shows the monthly average yield at issuance for green and conventional bonds. Between 2014 and 2017, conventional bonds exhibited a lower yield compared to their green counterparts. However, since around 2018, a notable reversal occurred as green bonds began to exhibit a negative premium, implying a lower yield than conventional bonds. This premium deepened further after 2020. While the average

**Figure 2:** Value of green bonds by geographical area and year. Billion of euros.

Note: Data for the year 2023 are limited to the January-October period due to data availability. Sources: Dealogic and LSEG.

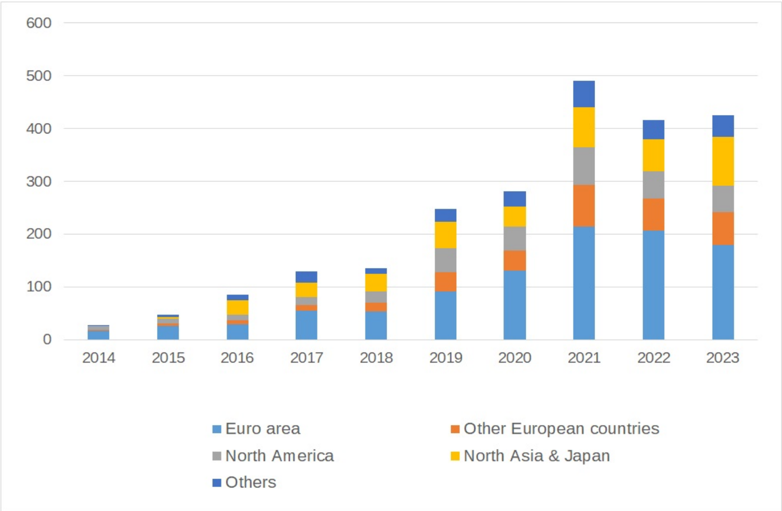
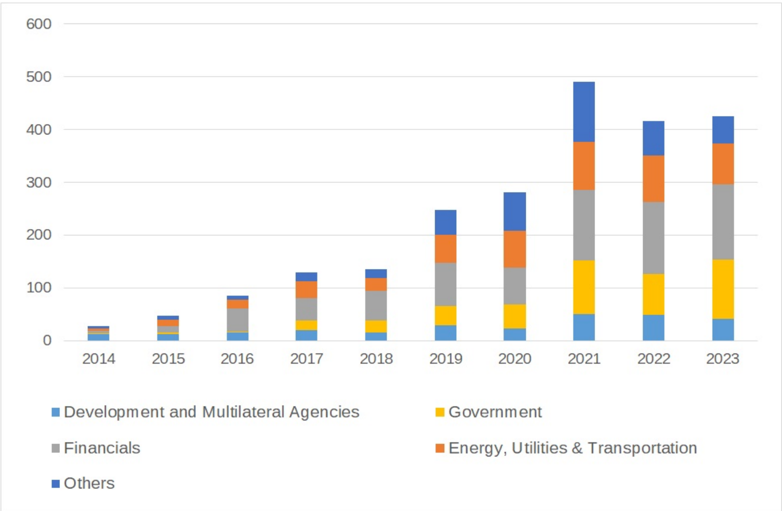



**Figure 3:** Value of green bonds by issuer sector and year. Billion of euros.

Note: Data for the year 2023 are limited to the January-October period due to data availability. Sources: Dealogic and LSEG.

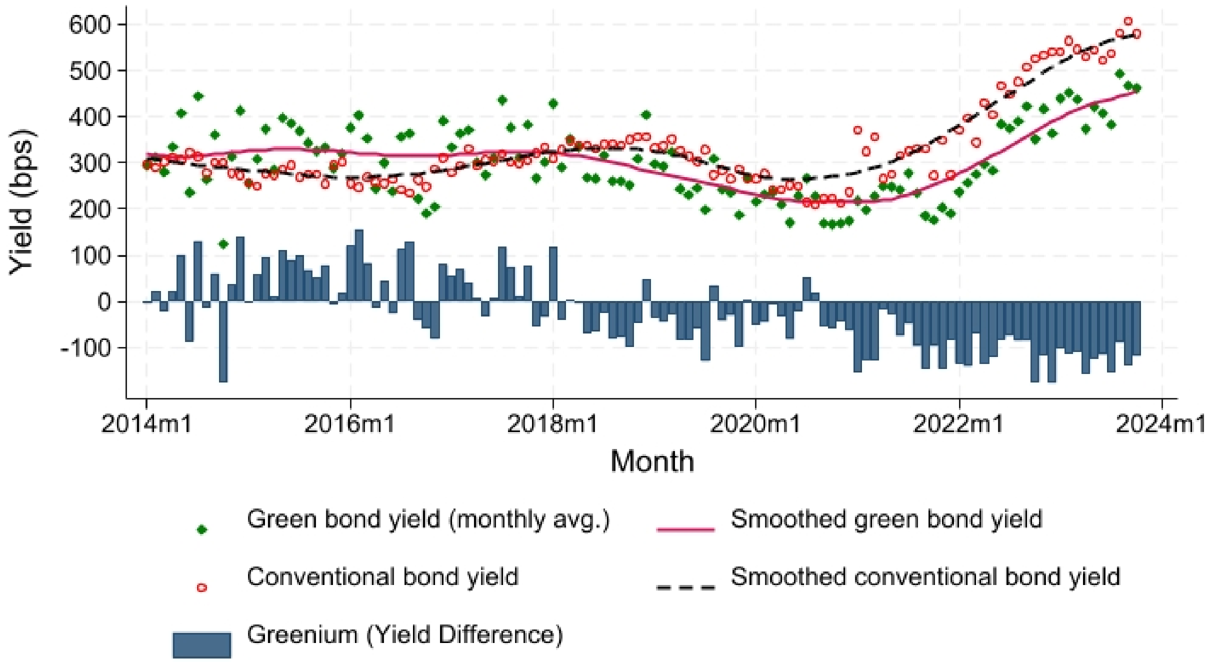



yield differential between green and conventional bonds amounted to 28 basis points over the full sample period, the gap widened markedly after 2020, exceeding 100 basis points.

It is crucial to note that the observed difference in yields between the two sets of bonds is a purely descriptive and naïve measure of the greenium. This is due to the significant heterogeneity in bond characteristics and issuer profiles across different times and geographical areas. To accurately determine the size of the greenium from an econometric perspective, it is essential to

**Figure 4:** Yield at issuance for green and conventional bonds and their gap.

Note: This figure shows the monthly average yield at issuance across our sample (Jan 2014 - Oct 2023) for green (diamonds) and conventional - brown - bonds (circles). The straight lines are locally weighted scatterplot smoothing (Lowess) fitted to the original observations. The barchart in the lower panel is the spread between the two bond categories, i.e. a naïve measure of the greenium. Values on the y-axis are in basis points. Sources: Dealogic and LSEG.




create comparable samples of green and conventional bonds. This issue will be addressed in the next subsection.

### 3.2 The matching procedure

Ensuring that the estimated yield differential genuinely reflects the issuer's green footprint or the bond's green label, requires achieving comparability between green and conventional bonds. Traditional regression analyses in which the two groups are pooled are exposed to selection bias when the two bond samples differ systematically on characteristics that are likely to influence the yield, but are not properly controlled for. For instance, if green bonds are predominantly issued by high-credit quality firms and have shorter maturities relative to non-green bonds, then a simple regression of green and conventional bond yields on a constant and a dummy for the green bonds might capture the combined effect of both the green label and the confounding factors (in the example, quality and maturity).

To mitigate this problem, we employ the Coarsened Exact Matching (CEM; Iacus et al., 2012), which constructs a matched sample of green and conventional bonds that are directly comparable across key observable characteristics. Unlike other commonly used matching procedures, for example the Propensity Score Matching (PSM), which estimate a continuous probability of treatment and depend on model specification, CEM is a fully non-parametric procedure that directly balances the distributions of multiple covariates by grouping them into predefined coarsened intervals. This approach mimics exact matching while retaining sufficient within-group variation across issuers, allowing us to capture differences in ESG performance, disclosure, and certification within a comparable sample. It ensures multidimensional balance without relying on a single latent score, thereby reducing model dependence and avoiding extrapolation outside the common support. Unlike PSM, where covariate balance is achieved ex post as a function of estimated propensity scores, CEM attains balance ex ante by construction, yielding estimates that are less sensitive to model misspecification. Moreover, it provides greater flexibility in handling both categorical and continuous variables, enhancing the accuracy of the matching across various bond and issuer characteristics.

