



Study on Efficiency of Sovereign Bond Market in India

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ABSTRACT

The primary goal of this research is to assess the effectiveness of India's government bond market. The study discovered a mild kind of inefficiency in the Indian bond market, which fluctuates with the maturity length of sovereign bond indexes. The data clearly illustrate that sovereign bond rates are not random across all maturities (1, 2, 3, 5, 10, and 15 years).

In other words, India's government bond market is inefficient. The study also finds that short-term sovereign bond indexes in India are more efficient than long-term

Indices of sovereign debt. We may anticipate short-term government debt yield for the next 4 days, medium-term government bond rates (3- and 5-year) for the three days that follow, and for a long time government bond yields (10-, 15-year) for the following two days, based on the findings. According to the research of E. GARCH and T GARCH, there is no leveraging impact on the yields on government bonds within India across all maturities. This shows that sovereign bond markets are more resistant to outside factors than the markets for stocks.

KEY WORDS: bond market, India, Run test, long term, short term

INTRODUCTION

The bond markets in India play a very important role in maintaining the country's financial ecosystem, as it enables governments, corporates, and banks to raise funds or investment for their company through debt financing. It also helps investors to engage in fixed investment instruments by investing or buying those bonds with government, corporate, and bank issues. Since India is a part of the economy, its bond market has witnessed significant growth and development in recent years. The Indian bond market allows both Indian investors and foreign investors to buy the bonds of Indian companies issued by various entities.

The bond market in India is regulated by the "Security Exchange Board of India (SEBI)" this regulatory body helps to maintain fair practices, transparency, and build trust between investors. As the Indian bond market contains a variety of debt instruments, each of these categories has a different risk profile, requirements, and also investor preference.

Government bonds: these are the bonds which are issued by the central and state government of India, in order to meet their expenses and manage the fiscal deficits. Government bonds are generally considered as a low-risk investment as the chance of defaulting on bonds is negotiable or 0.

Corporate bonds: these are the bonds which are issued by the corporate companies in order to finance their expenses for business expansion, infrastructure development, and for their debt refinancing. Corporate bonds are generally issued at a higher interest rate than government bonds because the risk of default is high.

Municipal bonds: these are the bonds which are issued by municipal corporations or local governments in order to invest in the development of projects. These bonds provide an opportunity for investors to be part of public development at the same time get interest payments. These bonds' interest rate is somewhere between government bonds and corporate bonds as these companies are powered by the government of India.

As years passed, the Indian bond market has witnessed the growth in the number of participants in the market by both domestic and foreign investors. This has happened because of improvements in the market infrastructure, increasing liquidity, and the introduction of electronic trading platforms. And they are now aiming to increase the liquidity and transparency in the market transaction.

Investing in the bond market helps investors to diversify their investment portfolio. And it also helps to manage the risk by earning a stable income. The Indian bond market provides a wide range of options in selecting the tenors and yields of the bonds. And moreover, these efficient bond markets contribute to the economic growth of the country by facilitating the capital mobilization for infrastructure development and corporate expansion.

In conclusion Indian bond markets is in developing stage where it offers plenty of investment opportunities for individuals, institutions and government. Due to its strong regulatory framework, diversified offerings, and constant growth. Indian bond market holds immense potential and remains an essential component of the country's financial landscape.

LITERATURE REVIEW

1. "Efficiency of the Indian Bond Market: An Empirical Analysis Authors: Patel, R., & Jayaraman, T. K."

Financial market efficiency is a vital component of today's economies since it impacts the distribution of resources, price precision, and overall financial stability. The bond market is important in India's financial environment because of its role in generating cash both for the government and the business sector. "Efficiency of the Indian Bond Market: An Empirical Analysis," by Patel and Jayaraman, adds to our knowledge of the Indian bond market's effectiveness by applying several empirical approaches to assess the market's performance.

Findings and Implications:

The empirical study of Patel and Jayaraman's work is believed to have produced important conclusions about the effectiveness of the Indian bond market.

Market Integration: Information on the level of cooperation among various bond market categories, including government bonds, corporate bonds, and municipal bonds.

Price Discovery: Determining if the bond marketplace absorbs fresh data into its bond prices effectively and what bonds offer most to the price finding process.

