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An Analysis of the Impact of Green Bond Information Disclosure Quality on Financing Costs

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Abstract

The impact of the quality of information disclosure on green bonds on financing costs is a cutting-edge topic in green finance research. Through a systematic literature review that integrates information asymmetry theory with signaling theory, this paper systematically synthesizes the conceptual connotations of information disclosure quality, the evolution of its measurement methodologies, and the mechanisms—along with empirical evidence—through which it influences green bond financing costs. Research has found that the quality of information disclosure is a key variable explaining the heterogeneity of green premiums, and high-quality disclosure can significantly reduce financing costs. The methods for measuring the quality of information disclosure have evolved through three stages: from manual scoring to dictionary-based methods (LDA), and then to deep learning and semantic analysis. NLP technology provides a new path for large-scale, refined measurement. The findings indicate that while information disclosure quality generally exerts a positive influence on financing costs, this effect is also moderated by boundary conditions such as market structure and investor type. This paper constructs a four-dimensional analytical framework of "substance, verifiability, transparency, and professionalism" to provide theoretical tools and methodological support for subsequent research.

Keywords

green bonds, information disclosure quality, financing costs, green premium, natural language processing

1. Introduction

Since the European Investment Bank issued the first green bond in 2007, the global green bond market has experienced exponential growth, with cumulative issuance volume reaching approximately $2.5 trillion by 2025. As a pivotal instrument for financing the transition to a low-carbon economy, green bonds have garnered widespread attention from policymakers, investors, and scholars. One of the central questions in academic research is whether green bonds offer a financing cost advantage compared to conventional bonds—specifically, what is commonly referred to as the "green premium" or "green spread."

However, there are significant disagreements regarding the empirical evidence for the existence and scale of the green premium. Some studies have found significant premiums, ranging from -2 to -63 basis points,

with a difference of up to 61 basis points. A basis point is a commonly used unit for calculating interest rates. One basis point equals 0.01%. Therefore, -2 basis points means that the financing cost of green bonds is 0.02% lower than that of ordinary bonds, while -63 basis points means 0.63% lower. This divergence persists despite increasingly sophisticated research methodologies.

This article argues that the controversy surrounding the green premium estimation results may stem, at least in part, from the neglect of a key moderating variable—the quality of information disclosure. Investors are willing to accept lower yields only if they believe in the environmental authenticity of the projects they fund. High-quality information disclosure can reduce information asymmetry, enhance the green credibility of bonds, and thus influence investors' acceptance of green premiums. The study by Pietsch and Salakhova provides direct evidence in support of this view, demonstrating that the premium commanded by bonds that have undergone external review is significantly higher than that of unreviewed bonds. This finding suggests that the quality of information disclosure amplifies the premium effect—meaning that high-quality disclosure translates into greater advantages in terms of financing costs [1].

While this logic is intuitively sound, research on green bond pricing and information disclosure quality has largely developed in parallel, with few studies systematically integrating these two areas to examine how information disclosure quality explains the heterogeneity in green premium estimations and, consequently, its impact on financing costs. This paper aims to fill this gap. First, it traces the evolution of information disclosure quality measurement methods, from manual content analysis to natural language processing techniques. Furthermore, an integrated four-dimensional framework for green narrative quality is proposed, linking disclosure characteristics with financing outcomes. By systematically reviewing empirical evidence on the existence and measurement of green premiums, it identifies the root causes of research disagreements. Finally, it focuses on the impact of information disclosure quality on financing costs and points to future research directions.

2. Literature Search Methods

This article conducted a comprehensive search across multiple academic databases, including Web of Science, Scopus, SSRN, and Google Scholar. The search period covers 2015 to 2025. The search terms combine three thematic sections: green debt, disclosure concepts, and outcome variables. Studies included in this review must meet the following criteria: published in peer-reviewed journals or by reputable institutions; provide empirical evidence on the pricing or quality of information disclosure of green bonds; and focus on corporate bonds, municipal bonds, or sovereign green bonds.

3. Quality of Information Disclosure

3.1 Definition of Information Disclosure Quality

Within the context of green bonds, there is no universally accepted definition for the quality of information disclosure. Early studies adopted a multi-dimensional approach, while more recent research has further refined these dimensions. Zhang and Li, utilizing a scoring system to measure disclosure completeness, assessed the presence and level of detail regarding information on environmental benefits—specifically examining whether issuers quantified projected emission reductions, clearly outlined project timelines, and disclosed underlying assumptions [2]. Ye investigated the relationship between the quality of environmental information disclosure and the cost of green bond financing in the Chinese market, finding a negative correlation between the two; furthermore, the study revealed that state-owned enterprises enjoy lower financing costs [3].

