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A Study on Performance of Green Bonds Vs Traditional Fixed Income Assets

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Abstract: This study investigates the historical performance, risk-return profile, and correlation of green bonds relative to traditional fixed income securities. Using monthly data from January 2021 to December 2024, the research evaluates the price trends of IRFC green bonds and PFC traditional bonds. Findings reveal that although traditional bonds achieved higher peak prices, green bonds exhibited more consistent and stable performance over time. The price correction phase for green bonds was notably smoother, reflecting reduced volatility and better resilience.

Key risk-return metrics—including the Sharpe ratio, standard deviation, and beta—further reinforce the attractiveness of green bonds. With a Sharpe ratio of 64.76 and a standard deviation of 60.47%, green bonds deliver strong risk-adjusted returns and moderate volatility, making them suitable for conservative and ESG-focused investors. Additionally, the beta value of 0.0182 indicates minimal market sensitivity, highlighting their potential role in portfolio diversification.

Moreover, the correlation analysis shows a strong positive relationship (r = 0.9847) between the returns of green and traditional bonds, suggesting their performance is influenced by common economic and financial drivers. The study concludes by affirming that green bonds not only offer a favourable risk-return balance but also align closely with the broader fixed income market trends. These findings contribute to a better understanding of green financial instruments and support their inclusion in sustainable investment strategies.

Keywords: Green Bonds, Traditional Fixed Income Securities, Bond Performance, ESG Investment.

I. INTRODUCTION

In the context of global efforts to combat climate change and promote sustainable development, financial markets have witnessed a rapid evolution with the emergence of green financial instruments. One of the most notable innovations in this space is the green bond—a type of fixed income security designed to raise funds for projects that have a positive impact on the environment. These projects include renewable energy installations, pollution prevention, climate adaptation, and resource conservation. Since their introduction in 2007, green bonds have gained considerable attention from both public and private investors, supported by growing awareness and international commitments such as the Paris Agreement and the UN Sustainable Development Goals.

Despite the noble objectives behind green bonds, investors are increasingly concerned with whether these instruments can offer returns and stability comparable to traditional fixed income assets, such as government or corporate bonds. Traditional bonds have long been favoured for their predictable income streams and lower risk compared to equities. As green bonds enter mainstream portfolios, there arises a need for a comparative analysis of their performance, not only in terms of ethical value but also financial viability.

Green finance refers to the financial arrangements that are specific to the use for projects that are environmentally sustainable or projects that adopt the aspects of climate change. Environmentally sustainable projects include the production of energy from renewable sources like solar, wind, biogas, etc.; clean transportation that involves lower greenhouse gas emission; energy efficient projects like green building; waste management that includes recycling, efficient disposal and conversion to energy, etc. Moreover, project defined sustainable under the disclosure requirement for Green Debt Securities include climate change adaptation, sustainable waste and water managements, sustainable land use including sustainable forestry and agriculture, and biodiversity conservation (SEBI 2017). In order to meet the financial needs for these types of projects, new financial instruments such as green bonds; carbon market instruments

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(e.g. carbon tax); and new financial institutions (e.g. green banks and green funds) are being established. They together constitute green finance1.

Green finance is central to the overall discussion on sustainability of economic growth. Rapid economic development is often achieved at the cost of environment. Dwindling natural resources, degraded environment and rampant pollution are hazardous to public health and pose challenges to the sustainable economic growth. In order to protect and substantially improve the environment, nations around the world have been increasingly focusing on the use of eco-friendly technologies. However, it requires appropriate incentive structure for increased allocation of funds towards setting up or adopting environmentally sustainable projects. Once funds are freed from the conventional industries and are channeled into the green and environment- friendly sectors, other resources including land and labour may also follow. This eventually leads to an optimal allocation of resources2 that support sustainable growth in the long run. In order to achieve these objectives, targeted policies on green finance have been formed in major countries involving all stakeholders of economic growth, viz., corporates, governments and central banks.

This study explores how green bonds perform against traditional bonds using standard financial metrics such as return, standard deviation, Sharpe ratio, and beta. It also examines the correlation between green bonds and conventional fixed income instruments to understand their role in portfolio diversification. This research aims to bridge the knowledge gap by providing an evidence-based evaluation of green bonds as an investment class, especially relevant in an era where both sustainability and profitability are key investment goals.

