

The Green Signal: Event Study of Stock Reactions to Green Bond Announcements in India

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Abstract

This study explores the short-term reaction of the stock market to announcements of green bond issuance by Indian firms using an event study methodology. Drawing upon signalling theory and supported by a robust dataset of 35 green bond issues from 2015 to 2024, the analysis applies Market Adjusted Returns, Market Model Abnormal Returns, and Risk Adjusted Returns to evaluate abnormal returns over a $[-20, +20]$ trading day window. The findings reveal statistically significant positive abnormal returns immediately following green bond announcements, particularly on days +2, +8 and +12, suggesting investor optimism and perceived commitment to sustainability. However, both pre- and post-event windows exhibit negative returns, which imply either information leakage or short-term correction. The research supports the applicability of green bonds as a strategic investment tool but calls for stable ESG integration and transparent certification mechanisms to maintain long-term investor trust.

Keywords

Green bonds, stock market reaction, event study, sustainable finance, ESG, emerging markets, abnormal return, India

Introduction

Global green bond issuance has expanded rapidly over the past decade, with cumulative aligned green bond volume reaching about \$3.4 trillion by the end of

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Q3 2024, as governments, corporates and financial institutions increasingly use these instruments to finance climate-aligned projects in areas such as renewable energy, energy efficiency, transport and water infrastructure. This growth reflects strong demand from ESG-focused investors who view green bonds as a way to combine financial returns with environmental impact, and has firmly embedded green bonds within the broader sustainable debt market.

India entered the green bond market in 2015, when Yes Bank issued the country's first labelled green bond to finance renewable energy projects, after which issuance spread to public sector undertakings, commercial banks and non-financial corporates. Supported by SEBI's 2016 guidelines (updated in 2017) and subsequent policy initiatives, India's green and broader GSS+ bond market has grown quickly. By the end of 2024, cumulative aligned green debt originating from India was around \$46.6 billion, and total aligned GSS+ volume was about \$55.9 billion, with green bonds accounting for roughly four-fifths of this amount. Despite this progress, India's green bond market still represents a small share of global issuance around 1% of cumulative aligned green volume as of the end of 2024 and remains concentrated in low-carbon energy, while sectors such as waste management, water infrastructure and green buildings are comparatively underrepresented.

Table 1 highlights India's position in the global green bond market as of Q3 2024. Despite a cumulative issuance of \$25.0 billion, India's share remains modest at approximately 0.7% of the global market. Notable Indian issuers include Yes Bank, Adani Green, State Bank of India and Axis Bank. India has positioned itself as a key player in the green finance landscape among emerging economies. Since the inaugural issuance by Yes Bank in 2015, the green bond market in India has grown significantly. As of December 2021, India's total issuance of Green, Social and Sustainability (GSS) bonds stood at \$19.5 billion, of which \$18.3 billion was from green bonds (Climate Bonds Initiative, 2021). The growth has been led by non-financial corporates like Adani Green Energy and Renew Power, and financial institutions like Axis Bank and State Bank of India. However, despite this upward trajectory, India ranks only 15th globally in terms of bond market

Table 1. Global and Indian Green Bond Issuance (as of Q3 2024).

Region/ Country	Cumulative Green Bond Issuance (USD Billion)	Share of Global Market (%)	Notable Issuers
Global (Total)	3,400	100	World Bank, Apple, Tesla, etc.
United States	900	~26.5	Apple, Bank of America
China	800	~23.5	ICBC, Bank of China
France	300	~8.8	Government of France
Germany	250	~7.4	KfW, Government Bonds
India	25	~0.7	Yes Bank, Adani Green, SBI, Axis Bank

Source: Climate Bonds Initiative (2025).

size, indicating substantial untapped potential (Dwivedi, 2024). A key impetus behind the growth of green bonds in India has been the introduction of enabling policy frameworks. The Securities and Exchange Board of India (SEBI) issued guidelines for green bonds in 2016 and updated them in 2017 to align with the Green Bond Principles developed by the International Capital Market Association. The guidelines focused on four key elements: use of proceeds, project selection and evaluation, management of proceeds and reporting. The new SEBI regulations improved transparency and accountability, and thus investor confidence (International Capital Market Association, 2017, 2018; Verma & Agarwal, 2020). Figure 1 shows green bond issuance in India rising steadily from 2015 to 2023, reflecting growing investor interest in sustainable finance. Issuance grew from \$1.1 billion in 2015 to \$12.3 billion in 2023 (data extracted from Bloomberg by authors). Surprisingly, the mean coupon rate has exhibited a steady downtrend, indicating enhanced credit confidence and a narrowing ‘greenium’ the yield premium investors pay for labelled green bonds, though India’s average coupon of 7.1% remains higher than global levels. Even with a slight decline in 2024, the forecasted recovery in 2025 signals strong market potential.

