

# The Impact of Green Bond Issuance on Corporate Financial Performance and Environmental Sustainability: A Quantitative Analysis

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**Abstract:** *This paper explores the impacts of Green Bond issuance on corporate financial performance and environmental sustainability by conducting Spearman's Rank Correlation, Mann-Whitney U Test and Kruskal-Wallis H Test. The data for this purpose has been collected from the Bloomberg terminal. The Results revealed that the issuance of Green Bonds has no statistically significant impact on corporate financial performance. Instead, it was exposed by the results of the Mann-Whitney U Test and Kruskal-Wallis H Test. The current study findings have identified a weak relationship between the issuance of Green Bonds and corporate financial performance and failed to demonstrate a strong impact on the financial performance of firms due to issuing Green Bonds. However, the scope of this study remains broad for future studies to focus more on how Green Bonds could play a potential role in fostering sustainable development as well as the achievement of corporate financial success.*

**Keywords:** *Green bonds, corporate financial performance, ESG risk score, sustainable finance, green bond market in India, environmental risk, capital market sustainability.*

## 1. Introduction

The past decade has marked the green bond market in a way that has become a very important tool for financing environmentally sustainable projects and initiatives. This was especially true in emerging economies such as India, whose need for environmental conservation and sustainable development has reached critical levels. Green bonds are debt instruments issued to raise capital for projects that have environmental benefits, such as renewable energy, energy efficiency and pollution reduction (Abhilash, Shenoy, & Shetty, 2024). Increasing green bonds in India reflects the country's commitment towards its climate goals under the Paris Agreement. In this regard, there is a need to understand their impact on corporate financial performance and sustainability outcomes.

The most important point of research deals with the financial performance of companies that issue green bonds. It is generally accepted that firms with effective ESG policies, such as green bond issuance, have better financial performance and investor confidence (Afeku-Amenyo, 2022). Several studies support this theory by showing that green bond issuers reduce their cost of capital, increase access to financing and improve market perception (Mingfang, 2024). The ESG factors have increasingly become relevant for investors and green bonds have been perceived to be an attractive financial instrument for further strengthening the financial position of companies engaged in environmental sustainability.

The Indian context also brings forth unique challenges and

opportunities in the green bond market. India has high renewable energy target setting, both by 2022 with the capacity of reaching 175GW and by 2030, where it aims for 500 GW. This causes a high level of demand for green bond financing infrastructure projects that will benefit these targets. However, awareness and regulatory aspects related to a specific market face many challenges, including the unawareness of its investors, missing frameworks of their respective regulations and requirements of their standard reporting-on an Indian aspect (Liu, 2024). And overcoming these limitations can play important roles in heightening the efficiencies of green bonds, both in the performance of company issues and to impact the concern on environmental issue.

The Indian corporate sector is increasingly recognizing the linkage between environmental sustainability and corporate performance. Companies that issue green bonds contribute not only to the environmental goals but also place them at the helm of corporate sustainability, which might enhance their reputation in the market and gain customer loyalty (Jaycocks, 2019). The social impact of green bonds is equally important since many green bond projects are focused on energy access, water conservation and poverty alleviation; hence, contributing to the bigger SDGs. The Indian green bond market has had tremendous growth over recent years. As one of the leading Asian economies, India is one of the most exposed economies to climate change effects. This has made the private and public sectors look for alternative sustainable funding. The issuance of green bonds in India has therefore become part and parcel of the country's efforts towards achieving renewable energy

targets and combating climate change (Mingfang, H., 2024). Indian companies, especially within energy, infrastructure and real estate companies, have been applying green bonds to finance initiatives related to clean energy, waste management and more environmentally related projects in the country (Abhani Dhara, K., & Desai, J., 2023).

The increased trend of green bonds in India and other countries suggests that the environmental issues can only be dealt with through financial innovations and is gradually becoming a conscious awareness among stakeholders. The attention given to green financing has resulted in the development of indices as well as a set of norms that have further guided issuers and investors who wish to provide and acquire their green bonds and also guarantee proper clarity (Jaycocks, A., 2019). Such norms guide the projects regarding credibility while being green-oriented in order to attract sufficient confidence toward investors, both in terms of financial and environmental issues involved in the processes.

Emerging markets, including India, have also seen growth in green bond issuances, though the growth pace is slower than that of developed markets. The Indian market, however, has been promising, especially with the increasing efforts of the Indian government to support green infrastructure projects. (Upadhyay, S. (2024) emphasizes that India's green bond market is becoming more active, with many state-owned enterprises and private corporations issuing green bonds to fund renewable energy projects, energy efficiency initiatives and green building construction.