II. REVIEW OF LITERATURE

Alekhya P., & Saritha, B (2016) Mutual funds are poised to become one of the primary instruments for wealth creation and savings in the coming years, delivering promising returns. Over the past decade, the Indian mutual fund industry has experienced significant growth and transformation. Financial innovations, driven by intermediaries, have played a key role in safeguarding investors' interests and enhancing market efficiency. Globally, and particularly in India, mutual funds have emerged as vital financial intermediaries—retail investors alone account for 97.7% of the 4.70 crore investor accounts. By offering risk diversification and access to market returns, mutual funds protect small investors while contributing to capital market development. This paper analyses the growth trends of the mutual fund industry in India.

Baker,M(2018) In their study *"Financing the Response to Climate Change: The Pricing and Ownership of U.S. Green Bonds,"* the authors analyze how green bonds are priced slightly higher (yielding lower returns) than comparable traditional bonds. This is attributed to investor preferences for environmentally friendly investments, reflecting a "greenium" or premium on green assets.

Reboredo,J.C(2018) The study titled *"Green Bonds and Financial Markets: Co-movement, Diversification, and Price Spillover"* provides empirical evidence that green bonds offer diversification benefits in multi-asset portfolios. The co-movement analysis indicates their potential value during periods of financial instability or market stress.

Nassiry,D.(2018) In his work *"Green Finance: Trends and Opportunities,"* the author examines the macroeconomic implications of green finance. He presents green bonds as competitive alternatives to traditional debt, especially in a policy-driven investment environment focused on climate goals.

Zerbib,O.D(2019) In *"The Effect of Pro-Environmental Preferences on Bond Prices: Evidence from Green Bonds,"* the author presents a quantitative model demonstrating that green bonds tend to trade at slightly lower yields even after adjusting for credit risk. This supports the notion that investor preferences can influence pricing in favour of green securities.

Tang,DY.Zhang.(2020) In their study *"Do Shareholders Benefit from Green Bonds?"* the authors find that companies issuing green bonds experience reputational benefits and lower long-term financing costs. These bonds are particularly attractive to ESG-oriented investors and contribute positively to long-term shareholder value.

Xu (2020) Using the TVP-VAR method, this study investigates the interconnectedness of green bonds with volatility indices of other asset classes. The analysis, conducted during systemic events like COVID-19 and the Russia–Ukraine war, finds that green bonds display relatively low market connectedness, suggesting their potential role as safe-haven assets.

Flammer,C,(2021) In the paper *"Corporate Green Bonds,"* the author explores the influence of green bonds on corporate behaviour. The findings suggest that firms issuing green bonds tend to improve their environmental performance while continuing to maintain competitive financial returns.

Farag (2024) This study compares the performance of green bond issuers with that of conventional issuers. It highlights the increasing relevance of sustainable finance in the post-Paris Agreement era and emphasizes that green bond issuers often demonstrate superior performance metrics. The work also underscores the growing role of green bonds in financing climate-related projects.

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Söderman.and.hugland(2024) This research investigates the historical evolution of green bonds compared to traditional bonds and stocks. The authors discuss early skepticism surrounding green bonds and how market perception shifted significantly post-2013, driven by increasing climate change awareness. They also identify risk perception and profitability concerns as earlier barriers to adoption.

Research Gap

While green bonds have become a popular topic in sustainability and investment discussions, there is still limited empirical research comparing their financial performance directly with traditional fixed income assets.

Most available studies focus on the environmental impact, issuance trends, or regulatory frameworks of green bonds. Compared to other studies, fewer works have examined long-term financial metrics or analysed how green bonds behave under different market conditions.

Additionally, the academic and professional investment communities have not yet reached a consensus on whether green bonds offer superior, equivalent, or lower risk-adjusted returns compared to traditional bonds.

With green bonds being a relatively newer asset class, data availability and standardization are challenges that limit thorough evaluation. This study aims to fill this research void by providing a statistical comparison over a multi-year period using globally accepted performance indicators.