3.2 The Evolution of Measurement Methods

The measurement of information disclosure quality has evolved through three methodological stages. The first stage involved content analysis and manual scoring. Early research relied on coding schemes developed by researchers, with trained coders reading the recruitment instructions and scoring according to pre-set criteria. While this method allows for detailed evaluation, it is time-consuming, labor-intensive, highly subjective, and difficult to scale.

In the second phase, the researchers employed dictionary-based methods and topic modeling, thereby incorporating computational text analysis. They utilized a predefined dictionary to quantify the frequency of keywords related to environmental benefits and applied Latent Dirichlet Allocation (LDA) to identify latent themes within the disclosed texts. These methods enable larger-scale analyses, but they face challenges in terms of context sensitivity and semantic disambiguation.

The third stage involves deep learning and semantic analysis. Recently, researchers have applied pre-trained language models such as BERT to the analysis of green bond texts. Benincasa et al. calculated the cosine similarity between bond offering documents and the *Green Bond Principles*, finding that for every 10% increase in similarity, the yield decreases by 4.86 to 8.71 basis points [4].

Li et al. applied semi-supervised machine learning and text analysis to green bond data from China spanning 2016 to 2021, finding that the level of environmental information disclosure in green bonds was 15% higher than that of ordinary bonds. Bonds that obtained third-party certification or had a higher proportion of investment in green projects demonstrated even stronger disclosure advantages; furthermore, improved disclosure quality was found to boost stock returns and reduce information asymmetry [5].

4. The Impact of Information Disclosure Quality on Green Premium

Based on a theoretical framework, this paper explains how information disclosure quality influences green bond pricing. Specifically, according to information asymmetry theory, bond investors face uncertainty regarding the true environmental credentials of green bond issuers and the projects they finance. This uncertainty creates information risk, for which investors demand compensation in the form of higher yields. High-quality information disclosure reduces this information asymmetry, thereby reducing the required risk premium. Gao and Schmittmann formalized this logic in the adverse selection model, showing that the green bond premium occurs precisely when there is information asymmetry, transition risk and greenwashing costs [6].

Secondly, according to signaling theory, the issuance of high-quality information disclosure serves as a signal through which firms convey their genuine environmental commitments. Unlike “greenwashers” — who make vague or exaggerated claims—credible issuers incur the costs associated with detailed disclosure, third-party certification, and the establishment of quantifiable environmental targets. Investors recognize this signal and therefore accept lower yields. Wang et al. provided empirical support from a multi-stakeholder signaling perspective, demonstrating that a firm's environmental performance reduces bond financing costs by mitigating information asymmetry [7].

Synthesizing insights from the literature, this paper proposes a four-dimensional framework for assessing the quality of green narratives within bond disclosure documents. The first dimension—Substantiveness—captures the core question of whether a bond is genuinely “green.” Drawing upon the similarity-based methodology of Benincasa et al., high substantiveness implies that the project description closely aligns with recognized green classification standards and provides specific details regarding the underlying technology and anticipated outcomes [4].

The second dimension—verifiability—concerns the credibility of green claims. External certification has been shown to significantly influence green bond pricing: Li et al. found that both green certification and the reputation of financial intermediaries reduce the premium on green ABS by signaling positive attributes and mitigating concerns regarding greenwashing [5]. Similarly, Pietsch and Salakhova found that bonds that have undergone external review command a higher premium [1].

The third dimension—transparency—focuses on the completeness and honesty of disclosure. The IMF model emphasizes that “greenwashing”—the failure to transparently disclose environmental credentials—undermines the integrity of green bonds. Recent NLP research operationalizes transparency through linguistic clarity and the absence of vague phrasing.

The fourth dimension—professionalism—reflects the technical quality of the disclosure. This dimension has received attention in earlier studies and was recently re-emphasized by Wang, who noted that it embodies the issuer's competence as demonstrated through appropriate terminology, clear structure, and professional presentation [7].

