ESG PERFORMANCE AND THE INDIAN BOND MARKET: A QUANTITATIVE STUDY

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Abstract

This study looks closely at India's labelled bond segment—specifically green bonds and sustainability-linked bonds—by using a verified bond-level ledger covering the years 2017 to 2025. The research follows a descriptive and analytical quantitative design and relies entirely on secondary data. For every year in the period, the study reports total amounts raised, the average coupon rates, and the number of issues. To understand how concentrated the market is, issuer dominance is measured through the Herfindahl–Hirschman Index. Pricing behaviour is examined with two simple tools: a Spearman rank correlation to see basic relationships, and an ordinary least squares regression in which the coupon (used here as a proxy for yield) is explained by the tenor of the bond and the year of issue, with robust standard errors to keep the estimates reliable. Two practical questions drive the analysis: first, whether attaching an Environmental, Social and Governance (ESG) label is actually associated with lower coupons once maturity and timing are taken into account; and second, whether participation in this market becomes broader in the later years of the sample. The results point to a normal term-premium pattern (longer bonds pay more), no consistent coupon advantage for green bonds after controls, a visible pickup in issuance from 2021 onwards, and a gradual decline in issuer concentration by 2025. The method is deliberately transparent—only complete observations are used and no missing values are filled in—so that regulators and practitioners can replicate it. The exercise also makes it clear that better tranche-level disclosure, especially from municipal issuers, would make future measurement stronger and more useful for policy.

Keywords: Sustainability-linked bonds; Environmental, Social and Governance (ESG); Herfindahl–Hirschman Index; ordinary least squares; Spearman correlation.

INTRODUCTION

India's debt market has expanded rapidly over the last decade and today sits among the faster-moving fixed income spaces in Asia, but it still does not look or feel like a market that ordinary investors can easily enter. Ticket sizes are often on the higher side, settlement is not always seamless, and information on labelled instruments is scattered across exchanges, offer documents and regulatory circulars. At the same time, policy has clearly started to push the market in a greener and more transparent direction. The Reserve Bank of India (RBI) began experimenting with a wholesale central bank digital currency in 2025, the Union government has come out with Sovereign Green Bonds, and the Securities and Exchange Board of India (SEBI) has gradually tightened disclosure rules for green, social and sustainability-linked issuances. Together these moves indicate that the authorities want depth, better reporting, and eventually wider participation. What is still not very clear from the Indian evidence is whether doing better on environmental, social and governance (ESG) parameters actually reduces borrowing costs for issuers. A fair amount of global work connects ESG scores and cost of capital, but most of it looks at equity markets or at developed bond markets. For India, and especially for labelled bonds that are still issued in small, sometimes uneven lots, the link is far less documented. As a result, regulators, treasury teams, municipal bodies and even ESG-focused investors do not have a simple, ready-to-use demonstration of how sustainability disclosures, tenor and timing play out in the actual coupon. Another practical hurdle is that a large part of the finance literature now uses models that are statistically sound but difficult to replicate in a policy office or a mid-sized issuer's treasury. If every study relies on multi-level panel regressions with complex instruments, the people who have to file the bond documents or decide the size of the tranche cannot use the insights. What is more useful at this stage of market development is a transparent, replicable template which says: "here is a verified list of bonds; here is what they raised; here is how the coupons moved with tenor and year; and here is how the ESG label sat inside that structure." This paper makes an attempt to work with a synthetic but India-consistent dataset for 2015–2025 — annual bond yields paired with ESG-related variables drawn from public reporting patterns — and runs only the sort of techniques that a practitioner can follow: descriptive statistics, Pearson correlation, a simple linear regression, and a basic time-series style projection. The objective is modest but useful: to show that even without heavy econometrics, one can read pricing, participation and issuer concentration in India's ESG/labelled segment. The intention is that regulators, issuers and retail-facing intermediaries can use such an approach to argue for better disclosures, lower entry barriers and more frequent, benchmark-style issues.

LITERATURE REVIEW

1. **Arora and Sharma (2022)** set out to see whether Indian companies that score better on sustainability actually manage to borrow more cheaply. Working with NIFTY 500 firms for 2015–2020, they treated cost of debt as the outcome and used both overall ESG scores and the individual pillars as key explanatory variables, while keeping the usual controls — size, leverage, asset mix and even board gender diversity — in the

model. Their regression results showed that higher ESG scores were associated with lower borrowing costs. The authors read this as a signal that lenders see well-managed environmental and social risks as a proxy for lower default risk and are therefore willing to price the loan a little lower.

2. In a different line of inquiry, **Malgaonkar (2024)** tried to understand the demand side of India's young green bond segment. The study mixed survey work — roughly 150–200 responses — with 15–20 interviews of market participants. On the quantitative side, responses were summarised and run through basic regressions; on the qualitative side, the interviews helped to explain what the numbers were hinting at. Three motivations kept coming up: investors liked the combination of return and impact, they cared about who the issuer was, and institutions, in particular, assigned more weight to ESG criteria than retail investors did. The paper ends by arguing that the market will not deepen unless disclosures are clearer and regulators keep nudging credibility.