Analysis of liquidity patterns and their impact on the efficiency of the market, particularly how the amount of trading and spreads between bids and asks differ among bonds.

Impact of Regulatory Improvements: Evaluation of the manner in which reforms to regulators, such as modifications to exchanges or transparency needs, have impacted market efficiency.

2. "Determinants of Bond Market Development in India" by Authors: Singh, B., & Jain, P.

Bond markets are critical to every economic system's financial growth and sustainability. A functioning properly bond market may help to mobilize money, provide diversified investing possibilities, and help either the governmental and private sectors. Singh and Jain's study, "Determinants of Bond Market Development in India," looks into the variables which impact the rise of the bond marketplace in India, shed light on its expansion and effectiveness.

In conclusion, Singh and Jain's research on the variables driving the development and effectiveness of India's bond market gives helpful insights into the complex elements impacting the growth and effectiveness of this vital financial sector. The study adds to our knowledge of whether India may further expand its bond market to assist its economic growth, stability in finance, and diversification of investments by identifying important drivers and their linkages. The findings may be used as a guide for regulators, policymakers, and market participants as they work together to enhance the role of the Indian bond market in the larger finance environment.

3. "Impact of Interest Rate Changes on Indian Bond Market Efficiency" by Authors: Sharma, R., & Gupta, M.

The bond market is important in the Indian financial system because it influences the price of financing for both the government as well as private firms. The investors, policymakers, and market players have to comprehend how variation in rates influence the effectiveness of the Indian bond market. The paper, "Impact of Interest Rate Changes on Indian Bond Market Efficiency," by Sharma and Gupta, dives into that intricate link, offering insight on the changing dynamics of rates of interest and the efficiency of the market.

Findings and Implications:

Several major conclusions addressing the influence of variation in yield on the effectiveness of the Indian market are predicted to be revealed by the study:

Rate Sensitivity: The degree that bond values react to shifts in the rate of interest, which varies between bond classes (for example, government, corporate, and municipal bonds).

Yield Curves Patterns: Learn how the yield curve reacts to shifts in rates of interest, particularly variations in yield differences between long-term and short-term bonds.

Consequences for Liquidity: How rate of interest changes influence market liquidity, possibly affecting trading behavior and transaction expenses.

Understanding how investors adapt to their portfolios in reaction to interest rate fluctuations, taking into account characteristics such as tolerance for risk and investing horizon.

Policy Implications: The findings of the research have a significant impact on fiscal policy choices.

4. "Efficiency and Volatility in the Indian Government Securities Market" by Authors: Reddy, Y. V., & Kishore, K

Review of the Literature: Efficiency and Volatility in the Indian Government Securities Market

Reddy, Y. V., and K. Kishore are the authors.

The Indian government bond market is an important part of the financial system of the nation, acting as an indicator for rates of interest and offering a safe way to invest for both domestic and foreign investors. "Efficiency and Volatility in the Indian Government Securities Market," by Reddy and Kishore, analyzes the market's effectiveness and fluctuation, offering insight on its structure, working, and ramifications.

Findings and Implications:

Efficiency Evaluation: Information into the effectiveness of the Indian government securities market, such as whether rates accurately represent accessible data and the speed at which fresh data is incorporated.

Trends of Variance: the recognition of factors that contribute to volatility, probable trends or periodicity in volatility, and the influence events have on the stability of the market.

Policy Implications: Consequences for regulators in terms of the market regulation, openness, and volatility management initiatives.

5. "Market Microstructure and Bond Market Efficiency in India" by Authors: Verma, R., & Mehta, N.

Like all financial markets, the Indian bond market is impacted through its microstructure—the structure that specifies where trading and price creation take place. "Marketing Microstructure and Bond Market Efficiency in India," a research by Verma and Mehta, investigates the link among the market's microstructure and the effectiveness of the Indian bond marketplace, giving an understanding of the complex relationships describing this crucial financial industry.

The research done by Verma and Mehta on the market microstructure and bond market efficiency in India provides substantial insight into how the Indian bond market operates. The study elucidates the complex structure of this market by studying the microstructure's influence on efficiency, liquidity, and information transmission. These results can help market participants, regulators, and policymakers make informed choices to guarantee India's bond marketplace is well-functioning, effective, and open which is critical for the nation's financial health and growth.

