Not All Green Is Equal: A Text-Based Analysis of Green Bond Yield Discount

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Abstract

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This paper investigates the pricing dynamics of U.S. corporate green bonds issued between 2015 and 2024. While prior literature has mixed findings but often failed to identify a statistically significant greenium—the yield discount associated with green bonds—at issuance, my results reveal a weakly significant greenium in the primary market. More importantly, I document a consistently and highly significant greenium in the secondary market, suggesting that investors increasingly recognize and price in the environmental value of green bonds over time. The novel contribution of this study lies in the construction of a comprehensive green commitment score derived from the textual analysis of bond prospectuses. By categorizing and scoring green bonds based on their disclosed use of proceeds, project evaluation, external review, and reporting/transparency, where use of proceeds and project evaluation are the most significant, I show that bonds with stronger green commitments are associated with larger yield discounts in the secondary market. On the contrary, weak disclosure is associated with no green premium. These findings highlight the growing importance of transparency and credibility in green finance and underscore the role of disclosure quality in shaping bond pricing beyond the primary market.

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1. Introduction

The growing urgency of addressing climate change has elevated the role of sustainable finance, with green bonds emerging as a key instrument for channeling capital toward environmentally friendly projects. As this market has expanded rapidly over the past decades, so too has the academic literature surrounding green bonds. One of the central questions in this literature is whether investors are willing to accept lower yields—so-called greenium—in exchange for financing environmentally sustainable initiative.

Several earlier studies—such as those by (Karpf & Mandel, 2017), (Baker, Bergstresser, Serafeim, & Wurgler, 2018), and (Zerbib, 2019)—have examined whether green bonds command a pricing premium relative to their non-green counterparts. These works primarily investigate municipal bonds, with the analysis of Zerbib (2019) also extending to sovereign and a limited set of corporate bonds. The empirical results are somewhat inconsistent: Karpf and Mandel (2017) report that green bonds exhibit a yield discount of around eight basis points, Zerbib (2019) identifies a modest yet statistically significant premium of two basis points, and Baker et al. (2018) find a premium close to six basis points.

Flammer (2021) finds no significant evidence of a greenium at issuance. The author further supports this finding through interviews with industry practitioners, many of whom state that they are not willing to lower their expected return simply because a bond is labeled "green." Similarly, (Larcker & Watts, 2020) arrive at the conclusion that there is essentially no yield discount for green bonds in the primary market.

Also, previous literature has offered mixed evidence on whether green bonds are priced differently from conventional bonds. While some studies find no significant greenium (Larcker & Watts, 2020), others suggest that in specific sectors or geographies, investors may reward environmental signaling (Zerbib, 2019)

While these findings are robust when green bonds are treated as a homogeneous group, this paper adopts a more granular approach. Following Flammer (2021), I collect all U.S. corporate green bonds issued between 2015 and 2024. I then apply Mahalanobis matching to identify the closest comparable non-green bond for each green bond, using firm-level and issue-level covariates such as Market-to-Book ratio, Return on Assets, Leverage, ESG score, SIC industry (2-digit), and year

of issuance. This allows for a more precise estimation of yield differentials between green and non-green bonds.

Using yield-at-issue and historical secondary market yields for both green and matched non-green bonds, consistent with prior work, I begin with a simple green bond dummy specification. In the primary market, results show a weakly significant greenium, aligning with Flammer (2021). In contrast, secondary market regressions reveal a strongly significant and economically meaningful greenium.

The core contribution of this paper, however, lies in a novel textual analysis of green bond prospectuses. I manually collect the prospectuses from the SEC's EDGAR database and use an open-source GPT model to identify keywords and phrases related to four categories of green commitment: (1) use of proceeds, (2) project evaluation, (3) external review, and (4) reporting/transparency. For each green bond, I compute category-specific and overall green commitment scores based on the frequency of these keywords relative to total word count within the prospectuses.

Using these scores, I classify green bonds into Lowest, Medium, and Highest Green Score groups based on interquartile ranges. In the secondary market, bonds with the lowest green commitment score exhibit a small and statistically insignificant greenium (-0.143), while those in the medium and highest categories show greenia of -0.659 and -0.842 respectively—both statistically significant. These findings provide strong evidence that investors differentiate between low disclosure and high disclosure bonds, but only in the secondary market.

When regressing each green commitment category separately, all four are significant predictors of secondary market greenium. However, when included jointly, only Use of Proceeds remains highly significant, followed by Project Evaluation with moderate significance, while External Review and Reporting/Transparency lose explanatory power. Importantly, none of these scores are significant in primary market regressions.

Overall, my findings reinforce the findings of Flammer (2021) and align with the sentiments of market practitioners: green labels alone do not command a premium at issuance. However, in the secondary market, investors reward transparency and credible environmental commitment as expressed in the prospectus. This study provides the first empirical evidence linking prospectus-

based green commitments to pricing differentials in secondary markets, offering new insights into how environmental disclosures are priced over time.

2. Literature Review

One of the earliest highlights of the greenium was revealed by the industry. Analysts of Barclays Bank analyzed yield differentials using a broad global sample from the Bloomberg Global Green Bond Index. Focusing on the secondary market from March 2014 to August 2015, the study applied an ordinary least squares (OLS) regression on credit spreads, isolating common risk factors, and found a negative premium of 17 basis points (Preclaw & Bakshi, 2015). HSBC (2019) and Shurey (2017) conducted separate studies using distinct methodologies and datasets. HSBC (2019) reported no evidence of a green bond premium, whereas Shurey (2017), using Bloomberg data, identified a negative premium exclusively in EUR-denominated government bonds. The negative premium was particularly evident among financial sector bonds and those with lower credit ratings. However, Ehlers & Packer (2017) reported no price premium in their secondary market analysis, though they did observe a premium for green bonds in the primary market. Using a broader dataset covering 2007–2017 and different control variables, Tang & Zhang (2020) found no price premium when comparing yield spreads for bonds issued by the same firm in the same year. However, in a larger sample, they observed that green bonds are issued with yield spreads 6.94 bps lower than comparable corporate bonds. In the U.S. municipal green bond market, evidence indicates that the green premium is a more recent development. Analyzing the yield curves of a large sample of U.S. municipal bonds, Karpf and Mandel (2018) found that, overall, green bond yield curves consistently lie below those of conventional bonds.