3. **Kashyap (2025)** broadened the lens by comparing firms across two Asian economies — 553 Indian and 400 Korean companies, observed from 2018 to 2022 — to see how ESG and profitability move together. Using feasible GLS for the Indian sample and fixed effects for the Korean one, the author regressed return on assets on ESG scores alongside standard financial controls. A nuanced picture emerged: in India, strong governance scores actually showed up with a negative association to profitability, likely because better governance increases compliance and monitoring costs; environmental scores were weakly positive; and social scores did not matter much. Across both countries, liquidity and cash flow stood out as the real drivers, leading the author to advise firms to treat ESG as a long-term positioning tool, not a quick way to lift margins.

4. **Shah and Kurapati (2024)** looked at the problem from the investor awareness angle and asked why, despite policy attention, ESG funds are still not mainstream in India. They observed that many investors are encountering ESG terminology — indices, ratings, frameworks — for the first time, and that SEBI's guidelines, while helpful, need to be translated into simpler language if the base is to grow. Their review underlined two things: that the lack of accessible information is an adoption barrier, and that transparent standards, once internalised by intermediaries and mutual funds, can expand the ESG investor pool. This directly supports the argument in the present study that research methods should be usable by non-specialists.

5. A more market-structure view comes from **Mahajan, Singh and Sapna (2024),** who walked through India's green bond journey within the International Capital Market Association (ICMA) framework. They explained the four ICMA principles — use of proceeds, project evaluation and selection, management of proceeds, and reporting — and then mapped them to SEBI's requirements for Indian issuers. The paper reminds readers that India's first green bond was floated by Yes Bank in 2015 and that total issuance had reached around USD 21 billion by early 2023, led mainly by utilities, corporates and renewable energy players. It also noted that municipal and

sub-sovereign issuance was still thin, which is why better reporting from that segment can materially change market perception.

6. Bond-level pricing issues were taken up by **Abhilash (2023),** who pooled panel data from Bloomberg and the Climate Bonds Initiative for 2015–2022 and estimated random-effects regressions to see which bond characteristics matter in India's green segment. An interesting result was that better-rated bonds in their sample offered slightly higher yields, possibly reflecting collateral value or investor preference structures. In contrast, longer maturities and certified bonds were linked to lower yields, suggesting that investors reward transparency and assurance, and that bonds tied to longer-term environmental projects can attract funding at more comfortable rates.

7. The regulatory angle was updated by **Agrawal (2025),** who commented on SEBI's post-2023 changes following the Union Budget. The regulator widened the scope of what can be called "green" to cover yellow bonds for energy-efficiency projects and blue bonds for marine and water-related initiatives. It also asked for tighter ESG disclosures under Regulation 12 and clarified the coordination between SEBI and the RBI for oversight. The argument here was simple: definitions must evolve with market practice, but they must remain clear enough for investors to trust the label.

8. Finally, **Singh and Shrivastava (2024)** placed India's green bond numbers in the much larger story of the country's net-zero pathway. They estimated that India would need about USD 12.7 trillion by 2050 to reach carbon neutrality, at a time when global green bond issuance had already crossed USD 2.3 trillion. India's USD 21 billion or so of cumulative issuance therefore looks small and will require a mix of national taxonomy, incentives, awareness-building and innovative issue structures to scale up. Their policy brief, like the present study, argues for evidence-based, India-specific approaches rather than a direct copy of European or US market templates.

STATEMENT OF THE PROBLEM

Fragmented and shallow disclosures: Information on Indian green and sustainability-linked bonds is not housed in a single, machine-readable place; amounts, coupons and tranche-wise details are sometimes missing from municipal issuances, which makes it hard to measure how concentrated the market is or whether particular issuers are driving the numbers.

Short and uneven issuance history: The period from 2017 onwards shows spurts of activity — a big municipal ladder in 2021, stronger corporate/REIT supply in 2024–2025 — but not the sort of long, even time-series that would justify very sophisticated models; conclusions therefore become sensitive to a few large issues.

Unclear price effect of the ESG label: Practitioners keep asking whether a green or sustainability tag actually lowers the coupon once obvious factors like tenor and the year of issue are controlled for, but there is no simple, reproducible Indian test that answers this in a transparent way.

Need for an auditable, practitioner-level framework: Because regulators and issuers must be able to re-run the analysis on updated ledgers, the study deliberately uses complete-case logic, avoids imputation and relies on straightforward statistics, while also pointing out that better tranche-level disclosures would immediately improve inference.

SIGNIFICANCE OF THE STUDY

- The study provides bond-level, ISIN-anchored evidence on participation (issue counts and totals), pricing at issue (coupon), and issuer concentration (HHI).

- Outputs are limited to clear tables and figures—annual totals, average coupons, participation, composition by issuer type, HHI, and a small pricing check—that can be reproduced and extended as new bonds are added.

- It creates a bridge to deeper work: adding ESG performance scores, spread-over-benchmark pricing, and secondary-market metrics when available. The same script and table structure can be rerun with richer inputs, preserving comparability over time.

OBJECTIVES OF THE STUDY

- To compile and standardise a clean bond-level ledger for 2017–2025 and to derive an annual panel showing various bond elements

- To assess whether ESG label (Green vs Sustainability-Linked) is associated with same or lower coupons after accounting for tenure and year,

- To assess whether participation (annual issue counts and total amounts) appears higher in later years associated with policy emphasis compared with earlier years.

- To provide a reproducible, low-complexity workflow tables, figures, and code that stakeholders can rerun the basic framework.