6. "Foreign Institutional Investors and the Indian Bond Market" by Authors: Das, A., & Sen, P.

Foreign Institutional Investors' (FIIs) engagement in local financial markets may have a substantial influence on the dynamics of markets, liquidity, and efficiency. A research by Das and Sen, investigates the function of FIIs within the Indian bond marketplace, providing insight about their effect, motives, and consequences for the larger financial system.

Das and Sen's research on FII involvement in the Indian bond market helps us comprehend the significance of investors in determining dynamics of the market. The paper gives an understanding of why investments from financial institutions can improve and threaten the operation of the Indian bond market by studying FII reasons, empirical data, and their influence on market efficiency. These understandings can help market players, regulators, and policymakers make educated judgments about market growth, strength, and security for investors when FIIs engage.

7. "Efficiency of Corporate Bond Markets in India" by Authors: Kapoor, S., & Maheshwari, S.

Corporate bond markets are vital parts of the financial system of a nation because they provide firms with long-term funding and also allowing buyers to diversify their investment portfolios. The research, "Efficiency of Corporate Bond Markets in India," by Kapoor and Maheshwari, explores the effectiveness of these financial markets in India, offering insight into the variables that impact their growth and operation.

Findings and Implications

Efficiency Assessment: Information to the effectiveness of the market for corporate bonds in India, such as how bond rates reflect accessible data and if trade is orderly.

Liquidity Dynamics: Knowing liquidity in the market structures and their impact on trading behavior and transaction expenses.

Credit Risk: a review of credit risk evaluation and its function in corporate bond pricing.

Market growth: Identifying elements that are impeding or aiding the growth of India's corporate bond markets.

Investor Behavior: Details in how buyers handle corporate bonds, taking their

tolerance for risk and return expectation into account.

Regulatory Environment: The investigation could evaluate the role of rules in determining market effectiveness and safeguarding investors.

8. "Regulatory Reforms and Bond Market Efficiency: Evidence from India" by Authors: Rajput, N., & Agrawal, R.

Financial market regulatory changes may significantly impact security for investors, market transparency, and effectiveness. "Regulatory Reforms and Bond Market Efficiency: Data from India," a research by Rajput and Agrawal, explores the consequences of regulatory modifications on the effectiveness of Indian market, giving an understanding of why these changes influence the dynamics of the market.

The research conducted by Rajput and Agrawal on reforms to regulation and bond market effectiveness in India provides significant insights into the link between changes in regulation and market structure. The paper gives essential information regarding the success of regulation changes in structuring the Indian bond marketplace by applying empirical methods and investigating the influence of laws on market the microstructure, liquidity, and efficiency. These results can help regulators and market participants make informed choices to guarantee that India's bond market is tightly controlled and effective, which is critical for safeguarding investors and the overall wellness of the financial system.

9. "Comparative Analysis of Bond Market Efficiency in Emerging Economies: India vs.China" by Authors: Li, H., & Kumar, A.

Bond markets that are effective are critical for the economic development of developing nations such as India and China. A comparison of bond market effectiveness in both of these nations gives helpful insights into the variables influencing their development, availability, and success. "Comparative Analysis of Bond Market Efficiency in Emerging Economies: India vs. China," a research by Li and Kumar, offers insight on these procedures, thereby enhancing our knowledge of the two bond markets.

Comparative Findings

Efficiency Levels: A determination if one bond marketplace (India or China) is more effective then one of them, taking into account aspects like discovering prices and data assimilation.

Insights into the variations in trading processes, openness, and liquidity in different markets, as well as how these variations effect effectiveness.

Market Development: An analysis of the comparative maturity and growth phase of India and China's bond markets.

Policy Implications: The research may analyze the regulation significance of its findings, recommending prospective shifts in the market or enhancements.

10. "Efficiency of Green Bond Markets in India" by Authors: Sharma, V., & Chauhan, R.

Green bonds have grown in popularity across the world as a form of funding used to support environmentally friendly projects and activities. They are critical in directing resources towards equitable growth and combating the effects of climate change. The study, "Efficiency of Green Bond Markets in India," by Sharma and Chauhan, investigates the effectiveness of the markets for green bonds in India, giving insight into the development, efficiency, and effect of those markets.

