The ESG Premium in the Green Bond Market: A Literature Review Based on Global Issuance Data

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Abstract. This study systematically investigates the ESG premium in the global green bond market through bibliometric methods. The results show that the yield discount phenomenon, i.e., "green premium", is common in green bonds, which is particularly significant in Europe, the United States, and other regions with sound ESG systems. Factors affecting the formation of the premium include third-party certification, disclosure quality, issuer credit rating, policy support, market liquidity, and investor preference. Among them, authoritative certification and high-quality disclosure can effectively improve investor trust and enhance the market recognition of green labels. This study not only enriches the theoretical system of green financial pricing mechanisms but also provides policy reference and empirical support for building a transparent and efficient green bond market. The results also indicate that disclosure transparency and policy consistency have the strongest explanatory power among influencing factors, suggesting that institutional quality remains the core driver of ESG premium formation.

Keywords: Green Bond, ESG Premium, Sustainable Finance.

1 Introduction

1.1 Research Background

The global trend towards sustainability is driving the rise of green finance, with green bonds as an important tool. Since 2007, green bonds have expanded rapidly, reaching a cumulative issuance of $2.9 trillion [1]. They are widely used in renewable energy and infrastructure development. Also, it has become an essential conduit for connecting capital with environmental objectives. ESG factors have gradually become key to green bond pricing, with high ESG ratings seen as a signal of low risk, attracting institutional investors to allocate and creating a "green premium". Policy and international standards have also strengthened ESG disclosure requirements, making ESG deeply embedded in the risk pricing mechanism of green bonds and becoming an important basis for understanding green financial market behavior.

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1.2 Motivation and significance of the study

Even though research related to green bonds continues to grow, whether the ESG premium is significant remains highly divergent. Some studies argue that there is a negative premium effect, while others point out that the premium becomes insignificant after controlling for key variables, reflecting that its formation mechanism is still unclear. The root of the "negative premium" controversy lies in inconsistent sample selection, market heterogeneity, and differences in controlling for key variables such as credit rating and liquidity. In addition, variations in green certification quality and investor preferences further complicate the observed pricing outcomes. Through a systematic literature review, this study summarizes the influencing factors, theoretical foundations, and empirical paths of green bond premiums. It also clarifies the status and main controversies in the literature, aiming to provide theoretical support and practical reference for future sustainable finance research and policymaking. This paper identifies and analyzes representative studies to construct a comprehensive review, offering insights for both scholars and practitioners, while supporting evidence-based policy development in the field of sustainable finance.

2 Relevant concepts and theoretical foundations

2.1 Definition and Characteristics of Green Bonds

Green bonds are debt financing instruments whose proceeds are dedicated to environmentally friendly projects, such as clean energy, sustainable transportation, and water conservation [2]. Based on the issuer, they can be categorized into corporate, government, financial institution, and multilateral development bank green bonds. Green bonds mainly include use-of-proceeds bonds, where funds must be allocated to specific green projects, and sustainability-linked bonds (SLBs), which tie bond terms to the issuer's sustainability performance but do not require fund earmarking. To ensure environmental credibility, global standards such as ICMA's Green Bond Principles, CBI certification, and the EU Taxonomy guide definitions and disclosures.

2.2 Connotation and Measurement of the ESG Premium

The ESG premium, also known as the greenium, refers to the yield discount that green bonds typically offer compared to otherwise similar non-green bonds, reflecting lower financing costs due to their sustainability features. This phenomenon can be interpreted through several theoretical lenses. Signaling theory suggests that green labels demonstrate an issuer's commitment to sustainability, thereby enhancing investor confidence.

Risk premium theory argues that issuers with strong ESG performance are viewed as less risky, leading investors to accept lower returns [3]. In contrast, investor preference theory emphasizes that some investors are willing to sacrifice part of their financial return to fulfill ethical goals or comply with ESG mandates. These two perspectives are closely related: while one focuses on perceived risk reduction, the other highlights non-financial utility. In practice, for example, a pension fund with long-term climate goals may choose green bonds with lower yields over conventional bonds, believing

the ESG alignment reduces future regulatory and reputational risks, while also aligning with beneficiaries' values.

3 Research methodology and data sources

This study is based on the Web of Science database and uses a keyword (green bond OR green debt OR green fixed income) AND (greenium OR ESG premium OR pricing OR yield spread OR green discount) search to obtain a total of 775 papers related to green bonds and ESG premiums. Since 2016, the field has entered a rapid development stage, with 163 publications in 2024. To reveal its research evolution path, this paper sets four types of core metrics: publication trend, authors and institutions, core journals and citations, and research hotspots and theme evolution. The above indicators can systematically depict the knowledge structure and development logic of this field from the dimensions of time, structure, and content, providing a solid foundation for subsequent bibliometric analysis.

