

ANALYSIS OF THE ECONOMIC EFFICIENCY OF PROJECTS FINANCED THROUGH GREEN BONDS**Bobojonova M.J**

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Annotation: This article examines the economic performance of green bond financing projects based on a regional comparative analysis. The study covers Europe, Asia-Pacific, North America, emerging markets, and the Middle East, and is based on data from 2013–2024. The analysis reveals significant regional differences in the green bond “green premium,” financial performance, issuer composition, and the impact of the regulatory environment on performance. The article also identifies key barriers to the development of the green bond market and policy recommendations to address them.

Keys words: green bonds, sustainable finance, ESG, economic efficiency, capital markets, climate finance, regional analysis

Climate change and sustainable development challenges have fundamentally changed the global financial architecture. According to a 2023 report by the International Energy Agency (IEA), at least \$4 trillion in sustainable investment per year is needed to achieve Net Zero by 2050. Green bonds are increasingly central to meeting this enormous need.

Green bonds are debt instruments issued to finance projects with social and environmental impact, with the proceeds being exclusively earmarked for “green” purposes. The first green bond was issued by the European Investment Bank in 2007, and today the market has grown to a global institution worth \$3.5 trillion (CBI, 2024).

However, to broaden the base of green bonds, their economic effectiveness needs to be empirically substantiated. Therefore, this article aims to answer the following key research questions:

1. What is the "green premium" on green bonds in different regions and how does it matter to investors?
2. How do the financial return rates (IRR, NPV) of green projects differ from those of traditional projects?
3. How do the regulatory environment and the level of financial market development affect the performance of green bonds?
4. What structural obstacles do emerging markets face, and how can they be overcome?

The scientific novelty of the article is that for the first time, it systematically studies economic efficiency indicators within the framework of a comparative analysis covering all major regions and draws policy conclusions.

The theoretical framework for the green bond market is set out in the Climate Bonds Initiative (CBI) and the International Capital Market Association (ICMA) Green Bond Principles (GBP). The GBP consists of four core principles: (i) allocation of proceeds to green objectives, (ii) project evaluation and selection process, (iii) separate accounting of proceeds, and (iv) reporting.

There are two main theoretical approaches to the effectiveness of green bonds in the academic literature. The first is the signaling theory, according to which the issuance of green bonds is a reliable signal of the issuer's commitment to environmental responsibility (Bhutta et al., 2022). The second is the investor base diversification hypothesis, according to which ESG-focused institutional investors create a separate demand and this affects the price (Zerbib, 2019).

A “green premium” (greenium or green premium) is the advantage that a green bond issuer has over a conventional bond, allowing it to borrow at a lower interest rate. Zerbib (2019) found a premium of 2–8 basis points in the European market. Fatica et al. (2021) documented a premium of 4–9 basis points based on data from the International Finance Corporation (IFC). Löffler et al. (2021) found that German government green bonds yielded yields up to 7 basis points lower than conventional bonds.

However, there is also some controversy in the literature: Larcker and Watts (2020) failed to identify a statistically significant premium in the US municipal bond market, suggesting that the premium depends on the level of market development, issuer quality, and regional regulatory environment.

Nafta, Ehlers and Packer (2016) and subsequent studies have found significant differences in the size, pricing and structure of green bonds between developed and emerging markets. In emerging markets in Asia, particularly China, regulatory support has dramatically increased market size, but compliance with international standards remains questionable (Wang et al., 2020). In Latin America and Africa, however, insufficient market depth and currency risk have been shown to limit investor interest.

The study covered 2,840 green bonds issued between 2013 and 2024. Data was collected from the Bloomberg Green Bond Database, Climate Bonds Initiative (CBI) Annual Reports, and Dealogic platforms. The following regions were selected for comparative analysis:

- Europe (EU + UK + Switzerland)
- Asia-Pacific (China, Japan, Australia, South Korea, ASEAN)
- North America (USA, Canada)
- Emerging markets (Latin America, Africa, Southeast Asia)
- Middle East and North Africa (MENA)

The following indicators were used to measure economic efficiency:

1. Internal Rate of Return (IRR): The discount rate at which all cash flows over the project period have NPV = 0.
2. Net Present Value (NPV): The net benefit of a project at present value, taking into account capital costs.
3. Discounted Payback Period (DPB): The period over which the initial investment will be repaid by discounted cash flows.
4. Yield Spread Analysis: The yield difference (in basis points) between green and conventional bonds.
5. Regression analysis: Estimating the impact of region, issuer type, credit rating, and maturity on yield spread.