Our matching procedure involved several steps. First, we categorized bonds into groups based on a selected set of control variables. The latter includes bonds characteristics such as year of issuance, issued amount, maturity, currency of denomination, coupon frequency, interest rate type, credit rating and other embedded options (subordination, callability and collateralization). Bonds are also matched according to the country of origin and sector of the issuers. Next, we coarsened the control variables. Coarsening involves transforming continuous variables into categorical variables by creating intervals, or bins, or recoding discrete variables into broader categories. This simplifies the matching process by reducing the number of unique values each variable can take, without a significant loss of information, since the original (uncoarsened) variables are subsequently included in the regression analysis. Selected variables, including year of issuance, currency denomination, embedded options and the issuer's country and business sector, were matched exactly, without any coarsening. The coupon rate was recoded into five categories, while the interest rate type remained as either fixed or floating. The credit rating of the bonds was reduced from 20 to eight categories, and continuous variables such as the amount issued and the maturity of the bond were classified into 12 and 11 items, respectively. After coarsening the variables, CEM performs exact matching within these coarsened groups. Each green bond is matched with $k$ non-green bonds (1-to-$k$ matching), i.e. those that fall into the exact same categories for all coarsened control variables. In each classification bin, the presence of more than one non-green bond for each green bond is controlled through the matching weights produced by CEM.[5] All unmatched bonds are excluded from further analysis, ensuring a high degree of comparability within the matched sample.

**Table 1:** CEM samples by region and sector

| | **Baseline Regression** | | **Restricted Sample** | | **Larger Sample** | |
|---|---|---|---|---|---|---|
| | Conventional | Green | Conventional | Green | Conventional | Green |
| **Num. Of obs.** | 12,103 | 2,589 | 8,919 | 2,152 | 30,063 | 3,886 |
| **Region:** | | | | | | |
| North America | 5,846 | 503 | 4,246 | 432 | 18,065 | 698 |
| Europe | 1,851 | 1,149 | 1,407 | 971 | 4,433 | 1,859 |
| North Asia & Japan | 4,047 | 766 | 3,031 | 618 | 6,825 | 1,027 |
| Others | 359 | 171 | 235 | 131 | 740 | 302 |
| **Sector:** | | | | | | |
| Multilateral Institutions | 632 | 327 | 461 | 266 | 1,724 | 534 |
| Government | 4,587 | 235 | 3,309 | 202 | 15,092 | 342 |
| Financials | 3,733 | 753 | 2,954 | 641 | 7,255 | 1,136 |
| Energy, Util. & Transport | 1,203 | 468 | 909 | 378 | 1,888 | 685 |
| Others | 1,948 | 806 | 1,286 | 665 | 4,104 | 1,189 |

Sources: Dealogic and LSEG.
Note: The Table reports the size and composition, by geographical region and sector, of the three green and conventional bond samples identified by the CEM selection algorithm, which are the underlying data for our baseline regression and selected robustness checks.

The application of the CEM algorithm resulted in a sample composed of 2,589 green bonds and 12,103 comparable conventional bonds, which are used in the regression analysis as weighted-matched controls. The ratio of treatment (green bonds) to control (conventional bonds) observations in our sample is 1:4.7, which supports a robust comparison and provides sufficient statistical power. For comparison, the related literature reports various ratios of common support, ranging from 1:1 in Flammer (2021) and Zerbib (2019), to 1:4 in Loeffler et al. (2021), and up to 1:8 and 1:10 in Gianfrate and Peri (2019) and Kapraun et al. (2019), respectively. Table 1 summarizes the composition of the regression sample, along with a larger sample and a restricted sample intended for robustness checks as detailed in Section 5. The larger sample relaxes the matching constraints, thereby incorporating additional observations and testing the robustness of the results to broader coarsening. In contrast, the restricted sample applies a finer coarsening to the issued amount and bond maturity, producing a closer correspondence between green and conventional bonds, at the expense of a smaller sample size.

[5] As a robustness check, we re-estimated the model without weights and after winsorizing the CEM weights for non-green bonds at different thresholds (top 5%, 5–95%, and 10–90%). The results remain virtually unchanged, confirming that the findings are not driven by the weighting structure or by a few highly weighted observations.

As a robustness check, we complement our baseline analysis based on CEM with a PSM approach. The propensity score, namely the probability of a bond being green, is estimated through a logit model including pre-treatment bond characteristics (maturity, issue size, collateralization, subordination, callable feature) and issuer-level controls (industry, credit rating, nationality, currency, and issuance year). Green bonds are then matched to comparable conventional bonds using a nearest-neighbor algorithm within the common support, and the benchmark regression is re-estimated on the matched sample, with standard errors clustered at the issuer level.[6] The matching diagnostics confirm a satisfactory overlap between treated and control observations. The results presented in Section 5 are highly consistent across both matching algorithms, confirming that our findings are not sensitive to the choice of the matching technique.

# 4 Modelling the greenium

## 4.1 The market assessment

To assess the size and determinants of the yield spread between green and non-green bonds, we rely on the following baseline model:

$$yield_{b,c,i,t} = \alpha + \beta * green_b + \delta * X_{b,i} + \gamma * \Theta_t + \lambda_{c,t} + \varepsilon_{b,c,i,t} \tag{1}$$

where $yield$ represents the annualized yield to maturity at issuance for bond $b$, denominated in currency $c$, placed by issuer $i$ at time $t$.[7] The variable $green$ is a dummy that takes a unit value for green bonds, and zero otherwise. The vector $X$ contains the bond and issuer characteristics: maturity (measured in years to maturity), amount issued in EUR millions, the coupon frequency, the interest rate type (fixed, floating, variable), dummies for collateralized, subordinate and callable bonds, the rating of the bond, the rating of the issuer, the nationality of the issuer, the industry sector of the issuer and three indicators from the issuer's balance sheet (total assets, leverage and ROE). In addition the vector $X$ contains also a dummy variable

[6] Each green bond is matched to comparable conventional bonds using a nearest-neighbor algorithm within a caliper equal to 0.25 standard deviations of the estimated propensity scores (Stuart and Rubin, 2008). We iterate the matching procedure over alternative numbers of neighbors (1, 2, 4, 8, and 10) and caliper widths (0.005, 0.01, 0.0163, 0.02), both with and without re-weighting by matching frequency.

[7] While interesting per se, the use of secondary market data is not fit for the research question of the paper. We are interested in assessing the cost of financing a green project and whether the green label of the bond or the availability of the ESG score affect it. Indeed, secondary market prices can be thought as the current market assessment of the security (Goldstein and Yang, 2017), but they do not change the face value of the already issued bonds and thus the cost for the issuer.

which identifies the level of greenness of the firm which, in subsequent econometric analysis, is used to form an interaction term with the variable *green*. The vector $\Theta$ includes time-varying financial and macroeconomic factors that are likely to affect bond yields. There are three classes of market indices at the daily frequency: (i) the VIX and VSTOXX indexes that are measures of the expected equity market volatility in the US and euro area, respectively; (ii) the CISS (Composite Indicator of Systemic Stress) indexes by Hollo et al. (2012) that measure the systemic stress in the financial markets in China, the euro area, the UK and the US; (iii) the iTraxx index that captures market-wide variation in Credit Default Swaps (CDS) spreads due to changes in fundamental credit risk, liquidity, and CDS market-specific shock (Acharya et al., 2014). In addition, also at the daily frequency, we include: (i) the index of macroeconomic surprises for the US and the euro-area provided by Citi; (ii) the index of economic policy uncertainty (EPU) by Baker et al. (2022) for the US, the UK and China (the latter at the monthly frequency). To account for global factors, we rely on: i) the monthly index of global commodity prices from the IMF Global Commodity Dataset that covers both oil and other commodities; ii) the geopolitical risk index (GPR) by Caldara and Iacoviello (2022). Finally, the term $\lambda$ indicates bond denomination currency time-varying fixed effects. Equation 1 is estimated by Ordinary Least Squares; standard errors are clustered at the issuer level.

Table 2 shows the estimate of the coefficients of interest from equation 1, while further details are reported in the Appendix.[8] At placement, green bonds benefit from a negative spread (i.e. greenium) of 11 basis points with respect to non-green bonds (column 1). Thus, issuing a green bond seems convenient, independently of the company environmental performance. The size of the estimate falls in the range of the findings of the literature, that suggests a negative greenium from few basis points, as in the early contribution by Zerbib (2019), to over 30 basis points as reported more recently by Moro and Zaghini (2025).[9] However, this estimate is still rough, since it does not include a relevant variable such as the availability of an ESG score.