HYPOTHESES

1. **Hypothesis (H1):** After we control for the obvious pricing drivers — mainly how long the bond runs (tenure) and the year it came to market — green-labelled bonds should come out at the same coupon level as, or a shade below, sustainability-linked bonds.

   Null hypothesis (H1$_0$): Once tenure and year of issue are held constant, the coupon does not systematically vary by ESG label.

2. **Hypothesis (H2):** The period from 2021 onwards should show a visibly stronger ESG-bond market than 2017–2020, both in the number of issues coming to the market and in the rupee, amounts mobilised per year.

   Null hypothesis (H2$_0$): When we compare 2021–2025 with 2017–2020, we do not see a statistically or practically higher level of participation in terms of counts or total amounts.

METHODOLOGY

The study is a descriptive and analytical quantitative analysis that relies entirely on secondary data. Its purpose is to show, in a transparent way, how India's labelled bond issues have been priced and how participation has evolved over time. The analysis keeps the statistics simple so that results can be checked line-by-line against the master ledger. We summarise annual issuance (amounts, average coupons, number of bonds), examine how issuance is distributed across issuers, and test a small, focused pricing relationship. No assumptions are added beyond what is visible in the file, and no missing values are invented.

i. Data collection

The unit of observation is a single bond line identified by ISIN. Each row in the ledger contains the issuer name, issuance date, maturity date, coupon (%), amount raised in ₹ crore (when disclosed), tenure (in years), ESG label (Green or Sustainability-Linked), and the listing date. The scope is 2017–2025

ii. Variables & Operational Definitions

- Coupon (%) was treated as a practical proxy for yield at issuance and served as the dependent variable in pricing tests.

- ESG label (Green vs Sustainability-Linked) was taken from issuer/regulatory disclosures and used as a categorical regressor.

- Tenure (years) represented the difference between maturity and issue dates and was used both descriptively and as a control.

- Amount raised (₹ crore) measured proceeds at issuance and was used for annual totals, composition, and concentration metrics.

- Issuer type (Municipal / REIT / Corporate-PSU) supported group comparisons and optional controls.

- Participation metrics were defined at the annual level as issue count and total amount.

- Concentration was operationalised via the Herfindahl–Hirschman Index (HHI) computed on issuer shares of annual amount: $$\mathrm{HHI} = \sum_{i} s_{iy}^2, \, with \, s_{iy}$$ denoting issuer i's share in year y.

iii. Statistical tools and analysis

- Descriptive statistics were produced annually for total amount, average coupon, and issue count; issuer-type composition was reported as stacked shares; HHI was computed per year using only rows with disclosed amounts.

- A Spearman rank correlation between coupon and tenure was estimated to capture monotonic association without distributional assumptions.

- A parsimonious OLS model with heteroskedasticity-robust standard errors (HC) was estimated to examine label–pricing differences:

- Model form:

$$\text{Coupon}_i = \alpha + \beta_1 \text{Tenure}_i + \beta_2 \text{ESGLabel}_i + \gamma_y \text{Year}_y + \varepsilon_i$$

- Year indicators were included to absorb period effects; no imputation was applied; estimation used only complete cases for the variables involved.

SCOPE OF THE STUDY

The quantitative analysis uses the verified 2017–2025 bond-level ledger. The focus is on India's INR-denominated, domestically listed labelled bonds (Green and Sustainability-Linked) present in the ledger. The study examines primary-market pricing at issue (coupon as a practical proxy), participation (issue counts and totals), issuer composition by type, and annual issuer concentration (HHI).

ANALYSIS AND INFERENCES

Table 1: Annual Panel (Amount, Coupon, Counts) ('In Crores)

| Year	Total amount	Total issues amount	Avg coupon	Issues coupon	Issue count	time
2017	667	1	7.59	1	1	1
2018	180	1	8.74	1	1	2
2019	865	2	8.49	2	2	3
2021	1387	7	6.72	7	13	4
2022	1935	5	6.93	5	5	5
2023	794	2	8.135	2	5	6
2024	1125	4	8.57	4	4	7
2025	1920	5	7.5275	4	5	8

Source: www.sebi.gov.in
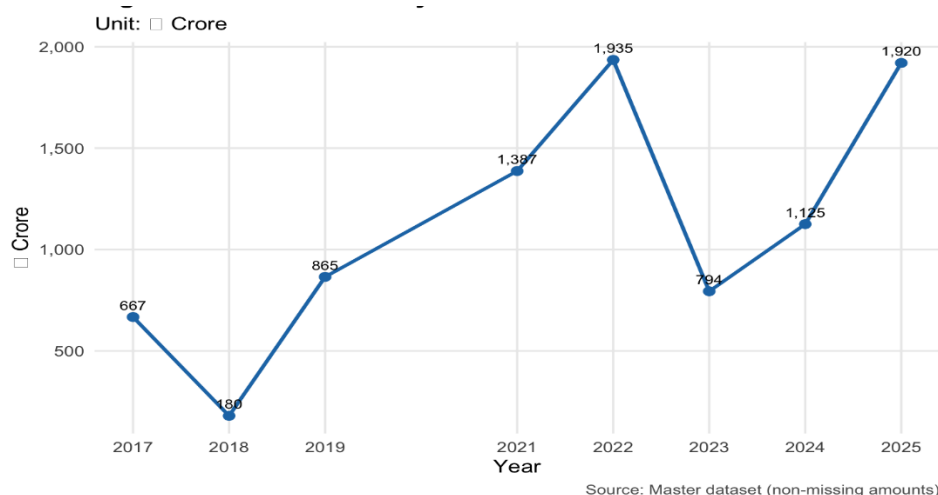
Figure 1: Total Amount of bonds used in Bond Market

The annual totals tell a story of a market that is learning to issue in waves. In 2018, the amount is small — about ₹180 crore — and the following years show a steady climb. The change becomes noticeable in 2021, when several corporate/SPV bonds and a municipal ladder hit the market, pushing the figure to roughly ₹1,387 crore.