In addition, increasing sensitivity to ESG concerns and India’s global climate pledges such as the Paris Agreement and the United Nations Sustainable Development Goals have also augmented the significance of green bonds. India’s goal of net-zero carbon emissions by 2070 and its commitment to becoming a 500 GW renewable energy producer by 2030 require unlocking enormous financial resources. Green bonds are considered a critical tool for raising finance for the transition towards a low-carbon, climate-resilient economy (Abhilash et al., 2023; Agarwal & Singh, 2021).

Despite these promising advances, the Indian green bond market still confronts substantial structural, operational and market development challenges that

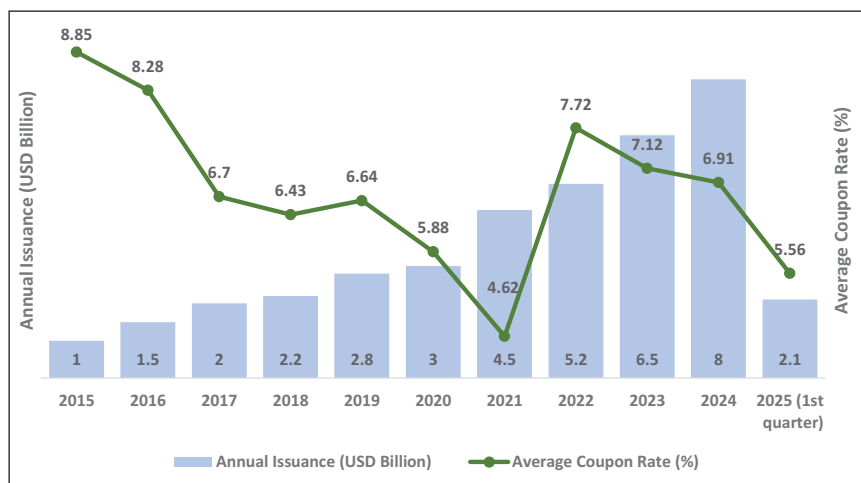


Figure 1. Green Bond Issuance and Average Coupon Rate in India.

Source: Data extracted from Bloomberg.

constrain its full potential. Key hurdles include the absence of a comprehensive national green taxonomy a standardised classification system for environmentally sustainable economic activities which creates uncertainty for investors about what truly qualifies as 'green' (unlike the EU Taxonomy or other mature frameworks). High transaction costs associated with certification, legal structuring and international listings further deter smaller issuers, while limited financial incentives (such as tax breaks or subsidies for green projects) fail to sufficiently offset these expenses. Investor awareness remains narrow, particularly among domestic retail and institutional players who prioritise traditional fixed-income assets over sustainable ones (Abhilash et al., 2023).

A concrete illustration of these frictions is India's average green bond coupon rate of 7.1%, which significantly exceeds the global average of approximately 3%–4% observed in more developed markets like the USA and Europe. This elevated pricing reflects higher perceived risks, shallower liquidity, and less mature ESG integration, even as it attracts yield-seeking foreign investors (Dwivedi, 2024). Moreover, green bond proceeds remain heavily concentrated in renewable energy (over 80% allocation), leaving critical sectors like waste management, green buildings, urban transport, and water infrastructure chronically underfunded despite India's pressing sustainability needs.

The financial impact of green bond issuance particularly its effect on stock performance remains an area of ongoing academic inquiry. Theoretically, green bonds are posited to enhance firm value through signalling theory (Spence, 1973), as their issuance conveys a credible commitment to sustainability. This can lead to reputational gains, improved stakeholder trust, and eventually higher valuations. Conversely, if investors suspect greenwashing or perceive limited material impact from the projects financed, market reactions may be muted or even negative (Tang & Zhang, 2020; Wang et al., 2021).

Empirical evidence from global studies is mixed; Flammer (2021) established that U.S. corporate green bond announcements generate positive abnormal returns, consistent with the signalling hypothesis. However, Fatica & Panzica (2021) identified more complex results in the EU, where the performance of the stock depended on the sector of the issuer and the external certification of the bond. Such disparities necessitate country-specific research as the key to interpreting localised investor behaviour and regulatory effects.