The Indian Green Bond market has come to represent a critical source of financing for environmentally sustainable projects. The market is expanding rapidly, with the increasing interest from companies and government entities in raising funds for projects in the field of renewable energy, energy efficiency and environmental conservation. A Green Bond, therefore, is a class of fixed income instruments especially for use in funding projects which verifiably have environmental value. A very fast growing space among companies in India and investors alike, the chapter explores trends and developments within India's Green Bond market- the key drivers, challenges and future prospects.

## 2. Literature Review

Nugraha (2022) assesses the sustainable impact of green bonds from a management accounting perspective, revealing insights into how these instruments influence issuing companies' sustainability practices. Green bonds are debt instruments issued to finance or refinance environmentally friendly projects and have been issued tenfold over the past decade (ICMA, 2023). Although much has been researched into their pricing and issuance motivations, as in Flammer (2021) and Maltais & Nykvist (2020), this study fills the rather unexplored area of their actual effects on sustainability. The study applies the

framework of management control systems in understanding through four expert interviews, how green bonds operationalize mechanisms toward driving sustainable change. The results indicate that the primary impact of green bonds originates from organizational cultural control systems that encourage an orientation toward sustainability and sustainability practice.

Climate finance and the development of the green bond market Jaycocks (2020) acknowledges the importance of private sector engagement as a way to overcome climate challenges. Mao (2020) examines how sustainability experiments in green bonds contribute to sustainability transitions. The findings reveal that networks in green bonds depend on already existing business ties, whereas sustainability experiments align the expectations of various stakeholders and generate learning through frameworks, performance evaluation and experience sharing. Landscape-level pressures, such as climate change and supportive regime-level elements like market preferences and government backing, create avenues for green bonds to influence transitions, but opportunities abound, however, including but not limited to: lack of easy access to information on projects, weak civil society engagement and a need for more formalized learning processes. The study sheds light on the potential of green bonds to inspire climate mitigation and adaptation efforts globally, providing insights into overcoming barriers to scaling sustainability initiatives.

Alharbi et al. (2023) examine the efficiencies of in-house manufacturing versus outsourcing in garment production through a network DEA model and finds that in-house cutting and outsourcing sewing show similar efficiencies, but outsourcing has cost and speed advantages. Analysis by Manoharan et al. (2017) focuses on the impact of rising nationalism on consumer behaviour in India and finds that nationalistic branding affects buying motivations, but the authenticity of such campaigns is still in question. Zheng et al. (2023) looks at the role of guanxi in multicultural academic environments, showing its importance in the Chinese context and its linkage to Hofstede's cultural dimensions in research collaboration. Andi et al. (2018) argue that research gaps exist in the area of entrepreneurship in emerging markets (EMs) due to the ignorance of specific contexts unique to EMs, which include poor infrastructure, institutional voids and governance challenges. Wang (2022) explores how quality corporate governance impacts the preferences for green bond issuance based on an international dataset consisting of 336 green bond and 13,408 conventional bond issuances from 30 economies. These results underscore the significance of governance quality in shaping sustainable finance decisions.

Ghosh A (2023) explore the effect of green bonds on carbon emissions and GDP growth, focusing specifically on the Indian

economy. The study finds a significant and positive impact of green bond investments on both reducing carbon emissions and promoting GDP growth, suggesting that green bonds can drive sustainable development. Liu (2024) explores the governance of green bonds in China, focusing on the key drivers behind their "greenness" in the context of the bond market's growth. Among its findings, this study identifies the five major influences on green bond governance: these are regulators, bond issuers, investors, auditors and regional authorities.

According to the Mingfang's Study (2023), it focuses on the development of green finance through the industrial bank's issuance of Sustainable Development Bonds. This study seeks to understand the efforts by the bank towards green finance promotion and the influence of these bonds on the bank's business, market response and the larger green economy. The study is intended to advise other commercial banks on how to better enhance their green finance initiatives. From the findings, key observations indicate that Industrial Bank has managed to use its sustainable development bonds to increase its green finance activities while maintaining considerable support toward the transition of the economy of China to a greener one.

Kovačević et al. (2023) discuss the impact of existing green bond standards on the application of proceeds from green bond issuances, focusing on the limitations of these standards and their potential for improvement. The study reveals the problem of "greenwashing," which occurs when issuers mislead investors about the actual environmental impact of their projects. Kovačević et al. (2023) conclude that there is a significant need for more detailed and harmonized standards to enhance the credibility and effectiveness of the green bond market, ensuring that funds are used as intended and fostering greater market growth and investor confidence. This study provides critical insights for regulators, issuers and investors in advancing the green bond market.