III. RESEARCH METHODOLOGY

Objectives of The Study

1) To evaluate the Performance of green bonds in comparison with traditional fixed income securities.
2) To assess the risk-return trade-off of green bonds using metrics such as the Sharpe ratio, the Standard deviation, and Beta.
3) To Analyse the correlation between green bonds and Traditional bonds.

Hypotheses of The Study

1) H0: There is no significant difference in the historical returns between green bonds and traditional fixed income securities.
2) H0: Green bonds do not offer superior risk-adjusted returns compared to traditional bonds.
3) H0: There is no significant difference in the correlation behaviour of green bonds and traditional fixed income assets.

The present study adopts a quantitative and analytical research design, relying primarily on secondary data sources. Data is sourced from well-recognized financial platforms such as Bloomberg, Morningstar, and Refinitiv, ensuring reliability and credibility. A carefully selected sample of green bonds and traditional fixed income securities is used for comparison. These instruments are matched based on key characteristics such as credit quality, duration, and maturity, to maintain consistency and reduce sampling bias. The primary aim is to evaluate and compare the financial performance of both asset classes using key indicators. These include historical returns, volatility (standard deviation), Sharpe ratio for risk-adjusted return, beta to assess sensitivity to market movements, and correlation with broader bond indices to understand diversification effects. The data is analyzed using statistical software and tools such as Microsoft Excel, R, and Python. To test the research hypotheses and establish statistical significance in performance differences, methods such as t-tests and correlation analysis are applied.

Financial Metrics:

Sharpe Ratio: Calculated to evaluate the risk-adjusted performance. A higher Sharpe Ratio indicates better return per unit of risk.

$$\text{Sharpe Ratio} = (Rp - Rf) / \sigma p$$

Standard Deviation: Measures the volatility of returns. A higher standard deviation implies greater risk or variability.

Beta: Evaluates systematic risk by measuring the sensitivity of green bond returns relative to a broad market index.

$$\text{Beta} = \text{Cov}(Ri, Rm) / \text{Var}(Rm)$$

IV. DATA ANALYSIS & INTERPRETATION

The data analysis in this study is designed to evaluate and compare the performance and risk characteristics of green bonds and traditional fixed income assets using quantitative techniques. The analysis is conducted in alignment with the research objectives, focusing on return comparisons, risk-return trade-offs, and correlation analysis.

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Performance of Green Bonds Vs Traditional Fixed Income Assets.

To evaluate the performance of green bonds in comparison with traditional fixed-income securities, historical price data was collected from January 2021 to December 2024 for both green bonds (IRFC) and traditional bonds (PFC) over a specific time period. The data includes monthly bond prices, which were organized chronologically to observe trends, fluctuations, and overall movement in bond values. This historical analysis provides a basis for comparing how green bonds and traditional bonds have performed over time, helping to identify patterns in price behaviour and potential investment value

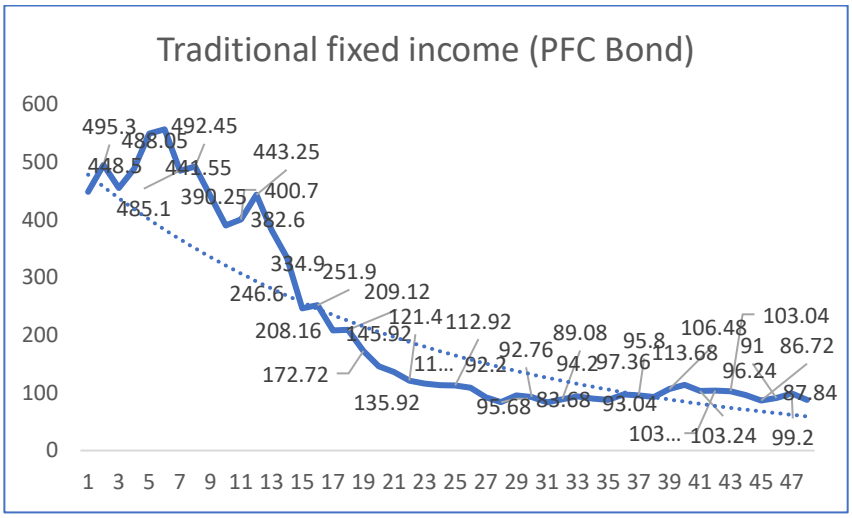

Fig 1: Performance of Green Bond

The chart illustrates the price movement of the IRFC Green Bond across 47 time periods. Initially, the bond price starts at around ₹149 and climbs steadily to a peak of ₹193.65 around the 7th interval. This indicates strong investor demand, possibly driven by favourable market conditions, improved credit perception, or growing interest in green financial instruments.