Verma and Bansal (2023) examined six Indian companies employing a 21-day event study and reported largely positive cumulative abnormal returns (CAR) after the announcement, with Yes Bank appreciating by 5.3%, suggesting a positive investor reaction. Based on this, the current research seeks to investigate whether green bond issuance in India serves as a good market signal (Flammer, 2021), provides short- or long-term stock performance advantages (Fatica & Panzica, 2021), differs across industries (Tang & Zhang, 2020), and is affected by external certifications like Climate Bonds Certification or Second Party Opinions (Agarwal & Singh, 2021; Climate Bonds Initiative, 2021). These questions have real-world implications for many stakeholders. For corporates, a positive share price reaction may encourage further engagement with sustainable finance. For investors, knowledge of share price behaviour after green bond issuance can

shape portfolio strategy. For regulators and policymakers, it can inform attempts to create more effective frameworks to promote both environmental sustainability and market efficiency.

Against this backdrop, this research seeks to conduct an in-depth analysis of stock market reaction to green bond issuance in India. Using an event study approach, backed by sentiment analysis and financial performance measures, the research will examine whether green bonds are value-enhancing instruments in the Indian capital market. It will also investigate if India's green bond ecosystem is developing in a way that enables financial performance along with climate action. This study extends prior Indian evidence by employing a larger multi-sector sample and multiple abnormal return models, thereby offering more robust and generalisable insights into investor reactions.

Literature Review

The changing world of sustainable finance has placed green bonds at the centre of research into climate-themed investments and market performance. As an emerging asset class, green bonds are being highlighted by academia and industry for their potential to align financial returns with environmental goals. Researchers have grown increasingly interested in investigating the impact of green bond issuances on stock market reactions, stock prices, firm valuation, and investor sentiment across developed and emerging markets. Such studies provide the foundation for assessing the effectiveness of green bonds not just as environmental instruments but also as signalling financial instruments.

Theoretical Framework

Green bonds and their impact on stock market performance rest on several core financial and sustainability theories, each generating distinct testable predictions for this study.

Signalling theory (Spence, 1973) posits that green bond issuance serves as a credible signal of a firm's commitment to sustainability, reducing information asymmetry between managers and investors. This should manifest as positive abnormal returns concentrated around the announcement date, as markets reward firms perceived to be genuinely pursuing environmental goals.

Stakeholder theory suggests that addressing environmental concerns strengthens relationships with diverse stakeholders investors, customers, regulators and communities yielding reputational capital and operational efficiencies over time. This predicts longer-term performance improvements and sustained reputational benefits beyond the immediate announcement effect.

Finally, the efficient market hypothesis (EMH) in its semi-strong form underpins the event study methodology, assuming that stock prices rapidly incorporate all publicly available information, including green bond announcements. Consequently, any abnormal returns should be short-lived and concentrated around the event date, with prices reverting to fundamentals thereafter.

Together, these theories provide a cohesive framework for the hypotheses. Signalling theory predicts immediate positive market reactions to green bond announcements, while stakeholder theory anticipates longer-term benefits from enhanced reputation and stakeholder alignment. The EMH ensures that any observed abnormal returns will be concentrated around the event window, guiding the event study methodology and window selection in this analysis. This integrated theoretical lens motivates testing whether green bond issuance generates significant short-term abnormal returns (H_1) in the Indian context, with potential implications for sustained value creation.

Empirical Insights and Global Evidence

Empirical research on green bond announcements offers evidence of positive reactions in many developed markets. Flammer (2021) documents significantly positive abnormal stock returns around corporate green bond announcements in the USA, attributing this to improved environmental reputation and investor confidence. Tang and Zhang (2020) similarly show that shareholders often interpret green bond issuances as credible signals of a firm's long-term sustainability orientation, leading to short-term wealth gains. Roslen et al. (2017) also report positive shareholder wealth effects across several countries, particularly where disclosure standards and green finance ecosystems are relatively mature.

However, a growing body of work points to mixed or conditional reactions. Mocanu et al. (2021) find that while short-term stock price responses to sustainability bond issuances are generally positive, longer-term effects are more muted and highly sensitive to market maturity and regulatory context. Antoniuk and Leirvik (2021) show that transition climate risks can dampen or offset the advantages of green bonds, especially for firms with substantial exposure to carbon-intensive activities. Kazokas (2024) reports heterogeneity in market reactions among European issuers, with responses varying systematically by firm size, industry and prevailing investor sentiment, suggesting that not all green bond announcements are rewarded equally.