4 Results of Literature Analysis of ESG Premium Studies on Global Green Bonds

4.1 Overall Evolutionary Trend of ESG Premium Research on Green Bonds

Since the introduction of green bonds in 2007, academic interest in the ESG premium and green bond pricing mechanisms has steadily intensified. As mentioned before, due to the Paris Agreement and global policy support, the number of related publications surged after 2016. Peaking at 167 articles in 2024. Although this number slightly declined to 116 in 2025, the overall upward trend remains evident. Research in this field demonstrates a clear internationalization trend, with China, Europe, and the United States taking the lead. Scholars from the U.S., U.K., and China have shown particularly strong engagement, with universities serving as the main contributors to knowledge output. Notable institutions such as Columbia University, the University of Zurich, and Renmin University of China have made significant advancements in green finance research.

Close collaboration between Europe and the U.S. reflects strong institutional alignment and regulatory development, while cross-border academic cooperation in Asia is gradually expanding, particularly under differentiated policy frameworks. The focus of ESG premium research has shifted from early conceptual discussions to rigorous empirical analysis, underscoring the strategic importance of green finance and the sustained academic interest in this global topic.

4.2 Highly Cited Literature and Academic Classics Combining

To further identify the knowledge base and theoretical evolution path of green bond ESG premium research, this paper selects representative literature with high citation frequency in the Web of Science database, whose content is closely related to the green bond pricing mechanism, to focus on the analysis. First, Zerbib's study, published in

2019, is one of the most highly cited in this field, one of the classic literatures in the field [4]. He argues for the existence of a "green premium" and, using a matching methodology that controls for credit ratings, maturity, and issuer characteristics, finds that green bonds have slightly lower yields on average, suggesting that investors are willing to accept lower returns to support sustainable projects. This study is widely cited as the theoretical basis for measuring green discounting mechanisms.

The second representative paper is "Corporate green bonds", this study found that green bond issuance not only helps to improve corporate governance structure and social responsibility performance but also enhances shareholders' perceptions of long-term corporate value [5]. In addition, Tang and Zhang's paper focuses on the signaling effect of green labels. Their empirical results show that the spreads of green bonds are significantly lower if they are certified by a third party, suggesting that the market's recognition of the "green" label depends on the external verification mechanism [6]. It is worth noting that the existence of a green premium is not universally observed across markets. For example, Li, Zhang, and Wang found that in China's green bond market, there was no statistically significant yield advantage for green bonds compared to conventional bonds, unless those green bonds were officially certified. This suggests that the formation of the green premium is highly context-dependent and influenced by factors such as certification credibility and market maturity, highlighting the limitations in generalizing the premium effect across different countries [7]. In addition, Ehlers & Packer point out that the lack of uniformity in green labeling standards may affect investors' determination of their value [8].

In summary, green bond ESG premium research has formed a research paradigm dominated by European and American scholars and centered on risk pricing and information disclosure mechanisms and has gradually expanded to multiple directions, such as behavioral finance and policy effect analysis. The highly cited literature not only lays the academic cornerstone of the field but also provides a theoretical framework and methodological reference for subsequent research.

4.3 Analysis of Research Topics and Hot Spots

Keyword co-occurrence analysis reveals several core themes in ESG premium research. "Pricing mechanism" is the most central, with frequent use of terms like greenium and yield spread, reflecting sustained interest in how green bonds are priced. Closely linked is the theme of "certification standards and disclosure", emphasizing the importance of transparency in shaping investor perception. For instance, green bonds with third-party certification (e.g., Climate Bonds Initiative, EU Green Bond Standard) are seen as more credible and often enjoy a stronger ESG premium, as they reduce information asymmetry and perceived risk.

Another major cluster is "investor preference and motivation," highlighting how ethical goals and ESG mandates drive demand, even at the cost of lower returns. Clusters around "policy impact" and "market efficiency" further examine how regulation shapes pricing and liquidity.

The research focus has evolved from simple yield comparisons to multidimensional analysis involving investor psychology, governance, and regulatory context. In the future, AI-based methods and cross-market studies are expected to uncover deeper mechanisms behind green bond pricing.

4.4 Summary of key factors influencing ESG premium research

The ESG premium level of green bonds is subject to the combined effect of a variety of internal and external factors, and this paper summarizes five types of key influencing factors through the literature analysis, which constitute important dimensions in the study of the green bond pricing mechanism.

First, green certification and disclosure transparency are important prerequisites for determining green bond market recognition. Bonds with third-party certifications such as CBI (Climate Bonds Initiative) or ISS-ESG are more likely to be regarded as "truly green" by investors, and their green attributes are more highly recognized, thus increasing the market premium. Meanwhile, high-quality and transparent information disclosure can enhance investor confidence and effectively alleviate the suspicion of "greenwashing". Therefore, the consistency of certification standards and the standardization of information disclosure become the basic conditions for the formation of a premium.