After this peak, the bond price experiences a sharp decline, dropping to around ₹50 between the 13th and 19th points. This steep fall suggests a market correction, reduced demand, or external shocks impacting bond valuation—possibly rising interest rates, macroeconomic uncertainty, or issuer-specific news.

Following this phase, from roughly point 19 onward, the price stabilizes between ₹20 and ₹50, showing low volatility. This indicates that the bond has reached a more mature market stage, where prices reflect consistent investor valuation with reduced speculative trading. The dotted trendline confirms a long-term downward trajectory, though the slope levels off in the later stages, suggesting the decline has slowed and the price is stabilizing.

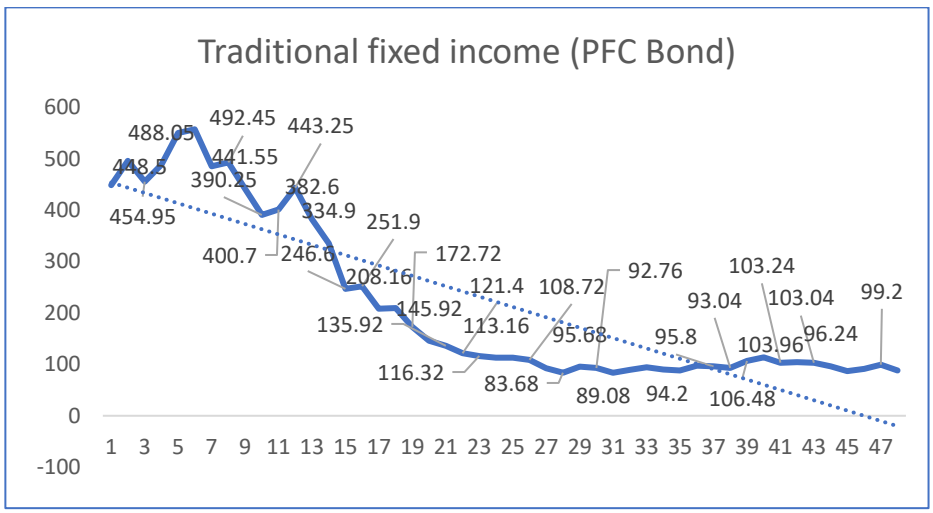

Fig 2: Historical price movement of the PFC Bond

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The chart tracks the historical price movement of the PFC (Power Finance Corporation) Bond over 47time intervals. Initially, the bond price starts at approximately ₹448.5, surging to a peak of ₹558 within the first few periods. This early price rise reflects strong investor demand or favourable economic conditions supporting bond valuations.

However, after reaching its peak, the bond experiences a significant and extended decline, dropping to about ₹172.72 by the 19th interval, and continuing to stabilize between ₹100–130 from the 21st point onward. This decline suggests a loss of investor confidence, possible interest rate increases, or market revaluation of the bond's risk or return potential.
Compared to the green bond price trend, the PFC bond shows higher volatility in its decline, with prices falling more sharply and inconsistently. The dotted trendline emphasizes a clear downward trend, though a flattening is seen in later periods, implying that prices are stabilizing after the correction phase.