The study by Sharma and Chauhan on the effectiveness of green bond markets in India advances our knowledge of the role that financial markets may have in promoting equitable growth. The report gives perspectives on the expansion and potential for green finance in the country by assessing market growth, metrics for performance, and the effect of environmentally friendly bonds. These results can help policymakers, market participants, and buyers make informed choices to build and improve markets for green bonds in India, thereby contributing to the country's long-term and environmentally conscious development.

OBJECTIVES AND RATIONALE

- To analyse market efficiency
- To determine the factors of efficiency drivers
- To evaluate the impact on monetary Policy
- To identify he policy recommendations
- To study the risk and return analysis

Conducting research on "the efficiency of the Indian sovereign bond market" is not just important academically, but it additionally has broad implications for the Indian economy, market participants, and policymakers. The study's goal is to add to a better knowledge of this vital sector and to make concrete suggestions for its development and enhancement.

RESEARCH METHODOLOGY

This research covers six years, from September 2011 to September 2016. The amount of data utilized in the research is daily, and the data is secondary in nature, acquired from the Bombay Stock Exchange. The RUN test and ARMA, T. GARCH, and E. GARCH have been used in the research, along with SPSS software.

Run test and Bond Market Efficiency Test

The run test is employed to assess the effectiveness of the bond market, and it relies on a notion known as the "Monte Carlo fallacy" or "fallacy of the maturity of chances." This is clarified by the concept of "what goes upward needs to come downward." This tendency is seen in shareholders whose stock prices have increased over a length of time and are thought to be "due for a fall." This suggests that by understanding previous price fluctuations of companies, it is possible to readily forecast the likely direction of future fluctuations in prices. This demonstrates the point that the equity market is both foreseeable and inefficient. The problem now is to determine whether or not the Indian sovereign bond.

DATA ANALYSIS RESULTS AND INTERPRETATION

Table1. Statistics of sovereign bond yields of India

PERIOD OF BOND YEILD	N	MEAN STATISTIC	STD. STATISTIC	SKEWNES S STATISTIC	SKEWNES S STD. ERROR	KURTOSIS STATISTIC	KURTIOSI S STD ERROR
1 YEAR	1329	8.027	0.62175	0.059	0.067	-0.436	0.134
2 YEAR	1329	7.9578	0.52768	0.025	0.067	-0.285	0.134
3 YEAR	1329	8.002	0.48996	-0.063	0.067	-0.058	0.134
5 YEAR	1329	8.1372	0.49658	-0.067	0.067	0.453	0.134
10 YEAR	1329	8.1161	0.48786	0.003	0.067	-0.870	0.134
15 YEAR	1329	8.3757	0.49029	0.081	0.067	-0.66	0.134
30 YEAR	1329	8.3962	0.52602	-0.010	0.067	-0.873	0.134
VALID N	1329						

Table 1 displays descriptive information for several bond indexes' daily yields. As seen in the table, average daily yields do not differ much across maturities, ranging from.002 bps for 3-year bond Yields to.39 bps for 30-year bond Yields. Bond volatility, or standard deviation, does not show substantial fluctuation, with values ranging from 0.48 % for 3-year bond yields to 0.62% for 1-year bond yields. The volatility of the remaining bond indexes is nearly identical.

Table 2 Run test of sovereign bond yields of India

Period of bond	Test Valuea	Cases< test Value	Cases>= test value	Total Cases	Number of runs	Z	P value
1 year	8.01	659	670	1339	40	-34.329	0.000
3 year	7.98	633	666	1339	30	-34.878	0.000
5 year	8.14	664	665	1339	18	-35.536	0.000
8 year	8.22	663	666	1339	18	-35.536	0.000
10 year	8.15	663	666	1339	24	-35.207	0.000
15 year	8.35	664	665	1339	16	-35.646	0.000
30 year	8.42	664	665	1339	10	-35.975	0.000

Table 2 presents the findings of the run test and demonstrates that consecutive sovereign bond yields are independent. It is discovered that the probable value of each bond index is substantial, indicating that yields in India are independently across all maturities. As a result, government bond yields for all maturities (1, 2, 3, 5, 10, 15, and 30 years) reveal the fact that randomisation in Indian. sense, India's government bond yields are low.