A third stream emphasizes the role of certification and credibility in shaping market responses. Wu (2022) argues that green bonds are not necessarily priced below traditional bonds in primary or secondary markets, challenging the assumption of a universal 'greenium' in bond yields and indicating that investors scrutinise issue quality and issuer fundamentals rather than paying an automatic price premium. This has implications for equity reactions as well: If investors do not systematically reward green bonds through lower yields, any stock price response is more likely to depend on perceived credibility, transparency of use-of-proceeds and alignment with broader ESG strategies rather than the label alone. Boschetti and Baldini (2017) further suggest that the success of a green bond, in both bond and equity markets, hinges on the perceived genuineness of the issuer's environmental claims and the strength of external verification or second-party opinions. Together, this literature indicates that while positive abnormal returns are common, they are neither universal nor uniform

and depend strongly on sector, certification and the institutional quality of the underlying market.

Indian and Emerging Market Context

Research on green bonds in India and other emerging markets remains limited but is steadily growing, highlighting both opportunities and unique challenges. Verma and Bansal (2023) conducted one of the earliest event studies specific to the Indian market, analysing six green bond issuers over a 21-day event window and reporting overall positive cumulative abnormal returns (CAR). For instance, Yes Bank experienced a 5.3% CAR, reflecting favourable investor sentiment toward credible sustainability commitments (exact figures confirmed from published study). Prakash and Sethi (2021) emphasise the importance of supportive policy frameworks and favourable macroeconomic conditions in enhancing the effectiveness of green bonds across Asia, while Bansal et al. (2023) identify persistent challenges in India, including high coupon rates, limited investor awareness, and insufficient sectoral diversification. Verma and Agarwal (2020) criticise the heavy concentration of green bond proceeds in renewable energy and advocate for broader allocation to underserved areas, such as water infrastructure and waste management. Glavas (2018, 2020) demonstrates that regulatory clarity significantly bolsters market confidence, underscoring the need for standardised green bond guidelines. Ahmed et al. (2024) argue that green bonds can effectively bridge corporate finance with the UN Sustainable Development Goals, provided transparency and third-party certifications are robustly implemented.

This study extends Verma and Bansal (2023) in four key ways: (a) a larger sample of 35 green bonds from 14 listed firms (vs. their 6 firms), (b) a longer time horizon spanning 2015–2024 to capture market evolution, (c) multiple robustness models (MAR, MKAR, RAR) beyond a single specification and (d) wider sectoral coverage including banking, energy, and infrastructure for more comprehensive insights.

Emerging markets like India present distinct dynamics compared to developed markets: weaker disclosure standards, higher funding costs due to sovereign risk premiums and thinner market liquidity can lead to more volatile and delayed investor reactions in event studies. These factors may amplify the role of signalling through green bonds while potentially muting long-term effects due to macroeconomic noise and limited ESG data integration.

Green Bonds During Crises and Market Spillovers

The resilience of green bonds under economic stress and their integration into global portfolios have also attracted research attention. Sisodia et al. (2022) and Yi et al. (2021) demonstrate that green bonds exhibited relative stability during the COVID-19 crisis, displaying hedging qualities against equity market volatility. Guo and Zhou (2021) confirm this pattern in US and Chinese markets, while Dong et al. (2023) note that green bonds show lower correlation with conventional equities, enhancing portfolio diversification benefits. Mensi et al. (2023) and Tiwari et al. (2023) document increasing financial spillovers between green

bonds, global equity markets, and even Islamic financial assets, signalling their growing systemic integration.

These findings matter for equity event studies because green bonds' demonstrated diversification and resilience qualities may influence investors' stock price responses at issuance, particularly for firms targeting ESG-oriented portfolios that value stability during uncertainty.

Methodological Approaches and Sectoral Trends

Event study methodology is the most widely practised method of green bond impact evaluation, as articulated by Ederington et al. (2015). It is often possible to employ a short event window to capture swift investor reaction, but according to researchers such as Makpotche et al. (2024) and Bhutta et al. (2022), longer-horizon stock performance also needs to be considered. Paul and Solli (2021) extend green bond research into the shipping sector, whereas Zhou and Cui (2019) find that green bond issuance leads to better corporate social responsibility (CSR) rankings and stakeholder relationships. Although the literature is growing, gaps remain. Most current research focuses on developed markets, with emerging markets such as India remaining underrepresented. In addition, while positive short-term market responses are frequently reported, the long-term financial and ESG performance of green bond issuers is not yet adequately investigated. Furthermore, the impact of external audits and certification quality on investor confidence and bond pricing remains to be determined conclusively.

Research Gaps and Hypotheses

Current literature reveals several critical gaps that this study addresses, particularly in the Indian context. While global studies often report positive short-term market responses, analyses of long-term financial and ESG performance among green bond issuers remain limited. Sectoral distinctions such as differences between banking, energy and infrastructure are rarely explored, despite varying investor perceptions across industries. Additionally, the influence of third-party certification and ESG disclosures on investor sentiment has not been fully examined for emerging markets like India, where disclosure standards and market liquidity differ from developed economies.