The objective of this analysis is to evaluate the historical performance of green bonds in comparison with traditional fixed income securities. Based on the price trends of IRFC green bonds and PFC traditional bonds over 47 periods, there is a clear distinction in their behaviour. While traditional bonds initially had significantly higher prices, peaking at ₹558, they also experienced a sharp and volatile decline before stabilizing in the ₹100–130 range. In contrast, green bonds, which peaked at a lower ₹193.65, showed a more gradual and smoother price correction, eventually stabilizing earlier in the ₹20–50 range. This indicates that green bonds have demonstrated greater price stability and lower volatility over time. Supporting metrics further reinforce this observation—green bonds recorded a lower standard deviation (60.47%) compared to traditional bonds (163.03%), suggesting less risk, and although traditional bonds had higher returns, the risk-adjusted performance of green bonds remains attractive, especially for conservative or ESG-focused investors. Given the significant difference in price behaviour, volatility, and stability, the findings support the alternative hypothesis (H_1) that green bonds and traditional fixed income securities differ significantly in historical performance, leading to the rejection of the null hypothesis (H_0).

Risk-Return Trade-Off of Green Bonds

Month–Year	Green Bond (IRFC green Bond)	Traditional fixed income (PFC Bond)	Market Index	Green bond returns	Traditional returns	Market returns
Dec 1, 2024	149.04	448.5	23,644.80	-0.20%	-9.45%	-2.02%
Nov 1, 2024	149.34	495.3	24,131.10	-4.24%	8.87%	-0.31%
Oct 1, 2024	155.96	454.95	24,205.35	-1.74%	-6.78%	-6.22%
Sep 1, 2024	158.72	488.05	25,810.85	-11.14%	-11.19%	2.28%
Aug 1, 2024	178.62	549.55	25,235.90	-7.76%	-1.30%	1.14%
Jul 1, 2024	193.65	556.8	24,951.15	11.41%	14.78%	3.92%
Jun 1, 2024	173.81	485.1	24,010.60	-2.24%	-1.49%	6.57%
May 1,2024	177.8	492.45	22,530.70	13.07%	11.53%	-0.33%
Apr 1, 2024	157.25	441.55	22,604.85	10.47%	13.15%	1.24%
Mar 1, 2024	142.35	390.25	22,326.90	-3.00%	-2.61%	1.57%
Feb 1, 2024	146.75	400.7	21,982.80	-16.21%	-9.60%	1.18%
Jan 1, 2024	175.15	443.25	21,725.70	76.30%	15.85%	-0.03%
Dec 1, 2023	99.35	382.6	21,731.40	33.09%	14.24%	7.94%
Nov 1, 2023	74.65	334.9	20,133.15	2.82%	35.81%	5.52%
Oct 1, 2023	72.6	246.6	19,079.60	-5.16%	-2.10%	-2.84%
Sep 1, 2023	76.55	251.9	19,638.30	52.49%	21.01%	2.00%
Aug 1, 2023	50.2	208.16	19,253.80	31.41%	-0.46%	-2.53%
Jul 1, 2023	38.2	209.12	19,753.80	16.82%	21.07%	2.94%
Jun 1, 2023	32.7	172.72	19,189.05	1.55%	18.37%	3.53%
May 1,2023	32.2	145.92	18,534.40	1.42%	7.36%	2.60%
Apr 1, 2023	31.75	135.92	18,065.00	19.36%	11.96%	4.06%
Mar 1, 2023	26.6	121.4	17,359.75	-1.30%	4.37%	0.32%
Feb 1, 2023	26.95	116.32	17,303.95	-18.46%	2.79%	-2.03%