### 3. Research methodology

This study examines the impact of green bond issuance on corporate financial performance and environmental sustainability, assessing whether green bonds contribute to financial growth and improved sustainability outcomes. The issuance of green bonds has garnered popularity as an instrument that propels corporate sustainability, but also arguably enhances the corporation's financial performance. Yet, whether the issuance of green bonds increases corporate financial ratios such as revenue, net income and ROA is unexplored within the Indian markets (Abhilash, Shenoy, & Shetty, 2024). While studies conducted in developed markets have reported a positive correlation between green bonds and financial performance, only a few such studies are available in the context of whether the benefits are available for the Indian

corporate landscape as well (Fatima, 2023). The literature points out that green bonds minimise environmental risk because they fund projects that contribute to nature. It also assists in improving the ERS of a firm (Nugraha, 2022). However, issues such as greenwashing and less uniform regulatory policies pose a challenge for measuring the effect of such regulations Kovačević et al. (2023). For the Indian context, regulatory efforts from SEBI and RBI brought some standards in green bonds, but whether such regulations affect corporate financial performance remains uncertain (Mingfang, 2024).

Empirical results of the global markets show mixed results. While some research studies indicate that lesser capital costs and better market perception could be obtained (Afeke-Amenyo, 2022), other researches argue that the financial benefits are industry-specific and investor sentiment-specific. Furthermore, Indian firms have several distinctive issues; these include high issuance costs, sceptical investors and also an immature green bond market for issues (Chandrasekaran, 2018). Considering these areas of a gap, the present research study makes a quantitative analysis about relationships between Green Bond Issuance, Corporate Financial Performance and Environmental Sustainability in India, validated by Spearman's Rank Correlation, Mann-Whitney U Test and Kruskal-Wallis H Test.

#### 3.1 Objectives of the study

1. To examine the relationship between Green Bond Issuance and corporate financial performance (Revenue, ROA, Net Income).
2. To analyse whether Green Bond Issuance significantly influences environmental sustainability (Environmental Risk Score).
3. To compare financial performance between companies with high and low levels of Green Bond Issuance. Variables Classification

This study seeks to investigate how Green Bond Issuance has affected corporate financial performance and sustainability outcomes in an Indian context. While green bonds have gained prominence globally, research on their implications for corporate revenues, profitability and sustainability performance in emerging markets is still an open area. The research mainly takes into consideration the relationship of Green Bond Issuance, in millions of USD, to the key financial indicators, that is, revenue, net income and Return on Assets, to check whether this green financing aids corporate performance or not. Finally, it takes into account whether green bonds also affect ERS or not by measuring their performance towards sustainability issues.

The study is confined to Indian companies that have issued green bonds, which allows a contextualized analysis of financial

and sustainability outcomes. A comparison between firms with high and low levels of Green Bond Issuance will help in determining whether higher participation in green finance translates into measurable advantages.

This study makes use of the quantitative approach in order to examine the impact that Green Bond Issuance may have on the corporate financial performance and environmental sustainability. The emphasis is on the Indian companies that have issued green bonds; it would thus make possible an industry-specific analysis of financial and sustainability outcomes. The database combines firm-level data on a yearly basis on green bond issuance (number of bonds and total amount raised) with performance indicators from 2020 to 2024. These include financial metrics such as revenue, operating income, net income, ROA and ROE, as well as sustainability measures like ESG risk scores and the S&P Global ESG score. The data scope covers the largest global companies, including Microsoft, Apple, Alphabet, Tesla, General Motors, Siemens, Unilever and Procter & Gamble, which ensures representation of different kinds of industries. Such firms have consistently raised green bonds, which makes this sample relevant for the study of the trend of financial and environmental performance. Concentrating on 2020-2024 will provide both short-term and long-term impact of green bond issuance, which can be sorted to study and analyse the trends and patterns across various years (Fatima, 2023).

This research will be based on a quantitative research approach that utilizes secondary data acquired from Bloomberg terminal, which are credible and exhaustive financial and sustainability metrics for firms that have issued green bonds. The dataset will be for a number of years, 2020-2024 and for firms across different industries to perform a longitudinal analysis of the effect of Green Bond Issuance on Corporate Financial Performance and Environmental Sustainability. It has very well been accepted that green bonds are identified as an alternative source of funding of sustainable projects and their financial analysis is still subjected to persistent research study work (Abhilash, Shenoy, & Shetty, 2024).

