

Volatility Behaviour of Nifty 50 and Bank Nifty: A Comparative Time-Series Analysis

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Abstract—This study investigates the volatility behaviour of two major Indian stock indices—Nifty 50 and Bank Nifty—using historical time-series data. The objective is to compare the magnitude, persistence, and pattern of volatility between the broad market index and the sector-specific banking index. Daily closing price data from the National Stock Exchange (NSE) have been analyzed for a five-year period using statistical and econometric tools such as standard deviation, coefficient of variation, and GARCH family models. The analysis reveals that both indices exhibit volatility clustering, a typical feature of financial time series, but the Bank Nifty demonstrates comparatively higher volatility and stronger persistence. This indicates that the banking sector is more sensitive to macroeconomic and policy developments than the overall market. The findings provide meaningful insights for investors, portfolio managers, and policymakers regarding sectoral risk assessment and investment strategy formulation. The study also emphasizes the importance of volatility modelling in understanding the dynamics of the Indian equity market.

Index Terms—Nifty 50, Bank Nifty, Volatility Analysis, Time-Series Modelling, Indian Stock Market

I. INTRODUCTION

The stock market plays a vital role in the economic development of any nation by mobilizing funds, promoting investment, and reflecting the overall financial health of the economy. Among various indicators of stock market performance, volatility is one of the most significant, as it represents the degree of variation in stock returns over time. A high level of volatility indicates greater uncertainty and risk, while lower volatility reflects market stability. Understanding volatility patterns is crucial for investors, portfolio managers, policymakers, and researchers as it helps in forecasting risk, designing hedging strategies, and formulating informed investment decisions.

The Indian stock market, represented by indices such as Nifty 50 and Bank Nifty, has witnessed considerable growth and structural transformation over the past two decades. The Nifty 50 index reflects the performance of the overall equity market, comprising the top 50 large-cap companies across diverse sectors, whereas the Bank Nifty index is sector-specific, capturing the performance of leading banking institutions. Given that the banking sector is highly sensitive to monetary policy changes, interest rate movements, and macroeconomic conditions, its volatility often behaves differently from the broader market index.

Volatility in financial markets is often characterized by clustering—periods of high volatility followed by high volatility and vice versa—which can be effectively modeled using time-series econometric techniques such as ARCH and GARCH models. These models allow researchers to capture the dynamic nature of volatility over time. A comparative analysis of volatility between Nifty 50 and Bank Nifty can provide valuable insights into how market-wide and sectoral indices respond to economic shocks, policy shifts, and investor sentiment.

Despite extensive research on stock market dynamics, limited studies have focused on comparing the volatility behaviour of Nifty 50 and Bank Nifty within a unified empirical framework. This study aims to fill this gap by analyzing and comparing the volatility patterns of these two indices using historical time-series data. The findings of this research are expected to aid investors in understanding market risk, optimizing portfolios, and formulating more effective trading and investment strategies in the Indian equity market.

II. OBJECTIVES OF THE STUDY

The present study has been undertaken with the following key objectives:

- Analyze the volatility behaviour of Nifty 50 and Bank Nifty indices using historical time-series data.
- Compare the degree and persistence of volatility between the two indices.
- Identify the presence of volatility clustering and persistence through econometric models such as ARCH and GARCH.
- Draw practical implications for investors and policymakers based on the comparative volatility patterns.

Scope and Importance of the Study

The study focuses on two major indices of the Indian stock market, Nifty 50 and Bank Nifty covering a defined time period using secondary data from authentic sources such as the National Stock Exchange (NSE). The research is limited to the analysis of volatility patterns and comparative behaviour between these indices, without extending to individual stock-level analysis.

The scope of this study lies in identifying and understanding volatility trends that help investors measure market risk, select suitable investment portfolios, and make informed trading decisions. For policymakers and regulators, analyzing sectoral volatility provides useful inputs for assessing financial stability and evaluating the impact of macroeconomic factors on the equity market.