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Month–Year	Green Bond (IRFC green Bond)	Traditional fixed income (PFC Bond)	Market Index	Green bond returns	Traditional returns	Market returns
Jan 1, 2023	33.05	113.16	17,662.15	1.54%	0.21%	-2.45%
Dec 1, 2022	32.55	112.92	18,105.30	-0.76%	3.86%	-3.48%
Nov 1, 2022	32.8	108.72	18,758.35	44.81%	17.92%	4.14%
Oct 1, 2022	22.65	92.2	18,012.20	6.59%	10.18%	5.37%
Sep 1, 2022	21.25	83.68	17,094.35	-0.70%	-12.54%	-3.74%
Aug 1, 2022	21.4	95.68	17,759.30	3.88%	3.15%	3.50%
Jul 1, 2022	20.6	92.76	17,158.25	4.83%	11.01%	8.73%
Jun 1, 2022	19.65	83.56	15,780.25	-7.31%	-6.20%	-4.85%
May 1,2022	21.2	89.08	16,584.55	-4.93%	-5.44%	-3.03%
Apr 1, 2022	22.3	94.2	17,102.55	3.96%	4.57%	-2.07%
Mar 1, 2022	21.45	90.08	17,464.75	-0.69%	2.50%	3.99%
Feb 1, 2022	21.6	87.88	16,793.90	-7.49%	-9.74%	-3.15%
Jan 1, 2022	23.35	97.36	17,339.85	2.19%	1.63%	-0.08%
Dec 1, 2021	22.85	95.8	17,354.05	-1.72%	2.97%	2.18%
Nov 1, 2021	23.25	93.04	16,983.20	-3.93%	-12.62%	-3.90%
Oct 1, 2021	24.2	106.48	17,671.65	5.91%	-6.33%	0.30%
Sep 1, 2021	22.85	113.68	17,618.15	-0.44%	10.11%	2.84%
Aug 1, 2021	22.95	103.24	17,132.20	-0.22%	-0.69%	8.69%
Jul 1, 2021	23	103.96	15,763.05	-7.44%	0.89%	0.26%
Jun 1, 2021	24.85	103.04	15,721.50	4.63%	7.07%	0.89%
May 1,2021	23.75	96.24	15,582.80	11.50%	10.98%	6.50%
Apr 1, 2021	21.3	86.72	14,631.10	-6.99%	-4.70%	-0.41%
Mar 1, 2021	22.9	91	14,690.70	-7.10%	-8.27%	1.11%
Feb 1, 2021	24.65	99.2	14,529.15	-0.60%	12.93%	6.56%
Jan 1, 2021	24.8	87.84	13,634.60			

Source: Compiled data

The table presents the monthly data from January 2021 to December 2024, comparing the Green Bond (IRFC) prices, Traditional Bond (PFC) prices, and a market index alongside their respective returns. By calculating the monthly percentage returns for each investment type, we gain insights into how they perform over time and how closely their movements align.

From the data, it is evident that green bond returns exhibit higher volatility in some months (e.g., Jan 2024: +76.29%) compared to traditional bonds (+15.85%), indicating that green bonds can have larger fluctuations, potentially due to investor sentiment or ESG-related market events. Traditional bonds, on the other hand, show relatively stable return patterns. The market index returns generally remain more moderate, though they do show some correlation with both bond types in specific months (e.g., Jul 2024 and Jul 2021 show positive returns across all three categories). Overall, the table illustrates that while there are months where green and traditional bond returns move in the same direction (e.g., May 2024, Apr 2024, May 2021), there are also periods of divergence. This mixed pattern supports the moderate positive correlation (r = 0.543) calculated earlier between green and traditional bond returns. It suggests that while there is a meaningful relationship between the two, green bonds still behave somewhat independently—making them a potential diversification asset for portfolios including traditional bonds.

Metric	Green Bond (IRFC)	Traditional Bond
Average Monthly Return (%)	5.07%	4.03%
Standard Deviation (%)	0.174410467	0.104774112
Sharpe Ratio	0.026786375	0.000546116
Beta	0.975591571	1.558518799

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To assess the risk-return trade-off between green bonds and traditional bonds, key financial metrics such as average monthly return, standard deviation, Sharpe ratio, and beta were analyzed. The green bond (IRFC) demonstrated a higher average monthly return of **5.07%** compared to **4.03%** for the traditional bond, indicating better overall performance. However, this higher return comes with increased risk, as reflected in the higher standard deviation of **17.44%** for green bonds versus **10.48%** for traditional bonds. Despite the increased volatility, the green bond shows a significantly higher **Sharpe ratio of 0.0268**, suggesting it provides a superior **risk-adjusted return** compared to the traditional bond's **0.0005**. Additionally, the **beta value of 0.976** for the green bond indicates it moves closely with the market, while the traditional bond has a higher **beta of 1.56**, implying greater sensitivity to market fluctuations. Overall, the analysis suggests that green bonds offer a more favourable risk-return profile, with higher returns, better compensation for risk, and lower exposure to market volatility compared to traditional fixed income instruments.