As the green bond regulatory framework has evolved, disclosure expenses—often referred to as "green transaction costs"—have been an early concern in the market's development (Febi et al., 2018). For example, obtaining Climate Bonds certification incurs costs of about 0.1 bps. Additionally, hiring a third party to verify asset allocations and fulfill reporting obligations adds further expenses. Altogether, voluntary reporting costs are estimated at roughly 0.5 to 3 bps, while Harrison (2019) finds mixed results in yield comparisons. Another report by the European Central Bank (ECB) shows that greenium can be observed only in green bonds whose issuers' external review elements are solid and robust (Pietsch & Salakhova, 2022).

My findings, however, reveal how to distinguish between green bonds with promising disclosures and those with weak disclosures, shedding light on how green bonds with solid prospectuses outperform those with vague green promises.

3. Measuring Green Promise

To move beyond the binary classification of green bonds, this paper introduces a structured approach to quantify the green promise embedded in bond prospectuses. While all green bonds share an environmental label, the degree to which they communicate credible and transparent environmental intentions varies widely across securities. Capturing this variation is essential to understanding how markets interpret and price sustainability-related disclosures.

To this end, I begin by identifying sustainability-related keywords that signal environmental commitment. These keywords such as "renewable", "wind", "solar", and "energy efficiency" were selected using an open-source GPT-based language model, which was prompted to extract terms typically associated with credible green finance practices. The full list of selected keywords is provided in the Appendix.

After identifying relevant terms, the same language model was used to group these keywords into four distinct categories based on common reporting standards and green bond frameworks:

Use of Proceeds – keywords related to how the raised capital will be spent (e.g., "solar", "wind", "recycling").

Project Evaluation – terms linked to how projects are selected and evaluated (e.g., "governance", "greenwashing").

External Review – references to third-party audits, second opinions, or certification (e.g., "assurance", "audit", " sustainalytics").

Reporting & Transparency – mentions of ongoing disclosures, impact measurement, or periodic updates (e.g., "impact report", "monitoring").

For each green bond, I calculate category-specific and overall green commitment scores by computing the ratio of the number of category-specific keywords to the total word count of the

prospectus. This relative frequency approach ensures comparability across documents of varying lengths and avoids biases stemming from document verbosity.

The resulting scores provide a continuous measure of how strongly each bond signals environmental commitment in its formal documentation. This framework allows us to move beyond the "green label" and assess whether markets respond differently to bonds that make stronger, more credible green promises—an aspect that has thus far been largely unexplored in the literature.

4. Data

This study integrates textual, financial, and ESG data to investigate whether green bonds deliver a pricing advantage in either the primary or secondary market—and whether this advantage is linked to the strength of the environmental promises made in the bond prospectuses.

4.1. Data Sources

The dataset combines information from three primary sources. I collect the bond prospectuses from the U.S. Securities and Exchange Commission (SEC) EDGAR database, pricing data Bloomberg terminal, and ESG data from Sustainalytics.

I manually collected green bond prospectuses from the U.S. Securities and Exchange Commission (SEC) EDGAR database for all corporate green bonds issued in the United States between 2015 and 2024. Each document was cleaned and tokenized to extract individual words. Using the keyword dictionary developed with a GPT-based model, I identified sustainability-related terms and computed their frequency as a ratio of total word count. These ratios form the basis for the green commitment scores used in the analysis.

Financial and Pricing Data: Quarterly bond pricing and yield data were retrieved from the Bloomberg Terminal. This includes both yield at issue (for primary market analysis) and historical yield data (for secondary market analysis). Additional issuer-level financial metrics such as Market-to-Book ratio, Return on Assets (ROA), Leverage, and industry classification (based on 2-digit SIC codes) were also obtained from Bloomberg.

ESG Scores: To account for the issuer's broader sustainability profile, I collected ESG scores from Sustainalytics, which are incorporated into the matching procedure described below. This ensures that the green and non-green bonds being compared are not only similar in financial characteristics, but also in their overall environmental, social, and governance profiles.

4.2. Matching and Modeling Framework

To isolate the yield effect attributable to green bond status and green promise intensity, I adopt a Mahalanobis matching procedure. For each green bond, I find a non-green corporate bond issued in the same year with the closest multivariate distance on the following characteristics: Market-to-Book ratio, ROA, Leverage, ESG score, SIC industry code (2-digit), and issuance year. This matching strategy reduces bias stemming from structural differences between green and non-green issuers.

The matched dataset is then used to estimate the presence of a greenium—first using a simple green bond dummy and later using the green commitment scores developed from prospectus text. I run regressions separately for the primary market (yield at issue) and the secondary market (quarterly yield spreads), allowing for a comparison of how investor preferences may shift over time.

Table 1: Descriptive Statistics

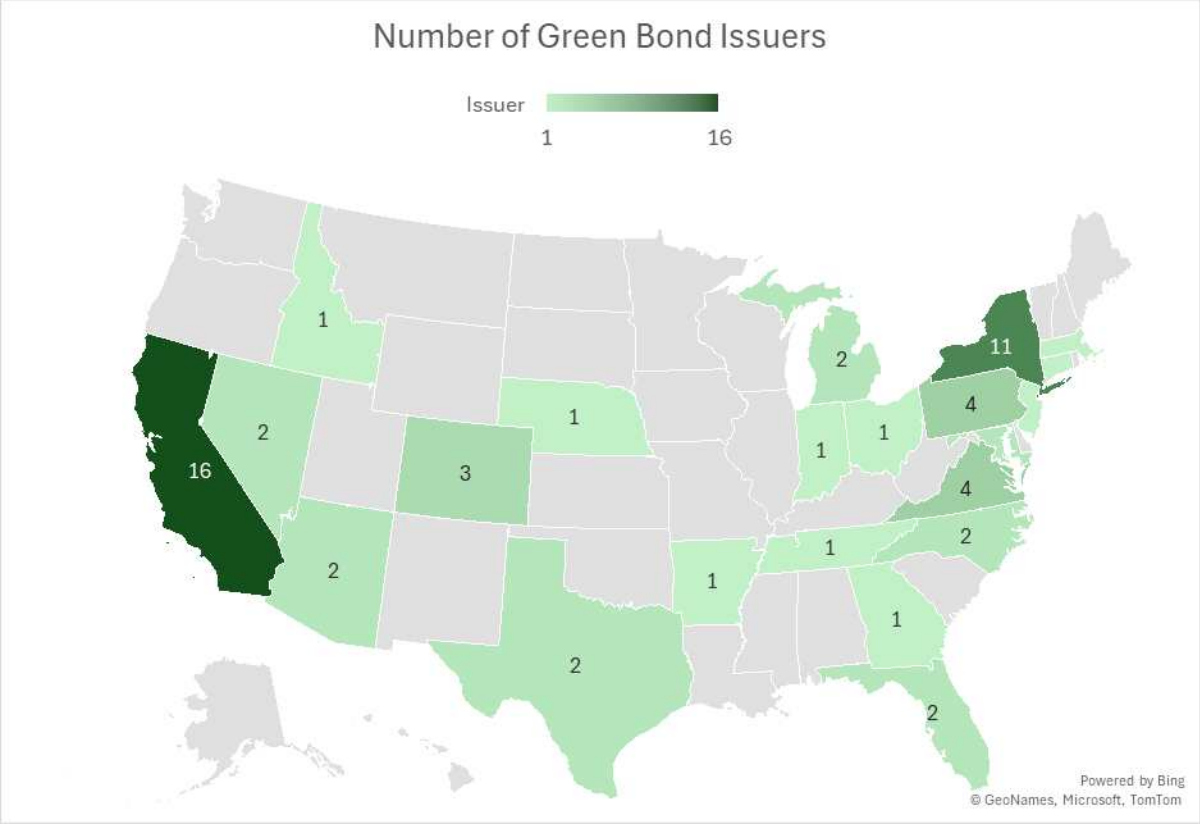
	Green Bonds			Non-Green Bonds		
	Obs	Mean	Std. Dev	Obs	Mean	Std. Dev
Yield at Issue	158	4.21	1.97	158	4.98	4.99
Market to Book Ratio	158	1.60	0.90	158	1.88	1.82
Return on Assets (ROA)	158	0.01	0.09	158	0.07	0.25
Leverage	158	0.38	0.14	158	0.35	0.24
Issue Size (mil. USD)	158	542.18	544.62	158	792.27	747.14
Green Keyword Score	158	2.42	1.39			
Use of Proceeds Score	158	0.86	0.66			
Project Evaluation Score	158	1.15	0.76			
External Review Score	158	4.69	1.99			
Reporting/Transparency Score	158	3.21	1.74			