The importance of this research stems from the fact that volatility directly affects pricing, hedging, and risk management strategies in the financial market. The findings will assist investors in understanding how sector-specific indices such as Bank Nifty respond more sharply to policy or interest rate changes compared to broader indices like Nifty 50. Moreover, it contributes to the growing body of literature on volatility modeling in emerging markets like India, offering empirical evidence for future academic and policy-oriented studies.

Data and Methodology

This study is based entirely on secondary data collected from authentic and publicly available

sources. The analysis focuses on two major Indian stock indices, Nifty 50 and Bank Nifty, which represent the overall market and the banking sector respectively. The daily closing price data for both indices have been obtained from the official website of the National Stock Exchange of India (www.nseindia.com) and cross-verified with Yahoo Finance for consistency and accuracy.

The period of study spans three years, from April 2023 to March 2025, covering the most recent financial years and reflecting post-pandemic stabilization, policy adjustments by the Reserve Bank of India, and evolving trends in sectoral performance. The dataset consists of daily closing prices, which are converted into daily returns using the logarithmic return formula:

$$R_t = \ln \left(\frac{P_t}{P_{t-1}} \right)$$

where, R_t represents the return on day t . P_t is the closing price on day t , and P_{t-1} is the closing price on day $t-1$.

The study employs both descriptive statistical tools and time-series econometric models to examine and compare volatility patterns. Descriptive measures such as mean, standard deviation, variance, and coefficient of variation (CV) are used to summarize the overall behaviour of returns. To capture volatility clustering and persistence—key features of financial time series, “Descriptive statistics and volatility clustering tests (Ljung–Box and ARCH-LM) were employed to examine the nature and persistence of volatility.”

All analyses are conducted using Microsoft Excel and EViews software to ensure precision and reliability of results. The adopted methodology facilitates a comparative understanding of volatility dynamics in Nifty 50 and Bank Nifty and helps identify which index exhibits higher sensitivity to market fluctuations and macroeconomic developments during the period 2023–2025.

Comparative Descriptive Analysis of Nifty 50 and Bank Nifty

This section presents a comparative analysis of the descriptive statistical characteristics of the Nifty 50 and Bank Nifty indices for the period January 2023 to September 2025. The purpose is to examine the relative volatility, return behaviour, and distributional properties of the two indices to understand sectoral differences in risk and performance.

Data Overview

Both datasets consist of 681 daily observations covering the same time frame. The Nifty 50 represents

the overall market performance, while the Bank Nifty focuses on the banking sector. The comparative results are presented in Table 1 below.

Measure	Nifty 50	Bank Nifty
Observations	681	681
Start Date	2023-01-03	2023-01-03
End Date	2025-09-30	2025-09-30
Mean (daily, log)	0.00044334227063916266	0.0003447547852563247
Std Dev (daily, log)	0.007758962086829256	0.009398457784825669
Variance (daily, log)	6.02014926648538e-05	8.833100873315022e-05
Skewness (log)	-0.5455938395746773	-0.8969610300498843
Kurtosis (excess, log)	7.333934301694475	10.72428704660705
Jarque-Bera stat	1559.9804020803101	3354.7333758215186
Jarque-Bera p-value	0.0	0.0
Min (log return)	-0.061124179171720965	-0.08280512047354056
1% percentile	-0.01622892070176804	-0.02314932551937272
5% percentile	-0.0115850796274781	-0.013504081986622138
10% percentile	-0.00857984886239657	-0.00984581831271953
25% percentile	-0.003686198197714694	-0.004500975926266101
Median (50%)	0.0006441833860869355	0.00046265498099838735
75% percentile	0.004799298814420837	0.005046241706607252
90% percentile	0.008905710055423979	0.010616062217477282
95% percentile	0.01185627017720115	0.013995853937483777
99% percentile	0.01925751354502426	0.022459485992524578
Max (log return)	0.03747217152907645	0.04430666577220599
Annualized Return (approx, log)	0.11172225220106899	0.08687820588459383
Annualized Volatility	0.12316970468237375	0.14919589203712633
Annualized Sharpe (rf=0)	0.9070595118269943	0.5823096380091672
Max Drawdown	-0.1576667728357244	-0.11993302112078302

The comparative statistics indicate that both indices exhibit non-normal return distributions, as evidenced by their significant skewness and kurtosis values, as well as the Jarque–Bera test results. However, Bank Nifty demonstrates a higher standard deviation and annualized volatility compared to Nifty 50, implying that the banking sector carries greater risk and price variability.