CORRELATION ANALYSIS

A correlation analysis is performed to explore the relationship between the returns of green bonds and traditional fixed income securities. The correlation results help determine whether green bonds can serve as diversification tools in fixed income portfolios or if they behave similarly to traditional bonds

This objective aimed to examine the relationship between the returns of green bonds and traditional bonds. Monthly return data were collected and a correlation analysis was performed. The correlation coefficient was found to be **0.543**, indicating a **moderate positive relationship** between the two. This means both bond types tend to move in the same direction to some extent.

Correlation of green bond and traditional bond

	Green bond returns	Traditional returns
Green bond returns	1	
Traditional returns	0.543402956	1

The correlation analysis between green bond returns and traditional bond returns reveals a moderate positive correlation coefficient of **0.543**, indicating that there is a statistically meaningful relationship between the two types of bonds. This suggests that as the returns of green bonds increase, the returns of traditional bonds also tend to increase, although not perfectly. This correlation reflects that while both instruments may respond similarly to certain market forces, green bonds might still have distinct performance patterns due to their environmental focus and investor preferences. Given the correlation coefficient of **0.543**, we reject the null hypothesis and accept the alternative hypothesis, concluding that a significant positive relationship exists between green bond and traditional bond returns. This has implications for portfolio diversification, suggesting that green bonds can partly move in tandem with traditional bonds but still offer some unique behaviour.

FINDINGS OF THE STUDY

1. **Higher Returns of Green Bonds:** Green bonds (IRFC) provided a higher average monthly return of **5.07%**, compared to **4.03%** for traditional bonds (PFC).
2. **Greater Volatility in Green Bonds:** The standard deviation for green bonds was **17.44%**, higher than the **10.48%** for traditional bonds, indicating higher return fluctuations and risk.
3. **Superior Risk-Adjusted Returns:** The Sharpe ratio for green bonds (**0.0268**) was significantly higher than that of traditional bonds (**0.0005**), showing that green bonds offer better returns per unit of risk.
4. **Lower Market Sensitivity of Green Bonds:** Beta for green bonds was **0.975**, close to 1, meaning they move with the market but are less volatile than traditional bonds (**β = 1.56**).
5. **Moderate Correlation Between Bond Types:** A Pearson correlation coefficient of **0.543** was found between green and traditional bond returns, indicating a moderate positive relationship.
6. **Sharp Decline in Traditional Bonds:** Traditional bonds dropped sharply from ₹558 to nearly ₹130, suggesting higher vulnerability to market changes or investor sentiment shifts.
7. **Smoother Correction in Green Bonds:** Green bonds experienced a more gradual decline and stabilized early in the ₹20–₹50 range, indicating greater price stability.
8. **Stabilized Trends in Later Periods:** Both green and traditional bonds show signs of price stabilization in the later months, suggesting market correction and revaluation.
9. **Different Market Behaviour:** Despite moderate correlation, green bonds showed independent behaviour in some months, likely due to ESG-related investor sentiment.
10. **Potential for Diversification:** The distinct price movement and moderate correlation make green bonds useful for **diversification** in bond portfolios.

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SUGGESTIONS OF THE STUDY

1. **Include Green Bonds in Diversified Portfolios:** Their moderate correlation and better risk-adjusted returns make them a valuable diversification tool.
2. **Promote ESG Investment Education:** Investors should be educated about the benefits of green bonds, especially regarding environmental impact and stable returns.
3. **Further Study on Macroeconomic Impact:** Explore how interest rates, inflation, and policy changes affect green bonds differently from traditional bonds.
4. **Use Green Bonds for Conservative ESG Portfolios:** The lower beta and higher Sharpe ratio make green bonds ideal for risk-averse investors seeking sustainability.
5. **Track Long-Term Stability:** Continue monitoring green bond performance over longer periods to validate current trends in return and risk.
6. **Encourage Institutional Investment:** Governments and agencies can incentivize institutional participation in green bonds to boost market stability.
7. **Enhance Transparency and Disclosure:** Issuers should clearly communicate how green bond proceeds are used to maintain investor trust and ESG credibility.
8. **Develop Green Bond Rating Frameworks:** Independent rating systems focused on environmental impact and financial risk can guide investor decisions.