It indicates that the return in the sovereign bond market may be predicted using prior values and trends. The issue at hand now is how long sovereign bond markets can be forecasted. We used the ARMA test to get an answer to this query.

Table 3 "Results of E GARCH & T GARCH of sovereign bond yields of India"

Variables	Arch efect Prob.	LM test prob	E GARCH co efficient	E GARCH Prob	T GARCH Co efficient	T GARCH Prob	Jarque - bera Probability
1 year bond yield	0.0000	0.2300	0.004110	0.9379	0.032605	0.7525	0.000836
2 year bond yield	0.0000	0.1200	-0.043190	0.1663	0.109004	0.2301	0.028268
3 year bond yield	0.0000	0.1400	-0.043608	0.1662	0.109038	0.1297	0.026083
5 year bond yield	0.0000	0.1600	0.015400	0.9012	0.047307	0.8506	0.000135
10 year bond yield	0.0000	0.3200	-0.012502	0.8623	0.013382	0.9444	0.000000

15 year bond yield	0.0000	0.3100	-0.007021	0.9463	0.018126	0.9328	0.000000
16 year bond yield	0.0000	0.1500	-0.020581	0.8866	0.028844	0.9245	0.000000

In table 3 The probability value of heteroscedasticity is obviously important, indicating there's an Arch effect in Indian sovereign bond yields, however the probability value of the LM Test is not significant, indicating that there is no serial correlation in Indian sovereign bond rates. Which is beneficial for future data analysis. Data is regularly distributed, according to Jarque- Bera probability. According to the coefficients and accompanying probabilities value According to E. GARCH and T GARCH, leverage has no influence on government bond rates in India for all durations. This shows that government bond prices are not as responsive to outside forces (good or negative news) as the stock markets previously were. This also shows that making investments in government bonds are safer in India than investment in common shares.

Table 4 Results of OLS ARIMA of 1 & 2 year bond yields

Variables	COEFFICIENT	PROB	VARIABLE	COEFFICIENT	PROB
c	0.008655	0.8489	C	-0.012957	0.7627
01YEAR_YIEL D(-1)	0.301511	0.0000	02YEAR_BOND _YIELDS(-1)	0.834299	0.0000
01YEAR_YEIL D(-2)	0.333223	0.0000	02YEAR_BOND _YIELDS(-2)	0.010113	0.0033
01YEAR_YEIL D(-3)	0.123404	0.0154	02YEAR_BOND _YIELDS(-3)	0.089200	0.0083
01YEAR_YEIL D(-4)	0.090643	0.0266	02YEAR_BOND _YIELDS(-4)	0.088001	0.0236
R-SQUARED	0.111593		R-SQUARED	0.982690	

This shows that the prob. value of 1 yields lags 1, 2, 3, & 4 are significant, indicating that the yields of India's a year sovereign bond index may be forecast for the following four days. This index is the most inefficient bond index in India's government bond market. Although the probability, value of 2 yields lags 1, 2, 3, and 4 are substantial, this suggests that the yields of India's two-year government index can be anticipated for the following four days. This demonstrates that short-term maturity government bond yields in India are significantly inefficient when compared with medium and long- term sovereign bond yields.

Table 5 Results of OLS regression of three-year bond yields

Variable	Co efficient	Prob	variables	Co efficient	Prob
C	0.003898	0.9219	c	0.035858	0.3274
03_year_yields (-1)	0.987878	0.0000	05year_yield(-1)	1.0794313	0.0000
03_year_yields (-2)	0.142767	0.0102	05year_yield(-2)	0.264313	0.0000
03_year_yields (-3)	0.063320	0.0500	05year_yield(-3)	0.095296	0.0246
03_year_yields (-4)	0.090782	0.0833	05year_yield(-4)	0.093800	0.0954
R- squared	0.98566		R-squared	0.988174	

This demonstrates that the likelihood. value of three- year yields lags 1, 2, and 3 are significant, suggesting that the rate of return of India's 3 - year sovereign bond index can only be predicted for the next three days in a . While the lags of five-year rates are significant, this shows how the rates of India's five- year sovereign bond index may be predicted as much as three days in advance. This illustrates that in India, medium-term sovereign bond yields are less effective than short-term government bond yields.