Similarly, when the issuer has a publicly available $E\!-\!score$ (i.e., there is a market disclosure), the bond also benefits from a yield discount. The estimate of the coefficient of the dummy

[8] More in detail, the Appendix provides, for the first five columns of Table 2, the regression results with all the interactions and the main regressors.

[9] Market evidence suggests that green bonds tend to be over-subscribed (Climate Bonds Initiative, 2022), which could, in principle, amplify the greenium via demand–supply imbalances (Caramichael and Rapp, 2024). Using data on 651 green bonds with available over-subscription rates, we find that the inclusion of an over-subscription dummy does not alter the main results, suggesting that excess demand plays only a limited role in explaining the observed yield differential.

*disclosure*, tracking the companies having a publicly available $E - score$, stands at 20 basis points (column 2). This indicates that disclosing a firm's environmental involvement provides per se a reduction in the cost of bond issuance. This finding is in line with the results reported by Immel et al. (2021) and Ferriani (2023) for an $ESG$ dummy.[10]

A more precise estimate of the greenium and an assessment about how the two characteristics interact are shown in the third column of the Table. For green bonds issued by companies without an $E - score$, the greenium amounts to 16 basis points, whereas for green bonds issued by companies with an $E - score$ the greenium increases to 27 basis points. At the same time, the effect of disclosing the $E - score$ provides a benefit of 23 basis points. Thus, while the two sources of discount do not perfectly add up, there is clear evidence of an additional convenience in disclosing the $E - score$ for green bond issuers or, viceversa, there is an additional convenience for disclosing issuers in placing a green bond instead of a traditional one. From an economic point of view, given that the unconditional mean of the cross section of yields at issuance stands at 2.44%, the greenium for disclosing companies amounts to a non-trivial 11% discount on the financing costs.

A further investigation concerns the possibility of a non-linear effect of the environmental performance of the issuing company on the bond yield. Disclosing a high score might be better received by investors than disclosing a low score, affecting both ordinary and green bonds. In addition, there might be a threshold below which the additional discount is not applied by market participants, or below which it even turns negative.[11]

The fourth column of Table 2 shows how the 11 basis point difference between the premium on green bonds (-0.1595) and that on green bond with disclosure (-0.2717) are awarded according to the cross-sectional distribution of the $E - score$. When the $E - score$ is in the top tercile of its cross-sectional values, the interaction of the green bond and the disclosure is rewarded by investors by additional 17 basis points with respect to green bonds issued by non-disclosing companies. Thus, the overall greenium on bonds in the top tercile of the distribution amounts to 33 basis points. No additional premium at issuance is attributed to the green bonds issued by companies in the other two terciles, indicating that disclosing a poor or an average environmental performance is neither rewarded nor penalized by investors. Overall, only a very good environmental performance matters for the greenium.

[10] For a critique on the divergence across rating agencies providing ESG scores see Berg et al. (2022)

[11] Note that, since green issuance is not included in the determinants of the $E - score$ provided by LSEG, there is not a mechanical link between the green bond placement and the $ESG - score$ of the issuer.

**Table 2:** Estimates of the *greenium* in the primary bond market

| | Green | Disclosure | G&D | E-score | Certified | ESG-score | G-score | S-Score |
|---|---|---|---|---|---|---|---|---|
| **Green** | -0.1115*** | .. | -0.1595*** | -0.1597*** | -0.2532*** | -0.1596*** | -0.1908*** | -0.1917*** |
| | (0.0372) | .. | (0.0579) | (0.0580) | (0.0710) | (0.0579) | (0.0531) | (0.0530) |
| **Disclosure** | .. | -0.2070*** | -0.2262*** | -0.2285*** | -0.2276*** | -0.2278*** | -0.2112*** | -0.2148*** |
| | .. | (0.0691) | (0.0737) | (0.0732) | (0.0709) | (0.0734) | (0.0696) | (0.0697) |
| **Green&Disclosure** | .. | .. | -0.2717*** | .. | .. | .. | .. | .. |
| | .. | .. | (0.0709) | .. | .. | .. | .. | .. |
| **Green*Disclosure*TOP** | .. | . | .. | -0.1712** | -0.1529* | -0.1427* | -0.0360 | -0.1339 |
| | .. | .. | .. | (0.0809) | (0.0942) | (0.0814) | (0.0854) | (0.0835) |
| **Green*Disclosure*MED** | .. | .. | .. | -0.0793 | 0.0111 | -0.1099 | 0.0032 | 0.0683 |
| | .. | .. | .. | (0.0923) | (0.1163) | (0.0890) | (0.0859) | (0.0969) |
| **Green*Disclosure*LOW** | .. | .. | .. | 0.0005 | -0.0465 | 0.0138 | -0.2377 | -0.0736 |
| | .. | .. | .. | (0.1426) | (0.1935) | (0.1865) | (0.1910) | (0.1463) |
| **Bond+Issuer Controls** | YES | YES | YES | YES | YES | YES | YES | YES |
| **Market Controls** | YES | YES | YES | YES | YES | YES | YES | YES |
| **Macro Controls** | YES | YES | YES | YES | YES | YES | YES | YES |
| **Currency*Year Controls** | YES | YES | YES | YES | YES | YES | YES | YES |
| **Observations** | 14,692 | 14,692 | 14,692 | 14,692 | 14,692 | 14,692 | 14,692 | 14,692 |
| $R2^a$ | 0.8294 | 0.8299 | 0.8303 | 0.8304 | 0.8308 | 0.8303 | 0.8303 | 0.8308 |

Robust standard errors clustered at the issuer level are reported in parentheses.

$^*$ denotes $p < 0.10$, $^{**}$ denotes $p < 0.05$ and $^{***}$ denotes $p < 0.01$

Note: The Table reports the coefficient estimates of separate regressions on the yield at issuance for a set of green and (matched) conventional bonds, controlling for a number of market and macroeconomic factors and with selected fixed and time effects. The environmental performance measure used to split companies across terciles in the last three lines of the Table is the cross-sectional $E - score$ as reported by LSEG. Green is a dummy variable that takes 1 for green bonds, and 0 otherwise. Disclosure is a dummy variable that takes 1 for bonds placed by an issuer for which a E-score is available, and 0 otherwise. TOP, MED, LOW are dummy variables taking 1 when the issuer's $E - score$ is in the first, second and third tercile of the $E - score$ cross-sectional distribution, respectively.

As a first check of the baseline results, column 5 focuses on the subset of green bonds having a third-party opinion certifying the consistency with the *Green Bond Principles* by ICMA (2021) or the *Climate Bond Standard* by Climate Bonds Initiative (2020). We observe an increase in the greenium to 25 basis points for non-disclosing companies and a slight reduction in the spread from the top tercile of disclosing companies. This suggests that certification enhances trust in the authenticity of the green credentials of the bond, especially for non-disclosing companies (Dorfleitner et al., 2022; Ghitti et al., 2023).

As a second step, we examine the disclosure and cross-sectional distribution of the $ESG-score$ as a whole and the two additional components of social performance ($S-score$) and governance performance ($G-score$) of the companies. When we employ the $ESG-score$ instead of the $E-score$, the estimate and the statistical significance of each coefficient are in line with the baseline regression (column 6 vs column 4). This evidence is not surprising given the strong positive correlation between the two scores (0.87). However, the coefficients associated to the $S-score$ and the $G-score$ have no statistical significance (column 7 and column 8, respectively), indicating that a firm's environmental performance is the only factor that significantly impacts the pricing of green bonds.

## 4.2 The role of climate awareness

We further investigate an additional factor that might influence the pricing of green bonds: the investors' climate awareness. In particular, Pastor et al. (2021) propose a theoretical framework to model the impact of changes in sustainability preferences on asset prices. Their model predicts that green shares outperform non-green shares when climate change concerns strengthen. For bonds, in particular, they show that the greenium between two matched bonds issued by the German Government was almost negligible at issuance (2 basis points), but it spiked around the occurrence of catastrophic climate-related events as the July 2021 floods in Central Europe. Such events may influence investors' behavior, increasing the perceived value of investments in sustainable projects and, consequently, the pricing of green bonds (Pastor et al., 2022).