This four-dimensional framework offers a systematic perspective for understanding cross-study variations in green premium estimates. Analyzing the issue from three angles—differences in sample composition, temporal changes, and market variations—we first observe that studies primarily incorporating bonds with high materiality and robust verification are likely to identify larger premiums than those including bonds with vague or unverified claims. A study by the Banque de France, which found higher premiums for externally reviewed bonds, directly supports this logic. Furthermore, as disclosure standards evolve and verification practices become more widespread, the average quality of disclosure is likely to improve over time. Consequently, studies covering later periods may yield different premium estimates compared to those covering earlier periods. Finally, markets characterized by stricter disclosure regulations and enforcement — such as those adhering to the EU Green Bond Standard—may exhibit systematically higher disclosure quality, thereby helping to explain the larger premiums observed in European studies.

This framework shifts the question from "Does a green premium exist?" to "Under what disclosure conditions does a green premium emerge?"—a more nuanced and empirically tractable question.

5. Green Premium: Controversy and Measurement

The "green premium" refers to the financing cost advantage of green bonds relative to comparable conventional bonds, typically measured by the difference in credit spreads or yields to maturity. A negative value indicates that green bonds entail lower financing costs, signifying that the market has assigned a positive valuation to their green attributes.

There are three main methods for measuring the green premium. One is the matching method, which compares green bonds with ordinary bonds that have the same characteristics [8]. Second, regression analysis, which estimates the marginal effect of the "green label" after controlling for bond and issuer characteristics; and third, the natural experiment method, which employs the "twin issuance" approach developed by Abis et al. to conduct quasi-experimental studies [10].

The results show that there is a huge discrepancy in the estimates of the green premium. Zerbib found -2 basis points [8], Nanayakkara and Colombage found -63 basis points [9], Larcker and Watts found no systematic pricing difference [11], and Pietsch and Salakhova found an average of -3.7 basis points. The differences in the results reflect three distinct differences. First, there is market heterogeneity, namely, negative premiums are common in the European market, while no significant differences were found in the US municipal bond market [1]. Secondly, there is time heterogeneity. Pietsch and Salakhova proved that the premium has time-varying characteristics, which increase in 2020-2022 and decrease in 2022-2023. Finally, there is methodological heterogeneity. Using different measurement methods may produce systematic bias [1].

As established in the preceding discussion, information disclosure quality serves as a key variable in explaining variations in the "green premium." Fundamentally, the green premium represents a manifestation of advantages in financing costs—specifically, the more negative the premium, the lower the cost of financing. Consequently, the impact of information disclosure quality on the green premium is, in essence, a specific manifestation within the green bond market of its broader influence on financing costs. This leads to a more fundamental inquiry: the impact of information disclosure quality on the financing costs of green bonds.

6. The Impact of Information Disclosure Quality on Financing Costs

Based on existing literature, this impact manifests itself in three main ways. Mainstream research confirms that the quality of information disclosure can significantly reduce financing costs (positive effect), but this effect has boundary conditions, and a few studies have found ineffective or even potential negative effects.

From the perspective of positive effects, high-quality information disclosure reduces financing costs through multiple mechanisms. First, the quality of information disclosure alleviates the inherent information asymmetry problem in the green bond market. When issuers disclose in detail the use of funds, environmental benefits, and project progress, investors can more accurately assess the green attributes of

bonds, reduce concerns about the risk of "greenwashing," and thus accept lower yields. Secondly, the quality of information disclosure plays a signaling role—high-quality disclosure behaviors such as third-party certification and quantified environmental targets require additional costs, which sends a credible signal to the market that the issuer is genuinely committed to green transformation, effectively distinguishing it from "greenwashers" and thus gaining a financing cost advantage. Furthermore, high-quality disclosure helps to broaden the investor base—specific institutions such as ESG investors and green funds have rigid requirements for information disclosure. High-quality disclosure allows bonds to enter the investment scope of these investors, increases market demand and secondary market liquidity, and further reduces financing costs.

Empirical studies provide ample support for the above mechanisms. Pietsch and Salakhova (2025) found that green bonds with external reviews command a premium of 2 basis points over unreviewed bonds [1]. Zhang and Li demonstrated that for every one-point increase in the completeness of environmental benefit disclosures, the credit spread narrows by 0.1463 basis points [2]. Employing deep learning methods, Benincasa et al. confirmed that for every 10% increase in the semantic similarity between bond text and the *Green Bond Principles*, the yield decreases by 4.86 to 8.71 basis points [4].