4.3. Geographic Distribution of Green Bond Issuers

Graph 1 illustrates the geographic distribution of corporate green bond issuers across U.S. states. The data reveals a notably uneven spatial concentration, with certain states emerging as clear hubs for green finance activity.

California leads the U.S. green bond market by a wide margin, hosting 16 unique green bond issuers and far surpassing all other states. The Northeast region, particularly New York with 11 issuers and Massachusetts with 4 issuers, also demonstrates a strong presence. Other states such as Texas, Florida, Illinois, and Georgia exhibit moderate issuer activity, with between 2 and 4 issuers each. In contrast, many states in the Midwest, Mountain West, and Deep South display minimal engagement, with either no issuers or only a single issuer.

Graph 1:



This regional clustering likely reflects broader economic and regulatory dynamics:

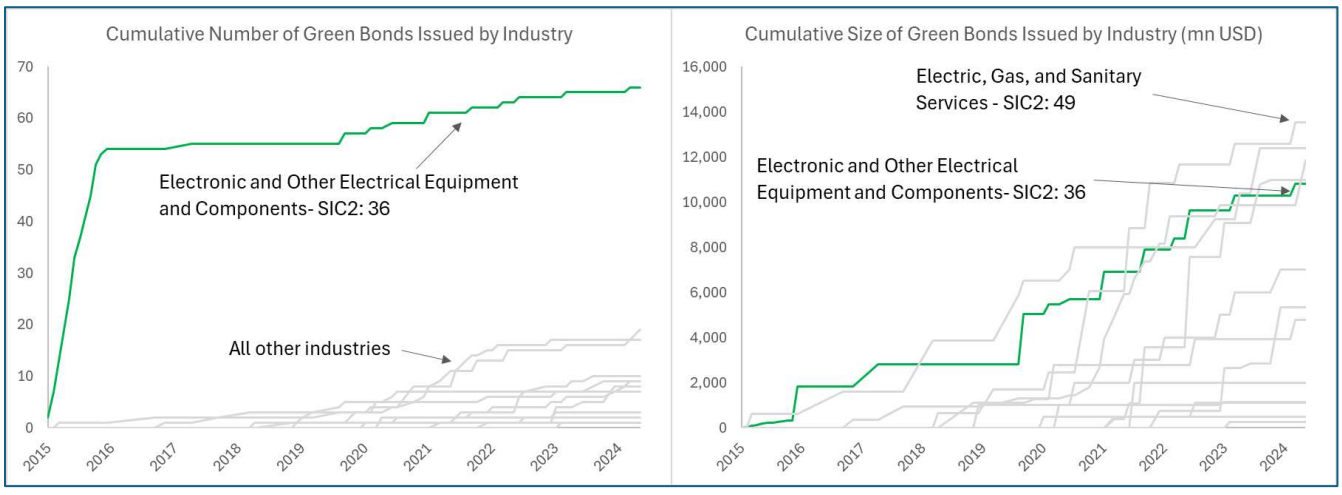
California's leadership in green bond issuance can be attributed to its progressive climate policies, large corporate sector, and active capital markets, all of which foster an environment conducive to

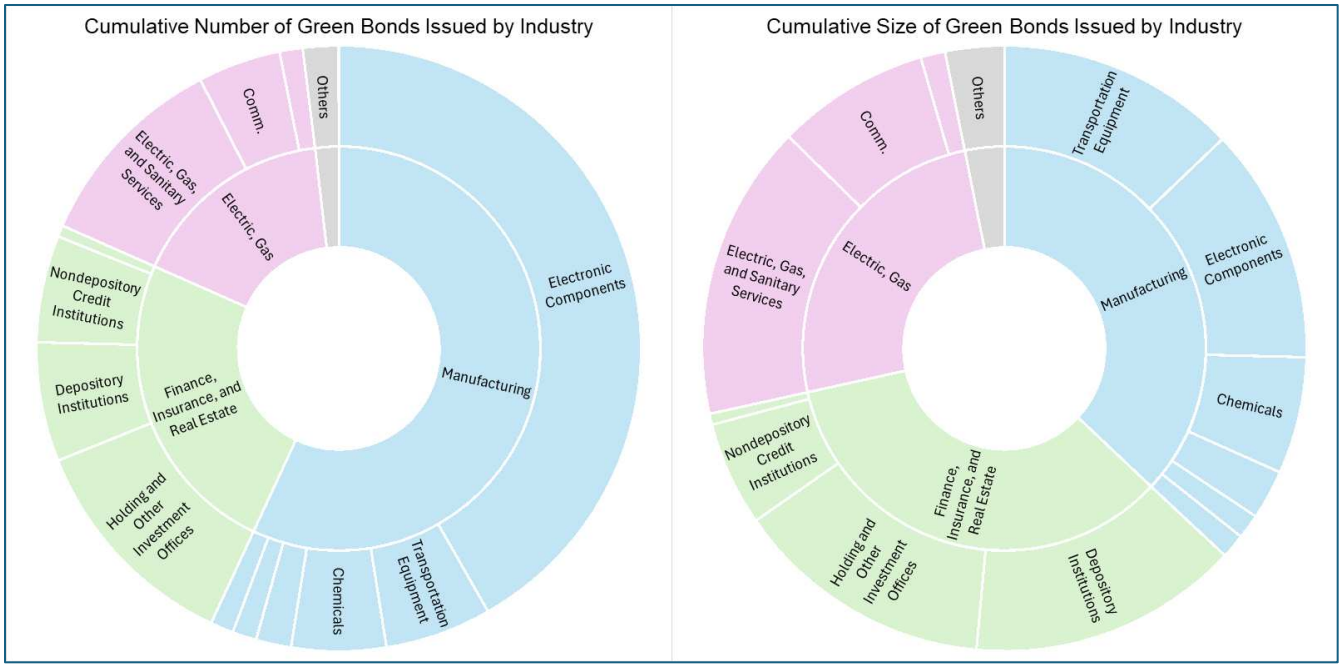
green finance. New York's strong presence is unsurprising, given its role as a global financial center and the home base of many ESG-focused investors and rating agencies. In contrast, states with lower issuer counts may reflect limited ESG investor demand, weaker regulatory pressure, or a smaller pool of firms with capital structures suitable for bond issuance.