In order to the test the prediction made by Pastor et al. (2021) for the equity market on our set of green and conventional bonds, we rely on three different indicators. The first is the Climate Policy Uncertainty (CPU) Index proposed by Gavriilidis (2021). This monthly index gauges climate change uncertainty based on news from major US newspapers and newswires. We also rely on the Media and Climate Change Concerns (MCCC) Index, also based on US news

**Table 3:** Estimates of the *greenium* with respect to climate uncertainty

| | CPU | CPU | CPU | MCCC | PhC |
|---|---|---|---|---|---|
| **Green** | -0.1593*** | -0.1592*** | -0.1397*** | -0.1417** | -0.1705*** |
| | (0.0580) | (0.0575) | (0.0576) | (0.0570) | (0.0508) |
| **Disclosure** | -0.2267** | -0.2249** | -0.2187** | -0.2351*** | -0.1801*** |
| | (0.0736) | (0.0735) | (0.0732) | (0.0749) | (0.0660) |
| **LowUncertainty*Green*Disclosure** | -0.0751 | .. | -0.0528 | -0.1081 | 0.1970 |
| | (0.0816) | .. | (0.0805) | (0.0845) | (0.2336) |
| **HighUncertainty*Green*Disclosure** | -0.2218** | -0.1657** | .. | .. | .. |
| | (0.0914) | (0.0960) | .. | .. | .. |
| **Green*Disclosure*TOP** | .. | -0.1576** | -0.3009*** | -0.2432*** | -0.3998* |
| | .. | (0.0810) | (0.0966) | (0.0883) | (0.2387) |
| **Green*Disclosure*MED** | .. | -0.0578 | -0.2958** | -0.1874* | -0.3841* |
| | .. | (0.1002) | (0.1417) | (0.1052) | (0.2365) |
| **Green*Disclosure*LOW** | .. | 0.0736 | -0.2089 | 0.0462 | -0.1901 |
| | .. | (0.1711) | (0.1502) | (0.1365) | (0.2828) |
| Bond+Issuer Controls | YES | YES | YES | YES | YES |
| Market Controls | YES | YES | YES | YES | YES |
| Macro Controls | YES | YES | YES | YES | YES |
| Currency*Year Controls | YES | YES | YES | YES | YES |
| N | 14,692 | 14,692 | 14,692 | 14,692 | 14,692 |
| $R2^a$ | 0.8304 | 0.8298 | 0.8350 | 0.8349 | 0.8352 |

Robust standard errors clustered at the issuer level are reported in parentheses.

$^{*}$ denotes $p < 0.10$, $^{**}$ denotes $p < 0.05$ and $^{***}$ denotes $p < 0.01$

Note: The Table reports the coefficient estimates of separate regressions on the yield at issuance for a set of green and (matched) conventional bonds, controlling for a number of market and macroeconomic factors and with selected fixed and time effects. The environmental performance measure used to split companies across terciles in the last three lines of the Table is the cross-sectional E-Score sourced from LSEG. Green is a dummy variable that takes 1 for green bonds, and 0 otherwise. Disclosure is a dummy variable that takes 1 for bonds placed by an issuer for which a E-score is available, and 0 otherwise. TOP, MED, LOW are dummy variables taking 1 when the issuer's E-score is in the first, second and third tercile of the E-score cross-sectional distribution, respectively. The variable LowUncertainty takes 1 in all the days when the headline index is below average, and 0 otherwise. The variable HighUncertainty takes 1 in all the days when the headline index is above average, and 0 otherwise. CPU is the Climate Policy Uncertainty Index by Gavriilidis (2021); MCCC is the Media and Climate Change Concerns Index by Ardia et al. (2023); PhC is the Physical Concern Index by Bua et al. (2024).

but computed at a daily frequency, as proposed in Ardia et al. (2023) and used to empirically confirm the prediction of the model by Pastor et al. (2021) on the US stock market using data for S&P 500 companies over the period January 2010 - June 2018. Last, we also employ the Physical Concern (PhC) Index by Bua et al. (2024), based on European news items and used originally to document the emergence of an economically significant physical risk in the European stock market since 2015.

In the regression framework we introduce two dummy variables for each index, tracking periods of high and low climate change stress based on realizations of the index being above or below its median value computed over the full period we look at. Starting with the CPU Index, estimation results in Table 3 show that in periods of heightened uncertainty about climate change, the greenium is larger (column 1), confirming the findings of Ardia et al. (2023) about the better performance of green stocks versus the brown ones in the US market.

We further analyze whether the non-linearity of the market reward is present in both periods of low and high uncertainty. In periods of reduced climate concerns, the usual ranking across the disclosure terciles applies (column 2). Specifically, when the CPU index falls below its median value, only the coefficient for the top tercile of the environmental score is statistically significant and in line with the estimations from Table 2 (16 vs 17 basis points).

Instead, two findings are worth noting in periods of high uncertainty (column 3). First, the market discount granted to the green issuance made by companies in the top tercile of the cross-sectional disclosure distribution is the largest across all regressions (30 basis points) and leads the overall greenium to reach 44 basis points. Secondly, the discount in the yield at issuance extends also to the firms in the middle tercile of the $E - score$. Thus, in periods of climate stress, investors not only seem prone to finance green projects at a higher cost, but are also willing to extend the additional reward to companies with a lower environmental performance. Results are confirmed when employing the MCCC Index and the PhC Index (columns 4 and 5, respectively).[12] Overall, this evidence suggests a sort of "dash for green" in challenging environmental times.

[12] For a recent analysis on how changes in the MCCC index and its sub-components affect global bond market indexes see Benkraiem et al. (2025).

## 5 Robustness

In this section we provide robustness checks to the results obtained so far along multiple dimensions. First, we constrain the bonds in the regression sample to match selected issuers characteristics. Then we test the sensitivity of the matching procedure in several ways. We begin by applying both a stricter and looser set of constraints for the CEM procedure, thereby giving rise to a smaller and a larger regression sample, respectively. Second, we replicate the analysis using a Propensity Score Matching (PSM) algorithm, based on nearest-neighbor matching within calipers. We iterate the procedure over alternative numbers of neighbors and caliper widths, including a benchmark caliper set to one quarter of the propensity-score standard deviation, and consider both weighted and non-weighted variants. Third, we re-estimate the model on the full, unmatched universe of bonds. Finally, we employ an alternative re-weighting approach based on entropy balancing.

In the first two columns of Table 4, the sample of bond issuers is reduced in two ways. First, we dropped all government institutions, thereby restricting our analysis to private sector corporations and multilateral development banks only (ending up with 9,870 observations). Second, we also excluded the issuance made by the banking system, further reducing the sample to 8,225 observations. Note that in order to have a proxy of the issuance of the non-financial sector, we maintained in the sample the financial vehicles of non-financial corporations (NFCs) and the insurance companies.

Regression results show that when government institutions are removed from the sample, the main findings remain qualitatively and quantitatively similar to the baseline case, i.e. disclosing the environmental performance of the issuer provides an additional benefit when placing a green bond, provided that the $E - score$ is in the top tercile of its cross-sectional distribution. The greenium for non-disclosing companies stands at 16 basis points, while that for disclosing companies reaches up to 35 basis points (column 1). Instead, a further reduction of the sample to a proxy of the non-financial sector only, leads to a larger greenium, especially for the disclosing corporations, for which it reaches 43 basis points. This evidence suggests that investors are more willing to directly finance the environmentally friendly projects of corporations by buying their green bonds (even at a higher price/lower yield), than going through the "intermediation" of banks' green bonds.

As a further set of robustness checks, we change the baseline regression sample by adjusting

**Table 4:** Sample robustness checks

| | No Gov | No Banks | CEM Small | CEM Large | Debut |
|---|---|---|---|---|---|
| **Green** | -0.1577** | -0.1901*** | -0.1700*** | -0.1899*** | -0.0952** |
| | (0.0647) | (0.0751) | (0.0555) | (0.0591) | (0.0470) |
| **Disclosure** | -0.2438*** | -0.2705*** | -0.2284*** | -0.1893*** | -0.2063*** |
| | (0.0773) | (0.0965) | (0.0796) | (0.0716) | (0.0719) |
| **Green*Disclosure*TOP** | -0.1964** | -0.2402** | -0.1720** | -0.1401* | -0.2710*** |
| | (0.0847) | (0.0974) | (0.0816) | (0.0824) | (0.0728) |
| **Green*Disclosure*MED** | -0.0977 | -0.1410 | -0.0603 | -0.0250 | -0.1782 |
| | (0.0939) | (0.1063) | (0.0920) | (0.1039) | (0.074) |
| **Green*Disclosure*LOW** | 0.0686 | -0.0051 | 0.0269 | 0.0438 | -0.0944 |
| | (0.1457) | (0.1899) | (0.1601) | (0.1331) | (0.1389) |
| **Bond+Issuer Controls** | YES | YES | YES | YES | YES |
| **Market Controls** | YES | YES | YES | YES | YES |
| **Macro Controls** | YES | YES | YES | YES | YES |
| **Currency*Year Controls** | YES | YES | YES | YES | YES |
| **Observations** | 9,870 | 8,225 | 11,071 | 33,949 | 14,692 |
| $R2^a$ | 0.8368 | 0.8312 | 0.8401 | 0.8239 | 0.6496 |

Robust standard errors clustered at the issuer level are reported in parentheses.