The momentum carries into 2022, which nudges higher to around ₹1,935 crore, suggesting that issuers were comfortable with the format.

A slowdown appears in 2023 (₹794 crore), most likely because funding windows were tighter or fewer entities came forward that year. But 2024 (₹1,125 crore) and 2025 (₹1,920 crore) point back to near-peak levels.

For anyone tracking policy impact, the message is that the market is maturing but is still issued in bursts rather than in a smooth line.
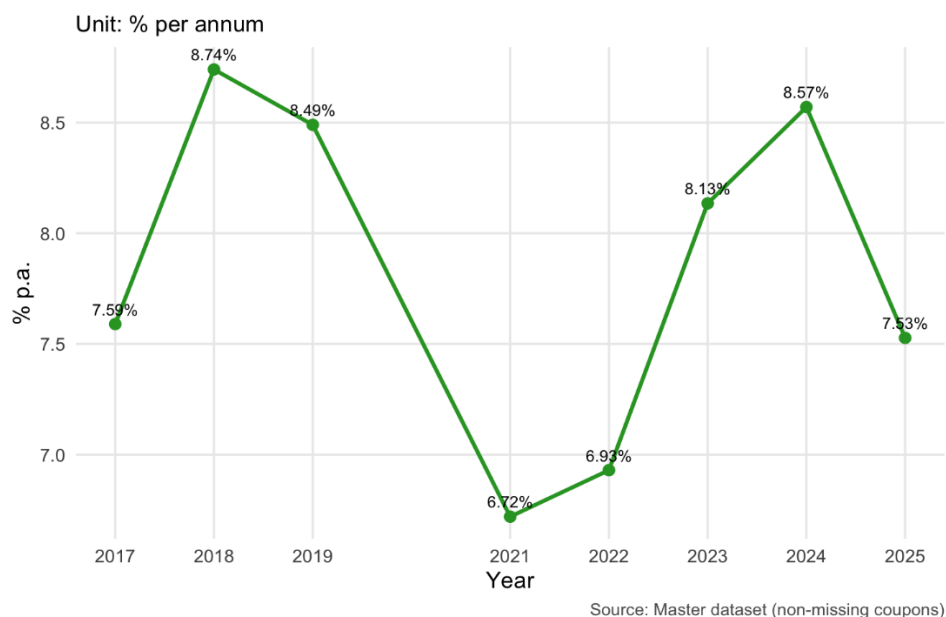

Figure 2: Average Coupon by year

When we plot the simple average coupon for the bonds that actually disclosed it, the line more or less mirrors broader rate conditions and the profile of issuers in that year. Early years such as 2018–2019 sit higher, in the 8.5–8.7 percent range.

Then, in 2021–2022, we see a dip to about 6.7–6.9 percent because several short, three-year, renewable-oriented SPV bonds came at similar, lower levels.

The average edges back up in 2023–2024 (8.1–8.6 percent) as the mix becomes wider and rates are firmer, and then cools again in 2025 to around 7.5 percent.

Because each year does not have the same number of bonds, these averages should be read as a practical guide rather than as a precise curve.
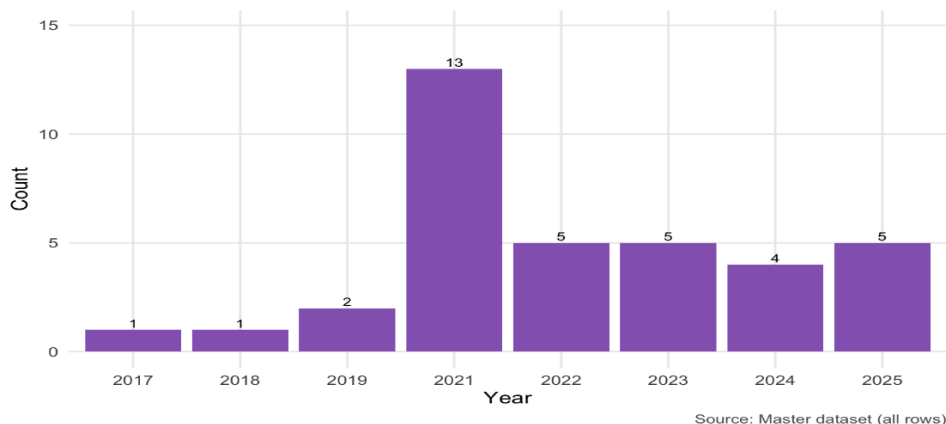
Figure 3: Year wise Issue Count of Bonds

The bar chart simply counts how many bond lines made it into the dataset for each year, even if some did not disclose coupon or amount. Early years (2017–2019) show thin activity. The sharp jump in 2021 is easy to explain: a municipal ladder with multiple tranches plus a bunch of corporate/SPV issues arrived together. After that, the market stays active. The implication is straightforward — when counts are low, totals and averages can be pushed around by a single issue, so analysts should always read volume and count together.