Overall, the geographic distribution suggests that green bond issuance is not only firm-specific but also heavily influenced by state-level economic, environmental, and regulatory contexts. These findings underscore the importance of incorporating geographic and policy considerations into future studies of green finance adoption and impact.

4.4. Industry-Level Patterns in Green Bond Issuance

The data reveal a divergence between the number of green bonds issued and the total amount raised across industries. While the manufacturing sector leads in terms of the number of green bonds issued, the Electric, Gas, and Sanitary Services sector (SIC2: 49) dominates in terms of cumulative issuance size. This suggests that some industries issue green bonds more frequently but in smaller amounts, whereas others issue fewer but significantly larger bonds. To provide further context, almost 90% of the bonds issued in SIC2 36 originated from a single company, which was later acquired; following the acquisition, the new private owner ceased issuing green bonds. As a result, the number of green bonds issued in SIC2 36 increased substantially between 2015 and 2016 but stabilized thereafter.





This distinction between frequency and intensity of issuance provides meaningful insight into the role of green bonds in corporate finance. In some sectors—particularly utilities and energy—green bonds may serve as a major capital-raising tool. In others, such as manufacturing, they may function more as signaling mechanisms aligned with ESG communication strategies.

These observations suggest that green bond activity should be evaluated not only by issuance count but also by total capital raised, as these reflect different underlying motivations and market behaviors across industries.

5. Model

This section outlines the empirical models designed to test various hypotheses regarding the existence and drivers of the greenium—a yield discount associated with green bonds—across both primary and secondary markets. All models are estimated using a matched sample of green and non-green bonds based on Mahalanobis distance and include the same baseline controls and fixed effects, embedded in the covariate matrix X_i.

The vector X_i comprises several firm and bond level characteristics designed to capture differences in financial health, capital structure, and issue-specific features. The Market-to-Book ratio serves as a proxy for firm growth opportunities; firms with higher ratios are generally perceived as having stronger future prospects, which may translate into lower required yields. Return on Assets (ROA) measures operating profitability, where higher values are expected to be associated with reduced credit risk and, consequently, narrower yield spreads. Leverage reflects the extent of debt financing in a firm's capital structure; higher leverage typically signals increased default risk and is therefore anticipated to widen yield spreads. The natural logarithm of issue size (in USD) controls for scale effects, as larger issues tend to be more liquid, which is expected to exert downward pressure on yields.

In addition, all models incorporate two-digit SIC industry fixed effects to account for unobserved sector-specific factors, such as regulatory environments or industry-wide risk profiles. Fixed effects for the number of quarters since issuance are also included to control for the bond's position along its lifecycle, capturing time-varying dynamics such as changes in liquidity and investor base over time.

Hypothesis 1: Greenium at Issuance (Green Dummy – Primary Market)

$$\text{YieldAtIssue}_i = \alpha + \beta_1 \cdot \text{GreenDummy}_i + \gamma \cdot X_i + \varepsilon_i$$

Hypothesis 2: Greenium in the Secondary Market (Green Dummy – Secondary Market)

$$\text{Yield}_{it} = \alpha + \beta_2 \cdot \text{GreenDummy}_i + \gamma \cdot X_i + \lambda_t + \varepsilon_{it}$$

Hypothesis 3: Green Keyword Score – Primary Market

$$\text{YieldAtIssue}_i = \alpha + \beta_3 \cdot \text{GreenScore}_i + \gamma \cdot X_i + \varepsilon_i$$

Hypothesis 4: Green Keyword Score – Secondary Market

$$\text{Yield}_{it} = \alpha + \beta_4 \cdot \text{GreenScore}_i + \gamma \cdot X_i + \lambda_t + \varepsilon_{it}$$

Hypothesis 5: Green Score Buckets (Low, Medium, High) – Primary Market

$$YieldAtIssue_i = \alpha + \beta_5 \cdot Medium_i + \beta_6 \cdot High_i + \gamma \cdot X_i + \varepsilon_i$$

Hypothesis 6: Green Score Buckets – Secondary Market

$$Yield_{it} = \alpha + \beta_7 \cdot Medium_i + \beta_8 \cdot High_i + \gamma \cdot X_i + \lambda_t + \varepsilon_{it}$$

Hypothesis 7: Category-Level Green Scores – Joint Regressions

Primary Market:

$$YieldAtIssue_i = \alpha + \Sigma(\beta_k \cdot CategoryScore_i^k) + \gamma \cdot X_i + \varepsilon_i$$

Secondary Market:

$$Yield_{it} = \alpha + \Sigma(\beta_k \cdot CategoryScore_i^k) + \gamma \cdot X_i + \lambda_t + \varepsilon_{it}$$

Hypothesis 8: Category-Level Scores – Separate Regressions

Example (Use of Proceeds only)

Primary Market:

$$YieldAtIssue_i = \alpha + \beta \cdot UseOfProceeds_i + \gamma \cdot X_i + \varepsilon_i$$

Secondary Market:

$$Yield_{it} = \alpha + \beta \cdot \ UseOfProceeds_i + \gamma \cdot X_i + \lambda_t + \varepsilon_{it}$$

This dual analysis—across both primary and secondary markets—not only allows us to identify whether a greenium exists, but also helps pinpoint where it originates based on the strength and type of green commitments. By examining both overall score buckets (Low, Medium, High) and individual disclosure categories (e.g., Use of Proceeds, Project Evaluation), it is possible to gain deeper insight into when and how investors respond to different dimensions of sustainability

signaling. This enables a richer understanding of market dynamics and suggests that investors may weigh green disclosures differently depending on the timing and context of bond pricing.