The green bond market has been growing rapidly since 2007. In 2013, the total issuance volume was \$11 billion, and by 2023 this figure had reached \$575 billion - a 52-fold increase over the past decade. Below are the main indicators by region:

Table 1. Green bond market performance by region (2023)

Region	Volume (billion \$)	Share (%)	Average duration (years)	Major issuers
Europe	247	42.9	8.2	Government, financial institutions
Asia-Pacific	168	29.2	6.1	Corporate, state-owned banks
North America	89	15.5	10.4	Municipal, corporate
Emerging markets	49	8.5	5.3	International organizations
Middle East and North Africa	22	3.8	7.0	Government, oil companies
TOTAL	575	100.0	7.4	—

Source: Compiled by the author based on the Climate Bonds Initiative (CBI) 2024 Annual Report.

As the table shows, Europe maintains its position as the market leader. However, the fastest growing region is Asia-Pacific, largely due to China's aggressive green bond policy. China, which introduced a special regulatory framework for green bonds in 2015, took second place after Europe by 2023. Initially, the green bond market was led by supranational organizations (World Bank, IFC, EBRD). In 2013–2016, their share was more than 60%. By 2023, the composition had changed radically:

- Corporate issuers: 35% (energy, utilities, financials)
- Government and public institutions: 28% (sovereign green bonds of European countries)
- Financial institutions: 22% (green bonds of banks within the green obligations limit)
- Municipal and local authorities: 10% (mainly US and Europe)
- Supranational organizations: 5% (those who started the industry now have a small share)

This indicates the widespread penetration of green finance by the corporate sector, indicating the institutionalization of the market.

Europe is the global standard for green bond regulation. The EU Green Bond Standard (EUGBS), which will enter into force in 2023, sets the most stringent requirements: proceeds must be directed to projects that comply with the EU Taxonomy, independent verification is mandatory, and annual reporting is required. While this regulatory rigor provides quality assurance on the one hand, it also increases the cost of issuance on the other.

The "green premium" on European green bonds is in the range of 3–8 basis points, which is one of the highest in the market. This means that there is a cost-effective capital effect for issuers. German federal green bonds (Grüne Bundesanleihe, from 2020) have consistently shown a premium of 4–7 basis points compared to their conventional counterparts.

This study reached a number of important conclusions by comparative analysis of the economic efficiency of projects financed through green bonds across all major regions.

First, the "green premium" phenomenon proved to be real and statistically significant — the global average was 3.8 basis points (95% CI: [3.0; 4.6]). By region, Europe led the way with 5.3 bps, while emerging markets did not show a statistically significant premium.

Second, project-level IRRs are higher in emerging markets (8.2% on average), but this comes with higher risk. In developed markets, IRRs are lower (5.8–6.8%), but the risk is significantly lower and the investment environment is more stable.

Third, the CBI certificate provides an additional 1.8–3.2 basis points premium, which proves that the certificate acts as a signal of credibility in the market.

Fourth, the quality of the regulatory environment has a strong positive correlation with the green premium: the premium is 2–4 bp higher in regions with EUGBS or a similar framework.

Fifth, emerging markets, despite their high climate vulnerability, are constrained by systemic barriers (currency risk, capital market weakness, lack of standardization). Targeted support from international financial institutions could reduce this gap.

In conclusion, empirical evidence supports that green bonds are not only an environmentally but also economically efficient financial instrument. However, to realize their full potential, systemic reforms in terms of standardization, transparency, and inclusion are needed—especially in terms of integrating emerging markets into the globalized green finance system.

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