Second, issuer credit rating directly affects the risk pricing logic of green bonds. Highly rated issuers (e.g., governments, international development banks) usually have higher solvency and market reputation, and their green bonds are more likely to be favored by investors, enjoying lower yields and forming positive premiums. On the contrary, green bonds issued by private firms with lower credit ratings may have a negative premium due to a risk premium that masks the spread advantage of their green attributes.

Third, policy support and regulatory environment play a key role in guiding the pricing mechanism of green finance. Perfect green classification standards, tax incentives, disclosure regulation, and green guarantee mechanisms can reduce investment risks, enhance market transparency, and help form and stabilize premiums. Especially in the EU, China, and other regions with more mature green financial policies, the premium effect of green bonds is more significant, reflecting the close connection between the policy framework and market behavior.

Fourth, market liquidity and issuance scale effects also have an important impact on the level of green bond premium. Highly liquid bonds are more attractive because they are easy to trade, and their yields are usually lower, while low liquidity may result in a liquidity discount. In addition, green bonds issued on a large scale are more likely to be included in mainstream indices or institutional portfolios, thus enjoying a liquidity premium and a subscription premium.

Finally, investor preferences and ethical motives are the core psychological factors that determine whether an ESG premium exists for green bonds. Some investors are willing to sacrifice part of their financial returns to support green projects due to environmental responsibility, ethical values, or ESG investment philosophy. This preference drives higher demand for green bonds, pushing up their prices and lowering their yields, creating a negative spread, i.e., a positive premium.

In summary, the ESG premium of green bonds is not driven by a single factor but is a dynamic reflection of multiple interactions among institutional design, market structure, and behavioral preferences, and an in-depth analysis of which can help build a better green finance pricing model.

5 Discussions and cutting-edge issues

5.1 Consensus and Disagreement in Existing Research

Existing research generally supports the existence of a "green premium". Most of the research suggests that green bonds tend to yield slightly less than comparable conventional bonds owing to investors' preference for sustainable assets. However, significant disagreement remains as to the magnitude, direction, and consistency of this premium across different scenarios. Some studies report persistent negative premiums, while others find no significant effect after controlling for bond characteristics such as credit rating and maturity. Cross-market comparisons show further divergence [9]. Green bonds in Europe and the United States typically exhibit more pronounced and stable premiums, likely due to stronger regulatory frameworks and investor awareness. In contrast, results in emerging markets tend to be weaker or inconsistent, suggesting possible differences in green finance infrastructure and credibility. The type of bond also matters-sovereign and development bank bonds typically have higher premiums, while corporate green bonds are more sensitive to the issuer's ESG performance and perceived risk. In addition, the validity of green labels as market signals is increasingly being questioned. Concerns about “greenwashing”-that is, issuers exaggerating environmental benefits without meaningful impact-have affected market trust and investor decision-making. Future research should explore how the rigor and transparency of certification affect pricing and credibility.

5.2 Theoretical controversies and empirical difficulties

In the discussion of green bond pricing, there is ongoing controversy over whether the green label provides a credible market signal. While some scholars argue that such labels indicate an issuer’s commitment to sustainability and help reduce information asymmetry. At the same time, others point out that greenwashing is where environmental claims are exaggerated or misleading. In this way, it can undermine investor confidence. This disconnect between labels and actual impact may lead to mispricing. Also, reduced demand or investor skepticism, especially when green claims are not supported by transparent reporting or third-party certification.

Another major challenge lies in the inconsistency of ESG rating systems. Rating agencies differ significantly in their selection of indicators, weighting schemes, and scoring methodologies. As a result, the same issuer may receive vastly different ESG ratings from different providers, making it difficult to establish uniform benchmarks. This lack of standardization hinders cross-market pricing comparisons and introduces noise into empirical studies. To address this, future research should explore harmonization strategies for ESG metrics. For example, aligning key indicators or developing

unified taxonomies to support more accurate and comparable analysis in global green bond markets.

5.3 Suggestions for Future Research Directions

The study of green bond ESG premium is at the intersection of theoretical deepening and methodological innovation. In the face of the controversies and limitations of existing research, future scholars can further expand the research boundaries in the following four directions to enhance the theoretical explanatory power and policy practicality.

In the future, green bond ESG premium research can be deepened and expanded from four key directions. First, the integration of multi-dimensional ESG indicators and the enhancement of standards is the core breakthrough to deal with the fragmentation of the current rating system. Currently, mainstream research relies on data from a single rating agency, making it difficult to comprehensively reflect the sustainable performance of issuers [10]. In the future, principal component analysis (PCA), factor analysis, and other methods can be introduced to integrate the common information of different ratings and build a multi-dimensional indicator system with reasonable weights covering the E, S, and G dimensions, while promoting the standardization of information disclosure to provide a basis for international comparison.