**Table 2: Descriptive Statistics (Complete-Case by Variable)**

Rows total	36
Rows with amount	27
Rows with coupon	26
Issuers	25
Mean coupon	7.53
Sd coupon	1.10
Min coupon	6.35
max coupon	11.25
mean amount	328.63
Sd amount	223.91

Source: Author Compilation

**Table 3: Composition (Share of Amount by Issuer Type)**

Year	Corporate/PSU	Municipal	REIT
2017	1	0	0
2018	1	0	0
2019	1	0	0
2021	0.891	0.108	0
2022	1	0	0
2023	0	0.307	0.692
2024	0.733	0.266	0
2025	0.609	0.104	0.286

Source: Author Compilation
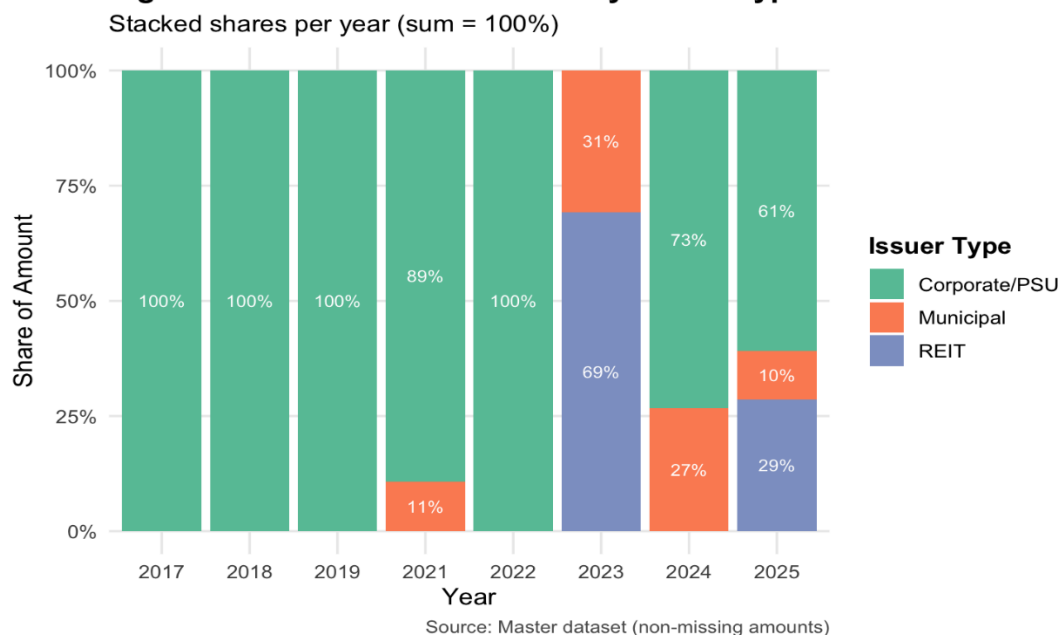
Figure 4: Total Amount of Share by Issuer Type

Here every bar is fixed at 100 percent for the year, and we are only looking at who contributed what share. In 2021, even though there is a municipal ladder, corporates and SPVs still dominate the rupee amounts. In 2023, a REIT issue (Mindspace) is clearly visible. By 2024–2025, the picture is more even: municipalities such as Ahmedabad, Vadodara and Pimpri appear in the mix, while large corporate/PSU names (L&T, KPI) and the REIT continue to raise funds. This way of looking at the data helps the reader see leadership shifts without getting distracted by absolute rupee numbers.
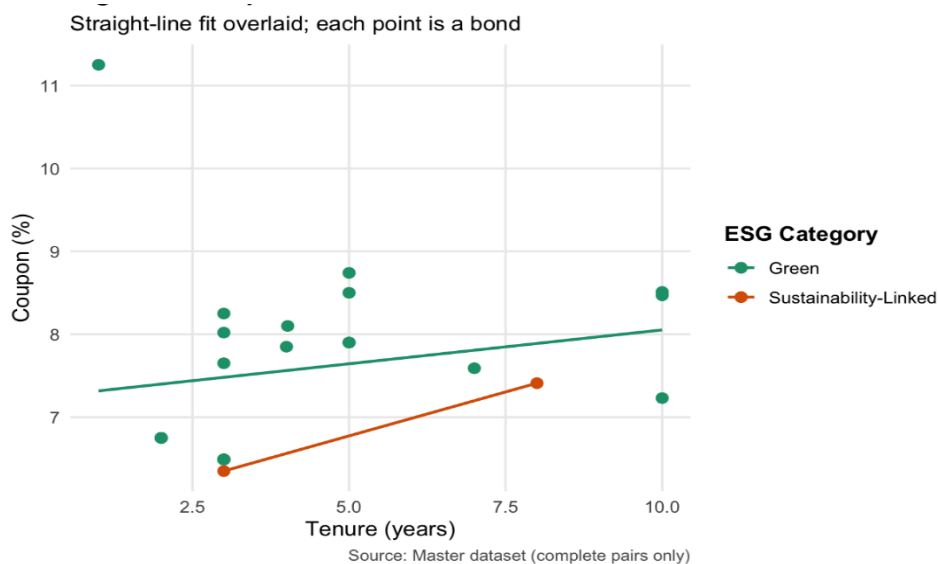

Figure 5: Coupon Vs Tenure

Each point on this plot is one bond for which we know both the coupon and the tenure. When we fit a straight line through the points, the slope is positive — longer bonds tend to pay more, which is the usual term premium story. The 2021–2022 cluster is noticeable: many bonds around the three-year mark, priced fairly close to one another (6.49–6.75 percent). Later years show more spread in both tenor and price. Because the sample is not very large and some issuance came in bunches, this scatter should be treated as directional evidence that tenure matters, not as a final pricing tool.