It is crucial to note that the green bond prospectus represents the central disclosure document at the time of issuance. If such disclosures carry informational content valued by investors, then any effect—be it a discount at issuance or altered pricing dynamics later on—should arguably be reflected consistently across both primary and secondary markets. By contrast, allocation reports or external audit verifications, which are typically published after issuance, represent ex-post mechanisms for accountability. While such documents may serve as powerful signals of credibility and provide indirect evidence of how bond proceeds are deployed, their role in shaping investor perceptions constitutes a distinct channel of information dissemination that extends beyond the scope of this paper. A systematic study of these post-issuance disclosures would therefore constitute a promising but separate avenue of future research.

By restricting attention to prospectus disclosures, this study operates under the expectation that, if sustainability-related promises are meaningful to investors, then their influence should manifest both at the moment of issuance and subsequently in the secondary market. However, as demonstrated in the empirical results, this expected consistency does not emerge. The measured effects are considerably weaker, and in many cases absent, in the primary market, while becoming more pronounced and statistically significant in the secondary market.

Several explanations may account for this divergence. One plausible interpretation is that investors may initially discount or disregard prospectus-based sustainability commitments due to the difficulty of verifying their credibility at issuance. In primary market transactions, investors may focus more heavily on traditional financial and structural characteristics, treating environmental promises as cheap talk until proven otherwise. As time progresses, however, market participants can update their beliefs by observing whether issuers actually allocate proceeds in line with the commitments outlined in the prospectus. This learning process may be facilitated through news releases, independent monitoring, or the issuer's history of repeated green bond issuance.

Issuers with the highest ex-ante "green commitment" scores in their prospectuses are arguably also those most likely to adhere to stated environmental objectives in practice. For such issuers, credibility builds gradually, which can generate a delayed market response that manifests primarily in secondary trading. This mechanism offers a rational explanation for why no clear greenium is

observed at issuance but becomes detectable later in the bond's lifecycle. In this sense, the secondary market may serve as the true testing ground for the credibility of sustainability promises, while the primary market reflects only investors' initial, and often skeptical, interpretation of such disclosures.

Taken together, these findings highlight a critical tension in the functioning of green finance markets: while the prospectus provides the formal foundation for signaling sustainability commitments, its informational value appears to be discounted at issuance and only gradually incorporated into prices through ex-post credibility mechanisms. This discrepancy underscores the importance of considering both market stages simultaneously and suggests that sustainability disclosures are not merely static inputs but dynamic signals whose influence evolves over time.

6. Results

6.1. Green Dummy Regressions

As shown in Table 2, when using a simple green bond dummy variable, I observe a weakly significant greenium (-0.492) at issuance in the primary market. While the sign of the coefficient is negative—as expected—the magnitude is small and statistical significance is marginal, in line with previous findings in the literature (e.g., Flammer, 2021; Larcker & Watts, 2020).

However, this picture changes notably in the secondary market. The green dummy is now associated with a strongly significant and economically meaningful yield discount (-0.444), suggesting that investors may begin to reward environmental labeling more consistently over time, rather than immediately at issuance. These findings support the hypothesis that investor pricing of green bonds is dynamic and may evolve post-issuance as information is processed and sustainability narratives are absorbed.

This delayed reaction could stem from the time needed to evaluate the credibility of environmental claims or the influence of post-issuance disclosures and external reviews. As ESG investing gains traction, investor scrutiny intensifies, and bonds that demonstrate clearer green commitments may gradually benefit from stronger market recognition—resulting in a more pronounced greenium in the secondary market.

Table 2: Green bonds and non-green bonds yield comparison on primary and secondary markets.

Variables	Primary Market	Secondary Market
Green Dummy	-0.492*	-0.444***
	(0.272)	(0.088)
Market to Book Ratio	-0.143	-0.118***
	(0.145)	(0.027)
Return on Assets	2.112**	0.685**
	(1.045)	(0.266)
Leverage	2.350**	4.302***
	(1.020)	(0.342)
ln(Issue Size in USD)	-0.063	-0.551***
	(0.097)	(0.016)
Constant	4.892***	13.459***
	(-1.730)	(0.414)
2 digit SIC FE	Yes	Yes
Quarter FE	Yes	Yes
Observations	316	5300
Adj. R^2	0.23	0.63