### 3.2 Hypothesis

- $H_0$  (Null Hypothesis): There is no significant correlation between Green Bond Issuance and corporate financial performance (Revenue, ROA, Net Income).
- $H_1$  (Alternative Hypothesis): There is a significant correlation between Green Bond Issuance and corporate financial performance.
- $H_0$  (Null Hypothesis): There is no significant difference in financial performance (Revenue, ROA, Net Income) between companies with High vs. Low Green Bond Issuance.

- $H_1$  (Alternative Hypothesis): There is a significant difference in financial performance between companies with High vs. Low Green Bond Issuance.
- $H_0$  (Null Hypothesis): There is no significant difference in Environmental Risk Score across different levels of Green Bond Issuance.
- $H_1$  (Alternative Hypothesis): There is a significant difference in Environmental Risk Score across different levels of Green Bond Issuance.

## 4. Data Analysis

### 4.1 Tests of Normality

**Table 1: Case Processing Summary & Test of Normality**

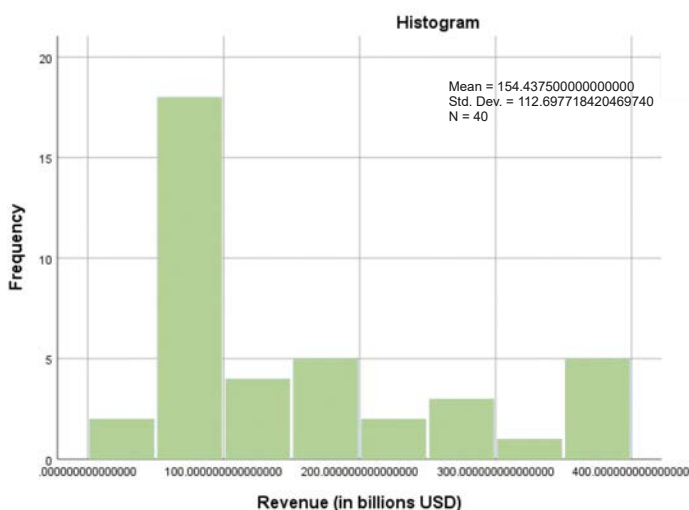
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Revenue (in billions USD)	40	100.0%	0	0.0%	40	100.0%
Operating Income (in billions USD)	40	100.0%	0	0.0%	40	100.0%
Net Income (in billions USD)	40	100.0%	0	0.0%	40	100.0%
Return on Assets (ROA)	40	100.0%	0	0.0%	40	100.0%
Return on Equity (ROE)	40	100.0%	0	0.0%	40	100.0%
ESG Risk Score	40	100.0%	0	0.0%	40	100.0%
Environmental Risk	40	100.0%	0	0.0%	40	100.0%
Social Risk	40	100.0%	0	0.0%	40	100.0%
Governance Risk	40	100.0%	0	0.0%	40	100.0%
S&P Global ESG Score	40	100.0%	0	0.0%	40	100.0%

	Tests of Normality					
	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Revenue (in billions USD)	.201	40	.000	.851	40	.000
Operating Income (in billions USD)	.318	40	.000	.787	40	.000
Net Income (in billions USD)	.332	40	.000	.786	40	.000

*contd....*

Tests of Normality						
	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Return on Assets (ROA)	.149	40	.025	.927	40	.013
Return on Equity (ROE)	.286	40	.000	.654	40	.000
ESG Risk Score	.215	40	.000	.925	40	.011
Environmental Risk	.244	40	.000	.778	40	.000
Social Risk	.245	40	.000	.847	40	.000
Governance Risk	.240	40	.000	.839	40	.000
S&P Global ESG Score	.271	40	.000	.822	40	.000

**Revenue (in billions USD)**



To determine whether the dataset follows a normal distribution, the Kolmogorov-Smirnov (K-S) and Shapiro-Wilk tests were conducted for all financial performance and sustainability variables. The null hypothesis ( $H_0$ ) for these tests states that the data is normally distributed. If the significance value (Sig.) is less than 0.05, the null hypothesis is rejected, indicating non-normality.

The results of the Kolmogorov-Smirnov and Shapiro-Wilk tests, as presented in Table 1, reveal the following:

**1. Financial Performance Metrics :** Revenue ( $p < 0.001$ ), Operating Income ( $p < 0.001$ ), Net Income ( $p < 0.001$ ), Return on Equity (ROE) ( $p < 0.001$ ) and Return on Assets (ROA) ( $p=0.013p = 0.013p=0.013$  where  $p < 0.001$ ) all exhibit significant values below 0.05. This indicates a deviation from normality for all financial performance variables.