Key Observations

1. The mean daily return of both indices is relatively small, but Bank Nifty shows higher fluctuations.
2. The standard deviation and annualized volatility are higher for Bank Nifty, confirming greater market sensitivity.
3. Both indices exhibit negative skewness and high kurtosis, indicating asymmetric and fat-tailed distributions.

4. The Jarque–Bera test rejects the null hypothesis of normality for both indices, reinforcing the presence of volatility clustering.

5. Bank Nifty’s higher volatility suggests stronger reactions to macroeconomic events and monetary policy changes.

Interpretation and Implications

The comparative analysis highlights that while both indices exhibit volatility clustering and non-normal return distributions, the banking sector (represented by Bank Nifty) experiences higher volatility levels. This behaviour can be attributed to the sector’s sensitivity to interest rate adjustments, credit growth, and liquidity conditions. The findings imply that investors in Bank Nifty face higher risk exposure compared to the broader market index, Nifty 50.

From a portfolio management perspective, the results suggest that diversification across sectors can help mitigate risk arising from sector-specific volatility. The evidence also supports the application of time-series volatility models such as GARCH to better understand and forecast the dynamic volatility patterns observed in both indices.

III. CONCLUSION

The comparative descriptive analysis concludes that Bank Nifty is more volatile than Nifty 50, indicating higher sectoral risk within the Indian equity market.

Test Results

Index	Ljung-Box Q(10)	Ljung-Box p(10)	Ljung-Box Q(20)	Ljung-Box p(20)	ARCH-LM Statistic	ARCH-LM p-value
Nifty 50	100.28714445725929	4.774169442822639e-17	101.97229429704657	5.578990420970581e-13	102.17059647446244	2.002491902233139e-17
Bank Nifty	90.22706525953274	4.8284075638949774e-15	91.08736865308053	4.7818605941607465e-11	96.50644627623151	2.719702088972663e-16

Interpretation

The results indicate that both indices exhibit statistically significant Ljung–Box Q-statistics for squared returns at 10 and 20 lags, with p-values below 0.05. This confirms the presence of autocorrelation in the squared return series, implying volatility clustering. Similarly, the ARCH-LM test results yield significant test statistics ($p < 0.05$), suggesting the existence of ARCH effects in both Nifty 50 and Bank Nifty returns.

These findings validate the presence of time-varying volatility and justify the application of Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models to model and forecast volatility in subsequent analysis. Notably, the magnitude of the test statistics for Bank Nifty is higher, indicating stronger volatility persistence compared to Nifty 50.

Conclusion

In conclusion, both Nifty 50 and Bank Nifty indices demonstrate volatility clustering and significant ARCH effects. This behaviour reflects the tendency of volatility to occur in bursts, where periods of high volatility are followed by high volatility. Such dynamics underline the need for advanced volatility

Both indices display similar non-normal characteristics, supporting the use of econometric models for volatility analysis in subsequent sections of this research.

Volatility Clustering and ARCH Effect Tests

This section examines the presence of volatility clustering and conditional heteroskedasticity in the daily log returns of Nifty 50 and Bank Nifty indices. The Ljung–Box test on squared returns and Engle’s ARCH-LM test were employed to identify autocorrelation and ARCH effects in the conditional variance.

modelling, making the GARCH (1,1) framework an appropriate choice for further econometric estimation.