To address these gaps, this study tests the following hypotheses using an event study approach with Average Abnormal Returns (AAR) and Cumulative Average Abnormal Returns (CAAR) across multiple event windows:

- H_0 (Null Hypothesis): Announcement of green bond issuance does not lead to significant abnormal returns for issuing firms in the Indian stock market.
- H_1 (Alternative Hypothesis): Announcement of green bond issuance leads to significant abnormal returns for issuing firms in the Indian stock market.

Subsidiary hypotheses:

- H_{1a} : Green bond announcements generate positive abnormal returns in the short-term announcement window $[0, +2]$.
- H_{1b} : There are no significant long-term abnormal returns in post-announcement windows $[2, +10]$ and $[10, +20]$.
- H_{1c} : Abnormal returns differ significantly across sectors (banking vs. energy vs. infrastructure).

These hypotheses directly test the signalling effect predicted by theory, the short-lived nature expected under EMH, and the heterogeneity suggested by sectoral and certification literature, using India's comprehensive green bond dataset from 2015–2024.

Data Collection

This study adopts a systematic approach to data collection in order to investigate the impact of announcements of green bond issuance on the stock price performance of Indian companies. Bloomberg was utilised to compile a comprehensive list of all existing and mature green bonds issued by Indian entities. The initial dataset comprised 99 green bonds, with detailed information extracted for each bond, including issuer name, ticker symbol (ISIN), bond serial number, green bond classification, issuance amount (in USD), ESG classification, issuing country, announcement and issue dates, maturity date, coupon rate, currency, security type and market sector description. To facilitate focused analysis, bonds were grouped into three categories: government entities (29 bonds), listed companies (43 bonds) and non-listed companies (27 bonds). The empirical analysis centred on the 43 bonds issued by listed companies, as these allowed for the evaluation of stock price reactions. After excluding eight bonds issued before the respective companies were publicly listed, the final sample comprised 35 green bonds issued by 14 publicly listed companies, spanning sectors such as banking, energy and infrastructure. Table 2 represents the entire dataset under study. Stock price data were retrieved from Google Finance, covering a window of ± 120 trading days around each bond's announcement date. Additionally, daily closing prices of the NIFTY 50 index from 2014 to 2024 were collected to serve as a benchmark for market performance.

Research Methodology

This study employs the event study methodology introduced by Fama et al. (1969) and grounded in the semi-strong form Efficient Market Hypothesis proposed by Fama (1970). It has been extensively used to empirically test corporate events and associated stock market responses (Werner, 2010). This method is based on the semi-strong form of the market efficiency hypothesis, which holds that it is not possible to consistently earn excess returns because all publicly available information is immediately reflected in stock prices. Because of its systematic

Table 2. Green Bond Issuances by Indian Corporations (2015–2024).

Company Name	Amounts in ₹ Crore	
	Amount Issued	Announcement Date
ADANIGREEN	409	27-Feb-2024
ADANIGREEN	363	03-Oct-2019
ADANIGREEN	750	01-Sep-2021
ADANIGREEN	500	30-May-2019
ADANIGREEN	1,552	23-Jan-2024
ADANIGREEN	950	05-Feb-2024
AXISBANK	40	11-Apr-2019
AXISBANK	24,300	27-May-2016
AXISBANK	500	23-May-2016
BAJFINANCE	100	14-Jul-2016
HEROMOTOCO	1,300	15-Feb-2016
HEROMOTOCO	16,974	21-Dec-2016
HEROMOTOCO	500	18-Jan-2016
IDBI	350	23-Nov-2015
IRFC	500	13-Jan-2022
JSWENERGY	707	10-May-2021
NTPC	20,000	03-Aug-2016
PFC	400	28-Nov-2017
PFC	300	06-Sep-2021
RECLTD	450	29-Jun-2017
RECLTD	750	03-Apr-2023
RECLTD	2,700	12-Jan-2024
RECLTD	31,000	12-Jan-2024
RECLTD	500	23-Sep-2024
RECLTD	27,400	12-Jan-2024
RECLTD	40,000	30-May-2024
SBIN	250	22-Dec-2023
SBIN	650	19-Sep-2018
SBIN	50	09-Jul-2018
SBIN	100	26-Mar-2020
TORNTPOWER	40,000	30-May-2022
WABAG	1,000	03-Jul-2023
YESBANK	10,000	16-Feb-2015
YESBANK	3,150	05-Aug-2015
YESBANK	3,300	29-Dec-2016

Source: Data extracted from Bloomberg.