**2. Sustainability Metrics:** ESG Risk Score ( $p=0.011p$  where  $p < 0.001$ ), Environmental Risk ( $p < 0.001$ ), Social Risk ( $p < 0.001$ ), Governance Risk ( $p < 0.001$ ) and the S&P Global ESG Score ( $p < 0.001$ ) also exhibit significance values below 0.05. This confirms that the sustainability variables do not follow a normal distribution.

**4.2 Correlation Analysis (Hypothesis 1)**

**Table 2: Nonparametric Correlations**

Correlations					
		Green Bond Amount (in millions USD)	Revenue (in billions USD)	Operating Income (in billions USD)	
Spearman's rho	Green Bond Amount (in millions USD)	Correlation Coefficient	1.000	-.141	-.228
		Sig. (2-tailed)	.	.387	.158
		N	40	40	40
Revenue (in billions USD)	Revenue (in billions USD)	Correlation Coefficient	-.141	1.000	.846**
		Sig. (2-tailed)	.387	.	.000
		N	40	40	40
Operating Income (in billions USD)	Operating Income (in billions USD)	Correlation Coefficient	-.228	.846**	1.000
		Sig. (2-tailed)	.158	.000	.
		N	40	40	40
Net Income (in billions USD)	Net Income (in billions USD)	Correlation Coefficient	-.235	.880**	.991**
		Sig. (2-tailed)	.144	.000	.000
		N	40	40	40
Return on Assets (ROA)	Return on Assets (ROA)	Correlation Coefficient	-.202	.750**	.945**
		Sig. (2-tailed)	.212	.000	.000
		N	40	40	40
Return on Equity (ROE)	Return on Equity (ROE)	Correlation Coefficient	-.126	.617**	.856**
		Sig. (2-tailed)	.439	.000	.000
		N	40	40	40
ESG Risk Score	ESG Risk Score	Correlation Coefficient	-.269	-.364*	-.251
		Sig. (2-tailed)	.094	.021	.118
		N	40	40	40
Environmental Risk	Environmental Risk	Correlation Coefficient	-.067	-.566**	-.390*
		Sig. (2-tailed)	.681	.000	.013
		N	40	40	40

contd....

			Green Bond Amount (in millions USD)	Revenue (in billions USD)	Operating Income (in billions USD)
Social Risk	N		40	40	40
	Correlation Coefficient		-.109	-.339*	-.347*
	Sig. (2-tailed)		.503	.033	.028
	N		40	40	40
Governance Risk	Correlation Coefficient		-.248	.083	.090
	Sig. (2-tailed)		.123	.611	.582
	N		40	40	40
S&P Global ESG Score	Correlation Coefficient		-.088	.032	.133
	Sig. (2-tailed)		.588	.847	.415
	N		40	40	40

**Correlations**

			Net Income (in billions USD)	Return on Assets (ROA)	Return on Equity (ROE)
Spearman's rho	Green Bond Amount (in millions USD)	Correlation Coefficient	-.235	-.202	-.126
		Sig. (2-tailed)	.144	.212	.439
		N	40	40	40
	Revenue (in billions USD)	Correlation Coefficient	.880**	.750**	.617**
		Sig. (2-tailed)	.000	.000	.000
		N	40	40	40
	Operating Income (in billions USD)	Correlation Coefficient	.991**	.945**	.856**
		Sig. (2-tailed)	.000	.000	.000
		N	40	40	40
	Net Income (in billions USD)	Correlation Coefficient	1.000	.926**	.833**
		Sig. (2-tailed)	.	.000	.000
		N	40	40	40
	Return on Assets (ROA)	Correlation Coefficient	.926**	1.000	.934**
		Sig. (2-tailed)	.000	.	.000
		N	40	40	40
Return on Equity (ROE)	Correlation Coefficient	.833**	.934**	1.000	

contd....

			Net Income (in billions USD)	Return on Assets (ROA)	Return on Equity (ROE)
	ESG Risk Score	Sig. (2-tailed)	.000	.000	.
		N	40	40	40
		Correlation Coefficient	-.254	-.343*	-.279
	Environmental Risk	Sig. (2-tailed)	.113	.030	.081
		N	40	40	40
		Correlation Coefficient	-.416**	-.455**	-.342*
	Social Risk	Sig. (2-tailed)	.008	.003	.031
		N	40	40	40
		Correlation Coefficient	-.316*	-.496**	-.397*
	Governance Risk	Sig. (2-tailed)	.047	.001	.011
		N	40	40	40
		Correlation Coefficient	.078	.191	.108
	S&P Global ESG Score	Sig. (2-tailed)	.633	.238	.507
		N	40	40	40
		Correlation Coefficient	.097	.182	.165
	Sig. (2-tailed)	.553	.261	.309	
	N	40	40	40	
	Correlation Coefficient	.000	.000	.000	