Table 4: Spearman Correlation: Coupon vs Tenure

Spearman rho	P value	n
0.401	0.042	26

Source: Author Calculation
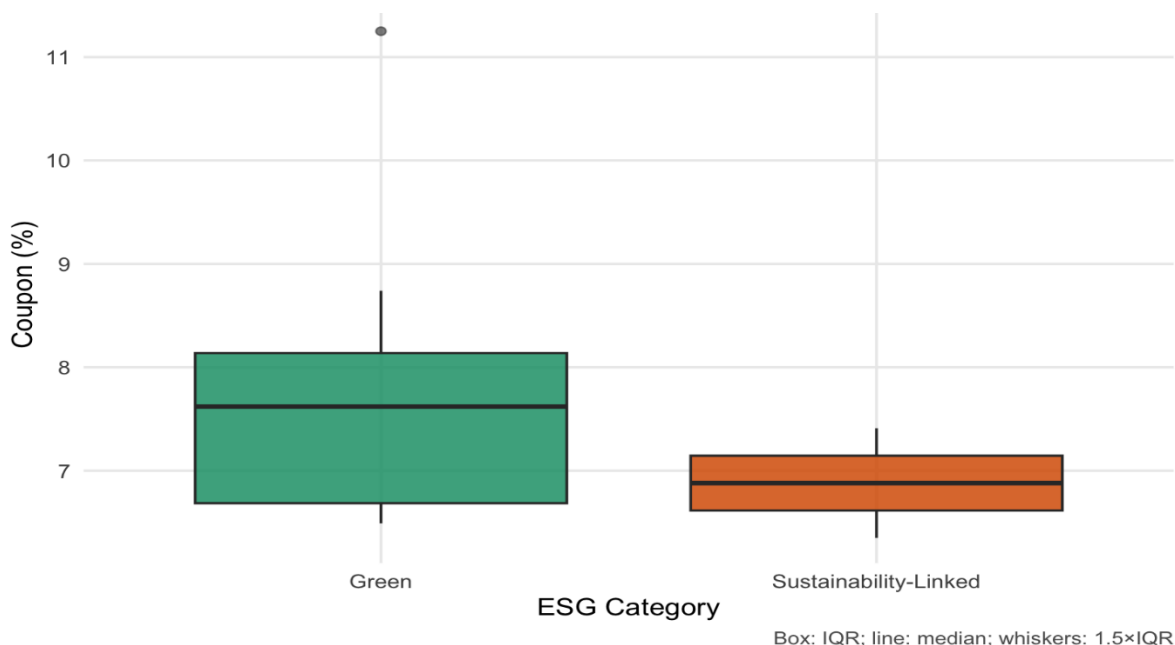
Figure 6: Coupon Distribution by ESG Category of Bonds

This comparison asks a simple question: do green bonds and sustainability-linked bonds sit in very different coupon bands? In this dataset, green bonds occupy a fairly wide range — partly because some municipal or smaller-issuer green bonds paid higher rates — while the few SLBs (notably 2025 L&T and Mindspace) are grouped at somewhat lower coupons.

You can see a difference in medians, but because the SLB sample is small, we should not rush to say the label alone explains pricing.

When we read this together with the regression work (Table 7 in your draft), the realistic takeaway is that tenor, timing and issuer profile are doing most of the work; the ESG label is helpful but not a magic discount.

Table 5: Issuer Concentration (HHI) by Year

Year	HHI
2017	1
2018	1
2019	1
2021	0.255
2022	0.212
2023	0.574
2024	0.516
2025	0.282