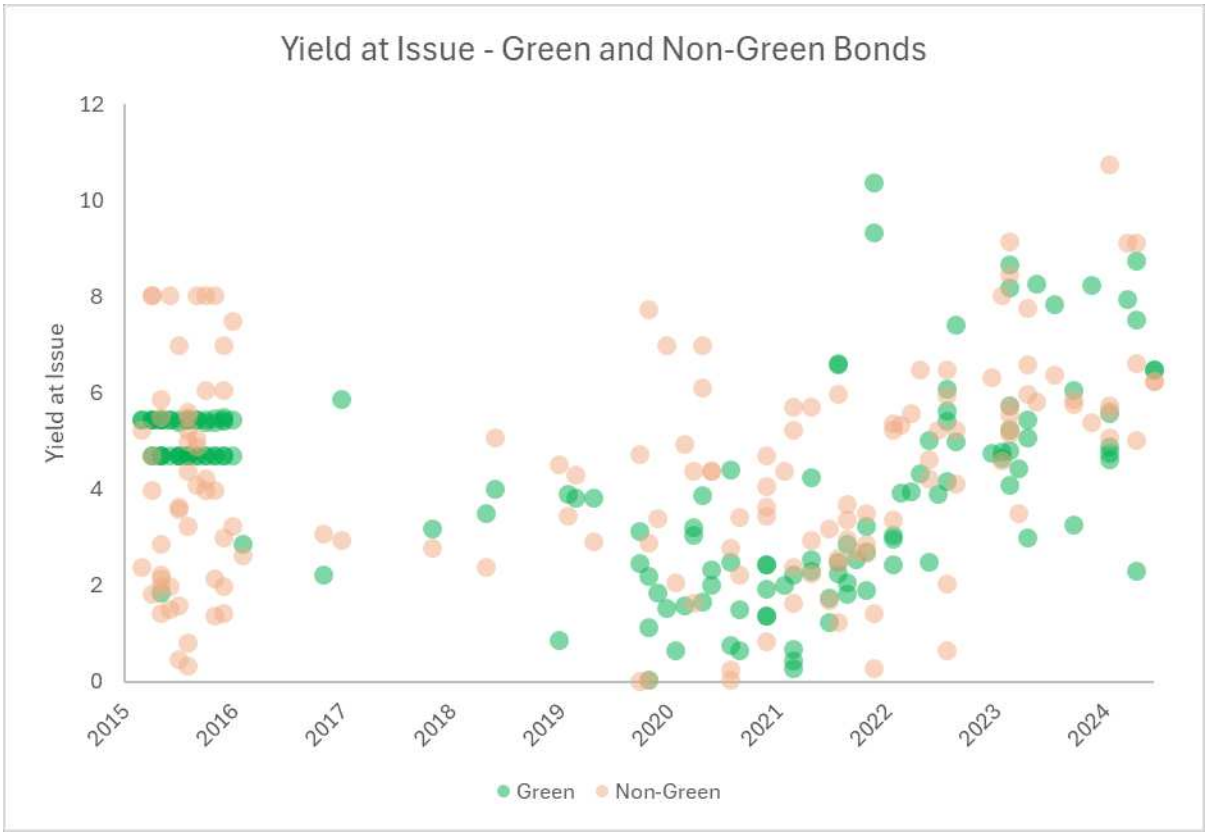
Significance is indicated as follows:
*p < 0.1; ** p < 0.05; *** p < 0.01.
Firm-clustured robust standard error are in the paranthesis.

As illustrated in Graph 2, which displays the issue yields of green bonds issued between 2015 and 2024 alongside their Mahalanobis-matched non-green counterparts, no clear or consistent pattern of greenium emerges in the primary market. In particular, during the 2015–2016 period, a single issuer repeatedly issued green bonds with almost identical yields, showing little to no pricing advantage despite their environmental labeling. Although this issuer contributed a large number of green bonds to the sample, the individual bond sizes were relatively modest, limiting their influence on overall market trends.

Rather than aggregating these bonds and treating them as a single observation, each was individually matched to the closest non-green bond using Mahalanobis distance, accounting for firm and issue-level characteristics such as leverage, profitability, and industry classification. This approach allows for a more precise and granular comparison, preserving the heterogeneity of the sample while ensuring robust statistical inference. The lack of a greenium pattern in this early

period supports the finding that investors may not immediately reward green bonds at issuance, particularly when environmental disclosures are not sufficiently differentiated or strong.

Graph 2:



6.2. Green Prospectus Scores

Building on the idea that green bonds are heterogeneous in their credibility and disclosure quality, I regress yields on green keyword scores derived from bond prospectuses. As presented in Table 3, this more granular approach reveals a richer and more nuanced pattern.

In the primary market, bonds with low green scores do not exhibit any statistically significant greenium, even after controlling for standard covariates. This suggests that superficial or generic green labeling is insufficient to influence pricing at the time of issuance.

In contrast, the secondary market results are more revealing. Bonds with medium and high green commitment scores exhibit increasingly significant and sizable greenia, indicating that investors are more likely to reward stronger and clearer environmental commitments—but only after the

bond has been trading in the market for some time. Specifically, for a green score range between 0 and 10, if a green bond's prospectus receives a score below 2.5, its expected greenium in the secondary market is not significantly different from that of its non-green match. If the score lies between 2.5 and 7.2, the bond is expected to outperform its match by 65.9 basis points in the secondary market. Finally, if the score exceeds 7.2, the green bond is expected to outperform its non-green match by 84.2 basis points. These findings suggest that market participants may take time to interpret and internalize the content of the prospectus, and that substantive green disclosures—rather than the green label alone—are eventually priced in.

Table 3: Keyword count score grouped green bonds and non-green bonds yield comparison on primary and secondary markets.

Variables	Primary Market	Primary Market	Secondary Market	Secondary Market
Green Keyword Score	-0.214		-0.227***	
	(0.134)		(0.033)	
Highest Green Score		0.213		-0.842***
		(0.672)		(0.214)
Medium Green Score		-1.440***		-0.659***
		(0.543)		(0.149)
Lowest Green Score		-0.281		-0.143
		(0.766)		(0.181)
Market to Book Ratio	-0.128	-0.113	-0.117***	-0.116***
	(0.145)	(0.144)	(0.027)	(0.029)
Return on Assets	2.197**	2.110**	0.733***	0.686**
	(1.046)	(1.038)	(0.265)	(0.283)
Leverage	2.257**	2.419**	4.562***	4.312***
	(1.029)	(1.027)	(0.342)	(0.340)
ln(Issue Size in USD)	0.011	0.027	-0.544***	-0.551***
	(0.088)	(0.087)	(0.016)	(0.016)
Constant	3.504**	3.147**	13.196***	13.459***
	(1.521)	(1.514)	(0.415)	(0.419)
2 digit SIC FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Observations	316	316	5300	5300
Adj. R^2	0.23	0.24	0.63	0.63

Significance is indicated as follows: *p < 0.1; ** p < 0.05; *** p < 0.01.
Firm-clustured robust standard error are in the paranthesis.

6.3. Category-Level Green Commitments

In Tables 4 and 5, I examine how different dimensions of green disclosure scores—affect bond yields in both the primary and secondary markets.

Across all four categories (Use of Proceeds, Project Evaluation, External Review, and Reporting/Transparency), the estimated coefficients on keyword scores are negative but statistically insignificant. Even when all categories are included jointly in the final column, none of the green disclosure categories appear to meaningfully impact yield at issuance. This suggests that, at the time of issuance, investors may not assign pricing advantages to more detailed or extensive green commitments disclosed in the prospectus.

This result aligns with prior literature (e.g., Flammer, 2021) and with anecdotal evidence from practitioners who state that they are unwilling to accept lower returns simply due to a bond's green label or associated disclosures at the time of issue.

Table 4: Keyword count score grouped green bonds and non-green bonds yield comparison on primary market.