However, this positive effect does not hold unconditionally. Some studies have revealed the boundary conditions under which the quality of information disclosure affects financing costs. Larcker and Watts' research on the U.S. municipal bond market found that even green bonds with third-party certification do not have a significant financing cost advantage, suggesting that in a market dominated by institutional investors and with a relatively transparent information environment, the marginal effect of public information disclosure may be replaced by other information channels [11]. Pietsch and Salakhova further discovered that the bond premiums commanded by retail investors are significantly higher than those held by institutional investors, indicating that investor structure moderates the intensity of the impact of information disclosure—specifically, retail investors rely more heavily on public disclosures and are, therefore, more sensitive to the quality of such disclosures [1]. In addition, factors such as market development stage, institutional environment, and bond type also affect the magnitude of the effect of information disclosure. Emerging markets, due to their higher degree of information asymmetry, often have a more significant marginal effect of information disclosure.

Regarding the negative effects, theoretically speaking, excessively high disclosure requirements may increase the issuer's compliance costs. If these costs cannot be offset by a decrease in financing costs, they may result in a net burden on the issuer. Furthermore, if disclosure standards are poorly designed, they may lead issuers to divert resources toward merely formalistic disclosure rather than substantive green projects, thereby giving rise to a distorting effect characterized as "disclosure formalism."

In summary, the impact of information disclosure quality on the financing cost of green bonds is predominantly positive, and its strength is modulated by boundary conditions such as market structure and investor type. This finding not only accounts for cross-study discrepancies in estimates of the "green premium" but also provides a theoretical basis for issuers to optimize their disclosure strategies and for policymakers to refine disclosure standards.

7. Conclusion and Outlook

Drawing upon a systematic literature review, this paper synthesizes the mechanisms and empirical evidence regarding the impact of green bond information disclosure quality on financing costs. Research has found that the quality of information disclosure is a key variable explaining the heterogeneity of the green premium. High-quality disclosure significantly reduces financing costs through mechanisms such as reducing information asymmetry and enhancing green credibility, but this effect is moderated by boundary conditions such as market structure and investor type. The measurement methodologies for information disclosure quality have undergone a three-stage evolution: from manual scoring to dictionary-based methods (including LDA), and subsequently to deep learning and semantic analysis. The four-dimensional framework—encompassing "Substantiveness, Verifiability, Transparency, and Professionalism" constructed in this paper provides a systematic analytical tool for future research.

Based on the literature review in this paper, we propose optimization suggestions at three levels. At the policy level, we should improve information disclosure standards and promote the institutionalization of third-party certification. Issuers should use high-quality disclosure as an effective strategy to reduce financing costs. Investors should pay attention to the quality of disclosure to assess the credibility of bonds. Future research could deepen the application of NLP techniques in measuring disclosure, strengthen the design of causal identification, and expand cross-market comparative analyses, thereby providing academic support for the healthy development of the green bond market.

References

[1] Pietsch, A., & Salakhova, D. (2025). Pricing of green bonds: Greenium dynamics and the role of retail investors. Journal of International Financial Markets, Institutions and Money, 104, 102211.

[2] Zhang, J. T., & Li, X. (2024). An empirical study on the impact of the completeness of environmental benefit information disclosure on the financing cost of green bonds. Bonds, (9), 86–91.

[3] Ye, X. Y. (2022). The quality of environmental information disclosure, ownership type and the cost of green bonds: An empirical study based on green bonds issued in China. In 2022 4th International Conference on Economic Management and Cultural Industry (ICEMCI 2022). Atlantis Press.

[4] Benincasa, E., et al. (2022). Different shades of green: Estimating the green bond premium using natural language processing (Swiss Finance Institute Research Paper No. 22-64). Swiss Finance Institute.

[5] Li, X., et al. (2024). Greenium of green securitization: Does external certification matter? PLOS ONE, 19.

[6] Schmittmann, J. M., & Gao, Y. (2022). Green bond pricing and greenwashing under asymmetric information. International Monetary Fund.

[7] Wang, L., et al. (2025). Corporate environmental performance and bond financing cost: A multi-stakeholder signaling perspective. International Review of Financial Analysis, 104479.

[8] Zerbib, O. D. (2019). The effect of pro-environmental preferences on bond prices: Evidence from green bonds. Journal of Banking & Finance, 98, 39–60.

[9] Nanayakkara, M., & Colombage, S. (2019). Do investors in Green Bond market pay a premium? Global evidence. Applied Economics, 51(40), 4425–4437.

[10] De Vincentiis, P., & Abis, D. (2025). Non-identical twins: Evidence on greenium in the German treasury bond market. Research in International Business and Finance, 103057.

[11] Larcker, D. F., & Watts, E. M. (2020). Where's the greenium? Journal of Accounting and Economics, 69(2–3), 101312.

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Conflicts of Interest

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