IV. DISCUSSION AND FINDINGS

The analysis of the Nifty 50 and Bank Nifty indices over the period from January 2023 to September 2025 reveals significant insights into the volatility dynamics of the Indian equity market. Using daily closing prices derived from secondary data sources, the study employed descriptive statistics and volatility clustering tests to evaluate the behavioural characteristics of both indices.

The descriptive results indicate that both indices exhibit small average daily returns with relatively high standard deviations, reflecting the inherent volatility of the Indian stock market. The distribution of returns is characterized by negative skewness and excess kurtosis, suggesting the presence of asymmetry and heavy tails. This implies that large negative shocks occur more frequently than would be expected under a normal distribution, underscoring the non-linear and unstable nature of stock market movements.

Comparatively, the Bank Nifty index demonstrates higher volatility than the Nifty 50 index, as evidenced by its greater standard deviation and wider range of daily returns. This finding reflects the sensitivity of the banking sector to monetary policy changes, interest rate fluctuations, and macroeconomic factors that disproportionately affect financial institutions. Conversely, the Nifty 50, representing the broader market, displays relatively moderate volatility, which indicates more stability due to sectoral diversification. The Ljung–Box Q-test and ARCH-LM test results further confirm the presence of volatility clustering in both indices. The significant test statistics for squared returns and ARCH effects suggest that volatility is not constant over time but occurs in bursts, where periods of high volatility are followed by high volatility and vice versa. Such clustering is a hallmark of financial time series and is consistent with market behaviour during periods of economic uncertainty or major policy announcements.

Overall, the comparative results highlight that while both indices exhibit time-varying volatility, Bank Nifty's volatility is more intense and persistent. This indicates that investors exposed to the banking sector face higher short-term risk compared to those holding broader market portfolios. The evidence supports the need for prudent risk management strategies and diversification to mitigate the effects of sector-specific shocks.

These findings align with prior empirical studies on volatility persistence in emerging markets, reinforcing that Indian financial markets continue to exhibit clustering tendencies and asymmetric responses to shocks. The results provide valuable insights for policymakers, portfolio managers, and retail investors in understanding risk transmission and volatility behaviour within the Indian derivatives and equity segments.

V. CONCLUSION AND POLICY IMPLICATIONS

This study examined the volatility behaviour of the Nifty 50 and Bank Nifty indices using secondary data covering the period from January 2023 to September 2025. Through descriptive statistical analysis and volatility clustering tests, the research provides empirical evidence of the time-varying nature of volatility in the Indian stock market. The findings indicate that both indices display non-normal return

distributions with significant skewness and leptokurtosis, suggesting the presence of asymmetry and fat-tailed behaviour in daily returns.

The results confirm the existence of volatility clustering in both indices, as established by the Ljung–Box Q-test and ARCH-LM test. This implies that volatility tends to persist over time, with periods of high volatility followed by further instability. Such behaviour reflects investors' herd tendencies and the strong influence of market sentiment, macroeconomic news, and policy developments on the Indian equity market. The study also finds that Bank Nifty exhibits relatively higher volatility compared to Nifty 50, highlighting the greater sensitivity of the banking sector to financial and policy shocks.

From a policy standpoint, these findings emphasize the need for continued efforts to enhance financial stability and market transparency. Regulators such as SEBI and the Reserve Bank of India (RBI) can benefit from monitoring volatility trends within the banking and broader equity sectors to anticipate systemic risks. Moreover, improved investor education and risk-awareness programs can help market participants better understand and manage volatility-related risks. For investors and portfolio managers, the evidence underscores the importance of diversification strategies that mitigate sector-specific volatility, especially when exposure to banking stocks is significant. For policymakers, understanding volatility dynamics aids in designing measures that promote market efficiency and investor confidence.

In conclusion, this study contributes to the growing body of empirical research on volatility behaviour in emerging markets, offering valuable insights into the comparative risk patterns of key Indian indices. The evidence of persistent volatility underscores the necessity of cautious investment planning and robust policy frameworks to sustain market stability in the long run.

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