$^*$ denotes $p < 0.10$, $^{**}$ denotes $p < 0.05$ and $^{***}$ denotes $p < 0.01$

Note: The Table reports the coefficient estimates of separate regressions on the yield at issuance for a set of green and (matched) conventional bonds, controlling for a number of market and macroeconomic factors and with selected fixed and time effects. The environmental performance measure used to split companies across terciles in the last three lines of the Table is the cross-sectional E-score as reported by LSEG. *Green* is a dummy variable that takes 1 for green bonds, and 0 otherwise. *Disclosure* is a dummy variable that takes 1 for bonds placed by an issuer for which an E-score is available, and 0 otherwise. *TOP*, *MED* and *LOW* are dummy variables taking 1 when the issuer's E-score is in the first, second and third tercile of the E-score cross-sectional distribution, respectively. The sample used in columns 1, 2 and 5 refers to the baseline CEM sample; in the column *No Gov* Government issuance is removed while in the column *No banks* the banking sector issuance is also eliminated from the analysis. The sample used in column *CEM small* has been obtained by more strict matching conditions than for the baseline estimation in Table 2, while the one used in column *CEM large* has been obtained by less strict matching conditions. In column *Debut* the is the *Green* dummy takes 1 for the first green bond issued, and 0 otherwise.

the CEM procedure. We initially rely on the smaller matched sample made of 11,071 bonds (8,919 conventional and 2,152 green; Table 1 in Section 3), for which the matching constraints are set with stricter conditions. Column 3 (CEM Small) in Table 4 shows again that results are in line with the baseline estimation, also when a smaller and even more homogeneous set of bonds is employed. We then rely on a larger matched sample, obtained by looser CEM conditions, of 33,949 observations (30,063 conventional bonds and 3,886 green). Regression estimates in column 4 (CEM Large) again bring support to the baseline results, both qualitatively and quantitatively.

Since the frequency of green bond placements is different across issuers, we assess whether regression results are influenced by multiple bond emissions by the same issuer. We thus consider for each issuer the first green bond issuance only (column 5). While the greenium stands somewhat lower (at 9.5 basis points) the main finding that the pricing mechanism is based on a two-tiered approach remains valid. In addition, given that the reward assigned to issuers showing a top tercile $E - score$ is higher relative to the baseline (27 vs 17 basis points), we may conjecture that investors tend to rely more on the ESG assessment than on the green label when facing a debut green issuance.

As an additional robustness exercise, we replicate the analysis using Propensity Score Matching (PSM), detailed in Section 3.2. The benchmark specification, reported in column 1 of Table 5, mirrors the baseline regression in Table 2 (column 4), employing a caliper equal to one fourth of the standard deviation of the estimated propensity scores and four nearest neighbors. This configuration can be regarded as the central specification within our PSM robustness set. The estimated coefficients for the green label, disclosure, and their interaction capturing the two-tiered pricing structure remain virtually unchanged and highly significant, confirming that the observed pricing differential between green and conventional bonds is robust to the choice of matching algorithm. We further test the sensitivity of the results by iterating the PSM procedure across alternative matching settings. To illustrate the range of outcomes, columns 2 and 3 reports two additional cases corresponding to a restrictive and permissive matching conditions. The magnitude of the estimated coefficients follows the expected pattern: tighter matching (PSM Small) yields smaller effects, while looser matching (PSM Large) increases the estimated greenium, as a larger caliper allows for less similar but more numerous matches, introducing a modest upward bias. Overall, the three PSM regressions confirm the robustness and stability of the main results across different matching algorithms and parameterizations.

**Table 5:** Matching robustness

| | PSM Benchmark | PSM Small | PSM Large | No Matching | Entropy |
|---|---|---|---|---|---|
| **Green** | -0.1817*** | -0.1413** | -0.2242*** | -0.4118*** | -0.2845*** |
| | (0.0521) | (0.0546) | (0.0528) | (0.0788) | (0.0638) |
| **Disclosure** | -0.2201*** | -0.1798*** | -0.2474*** | -0.2917*** | -0.1042 |
| | (0.0470) | (0.0632) | (0.0445) | (0.0623) | (0.0822) |
| **Green*Disclosure*TOP** | -0.1657** | -0.1851*** | -0.1424* | -0.2675* | -0.1505* |
| | (0.0719) | (0.0708) | (0.0734) | (0.1463) | (0.0804) |
| **Green*Disclosure*MED** | -0.1007 | -0.1145 | -0.0902 | -0.0813 | -0.1371 |
| | (0.0872) | (0.0812) | (0.0887) | (0.1019) | (0.0958) |
| **Green*Disclosure*LOW** | -0.2852 | -0.1452 | -0.3521 | -0.0219 | -0.0387 |
| | (0.1745) | (0.1371) | (0.2168) | (0.2833) | (0.1268) |
| **Weighted** | NO | YES | NO | NO | YES |
| **Bond+Issuer Controls** | YES | YES | YES | YES | YES |
| **Market Controls** | YES | YES | YES | YES | YES |
| **Macro Controls** | YES | YES | YES | YES | YES |
| **Currency*Year Controls** | YES | YES | YES | YES | YES |
| **Observations** | 26,708 | 13,167 | 39,582 | 214,479 | 204,482 |
| $R2^a$ | 0.7709 | 0.7769 | 0.7609 | 0.6496 | 0.6633 |

Robust standard errors clustered at the issuer level are reported in parentheses.

$^*$ denotes $p < 0.10$, $^{**}$ denotes $p < 0.05$ and $^{***}$ denotes $p < 0.01$

Note: The Table reports the coefficient estimates of separate regressions on the yield at issuance for a set of green and (matched) conventional bonds, controlling for a number of market and macroeconomic factors and with selected fixed and time effects. The environmental performance measure used to split companies across terciles in the last three lines of the Table is the cross-sectional E-score as reported by LSEG. $Green$ is a dummy variable that takes 1 for green bonds, and 0 otherwise. $Disclosure$ is a dummy variable that takes 1 for bonds placed by an issuer for which an E-score is available, and 0 otherwise. $TOP$, $MED$ and $LOW$ are dummy variables taking 1 when the issuer's E-score is in the first, second and third tercile of the E-score cross-sectional distribution, respectively. The first three columns refer to the robustness checks based on Propensity Score Matching (PSM). Specifically, $PSM$ Benchmark uses a caliper computed as sd/4 of the estimated propensity scores (Stuart and Rubin, 2008), equal to approximately 0.0163, with 4 nearest neighbors (non-weighted); $PSM$ Small applies a tighter caliper of 0.005 with 1 nearest neighbor and matching-frequency weights; $PSM$ Large relaxes the criterion with a caliper of 0.02 and 8 nearest neighbors (non-weighted). The remaining columns report results for the full unmatched sample and for the $Entropy\ Matching$ $(EM)$ algorithm. Standard errors are clustered at the issuer level.

Since matching procedures entail a considerable reduction in sample size, we perform two further robustness checks to verify the stability of the results. We first use the whole dataset, without filtering, and then employ a matching methodology that maintains almost entirely the size of the initial dataset, the so-called entropic matching (EM) approach proposed in Hainmueller (2012). When running regression (1) over the entire universe of 258,421 bonds placed over the period 2014-2023, the observations shrink to 214,479 due to some missing values of the control variables. Column 5 (Full sample) in Table 5 shows that the two-tier market pricing mechanism is again confirmed: green bond issuers get a negative premium at placement, but only issuers displaying a top tercile $E - score$ are awarded an additional premium. However, the size of both the basic greenium (41 basis points) and the additional premium (27 basis points) received by the greenest firms are larger relative to the outcome of the baseline estimate (see Table 2). The higher premium obtained in this alternative estimation based on the full sample most likely stems from the fact that it includes bonds issued in currencies that pay out higher returns and by entities with a lower credit rating, which were previously discarded by the matching algorithm.