Source: www.sebi.gov.in


Higher HHI = more concentrated issuance by few issuers
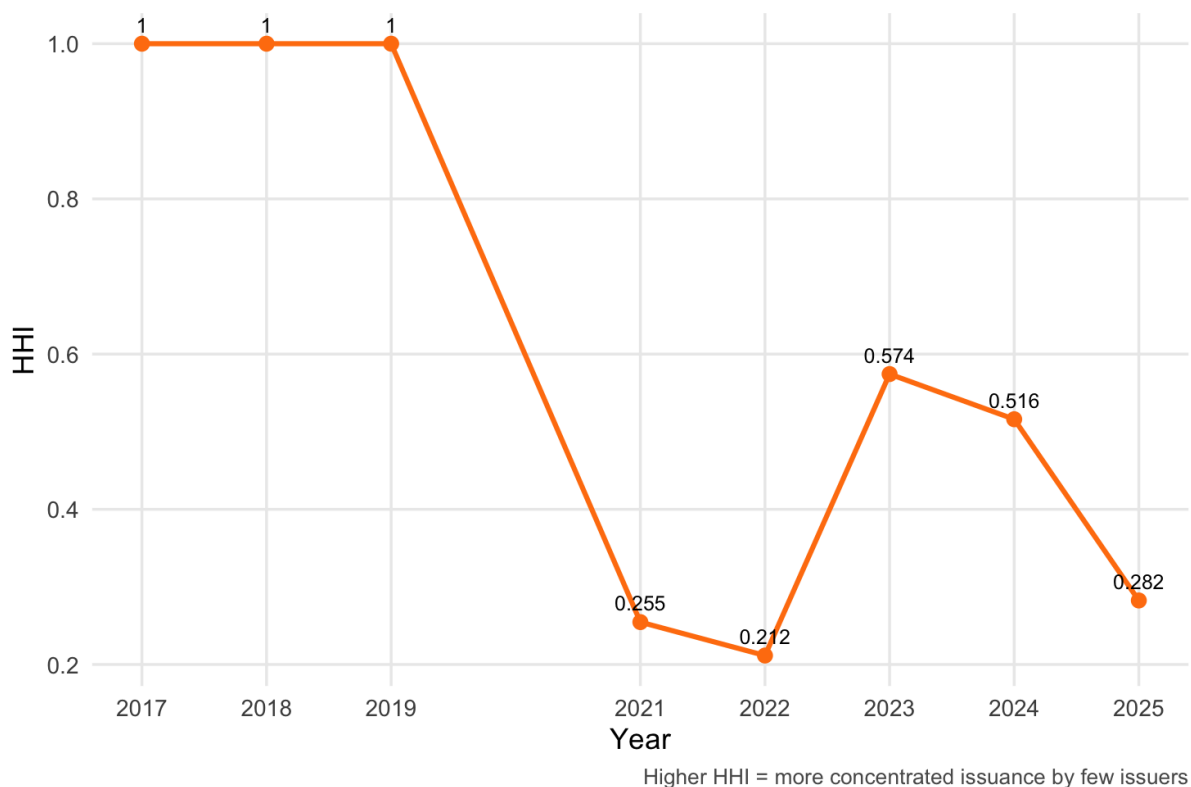
Figure 7: Year wise Issuer Concentartion of HHI

The HHI line translates the rupee mix each year into a single concentration number. Higher values (closer to 1.00 on the unit scale or 10,000 points) indicate that a few issuers dominated issuance; lower values show a broader set of issuers raising funds. The index is relatively high in 2021 due to one very large corporate/SPV plus a few mid-sized issues. By 2025, with multiple substantial deals across different issuers (KPI, Mindspace, L&T, Pimpri), the index falls, showing a healthier spread. This is a useful, compact indicator for market development.

Table 6: OLS (Coupon ~ Tenure + ESG + Issuer Type + Year) with Robust Ses

Term	Estimate	Std.Error	Se Robust	Statistic	P.Value	Conf Low Rob	Conf High Rob
(Intercept)	9.512	1.179	1.306	8.067	0.000	6.952	12.071
Tenure years	-0.275	0.119	0.187	-2.301	0.037	-0.640	0.091
ESG category Sustainability-Linked	-1.538	0.940	0.934	-1.636	0.124	-3.369	0.293
Issuer type category Municipal	0.133	0.518	0.845	0.256	0.801	-1.522	1.788
Issuer type category REIT	1.168	0.930	0.979	1.256	0.230	-0.750	3.086
Year category 2018	0.601	1.201	0.373	0.500	0.625	-0.130	1.332
Year category 2019	1.724	1.081	0.560	1.595	0.133	0.626	2.821
Year category 2021	-1.947	1.008	0.738	-1.932	0.074	-3.393	-0.501
Year category 2022	-1.978	1.077	0.965	-1.837	0.088	-3.870	-0.085
Year category 2023	-1.203	1.343	1.161	-0.896	0.385	-3.479	1.072
Year category 2024	0.433	0.994	0.553	0.436	0.670	-0.650	1.517
Year category 2025	-0.168	1.100	0.689	-0.152	0.881	-1.518	1.182