Figure 2. Timeline of the Study.

framework, this method has become more popular among researchers as a valid analytical tool. It involves comparing market performance before and after a significant event and evaluating influential variables such as trading volumes and return volatility (Khotari & Warner, 2006).

As shown in Figure 2, the timeline is divided into an estimation period (days -120 to -21 relative to the green bond issuance date) and an event window (± 20 days around the issuance date). Daily stock returns during the estimation period are used to calculate the mean return for each firm using a logarithmic return method. Abnormal returns are then determined within the event window using the mean-adjusted returns model. Abnormal returns after the event may suggest market inefficiency, while abnormal returns before could indicate insider trading:

$$AR_{it} = R_{it} - R_{ij},$$

Where AR_{it} represents the abnormal return on a specific day, R_{ij} is the mean return on the stock during the estimation period, and R_{it} denotes the actual log return of the stock. The daily log return was determined using the formula:

$$R_{it} = \ln(P_{it} / (P_{it} - 1)).$$

where P_{it} and $(P_{it} - 1)$ indicate the stock price on days t and $(t-1)$, respectively. The average stock return R_{ij} was calculated using the log return of stock prices.

Further, abnormal returns were calculated using the market-adjusted returns model. Abnormal return $AR_{i,t}$ is calculated by adjusting the actual return with the market return.

$$AR_{i,t} = R_{i,t} - R_{m,t}$$

is the return on the market (NIFTY index return).

$$R_{mt} = \ln(P_{mt} / (P_{mt} - 1)),$$

Moreover, to check the robustness of the model, a risk-adjusted model was used to support the results obtained through the previous models, using the following formula:

$$AR_{it} = R_{it} - (\alpha_i + \beta_i R_{m,t})$$

where ai and βi are estimates from a regression of the stock against the market index and AR_{it} and R_{it} are the same as defined earlier.

The same exercise is done for all companies that have issued green bonds. After that, all abnormal returns are averaged for the same day.

$$AAR = \frac{1}{N} \sum_{i=1}^N AR_{i,t}$$

To measure the total impact of announcements of green bond issuance over a specified period, all AARs are added individually to create the CAAR, as represented in the equation below.

$$CAAR(t_1, t_2) = \sum_{t=t_1}^{t=t_2} AAR_{i,t}$$

The CAAR was calculated by adding the abnormal returns for each window under analysis. An event window of 41 days was used for the study, from day -20 to day $+20$, where day 0 is the date on which green-bond issuance was announced.

To find the statistical significance, the t -test is considered.

$$t = \frac{AAR}{\sigma^{aar} / \sqrt{N}}$$

Here, σ^{aar} is the standard deviation of the average security return. N is the total number in the sample; here, it is 35. A t -statistic with a p value less than or equal to .05 is significant.

Empirical Results

This section presents the results of the event study analysis on the impact of green bond issuances on stock prices in the Indian capital market. Average Abnormal Returns (AARs) and their corresponding t -statistics were calculated for the $[-20, +20]$ event window using three models: Market Adjusted Returns (MAR), Market Model Abnormal Returns (MKAR), and Risk Adjusted Returns (RAR). These daily observations were further aggregated into CAARs across key event windows to assess overall trends before, during, and after the announcement.

Daily AAR and t -Statistics Analysis

Table 3 presents the AARs and corresponding t -statistics for each day from 20 days before to 20 days after the announcement date.

Pre-Event Window Analysis

In the pre-event window (Day -20 to Day -1), several statistically significant negative MARs and RARs are observed, notably on Day -10 (-0.93% , $t = -12.71$), Day -11 (-0.67% , $t = -9.22$), and Day -12 (-0.60% , $t = -8.14$), indicating investor pessimism or information leakage (Brown & Warner, 1985). However, brief

Table 3. Daily AARs and t-Statistics for Green Bond Announcements ([−20, +20]).