We run a final robustness check for the role played by the sample composition using the EM algorithm, controlling for the same covariates used for the CEM. The EM algorithm re-weights the observations so that the covariate distributions in the treated and control groups satisfy specified moment conditions (mean, variance, and skewness). In addition, unlike for Coarsened Exact Matching, Entropy Matching does not require a large data set nor leads to discarding large portions of the sample.[13] The results reported in column 6 (Entropy) confirm again the main results of the analysis. While the greenium is found to be somewhat higher than in the baseline estimation (28 vs 17 basis points), the additional premium granted to the greenest firms agrees with the evidence obtained for the baseline estimation (15 vs 17 basis points). As for the case in which the full set of bonds is employed, the larger greenium identified by the entropy matching algorithm is likely to be related to the inclusion of bonds issued in currencies paying out higher returns and by entities with lower rating. In this case, relative to the plain use of the full set of bonds, the relevance of such issuers paying out higher returns is mitigated by the weight associated to their bonds in the estimation.

[13] The EM can be seen as a generalization of a propensity score weighting: rather than estimating scores and verifying balance ex post, the algorithm directly determines the unit weights that equate selected moments of the covariates between treated and control units.

## 6 Conclusions

We provide evidence that investors price green bonds differently across issuers. We start from a large sample covering yields at issuance for green and traditional bonds issued between January 2014 and October 2023 by governments, supranational agencies and private sector corporations worldwide. However, as focusing on the bare difference between green and brown bond yields (greenium) may be misleading, we employ a matching algorithm to align the set of conventional bonds to the green bonds according to a restricted number of selected issuer and placement characteristics. This leads to using a smaller and more homogeneous sample that mitigates the effects of differences across issuers that could eventually affect our estimates.

Overall our findings suggest that the interaction of the green label of the bond with the environmental performance of the issuer provides a better assessment of the greenium. Pooled panel regressions run on the matched sample reveal that the premium attached to the green label of a bond has hovered around 16 basis points across the decade we examine. However, this estimate increases notably when the environmental performance of the issuing company is disclosed (indicated by the public availability of an $E - score$). The interaction between the green bond label and the disclosure flag is statistically significant, suggesting that green bonds issued by disclosing companies command a larger premium, potentially twice as large as the greenium associated to the green label alone.

Importantly, this interaction is non-linear. Market participants seem to be particularly attracted by green bonds issued by firms whose environmental score ranks high in the distribution of the $E - score$ across the firms in our sample. In other words, beyond displaying a general preference for green assets (as shown for the equity market by Pastor et al. (2022), Ardia et al. (2023), Ciciretti et al. (2023)), investors also seem to scrutinize the climate awareness and performance of the company placing the bond and are willing to give up additional yield to hold in their portfolios the bonds issued by such firms. Indeed, the doubling of the greenium mentioned above applies only to green bonds issued by firms in the top tercile of the distribution.

Further investigations underscore the importance of bonds' green certification in determining the correct value of the greenium and also highlight that the information conveyed by the environmental score is not subsumed by either governance or social scores. Moreover we provide evidence of a "dash for green" in periods of heightened climate change stress. By employing three different indexes to select periods of high climate uncertainty, we show that not only there is an additional premium granted to the issuers in the top $E - score$ tercile at the maximum level, but such a compensation is also extended to issuers with a medium level of environmental performance (the middle $E - score$ tercile).

Overall, relative to the average yield at issuance in our sample, the funding advantage for companies tapping the green bond market is economically sizable, ranging between 7 and 14 percent under normal conditions, and reaching up to 18 percent during periods of heightened climate-related stress.

A first policy implication of our analysis is that ESG rating agencies seem to play a crucial role in signaling and assessing corporate environmental performance, since market participants invest according to their scores, awarding a further discount to green projects of highly rated firms. In this respect, divesting from carbon-intensive corporations and investing in low-carbon ones contributes to mitigating transition risks. This strategy would also make access to finance more difficult for the brown firms and easier for the green ones, supporting an orderly climate transition.

A second implication is that any firm can obtain a price advantage when issuing a green bond. In fact, we estimated that there is always a premium attached to the green label of the bond. While the cost of the bond is certainly influenced by whether the firm is disclosing or not the environmental commitment and by the goodness of the ESG assessment, the single premium awarded to green label always remains unchanged. Therefore, also non-disclosing companies or companies without a top environmental performance do face an incentive in undertaking climate-friendly projects. This has a further relevant economic and financial implication. If market participants were to focus only on financing firms already reported as green, then there may follow a decline in the incentives of high emitters to transition to cleaner alternatives so that a successful decarbonization process may be endangered (Hartzmark and Shue, 2023; Angelini, 2024; Bartocci et al., 2024). The findings of this paper suggest instead that green bonds are a financial instrument able to support virtuous high-emitters committed to genuine and ambitious carbon footprint reduction efforts. Their participation in the green bond market will lead other less green companies to get at least a part of the overall greenium, the part directly associated to the green label.

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# Appendix

**Table A.1:** Estimates of the *greenium* in the primary bond market

| | Coefficient | Std. Err. | t-value | P> $\|t\|$ |
|---|---|---|---|---|
| Green | -0.1115 | 0.0372 | -3.00 | 0.003 |
| Total_ASSET (millions) | 0.0790 | 0.0550 | 1.44 | 0.151 |
| ROE | -0.0002 | 0.0003 | -5.13 | 0.000 |
| Leverage | -0.0000 | 0.0000 | -0.85 | 0.396 |
| Value (millions) | -0.0002 | 0.0006 | -3.43 | 0.001 |
| Maturity (days) | 0.0009 | 0.0001 | 8.17 | 0.000 |
| Collateralized | -0.1042 | 0.0878 | -1.19 | 0.235 |
| Subordinated | -0.1824 | 0.1641 | -1.11 | 0.266 |
| Callable | 0.6104 | 0.1276 | 4.78 | 0.000 |
| epu_uk | 0.0001 | 0.0002 | 0.88 | 0.380 |
| epu_us | -0.0012 | 0.0004 | -3.32 | 0.001 |
| macro_eu | -0.0011 | 0.0003 | -3.53 | 0.000 |
| macro_us | 0.0004 | 0.0003 | 1.30 | 0.193 |
| ciss_ea | 0.0028 | 0.0039 | 7.32 | 0.000 |
| ciss_cn | 0.0020 | 0.0003 | 6.24 | 0.000 |
| ciss_uk | -0.0002 | 0.0004 | -0.53 | 0.000 |
| vix | 0.0217 | 0.0117 | 1.86 | 0.064 |
| vstoxx | -0.0488 | 0.0118 | -4.15 | 0.000 |
| cons | 13.0270 | 1.832 | 7.11 | 0.000 |

Note: The Table reports the coefficient estimates of a regression of the yield at issuance for a set of green and (matched) conventional bonds on a number of market and macroeconomic factors as well as on selected fixed and time effects. *Green* is a dummy variable that takes 1 for green bonds, and 0 otherwise. *Total_Assets* are a firm's Total Assets, *ROE* is a firm's Return on Equity, *Leverage* is expressed as Debt over Assets, *epu_uk* and *epu_us* are policy uncertainty indices for the UK and the US, respectively, *macro_eu* and *macro_us* are macroeconomic surprises indices for the euro area and the US, respectively, *ciss_ea*, *ciss_cn* and *ciss_uk* are the CISS index of Hollo et al. (2012) computed for the euro area, China and the UK, respectively, *vix* and *vstoxx* are the equity market expected volatility indices for the US and the euro area and *cons* is a constant. *Value*, *Maturity*, *Collateralized*, *Subordinated* and *Callable* are standard bond characteristics.