**Correlations**

			ESG Risk Score	Environmental Risk	Social Risk
Spearman's rho	Green Bond Amount (in millions USD)	Correlation Coefficient	-.269	-.067	-.109
		Sig. (2-tailed)	.094	.681	.503
		N	40	40	40
	Revenue (in billions USD)	Correlation Coefficient	-.364*	-.566**	-.339*
		Sig. (2-tailed)	.021	.000	.033
		N	40	40	40
	Operating Income (in billions USD)	Correlation Coefficient	-.251	-.390*	-.347*
		Sig. (2-tailed)	.118	.013	.028
		N	40	40	40

contd....

		ESG Risk Score	Environmental Risk	Social Risk
Net Income (in billions USD)	Correlation Coefficient	-.254	-.416**	-.316*
	Sig. (2-tailed)	.113	.008	.047
	N	40	40	40
Return on Assets (ROA)	Correlation Coefficient	-.343*	-.455**	-.496**
	Sig. (2-tailed)	.030	.003	.001
	N	40	40	40
Return on Equity (ROE)	Correlation Coefficient	-.279	-.342*	-.397*
	Sig. (2-tailed)	.081	.031	.011
	N	40	40	40
ESG Risk Score	Correlation Coefficient	1.000	.577**	.798**
	Sig. (2-tailed)	.	.000	.000
	N	40	40	40
Environmental Risk	Correlation Coefficient	.577**	1.000	.754**
	Sig. (2-tailed)	.000	.	.000
	N	40	40	40
Social Risk	Correlation Coefficient	.798**	.754**	1.000
	Sig. (2-tailed)	.000	.000	.
	N	40	40	40
Governance Risk	Correlation Coefficient	.274	-.484**	-.235
	Sig. (2-tailed)	.087	.002	.145
	N	40	40	40
S&P Global ESG Score	Correlation Coefficient	-.002	-.395*	-.448**
	Sig. (2-tailed)	.988	.012	.004
	N	40	40	40

**Correlations**

		Governance Risk	S&P Global ESG Score
Spearman's rho	Green Bond Amount (in millions USD)	Correlation Coefficient	-.248
		Sig. (2-tailed)	.123
		N	40
	Revenue (in billions USD)	Correlation Coefficient	.083
		Sig. (2-tailed)	.611
		N	40

contd....

		Governance Risk	S&P Global ESG Score
Operating Income (in billions USD)	Correlation Coefficient	.090	.133
	Sig. (2-tailed)	.582	.415
	N	40	40
Net Income (in billions USD)	Correlation Coefficient	.078	.097
	Sig. (2-tailed)	.633	.553
	N	40	40
Return on Assets (ROA)	Correlation Coefficient	.191	.182
	Sig. (2-tailed)	.238	.261
	N	40	40
Return on Equity (ROE)	Correlation Coefficient	.108	.165
	Sig. (2-tailed)	.507	.309
	N	40	40
ESG Risk Score	Correlation Coefficient	.274	-.002
	Sig. (2-tailed)	.087	.988
	N	40	40
Environmental Risk	Correlation Coefficient	-.484**	-.395*
	Sig. (2-tailed)	.002	.012
	N	40	40
Social Risk	Correlation Coefficient	-.235	-.448**
	Sig. (2-tailed)	.145	.004
	N	40	40
Governance Risk	Correlation Coefficient	1.000	.492**
	Sig. (2-tailed)	.	.001
	N	40	40
S&P Global ESG Score	Correlation Coefficient	.492**	1.000
	Sig. (2-tailed)	.001	.
	N	40	40

To evaluate the relationship between Green Bond Issuance and Corporate Financial Performance, Spearman's Rank Correlation was employed due to the non-normality of the dataset, as confirmed in Section 4.1. The results of the correlation analysis are presented in Table 2.

**Interpretation of Correlation Coefficients**

**Green Bond Issuance and Financial Performance**

The correlation between Green Bond Issuance (Amount in millions USD) and Revenue is weak and negative ( $\rho = -0.141, p = 0.387, p = 0.387$ ), indicating no statistically significant association. Similarly, Net Income, Operating Income, ROA and ROE all exhibit weak, negative correlations with Green Bond Issuance, none of which are

statistically significant at the 5% level. This suggests that Green Bond Issuance does not exhibit a meaningful direct correlation with corporate financial performance metrics.