	Primary Market				
Variables	**Use of Proceeds**	**Project Evaluation**	**External Review**	**Reporting / Transparency**	**All Categories**
Score on Use of Proceeds	-0.558				-0.606
	(0.342)				(0.680)
Score on Project Evaluation		-0.368			-0.133
		(0.273)			(0.635)
Score on External Review			-0.088		0.106
			(0.074)		(0.204)
Score on Reporting / Transparency				-0.142	-0.086
				(0.103)	(0.235)
Market to Book Ratio	-0.127	-0.128	-0.131	-0.132	-0.126
	(0.145)	(0.145)	(0.145)	(0.145)	(0.146)
Return on Assets	2.209**	2.256**	2.186**	2.155**	2.223**
	(1.045)	(1.048)	(1.050)	(1.049)	(1.064)
Leverage	2.287**	2.291**	2.309**	2.211**	2.244**
	(1.026)	(1.031)	(1.033)	(1.040)	(1.049)
ln(Issue Size in USD)	0.011	0.011	0.014	0.012	0.009
	(0.088)	(0.088)	(0.088)	(0.088)	(0.089)
Constant	3.505**	3.481**	3.438**	3.507**	3.560**
	(1.521)	(1.525)	(1.526)	(1.525)	(1.538)
2 digit SIC FE	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes
Observations	316	316	316	316	316
Adj. R^2	0.23	0.23	0.23	0.23	0.22

Significance is indicated as follows: *p < 0.1; ** p < 0.05; *** p < 0.01.
Firm-clustured robust standard error are in the paranthesis.

In stark contrast, the secondary market results reveal a markedly different dynamic, offering strong evidence that investors do, in fact, differentiate between green bonds based on the quality and credibility of their environmental disclosures. All four categories of green commitment—Use of Proceeds, Project Evaluation, External Review, and Reporting/Transparency—are found to be highly statistically significant and negatively associated with bond yield. This indicates that bonds exhibiting stronger green commitments are associated with lower yields in the secondary market, consistent with the presence of a greenium.

Among these categories, the Use of Proceeds score demonstrates the largest individual effect size (–0.631), and the coefficient is significant at the 1% level. This suggests that clear and specific articulation of how the bond proceeds will be allocated—especially toward renewable energy, energy efficiency, or similar projects—is particularly valued by investors. Project Evaluation, External Review, and Reporting/Transparency categories also show strong negative coefficients, each significant at conventional levels, reinforcing the idea that a robust green governance framework and credible monitoring mechanisms are considered meaningful by market.

Furthermore, when all four categories are included simultaneously in a joint regression specification, the combined effect remains both economically and statistically significant, with an overall coefficient of –1.096 ($p < 0.01$). This not only confirms that individual categories matter but also points to the possibility of additive effects: bonds that score highly across multiple disclosure dimensions appear to benefit from a pricing advantage in the secondary market.

These findings suggest that while investors may initially overlook the depth and quality of green disclosures at issuance—perhaps due to information asymmetry or time constraints—they increasingly rely on these disclosures in the secondary market. As bonds continue to trade and more information is absorbed over time, the credibility and specificity of environmental commitments become central to how these instruments are valued. In this sense, sustainability-related signals embedded in prospectuses operate with a time lag, gradually informing market pricing through a process of investor learning and interpretation. This highlights the crucial role of detailed and transparent disclosure practices in enhancing the financial performance of green bonds beyond the primary issuance stage.

Table 5: Keyword count score grouped green bonds and non-green bonds yield comparison on secondary market.

Variables	Secondary Market				
	Use of Proceeds	Project Evaluation	External Review	Reporting / Transparency	All Categories
Score on Use of Proceeds	-0.631***				-1.096***
	(0.082)				(0.148)
Score on Project Evaluation		-0.283***			0.342**
		(0.075)			(0.168)
Score on External Review			-0.076***		0.046
			(0.018)		(0.048)
Score on Reporting / Transparency				-0.110***	-0.001
				(0.025)	(0.053)
Market to Book Ratio	-0.116***	-0.121***	-0.122***	-0.117***	-0.115***
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
Return on Assets	0.748***	0.776***	0.698***	0.705***	0.736***
	(0.265)	(0.266)	(0.266)	(0.266)	(0.268)
Leverage	4.607***	4.530***	4.369***	4.426***	4.547***
	(0.342)	(0.346)	(0.342)	(0.342)	(0.353)
ln(Issue Size in USD)	-0.544***	-0.547***	-0.549***	-0.548***	-0.548***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Constant	13.175***	13.224***	13.363***	13.328***	13.315***
	(0.415)	(0.420)	(0.415)	(0.416)	(0.422)
2 digit SIC FE	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes
Observations	5300	5300	5300	5300	5300
Adj. R^2	0.63	0.63	0.63	0.63	0.63

Significance is indicated as follows: *p < 0.1; ** p < 0.05; *** p < 0.01.
Firm-clustured robust standard error are in the paranthesis.

6.4. Score Buckets and Category-Based Heterogeneity

To further explore the interaction between green commitment intensity and bond pricing, I group the green keyword scores into terciles—Low, Medium, and High—within each disclosure category. This allows us to observe whether the magnitude of the greenium varies across score levels, and whether such differentiation is visible in both primary and secondary markets.

As shown in Table 6, none of the categories display a consistent or statistically significant relationship between green score buckets and yield at issuance. While some coefficients are negative (particularly for Medium Score in the External Review category), the overall pattern is

weak and statistically fragile. In the External Review category, Medium Green Score bonds show a weakly significant greenium (–1.118, $p < 0.05$), but this is not mirrored in the High score group, suggesting a non-monotonic pattern. In other categories, High or Medium scores show no significant difference from Low score bonds in primary market pricing. These results reinforce earlier findings: at the time of issuance, investors do not appear to differentiate between strong and weak environmental disclosures, regardless of category.

Table 6: Keyword count scores by category grouped green bonds and non-green bonds yield comparison on primary market..

	Primary Market			
Variables	**Use of Proceeds**	**Project Evaluation**	**External Review**	**Reporting / Transparency**
Highest Green Score	-0.807	-0.596	0.112	-1.212
	(0.764)	(0.763)	(0.733)	(0.747)
Medium Green Score	-0.694	-0.607	-1.118**	-0.254
	(0.517)	(0.559)	(0.529)	(0.523)
Lowest Green Score	-0.481	-0.418	-0.589	-0.431
	(0.775)	(0.364)	(0.748)	(0.375)
Market to Book Ratio	-0.125	-0.14	-0.117	-0.137
	(0.146)	(0.146)	(0.145)	(0.145)
Return on Assets	2.160**	2.132**	2.106**	2.140**
	(1.052)	(1.055)	(1.045)	(1.049)
Leverage	2.193**	2.324**	2.328**	2.134**
	(1.042)	(1.036)	(1.033)	(1.052)
ln(Issue Size in USD)	0.016	-0.052	0.021	-0.061
	(0.089)	(0.105)	(0.088)	(0.106)
Constant	3.459**	4.678**	3.285**	4.934**
	(1.536)	(1.878)	(1.522)	(1.892)
2 digit SIC FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Observations	316	316	316	316
Adj. R^2	0.23	0.23	0.23	0.23

Significance is indicated as follows: *p < 0.1; ** p < 0.05; *** p < 0.01.
Firm-clustured robust standard error are in the paranthesis.