**Table A.2:** Estimates of the *greenium* in the primary bond market

| | **Coefficient** | **Std. Err.** | **t-value** | **P> $|t|$** |
|---|---|---|---|---|
| disclosure | -0.2070 | 0.0691 | -3.00 | 0.003 |
| Total_ASSET (millions) | 0.1028 | 0.0618 | 1.66 | 0.096 |
| ROE | -0.0002 | 0.0003 | -5.11 | 0.000 |
| Leverage | -0.0000 | 0.0001 | -0.81 | 0.042 |
| Value (millions) | -0.0002 | 0.0005 | -3.35 | 0.001 |
| Maturity (days) | 0.0001 | 0.0001 | 8.34 | 0.000 |
| Collateralized | -0.1082 | 0.0839 | -1.22 | 0.221 |
| Subordinated | -0.1690 | 0.1641 | -1.03 | 0.303 |
| Callable | 0.6147 | 0.1275 | 4.82 | 0.000 |
| epu_uk | -0.0014 | 0.0001 | -9.60 | 0.335 |
| epu_us | -0.0012 | 0.0004 | -3.34 | 0.001 |
| macro_eu | -0.0011 | 0.0003 | -3.66 | 0.000 |
| macro_us | 0.0004 | 0.0003 | 1.27 | 0.203 |
| ciss_ea | 0.0028 | 0.0004 | 7.38 | 0.000 |
| ciss_cn | -0.0020 | 0.0003 | 6.48 | 0.000 |
| ciss_uk | -0.0002 | 0.0004 | -0.62 | 0.536 |
| vix | 0.0232 | 0.0117 | 1.99 | 0.047 |
| vstoxx | -0.0502 | 0.0118 | -4.27 | 0.000 |
| cons | 13.3270 | 7.7250 | 0.52 | 0.000 |

Note: The Table reports the coefficient estimates of a regression of the yield at issuance for a set of green and (matched) conventional bonds on a number of market and macroeconomic factors as well as on selected fixed and time effects. *Disclosure* is a dummy variable that takes 1 for bonds placed by an issuer for which an $E - score$ is available, and 0 otherwise. $Total\_Assets$ are a firm's Total Assets, $ROE$ is a firm's Return on Equity, *Leverage* is expressed as Debt over Assets, *epu_uk* and *epu_us* are policy uncertainty indices for the UK and the US, respectively, *macro_eu* and *macro_us* are macroeconomic surprises indices for the euro area and the US, respectively, *ciss_ea*, *ciss_cn* and *ciss_uk* are the CISS index of Hollo et al. (2012) computed for the euro area, China and the UK, respectively, *vix* and *vstoxx* are the equity market expected volatility indices for the US and the euro area and *cons* is a constant. $Value$, $Maturity$, *Collateralized*, *Subordinated* and *Callable* are standard bond characteristics.

**Table A.3:** Estimates of the *greenium* in the primary bond market

| | **Coefficient** | **Std. Err.** | **t-value** | **P> $\|t\|$** |
|---|---|---|---|---|
| green | -0.1595 | 0.0579 | -2.75 | 0.006 |
| disclosure | -0.2262 | 0.0737 | -3.07 | 0.002 |
| green*disclosure | -0.2720 | 0.0709 | -3.83 | 0.000 |
| Total_ASSET (millions) | 0.1043 | 0.0613 | 1.70 | 0.089 |
| ROE | -0.0015 | 0.0003 | -5.14 | 0.000 |
| Leverage | -0.0000 | 0.0000 | -0.78 | 0.438 |
| Value (millions) | -0.0018 | 0.0005 | -3.38 | 0.001 |
| Maturity (days) | 0.0009 | 0.0000 | 8.33 | 0.000 |
| Collateralized | -0.1044 | 0.0872 | -1.20 | 0.231 |
| Subordinated | -0.1556 | 0.1619 | -0.96 | 0.337 |
| Callable | 0.6075 | 0.1285 | 4.73 | 0.000 |
| epu_uk | 0.0001 | 0.0001 | 0.94 | 0.347 |
| epu_us | -0.0012 | 0.0004 | -3.38 | 0.001 |
| macro_eu | -0.0011 | 0.0003 | -3.59 | 0.000 |
| macro_us | 0.0004 | 0.0003 | 1.28 | 0.202 |
| ciss_ea | 0.0028 | 0.0004 | 7.28 | 0.000 |
| ciss_cn | 0.0020 | 0.0003 | 6.50 | 0.000 |
| ciss_uk | -0.0002 | 0.0004 | -0.52 | 0.600 |
| vix | 0.0231 | 0.0116 | 1.98 | 0.048 |
| vstoxx | -0.0498 | 0.0117 | -4.25 | 0.000 |
| cons | 13.3381 | 1.7676 | 7.55 | 0.000 |

Note: The Table reports the coefficient estimates of a regression of the yield at issuance for a set of green and (matched) conventional bonds on a number of market and macroeconomic factors as well as on selected fixed and time effects. *Green* is a dummy variable that takes 1 for green bonds, and 0 otherwise. *Disclosure* is a dummy variable that takes 1 for bonds placed by an issuer for which an $E-score$ is available, and 0 otherwise. $Total\_Assets$ are a firm's Total Assets, $ROE$ is a firm's Return on Equity, *Leverage* is expressed as Debt over Assets, *epu_uk* and *epu_us* are policy uncertainty indices for the UK and the US, respectively, *macro_eu* and *macro_us* are macroeconomic surprises indices for the euro area and the US, respectively, *ciss_ea*, *ciss_cn* and *ciss_uk* are the CISS index of Hollo et al. (2012) computed for the euro area, China and the UK, respectively, *vix* and *vstoxx* are the equity market expected volatility indices for the US and the euro area and *cons* is a constant. $Value$, $Maturity$, *Collateralized*, *Subordinated* and *Callable* are standard bond characteristics.

**Table A.4:** Estimates of the *greenium* in the primary bond market

| | **Coefficient** | **Std. Err.** | **t-value** | **P>** $\|t\|$ |
|---|---|---|---|---|
| green | -0.1595 | 0.0579 | -2.76 | 0.006 |
| disclosure*TOP | -0.2105 | 0.0644 | -3.27 | 0.001 |
| disclosure*MED | -0.2647 | 0.0753 | -3.52 | 0.000 |
| disclosure*LOW | -0.2077 | 0.1154 | -1.35 | 0.178 |
| green*disclosure | -0.2720 | 0.0677 | -4.02 | 0.000 |
| Total_ASSET (millions) | 0.1028 | 0.0616 | 1.67 | 0.095 |
| ROE | -0.0002 | 0.0003 | -5.04 | 0.000 |
| Leverage | -0.0000 | 0.0000 | -0.79 | 0.431 |
| Value (millions) | -0.0002 | 0.0003 | -1.37 | 0.170 |
| Maturity (days) | 0.0009 | 0.0001 | 8.28 | 0.000 |
| Collateralized | -0.1020 | 0.0866 | -1.18 | 0.239 |
| Subordinated | -0.1599 | 0.1620 | -0.99 | 0.324 |
| Callable | -0.6683 | 0.1281 | 4.73 | 0.000 |
| epu_uk | -0.0001 | 0.0001 | 0.94 | 0.348 |
| epu_us | -0.0013 | 0.0004 | -3.39 | 0.000 |
| macro_eu | -0.0011 | 0.0003 | -3.60 | 0.000 |
| macro_us | -0.0043 | 2.9470 | 60.00 | 0.000 |
| ciss_ea | 0.0028 | 0.0039 | 7.28 | 0.000 |
| ciss_cn | 0.0021 | 0.0003 | 6.43 | 0.000 |
| ciss_uk | -0.0002 | 0.0004 | -0.53 | 0.593 |
| vix | 0.0230 | 0.0115 | 1.98 | 0.047 |
| vstoxx | -0.4964 | 0.1167 | -4.26 | 0.000 |
| cons | 13.3533 | 1.7570 | 7.60 | 0.000 |

Note: The Table reports the coefficient estimates of a regression of the yield at issuance for a set of green and (matched) conventional bonds on a number of market and macroeconomic factors as well as on selected fixed and time effects. *Green* is a dummy variable that takes 1 for green bonds, and 0 otherwise. *Disclosure* is a dummy variable that takes 1 for bonds placed by an issuer for which an $E-score$ is available, and 0 otherwise. $TOP$, $MED$ and $LOW$ are dummy variables taking 1 when the issuer's $E-score$ is in the first, second and third tercile of the E-score cross-sectional distribution, respectively. $Total\_Assets$ are a firm's Total Assets, $ROE$ is a firm's Return on Equity, *Leverage* is expressed as Debt over Assets, *epu_uk* and *epu_us* are policy uncertainty indices for the UK and the US, respectively, *macro_eu* and *macro_us* are macroeconomic surprises indices for the euro area and the US, respectively, *ciss_ea*, *ciss_cn* and *ciss_uk* are the CISS index of Hollo et al. (2012) computed for the euro area, China and the UK, respectively, *vix* and *vstoxx* are the equity market expected volatility indices for the US and the euro area and *cons* is a constant. $Value$, $Maturity$, *Collateralized*, *Subordinated* and *Callable* are standard bond characteristics.