Days	MAR (AAR)	MAR (T)	MKAR (AAR)	MKAR (T)	RAR (AAR)	RAR (T)
−20	−0.34%	−4.67	−0.51%	−6.64	−0.33%	−4.51
−19	0.08%	1.12	0.47%	6.18***	0.09%	1.28
−18	−0.47%	−6.41	−0.12%	−1.63	−0.46%	−6.25
−17	−0.43%	−5.87	0.02%	0.23	−0.42%	−5.71
−16	−0.05%	−0.68	0.03%	0.46	−0.04%	−0.52
−15	0.20%	2.73**	0.36%	4.63***	0.21%	2.90***
−14	−0.12%	−1.60	−0.05%	−0.62	−0.11%	−1.44
−13	−0.17%	−2.35	0.14%	1.87*	−0.16%	−2.19
−12	−0.60%	−8.14	−0.23%	−2.94	−0.58%	−7.98
−11	−0.67%	−9.22	−0.35%	−4.51	−0.66%	−9.06
−10	−0.93%	−12.71	−0.53%	−6.96	−0.92%	−12.55
−9	0.16%	2.17**	0.63%	8.25***	0.17%	2.33**
−8	0.52%	7.16***	0.54%	7.10***	0.54%	7.33***
−7	−0.77%	−10.54	−0.46%	−5.98	−0.76%	−10.38
−6	0.07%	0.96	0.44%	5.71***	0.08%	1.13
−5	−0.05%	−0.66	0.01%	0.15	−0.04%	−0.49
−4	0.53%	7.22***	0.80%	10.49***	0.54%	7.39***
−3	−0.44%	−5.94	−0.63%	−8.26	−0.42%	−5.78
−2	−0.47%	−6.46	0.08%	1.02	−0.46%	−6.30
−1	−0.16%	−2.16	0.11%	1.40	−0.15%	−2.00
0	0.12%	1.66	−0.14%	−1.89	0.13%	1.82*
1	0.10%	1.31	−0.15%	−1.94	0.11%	1.47
2	0.24%	3.23***	0.37%	4.84***	0.25%	3.39***
3	−0.54%	−7.33	−0.24%	−3.07	−0.52%	−7.17
4	0.03%	0.42	0.04%	0.50	0.04%	0.58
5	−0.41%	−5.67	−0.18%	−2.31	−0.40%	−5.51
6	0.07%	0.99	0.50%	6.51***	0.08%	1.15
7	−0.07%	−1.00	−0.14%	−1.81	−0.06%	−0.84
8	0.38%	5.20***	0.57%	7.45***	0.39%	5.36***
9	−0.20%	−2.66	−0.19%	−2.46	−0.18%	−2.50
10	−0.25%	−3.38	0.04%	0.51	−0.24%	−3.22
11	0.02%	0.21	0.47%	6.16***	0.03%	0.38
12	0.26%	3.60***	0.63%	8.18***	0.28%	3.77***
13	−0.90%	−12.31	−0.80%	−10.43	−0.89%	−12.16
14	−0.58%	−7.88	−0.19%	−2.45	−0.56%	−7.72
15	0.09%	1.22	0.27%	3.57***	0.10%	1.38
16	−0.29%	−3.97	−0.38%	−4.96	−0.28%	−3.81

(Table 3 continued)

(Table 3 continued)

Days	MAR (AAR)	MAR (T)	MKAR (AAR)	MKAR (T)	RAR (AAR)	RAR (T)
17	-0.26%	-3.61	-0.15%	-1.93	-0.25%	-3.45
18	-0.57%	-7.74	-0.16%	-2.04	-0.56%	-7.59
19	-0.26%	-3.49	-0.13%	-1.72	-0.24%	-3.33
20	-0.05%	-0.62	-0.08%	-0.98	-0.03%	-0.46

Source: Authors' own compilation.

Notes: *, **, *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

positive spikes on Day -8 (0.52%, $t = 7.16^{***}$) and Day -4 (0.53%, $t = 7.22^{***}$) indicate some optimistic speculation ahead of the announcement. MKAR also exhibits mixed behaviour during this period, implying uncertain investor expectations and market speculation prior to the official green bond announcement. The results indicate significant negative abnormal returns in the pre-announcement period under MAR and RAR models, suggesting potential market anticipation, adverse firm-specific conditions, or gradual information diffusion before formal disclosure.

On the announcement date, abnormal returns are modest and largely insignificant, indicating that markets may partially anticipate the information.

Event Day (Day 0)

On the announcement day, a slight positive MAR of 0.12% ($t = 1.66$) is recorded, while RAR rises modestly to 0.13% ($t = 1.82^*$), indicating a short-term market endorsement of green bond announcements (Flammer, 2021). The insignificant MKAR (-0.14%, $t = -1.89$) supports the observation that markets may have already absorbed the information or remained cautiously neutral.

Post-Event Window Analysis

The post-event window (Day +1 to Day +20) begins with short-term positive returns, especially on Day +2 (MAR = 0.24%, $t = 3.23^{***}$), Day +8 (MAR = 0.38%, $t = 5.20^{***}$), and Day +12 (MAR = 0.26%, $t = 3.60^{***}$). These findings imply a delayed recognition of the strategic value of green bond issuance by investors. However, this is followed by sharp corrections, such as Day +13 (-0.90%, $t = -12.31$) and Day +14 (-0.58%, $t = -7.88$), signalling either profit-taking behaviour or market doubts about the long-term financial implications of such initiatives.