In contrast, Table 7 reveals strong and consistent patterns in the secondary market. In all four categories, bonds with High Green Scores exhibit statistically significant and economically meaningful greenia. For example, High Score bonds in the Reporting/Transparency category are associated with a yield discount of –0.899 bps ($p < 0.01$). Similarly, the Use of Proceeds (–0.556 bps), Project Evaluation (–0.638 bps), and External Review (–0.634 bps) categories all display significant and negative coefficients for the High Score group. Bonds in the Medium Score group show moderate statistical significance in certain categories (e.g., Project Evaluation: –0.371 bps, $p < 0.05$), though their coefficients are generally smaller in magnitude compared to those of the High Score group. Low Score bonds either exhibit no statistically significant greenium or small negative coefficients in some cases (e.g., External Review: –0.320 bps), reinforcing the notion that green labeling alone—absent strong disclosures—is insufficiently rewarded by investors.

These findings demonstrate that the intensity and credibility of green promises, as reflected in the bond prospectus, become more important over time as investors update their valuation models and prices adjust in the secondary market. This pattern underscores the importance of not only obtaining a green label but also substantiating it through detailed and credible documentation. Bonds that provide vague or generic descriptions of environmental objectives tend to be met with skepticism in secondary markets, suggesting that investors require more than superficial commitments. In contrast, bonds that outline concrete use-of-proceeds plans, robust project evaluation frameworks, and transparent reporting mechanisms are rewarded with lower yields, reflecting a clear market preference for verifiable impact.

Overall, these results offer compelling evidence that environmental disclosures are not merely regulatory formalities but are actively incorporated into investors' risk–return evaluations over time. As climate-related financial risk becomes an increasingly salient consideration, this differentiation between "low green" and "high green" bonds may become even more pronounced. From both policy and corporate governance perspectives, the findings encourage issuers to adopt comprehensive and transparent green disclosure strategies—not only to enhance their reputations but also to secure access to capital on more favorable terms in the long run.

Table 7: Keyword count scores by category grouped green bonds and non-green bonds yield comparison on secondary market..

Variables	Secondary Market			
	Use of Proceeds	Project Evaluation	External Review	Reporting / Transparency
Highest Green Score	-0.556***	-0.638***	-0.634***	-0.899***
	(0.206)	(0.222)	(0.206)	(0.186)
Medium Green Score	-0.257**	-0.371**	0.118	0.290**
	(0.125)	(0.145)	(0.133)	(0.123)
Lowest Green Score	-0.197**	-0.064	-0.320***	-0.358***
	(0.091)	(0.088)	(0.091)	(0.093)
Market to Book Ratio	-0.130***	-0.128***	-0.141***	-0.135***
	(0.028)	(0.028)	(0.027)	(0.028)
Return on Assets	0.681**	0.748***	0.688**	0.68**
	(0.268)	(0.269)	(0.267)	(0.266)
Leverage	4.395***	4.522***	4.566***	4.437***
	(0.342)	(0.351)	(0.347)	(0.341)
ln(Issue Size in USD)	-0.581***	-0.556***	-0.596***	-0.607***
	(0.021)	(0.021)	(0.022)	(0.022)
Constant	13.957***	13.408***	14.192***	14.450***
	(0.496)	(0.499)	(0.498)	(0.502)
2 digit SIC FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Observations	5300	5300	5300	5300
Adj. R^2	0.63	0.63	0.63	0.63

Significance is indicated as follows: *p < 0.1; ** p < 0.05; *** p < 0.01.
Firm-clustured robust standard error are in the paranthesis.

7. Conclusion

This study investigates the existence and nature of the greenium in U.S. corporate bond markets between 2015 and 2024. While prior research has generally failed to find robust evidence of yield discounts for green bonds at issuance, my results show that a weakly significant greenium does exist in the primary market. However, the effect becomes much more pronounced in the secondary market, where investors appear to reward green-labeled bonds with significantly lower yields.

More importantly, I demonstrate that green bonds are far from homogeneous. By conducting a detailed textual analysis of bond prospectuses—using keyword frequencies across four key dimensions: Use of Proceeds, Project Evaluation, External Review, and Reporting/Transparency—I construct a novel scoring system that captures the strength and credibility of a bond's green commitment.

My findings reveal that these green commitment scores are not priced in the primary market, but become highly significant in the secondary market. This pattern suggests that investors require time to process and price sustainability-related disclosures, and that credible green promises—not merely labels—drive yield differentials over time.

Further, I show that the intensity of green disclosures matters: bonds in the highest green score tercile exhibit the strongest greenium, while those in the lowest tercile show no pricing benefit. This effect is consistent across all disclosure categories in the secondary market.

These results offer two key contributions to the literature: They reconcile the absence of greenium at issuance with the observed investor demand for sustainability in the secondary market, and they establish that text-based analysis of prospectuses can be a powerful tool for distinguishing between "low green" and "high green" bonds. Overall, this study suggests that sustainability in bond markets is not just a matter of labeling, but of credible, transparent communication—and that such credibility is ultimately rewarded by the market.

Appendix

Keywords by category:

1. Use of Proceeds and Environmental Projects	2. Project Evaluation, Greenwashing Mitigation and Governance	3. External Review and Validation	4. Reporting and Transparency
renewable	additionality	second party opinion	impact
energy efficiency	decarbonizing	spo	transition
energy efficient	verified	assurance	emission
clean	greenhouse	verification	impact report
climate	carbon	sustainalytics	annual reporting
sustainable	mitigation	certified	allocation report
sustainability	use of proceeds	auditor	post-issuance
green	earmarked	audited	monitoring
electrification	exclusion criteria	external review	disclosure
biomass	eligibility	audit	transparency
wind	governance		kpis
solar	oversight		metrics
geothermal	accountability		
low-carbon	robust		
zero-emission	threshold		
decarbonization	materiality		
energy transition	due diligence		
recycling	greenwashing		
reforestation			
biodiversity			
electric vehicle			
electric vehicles			
emissions			
ghg			
carbon neutrality			
net-zero			
net zero			
energy			
hydropower			
bioenergy			
circularity			
LEED			

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