## Interrelationships Among Financial Performance Variables

Strong positive correlations exist between Revenue and Net Income ( $\rho=0.880, p<0.001$ ), Operating Income ( $\rho=0.846, p<0.001$ ) and ROA ( $\rho=0.750, p<0.001$ ) confirming the intrinsic relationships among financial indicators. Operating Income also strongly correlates with Net Income and ROA, reinforcing the coherence of these financial measures.

**Green Bond Issuance and Sustainability Metrics-** The correlation between Green Bond Issuance and ESG Risk Score is negative but not statistically significant ( $\rho=-0.269, p=0.094$ ). Similarly, Environmental Risk, Social Risk and Governance Risk show weak and statistically insignificant correlations with Green Bond Issuance. These findings suggest that Green Bond Issuance does not have a strong direct impact on ESG risk factors.

**Sustainability Metrics Interrelationships-** Strong inter-correlations are observed among sustainability variables, with ESG Risk Score significantly correlated with Environmental Risk ( $\rho=0.577, p<0.001$ ), Social Risk ( $\rho=0.798, p<0.001$ ) and Governance Risk ( $\rho=0.274, p=0.087$ ). Environmental Risk and Social Risk also exhibit a strong positive correlation, reinforcing the interconnected nature of ESG risk components

## Hypothesis Testing Outcome

**$H_0$  (Null Hypothesis):** There is no significant correlation between Green Bond Issuance and corporate financial performance.

**$H_1$  (Alternative Hypothesis):** There is a significant correlation between Green Bond Issuance and corporate financial performance.

Since all correlation coefficients between Green Bond Issuance and financial performance indicators (Revenue, Net Income, Operating Income, ROA, ROE) are weak and statistically insignificant ( $p>0.05$ ), we fail to reject the null hypothesis ( $H_0$ ). This indicates that Green Bond Issuance does not have a statistically significant direct correlation with corporate financial performance in this sample.

## 4.3 Non-Parametric Analysis (Hypothesis 2&3)

**Table 3: Mann-Whitney Test**

Ranks				
	GBIChighlow	N	Mean Rank	Sum of Ranks
Environmental Risk	1.00	21	20.33	427.00

contd....

	GBIChighlow	N	Mean Rank	Sum of Ranks
	2.00	19	20.68	393.00
	Total	40		

### Test Statistics

	Environmental Risk
Mann-Whitney U	196.000
Wilcoxon W	427.000
Z	-.095
Asymp. Sig. (2-tailed)	.924
Exact Sig. [2*(1-tailed Sig.)]	.936b

a. Grouping Variable: GBIChighlow

b. Not corrected for ties.

A benchmark for green bond issuance refers to the key indicators used to assess its market quality and performance, including issue size, pricing (greenium), investor demand and credit quality. A high benchmark green bond typically has a large size, strong demand and a lower yield than comparable conventional bonds, while a low benchmark issue is smaller, less liquid and shows little or no pricing advantage.

To examine whether firms with higher Green Bond Issuance (GBI) experience significantly different environmental and sustainability risks compared to firms with lower Green Bond Issuance, the Mann-Whitney U Test and Kruskal-Wallis H Test were employed. These non-parametric tests were chosen due to the non-normality of the data, as determined in Section 4.1.

## Mann-Whitney U Test: Environmental Risk

The Mann-Whitney U test was conducted to compare the Environmental Risk Scores of firms with high and low Green Bond Issuance (GBI). The results are summarized in Table 3.

Key Results:

- **Mean Rank (High GBI):** 20.33
- **Mean Rank (Low GBI):** 20.68
- **Mann-Whitney U:** 196.000
- **Wilcoxon W:** 427.000
- **Z-score:** -0.095
- **Asymptotic Significance (2-tailed):**  $p=0.924$
- **Exact Significance (2-tailed):**  $p=0.936$

Since the p-value is greater than 0.05, the result is not statistically significant, meaning that there is no substantial difference in Environmental Risk Scores between firms with high and low Green Bond Issuance.

## Hypothesis Testing Outcome

- **H<sub>0</sub> (Null Hypothesis):** There is no significant difference in environmental risk and ESG risk between firms with high and low Green Bond Issuance.
- **H<sub>1</sub> (Alternative Hypothesis):** Firms with high Green Bond Issuance have significantly lower environmental risk and ESG risk compared to those with low Green Bond Issuance.

The Mann-Whitney U test results suggest no significant difference in Environmental Risk Scores ( $p=0.924$   $p = 0.924$ ). Therefore, we fail to reject the null hypothesis ( $H_0$ ) for Environmental Risk.