Second, the mechanism test of micro-investor behavior is still a research gap. Most of the literature assumes that investors prefer green assets, but there is a lack of empirical evidence at the micro level. We can combine the behavioral finance approach with questionnaires, experiments, or investment flow data to explore the differences in the responses of different groups to green bonds, such as the impact of risk tolerance, value orientation and other variables on investment preferences, to clarify the difference between “moral motives” and “return expectations” in green discounting. In this way, the relative weights of “moral motivation” and “return expectation” in green discounting can be clarified.

Third, the linkage effect between the cross-country institutional environment and green bond pricing deserves attention. By building a cross-country panel data model, the impact of institutional differences (e.g., EU Taxonomy vs. China's Green Catalog) on ESG premium can be quantified, and the relationship between regulatory consistency and international synergy in green finance can be examined to assess the policy effectiveness.

Finally, the introduction of artificial intelligence (AI) and machine learning techniques can significantly enhance the analytical capacity of green bond pricing models. Specifically, methods such as XGBoost, neural networks, and natural language processing (NLP) are effective in processing large-scale, unstructured data sources, such as public opinion sentiment, ESG reports, and regulatory disclosures. These tools can uncover nonlinear relationships and hidden patterns that traditional econometric models often overlook, thereby improving the predictive accuracy and explanatory power of ESG premium models in diverse market environments.

6 Conclusion

6.1 Summary of key findings

Through the econometric analysis and core literature interpretation of the literature related to green bond ESG premium in the Web of Science database, this study systematically combs through the research evolution path and focuses on issues in this field, and the main conclusions are as follows:

First, the prevalence of green bond ESG premium has gained more extensive empirical support. It is found that after controlling for credit rating, maturity, and issuer characteristics, green bonds generally have slightly lower yields, showing the phenomenon of "green premium", which reflects the market's recognition of their sustainable attributes, especially in Europe and the United States and other regions with a strong sense of ESG, which is more obvious.

Second, the formation of the ESG premium is influenced by multiple factors, including green certification, disclosure transparency, credit ratings, policy support, market liquidity, and investor preferences. Among them, third-party certification and high-quality disclosure can help enhance the credibility of green labeling, thus increasing the level of premium, and a well-established market is also more conducive to the stable operation of the premium mechanism.

Finally, from a theoretical and practical point of view, ESG premium research promotes the expansion of financial pricing theory to non-financial factors, enhances the cross-fertilization of environmental finance and behavioral finance, and provides important references for policymakers to optimize the green financial system and promote sustainable investment.

6.2 Policy Recommendations

Combining the research findings and current institutional bottlenecks, this paper puts forward the following four policy recommendations:

(1) Strengthen green bond market regulation and standardization. Currently, green bond standards and certification practices remain fragmented across countries. It is recommended to promote the development of a globally unified green taxonomy, drawing from existing frameworks such as the EU Green Taxonomy, to establish consistent definitions of green projects. At the same time, efforts should be made to build an internationally recognized third-party certification system to ensure the credibility of green labels. These measures can help reduce the risk of greenwashing from the source and enhance trust and transparency in global green capital markets.

(2) Improve the quality and consistency of ESG disclosure. ESG-related disclosures significantly influence bond pricing and investment decisions. Therefore, it is necessary to implement mandatory ESG disclosure guidelines that are internationally aligned, such as those developed by the International Sustainability Standards Board (ISSB). Disclosure requirements should cover environmental impacts, fund allocation, and carbon reduction pathways, and promote digitalization and structured formats to enhance cross-border comparability and information interoperability.

(3) Guide long-term investors to participate in green finance. As green projects are long-term in nature, long-term capital such as pensions and insurance companies should

be attracted to invest in green bonds through tax incentives, risk mitigation mechanisms, and incentives. At the same time, investor education and green product ratings should be strengthened to lower the decision-making threshold and expand the depth of the market.

(4) Strengthen international cooperation and cross-border investment facilitation. The development of global green finance cannot be separated from institutional synergy and mutual recognition of policies. It is recommended to strengthen the connection and cooperation with international organizations (such as ICMA, CBI, UN PRI, etc.) to promote mutual recognition of green bond standards, certification systems, and disclosure systems, lower the barriers to cross-border issuance and trading, and enhance the efficiency of the global flow of green capital. At the same time, we should rely on international cooperation platforms such as the "Belt and Road" to promote institutional convergence with developing economies in terms of green classification standards, disclosure frameworks and financing mechanisms, and encourage multilateral development banks (such as the ADB and the World Bank) to participate in green project investment and financing cooperation, so that we can jointly build a green financial ecosystem with global influence and realize the efficient cross-border flow of green capital. A system with global influence that realizes efficient cross-border allocation of green capital.

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