Risk-Adjusted Insights

RAR trends closely align with MAR, confirming that the observed abnormal returns are not substantially influenced by changes in systematic risk. Notably, statistically significant RARs post-event reaffirm that investor sentiment

Table 4. Cumulative Average Abnormal Returns for Selected Event Windows.

Event Window	MAR	T Score	MKAR	T Score	RAR	T Score
{-20, -10}	-0.035	-24.02***	-0.0076	-1.05	-0.0337	-23.80***
{-10, -1}	-0.0153	-10.52***	0.0099	1.36	-0.0141	-9.99***
{0, 2}	0.0045	3.11***	0.0008	0.11	0.0049	3.46***
{2, 10}	-0.0075	-5.13***	0.0078	1.07	-0.0064	-4.53***
{10, 20}	-0.0278	-19.09***	-0.0047	-0.64	-0.0265	-18.72***

Source: Compiled by authors.

Note: *, **, ***denote statistical significance at 10%, 5%, and 1% levels, respectively.

momentarily favours green bond announcements, although this impact is not sustained in the long run.

Cumulative Average Abnormal Returns Analysis

To gain further insights, the AARs were aggregated over selected event windows. Table 4 presents the CAARs and associated *t*-values for the MAR, MKAR, and RAR models.

Pre-Announcement Periods ([−20, −10] and [−10, −1])

The CAARs for both pre-announcement windows are significantly negative under the MAR and RAR models, suggesting that the market possibly held pessimistic views or experienced uncertainty in the lead-up to the green bond announcements. For instance, the MAR CAAR in the [−20, −10] window is −3.5% with a highly significant *t*-statistic of −24.02. This may reflect broader market concerns or sector-specific weaknesses during that time.

Announcement Window ([0, 2])

A clear positive reaction is observed in the short-term announcement window. The MAR and RAR models show statistically significant positive CAARs (0.45% and 0.49%, respectively) with *t*-statistics above 3, indicating that investors react positively to green bond announcements. This is consistent with signalling theory, where the issuance of green bonds sends a positive message about the firm's commitment to sustainable practices, thus enhancing investor confidence (Flammer, 2021).

Post-Announcement Windows ([2, 10] and [10, 20])

However, the post-event window beyond Day +10 reveals significant negative CAARs, suggesting that initial optimism dissipates and prices revert toward fundamentals. The CAARs for these windows go negative again, particularly under the MAR and RAR specifications. For instance, the MAR CAAR for the [10, 20] window is −2.78% (*t* = −19.09), implying that the early market optimism is

fleeting and might be followed by profit-taking or correction behaviour. This trend is in line with findings from earlier research that environmental cues are likely to make a stronger, shorter-term impact and can lose influence if there is a lack of follow-up or underlying change (Tang & Zhang, 2020).

Model Comparisons

The MAR and RAR models identify more statistically significant abnormal returns than the MKAR model, which controls for systematic risk based on a regression-based market model. The results are consistent with suggestions by Brown and Warner (1985) and MacKinlay (1997) on employing several models to examine robustness in event studies. The MAR model, although less complex, captures investor sentiment around green bond announcements well in the Indian case.

Conclusions

The research finds that green bond announcements in India trigger considerable short-term positive abnormal returns, indicating that investors perceive them as a sign of a firm's sustainability commitment. This is consistent with signalling theory and prior evidence in developed markets. However, the negative returns before and after the event could indicate market uncertainty or short-term profit-taking. The MAR and RAR models were found to better capture these effects, which supports their application in event studies in emerging markets. Overall, the results validate the hypothesis that green bond announcements have a positive effect on stock prices in the short term.

Managerial Implications and Future Scope

The findings of this study carry significant implications for corporate managers, investors, and policymakers. From a managerial perspective, the issuance of green bonds can serve as a powerful strategic signal of a firm's environmental commitment, potentially enhancing reputation and attracting ESG-focused investors. The positive short-term stock reactions indicate that timing and transparency in announcements are crucial for maximising market impact. Managers, especially in sectors like waste management, water infrastructure, and green buildings currently underrepresented in green bond allocation can explore this financing tool as a means of diversifying capital sources and aligning with national sustainability goals. Moreover, the importance of third-party certifications and ESG disclosures underscores the need for enhanced communication strategies to mitigate investor scepticism and greenwashing concerns. Looking ahead, future research should delve into the long-term financial and ESG performance of green bond issuers in India, explore sector-specific investor responses, and examine how varying levels of regulatory oversight and external validation influence market

behaviour. Comparative studies across emerging and developed markets could also offer deeper insights into global best practices, thereby helping stakeholders strengthen India's green finance ecosystem.

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