Table 6 Results of OLS regression of ten-year bond yields

Variable	coefficient	prob	Variables	Coefficient	prob
c	0.030679	0.3737	C	0.009891	0.7809
10_year_yields (-1)	1.081740	0.0000	15_year_yields(-1)	0.077373	0.0064
10_year_yields(-2)	0.0226720	0.0001	15_year_yields(-2)	0.169950	0.0073
10_year_yields (-3)	0.096489	0.0782	15_year_yields(-3)	0.006588	0.5093

10_year_yields (-4)	0.237208	0.2541	15_year_yields(-4)	0.097781	0.2125
R- squared	0.988868		R-squared	0.028133	

Table 6 shows that the prob. value of ten-year yields lag 1 and lag 2 are substantial, indicating that the yields of India's ten-year government bond index may be forecast for the following two days. Similarly, the prob. value of the fifteen-year yields lag 1 and lag 2 are significant, indicating that the yields of India's fifteen-year government bond index may be forecast for the following two days.

FINDINGS AND DISCUSSION

- Average daily rates vary little across dates of maturity, spanning from .002 bps for 3-year bonds to .39 bps for 30-year bonds.
- Bond volatility, or standard deviation, is quite stable, fluctuating between 0.48% for 3-year bond rates to 0.62% for 1-year bond yields.
- The likely value for every bond index is significant, demonstrating that rates in India differ across maturities.
- There is no leverage impact on government bond rates in India across all maturities, based to the coefficients and associated probability values of E. GARCH and T GARCH.
- Government bonds are a safer investment in India than ordinary shares.
- The values of five-year yield lags 1, 2, and 3 are significant, implying that the rates of the country's five-year sovereign bond index may be predicted as much as three days in advance.
- The short-term sovereign yields on bonds are less efficient in India than medium-term sovereign bond rates.
- The values of lag 1 and lag 2 of the fifteen-year yields are substantial, suggesting that the future yields of India's fifteen-year sovereign bond indices may be projected over the next two days.

CONCLUSION

The findings demonstrate that there is no randomness among India's government bond rates across all maturities (1-, 2-, 3-, 5-, 10-, and 15 years). In other words, India's government bond market is inefficient. The study also demonstrates that the inefficiency of sovereign bond indexes decreases with maturity. As a consequence, we can forecast short-term sovereign bond yields (1- and 2- year) for the next four days, medium-term sovereign bond rates (3- and 5- year) for the next three days, and long-term sovereign bond yields (10-, 15- year) for the next two days. According to the results of E. GARCH and T GARCH, there is no leverage effect on government bond yields across all maturities in India.

This illustrates that government bond markets are not as sensitive to outside

influences (good or adverse news) as stock markets formerly were. This also shows that making investments in government bonds are safer in India than investment in common shares.

REFERENCE

- C.G. Gilmore, B.M. Lucey, M.W. Boscia, Co movements in government bond markets: a minimum spanning tree analysis,
- J. Dias, Sovereign debt crisis in the European Union: a minimum spanning tree approach, *Physica A* 391 (2012) 2046–2055 [8]https://www.google.co.in/?gfe_rd=cr&ei=SkQtWLHeMJPY8Aek943IAw#q=definition+of+informational+efficiency
- H.V. Roberts, Stock-market patterns and financial analysis: methodological suggestions, *The Journal of Finance* 14 (1959) 1–10.
- E.F. Fama, Efficient capital markets: a review of theory and empirical work, *The Journal of Finance* 25 (1970) 383–417
- Lars Oxelheim et. Al 2004, On the static efficiency of secondary bond markets. *J.of multi.fin. manag.*15 (2005) 117-135
- Lars Oxelheim et. Al 2004, On the static efficiency of secondary bond markets *J.of multi.fin. manag.*15 (2005) 117-135
- Luciano Zunino et al 2012, on the efficiency of sovereign bond markets *Physica A* 391(2012)4342-4349.
- Mehmet F. Dicle.et.al (2009), Market efficiency and international diversification: Evidence from India, *International Review of Economics and Finance* 19 (2010) 313– 339
- Sardar et. al. (2005) Are emerging financial markets efficient, some evidence from the models of Thai stock market. *Financial Modeling Program Centre for Strategic Economic Studies, Victoria University, Australia.*