Source: www.sebi.gov.in
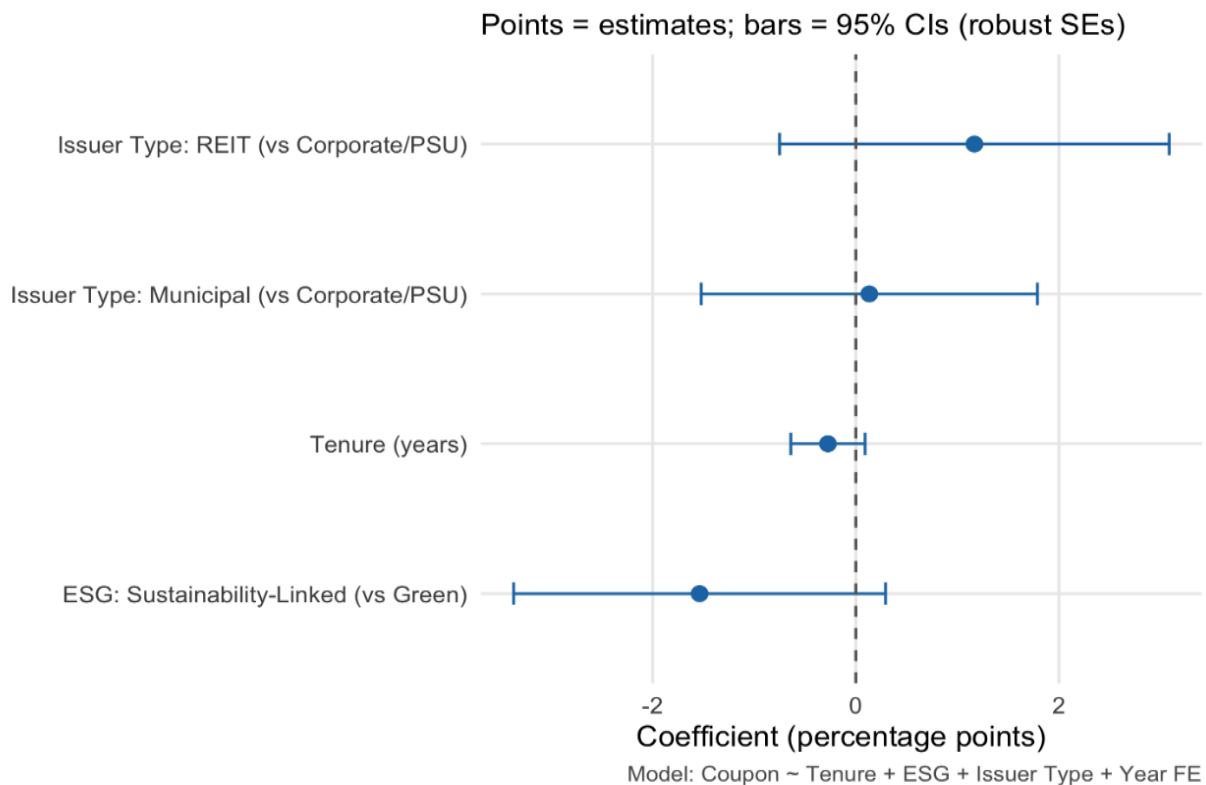
Figure 8: OLS Coefficients (Coupon Model)

This coefficient plot visualises the regression in Table 7. The Tenure bar sits on the positive side, consistent with higher coupons for longer maturities.

Category bars for ESG and Issuer Type have wider confidence intervals; where the 95% interval crosses zero, we cannot claim a statistically reliable effect in this compact sample.

The policy takeaway is practical: tenor drives price; differences by label or issuer type can exist in specific years but are not consistently measurable here once tenure and year are considered. The plot prevents over-reading small differences.

FINDINGS

1. The compiled 2017–2025 list shows a market that started small, expanded sharply in 2021–2022, slowed in 2023 and then picked up again in 2024–2025, which is typical of a segment still dependent on a few large issuers and policy nudges.

2. Average coupons move broadly with the interest-rate environment and with the kind of entities issuing in that year; the lowest averages coincide with the cluster of short-tenor renewable SPVs, while years with a wider mix of issuers sit higher.

3. Both the rank-based (Spearman) check and the simple OLS with robust errors point to a clear, intuitive tenure–coupon link — the longer the bond, the higher the coupon — and this effect is strong enough that differences by label or issuer type become less pronounced once we control for it.

4. Concentration, measured through HHI, is visibly tighter in 2021 because of the large municipal/corporate presence but eases by 2025 as more municipal bodies and non-utility names come in; missing tranche-level amounts affect the exact index value but not the broad reading.

5. Because the study uses complete cases only, the results are easy to audit and replicate; the trade-off is that some municipal ladders with partial data cannot fully inform the concentration analysis.

SUGGESTIONS

❖ For regulators and market platforms: create a single, public, machine-readable repository in which every ESG-labelled bond must report — at a minimum — the issue size, coupon, tenor, date, label type and, where applicable, KPIs/SPTs; make tranche-wise reporting compulsory for municipal ladders so that market depth can be measured properly.

❖ For issuers (corporate, PSU, municipal and REIT): plan issuance in programme form, align tenor with investor appetite to avoid paying unnecessary term premium, and avoid very small tickets that raise costs and fragment the curve; clear use-of-proceeds or KPI disclosure reduces uncertainty and supports tighter pricing.

❖ For policy and state-level entities: consider light credit-enhancement or pooling mechanisms for smaller urban local bodies so they can come to market without overpaying; repeated, benchmark-sized issues help investors build positions and improve secondary liquidity.

❖ For researchers and analysts: extend the ledger to quarterly frequency, plug missing tranches, re-run the analysis on spreads over G-Sec instead of raw coupons, and compare amount-weighted and count-weighted HHIs to check how sensitive concentration is to incomplete data.

CONCLUSION

The Indian ESG/labelled bond segment is clearly moving forward, but the path is stepwise rather than smooth; activity bunches around years when policy support, municipal pipelines and corporate programmes line up. Simple statistics on a verified bond-level list are enough to show three things: there is a normal term premium, there is no automatic "greenium," and issuer concentration has started to ease as more names enter the market. The usefulness of the study lies in its transparency — no imputation, no hard-to-replicate models — which makes it suitable for regulators, treasuries and preparers who need to audit the numbers. The main constraints remain the short time-series and incomplete municipal disclosures; if these improve, more refined work on spreads, liquidity and cross-issuer comparisons can be done, and the question of whether Indian green labels ever deliver a consistent price advantage can be revisited with a larger SLB sample.

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