### Hypothesis 3: Difference in ESG Risk Score Across Different Levels of Green Bond Issuance

**Table 4: Kruskal-Wallis Test**

Ranks			
	GBIChighlow	N	Mean Rank
ESG Risk Score	1.00	21	20.60
	2.00	19	20.39
	Total	40	

a. Kruskal-Wallis Test

b. Grouping Variable: GBIChighlow

	ESG Risk Score
Kruskal-Wallis H	.003
df	1
Asymp. Sig.	.957

### Hypothesis Statement:

- **H<sub>0</sub>:** There is no significant difference in ESG Risk Scores between firms with high and low levels of Green Bond Issuance.
- **H<sub>1</sub>:** There is a significant difference in ESG Risk Scores between firms with high and low levels of Green Bond Issuance.

**Test Conducted:** Kruskal-Wallis H Test

#### Results:

- **Mean Rank (High GBI):** 20.60
- **Mean Rank (Low GBI):** 20.39
- **Kruskal-Wallis H:** 0.003
- **Degrees of Freedom (df):** 1
- **p-value (Asymp. Sig.):** 0.957

Since the p-value is greater than 0.05, the results indicate no statistically significant difference in ESG Risk Scores between firms with high and low Green Bond Issuance.

Kruskal Wallis Test is presented in Table 4.

## 5. Conclusion

As per the study findings, the companies should enhance the transparency over the issuance process of their Green Bonds and reporting. The integration of transparent reporting on environmental as well as financial impacts of Green Bonds may attract more investors and build up credibility for the green finance market (Ngunjiri, 2022). The overall ESG Risk Score had an asymptotic significance of 0.957 for the Kruskal-Wallis H Test, thereby indicating that issuance of Green Bond does not influence the ESG risk scores of corporations under consideration.

Because of these outcomes, they are consistent with other studies apart from the one under discussion; Ngunjiri (2022) add that the results were mixed on the financial performance of Green Bonds. Despite all the motivational underpinnings of Green Bonds being for a positive cause - focusing more on financing environmentally friendly projects, the results of this study failed to show a strong impact on the financial performance of firms due to issuing Green Bonds. However, it must be noted that while the financial benefits are not directly manifested in Green Bonds, they could be part of the long-term sustainability objectives of organizations and the environment at large.

This study shows that there is no significant relationship between Green Bonds and corporate financial performance. This indicates that further research may be necessary to explore other factors, such as governance models, investor behaviour and regional variations, which may explain the nuanced role of Green Bonds in corporate strategy. Therefore, although Green Bonds represent a promising tool for sustainable financing, the direct financial impact might need further investigation in future studies.

Companies should take the integration of more comprehensive Environmental, Social and Governance (ESG) metrics into Green Bond frameworks in order to capture a more holistic sustainability approach. This would bridge gaps in the understanding of true environmental impact for Green Bond proceeds (Fatima, 2023). Encouragement of green finances can be achieved by the establishment of friendly government policies, fiscal incentives and administrative frameworks that influence the issuance of Green Bonds; this will motivate a larger issue of green instruments (Mejía et al. 2021).

While Green Bonds focus more on climate risks, financial performance considerations cannot be ignored. Companies should align their Green Bond strategy with long-term financial goals to balance environmental goals with profit-making aspirations (Jaycocks, 2019).

The firms should be able to diversify the investor base through reaching SRI funds and institutional investors to achieve a sustainable investment opportunity. The Demand for Green

Bonds shall be driven by their awareness regarding long-term benefits, which include both environmental and financial. Awareness programs will uplift knowledge among investors, financial analysts and companies regarding the benefits received through sustainable development relating to Green Bonds, Yang et al. (2024)

## Scope of Future Study

Future research may benefit from long-term longitudinal studies where researchers analyse the long-term financial implications of the issuance of Green Bonds on the companies' performance. Over an extended period, data analysis will enable researchers to evaluate if the consequences are sustained over time on both the financial performance and the environment (Ngunjiri, 2022).

Other area of study also comprises governance mechanisms connected with Green Bond issuance. Future researchers may note how diverse governance structures have implications on the performance of Green Bonds in relation to the delivered promised sustainability performance (Wang, 2022).

Further, A study could be conducted to examine how investors use behavioral finance in determining their decision to invest in Green Bonds. Understanding the risk appetite and environmental concerns that drive the investors would give a little insight into enhancing the attractiveness of Green Bonds to different groups of investors (Mejía et al. 2021).

Exploring the role of Green Bonds in emerging markets, particularly for those countries whose green finance markets are relatively underdeveloped, has not yet been fully explored. Future research may be conducted on how the Green Bonds can be used as a resource to develop sustainable economies by overcoming financial as well as infrastructural challenges

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