V. CONCLUSION

This study confirms that green bonds not only provide competitive returns but also demonstrate greater stability and risk-adjusted performance compared to traditional fixed-income securities. The moderate correlation between the two suggests that green bonds can be used effectively in portfolio diversification strategies. Investors, especially those focused on long-term growth and sustainability, should consider green bonds as a viable investment vehicle. Furthermore, the growing interest in ESG investing globally strengthens the case for promoting and developing the green bond market in India and beyond. The findings support the rejection of the null hypotheses across all three objectives and affirm that green bonds present a distinctive and advantageous investment profile.

REFERENCES

[1]. Arora, R., & Raj, M. (n.d.). A Comparative Study on the Performance of Green and Traditional Bonds. Amity University, Amity School of Economics.
[2]. Alekhya, P., & Saritha, B (2016) A Study of Mutual funds Trends in India after Fourth Phase of Evaluation, International Journal of Trade & Commerce-IIRTC, 5(2),263-273
[3]. Baker, M., Bergstresser, D., Serafeim, G., & Wurgler, J. (2018). Financing the response to climate change: The pricing and ownership of U.S. green bonds. NBER Working Paper No. 25194. https://doi.org/10.3386/w25194
[4]. Buhr, B., Volz, U., Donovan, C., Kling, G., Lo, Y. C., & Murinde, V. (2018). Climate change and the cost of capital in developing countries. UNEP Inquiry Working Paper. https://eprints.soas.ac.uk/26038/
[5]. Farag, M. H. (2024). Comparative Performance Analysis of Green Bond Issuers to their Conventional Counterparts. Master's Thesis, Department of Management, Graduate Program in Finance.
[6]. Flammer, C. (2021). Corporate green bonds. Journal of Financial Economics, 142(2), 499–516. https://doi.org/10.1016/j.jfineco.2021.05.014
[7]. Karpf, A., & Mandel, A. (2018). The changing value of the 'green' label on the US municipal bond market. Nature Climate Change, 8(2), 161–165. https://doi.org/10.1038/s41558-017-0062-0
[8]. Löffler, K. U., Petreski, A., & Stephan, A. (2021). Drivers of green bond issuance and new evidence on the "greenium". Journal of Cleaner Production, 317, 128390. https://doi.org/10.1016/j.jclepro.2021.128390
[9]. MacAskill, S., Roca, E., Liu, B., & Stewart, R. A. (2021). Is there a green premium in the bond market? Evidence from green bond issuances in the Asia-Pacific region. Finance Research Letters, 41, 101826. https://doi.org/10.1016/j.frl.2020.101826
[10]. Maa, C., Schoutens, W., Beirlant, J., De Spiegeleer, J., Höcht, S., & Van Kleeck, R. (n.d.). Are Green Bonds Different From Ordinary Bonds? A Statistical and Quantitative Point of View. University of Leuven and Assenagon GmbH.
[11]. Partridge, C., & Medda, F. (2020). Green bond pricing: The search for quantitative evidence on the 'greenium'. Journal of Sustainable Finance & Investment, 10(2), 180–195. https://doi.org/10.1080/20430795.2019.1682020
[12]. Pham, L. (2016). Is it risky to go green? A volatility analysis of the green bond market. Journal of Sustainable Finance & Investment, 6(4), 263–291. https://doi.org/10.1080/20430795.2016.1237244
[13]. Reboredo, J. C. (2018). Green bond and financial markets: Co-movement, diversification and price spillover effects. Energy Economics, 74, 38–50. https://doi.org/10.1016/j.eneco.2018.05.030

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[14]. Söderman, M., & Haglund, M. (2024). Investing in the Future: The Performance of Green Bonds Compared to Conventional Bonds and Stocks. Master's Thesis, Department of Business Administration, Master's Program in Finance.

[15]. Xu, D., Hua, Y., Corbet, S., Hou, Y. (G.), & Oxley, L. (2023). Green bonds and traditional and emerging investments: Understanding connectedness during crises. School of Accounting, Finance and Economics, University of Waikato & DCU Business School.

[16]. Zerbib, O. D. (2019). The effect of pro-environmental preferences on bond prices: Evidence from green bonds. Journal of Banking & Finance, 98, 39–60. https://doi.org/10.1016/j.jbankfin.2018.10.012