**Table A.5:** Estimates of the *greenium* in the primary bond market

| | **Coefficient** | **Std. Err.** | **t-value** | **P> $\|t\|$** |
|---|---|---|---|---|
| green | -0.1599 | 0.0578 | -2.76 | 0.006 |
| disclosure*TOP | -0.1598 | 0.0643 | -3.36 | 0.001 |
| disclosure*MED | -0.2662 | 0.0749 | -3.55 | 0.000 |
| disclosure*LOW | -0.2055 | 1.5499 | -1.33 | 0.185 |
| green*disclosure*TOP | -0.1707 | 0.8016 | -2.13 | 0.033 |
| green*disclosure*MED | -0.8249 | 0.9160 | -0.90 | 0.368 |
| green*disclosure*MED | 0.0088 | 1.4594 | 0.01 | 0.995 |
| Total_ASSET (millions) | 1.1016 | 0.0680 | 1.67 | 0.095 |
| ROE | -0.0002 | 0.0000 | -5.15 | 0.000 |
| Leverage | -0.0004 | 0.0000 | -0.79 | 0.428 |
| Value (millions) | -0.0002 | 0.0001 | -3.36 | 0.001 |
| Maturity (days) | 0.0009 | 0.0001 | 8.29 | 0.000 |
| Collateralized | -1.0278 | 0.0865 | -1.19 | 0.235 |
| Subordinated | -0.1635 | 0.1614 | -1.00 | 0.318 |
| Callable | 0.6106 | 0.1286 | 4.75 | 0.000 |
| epu_uk | 0.0014 | 0.0015 | 0.94 | 0.345 |
| epu_us | -0.0012 | 0.0036 | -3.38 | 0.001 |
| macro_eu | -0.0016 | 0.0029 | -5.48 | 0.000 |
| macro_us | -0.0043 | 0.0033 | -0.29 | 0.196 |
| ciss_ea | 0.0028 | 0.0039 | 7.28 | 0.000 |
| ciss_cn | 0.0232 | 0.0316 | -0.53 | 0.594 |
| ciss_uk | -0.0205 | 0.0385 | 0.53 | 0.594 |
| vix | 0.2296 | 0.1152 | 1.99 | 0.842 |
| vstoxx | -0.4964 | 0.1167 | -4.26 | 0.000 |
| cons | 13.3533 | 1.7570 | 7.60 | 0.000 |

Note: The Table reports the coefficient estimates of a regression of the yield at issuance for a set of green and (matched) conventional bonds on a number of market and macroeconomic factors as well as on selected fixed and time effects. *Green* is a dummy variable that takes 1 for green bonds, and 0 otherwise. *Disclosure* is a dummy variable that takes 1 for bonds placed by an issuer for which an $E - score$ is available, and 0 otherwise. $TOP$, $MED$ and $LOW$ are dummy variables taking 1 when the issuer's $E - score$ is in the first, second and third tercile of the E-score cross-sectional distribution, respectively. *Total_Assets* are a firm's Total Assets, $ROE$ is a firm's Return on Equity, *Leverage* is expressed as Debt over Assets, *epu_uk* and *epu_us* are policy uncertainty indices for the UK and the US, respectively, *macro_eu* and *macro_us* are macroeconomic surprises indices for the euro area and the US, respectively, *ciss_ea*, *ciss_cn* and *ciss_uk* are the CISS index of Hollo et al. (2012) computed for the euro area, China and the UK, respectively, *vix* and *vstoxx* are the equity market expected volatility indices for the US and the euro area and *cons* is a constant. *Value*, *Maturity*, *Collateralized*, *Subordinated* and *Callable* are standard bond characteristics.

**Table A.6:** Estimates of the *greenium* in the primary bond market

| | **Coefficient** | **Std. Err.** | **t-value** | **P$>|t|$** |
|---|---|---|---|---|
| certified green | -0.2535 | 0.0709 | -3.57 | 0.000 |
| disclosure*TOP | -0.2211 | 0.0620 | -3.57 | 0.001 |
| disclosure*MED | -0.2699 | 0.0712 | -3.79 | 0.000 |
| disclosure*LOW | -0.1884 | 1.4835 | -1.27 | 0.204 |
| green*disclosure*TOP | -0.1544 | 0.0942 | -1.64 | 0.100 |
| green*disclosure*MED | 0.0718 | 0.1158 | 0.86 | 0.951 |
| green*disclosure*LOW | 0.0455 | 0.1969 | -0.23 | 0.817 |
| Total_ASSET (millions) | 0.1080 | 0.0610 | 1.77 | 0.076 |
| ROE | -0.0002 | 0.0000 | -5.13 | 0.000 |
| Leverage | -0.0000 | 0.0000 | -0.86 | 0.388 |
| Value (millions) | -0.0012 | 0.0003 | -3.80 | 0.001 |
| Maturity (days) | 0.0000 | 0.0000 | 8.30 | 0.000 |
| Collateralized | -0.1195 | 0.0871 | -1.37 | 0.176 |
| Subordinated | 1.6378 | 1.6410 | 1.00 | 0.323 |
| Callable | 6.0111 | 1.2948 | 4.64 | 0.000 |
| epu_uk | 0.0001 | 0.0001 | 0.87 | 0.387 |
| epu_us | -0.0012 | 0.0027 | -0.38 | 0.702 |
| macro_eu | -0.0013 | 0.0036 | -0.35 | 0.726 |
| macro_us | 0.0023 | 0.0041 | 0.58 | 0.563 |
| ciss_ea | 0.0092 | 0.0041 | 1.79 | 0.076 |
| ciss_cn | -0.0012 | 0.0031 | -0.38 | 0.703 |
| ciss_uk | -0.0011 | 0.0031 | -0.37 | 0.709 |
| vix | 0.0245 | 0.0113 | 2.17 | 0.046 |
| vstoxx | -0.0485 | 0.0115 | -4.22 | 0.020 |
| cons | 13.3252 | 17.4179 | 0.76 | 0.450 |

Note: The Table reports the coefficient estimates of a regression of the yield at issuance for a set of green and (matched) conventional bonds on a number of market and macroeconomic factors as well as on selected fixed and time effects. $certified\ green$ is a dummy variable that is equal to one if a given bond has received an external/third-party certification and is zero otherwise. *Green* is a dummy variable that takes 1 for green bonds, and 0 otherwise. *Disclosure* is a dummy variable that takes 1 for bonds placed by an issuer for which an $E - score$ is available, and 0 otherwise. $TOP$, $MED$ and $LOW$ are dummy variables taking 1 when the issuer's $E-score$ is in the first, second and third tercile of the E-score cross-sectional distribution, respectively. $Total\_Assets$ are a firm's Total Assets, $ROE$ is a firm's Return on Equity, *Leverage* is expressed as Debt over Assets, *epu_uk* and *epu_us* are policy uncertainty indices for the UK and the US, respectively, *macro_eu* and *macro_us* are macroeconomic surprises indices for the euro area and the US, respectively, *ciss_ea*, *ciss_cn* and *ciss_uk* are the CISS index of Hollo et al. (2012) computed for the euro area, China and the UK, respectively, *vix* and *vstoxx* are the equity market expected volatility indices for the US and the euro area and *cons* is a constant. $Value$, $Maturity$, *Collateralized*, *Subordinated* and Callable are standard bond characteristics.

**Acknowledgements**

We thank Paolo Angelini, Riccardo Cristadoro, Fabrizio Ferriani, Johannes Gross, Alessandro Moro, Salvatore Perdichizzi, Greta Petrini, Riccardo Poli, Lorenzo Prosperi, Andreas C. Rapp, Peter Szilagyi, Marco Taboga and participants to a Banca d'Italia seminar, the Sustainable Finance Workshop (University of Padua, October 2024), the International Symposium on Climate, Finance, and Sustainability (Paris, November 2024) and the Conference on International Sustainable and Climate Finance (Edinburgh, June 2025).
The views expressed in the paper belong to the authors only and do not necessarily reflect those of the ECB or the Eurosystem.
This paper has been accepted in the Journal of International Money and Finance and the final version is available at https://doi.org/10.1016/j.jimonfin.2025.103498

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PDF ISBN 978-92-899-7616-9 ISSN 1725-2806 doi:10.2866/5177118 QB-01-26-004-EN-N