



Risk-return dynamics and inter-sectoral correlations in the Indian equity market: An empirical study of select NSE Sectoral Indices

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Abstract

Stock market indices serve as a barometer of the market, reflecting overall performance and tracking its movement over time. Sectoral indices, in particular, provide insights into the performance of companies operating within a sector. Against the backdrop of a progressively dynamic interconnected financial environment, understanding the risk-return characteristics and inter-sectoral relations among different sectors of the market becomes vital. Thus, the current study analyses the risk-return dimensions and correlation among the select sectoral indices and Nifty-50 from the National Stock Exchange (NSE) in India using daily logarithmic returns from April 1, 2016, to March 31, 2026. Nifty-Bank, Nifty-IT, and Nifty-Media were selected as service sector indices, and Nifty-Auto, Nifty-Metal, and Nifty-Pharma were selected as industrial sector indices, with Nifty-50 identified as the benchmark index for the study. Returns were assessed and compared using daily mean returns, while standard deviation was used as a metric to measure risk. The findings reveal Nifty-Metal generated the highest daily mean return among the indices, but this return was accompanied by the highest risk, as indicated by its standard deviation. Moreover, the study found Nifty-Bank, Nifty-Auto, along with Nifty-Metal, outperformed the benchmark index Nifty-50 in terms of daily average return, whereas Nifty-Media recorded a negative daily mean return, indicating weak sectoral performance during the study period. Notably, Nifty-50 recorded the lowest total risk when compared with the selected sectoral indices, signifying stable market behaviour during the sample period. Further, Spearman Rank-Order Correlation was used for correlation analysis since the data series were not normally distributed. The correlation analysis revealed positive and statistically significant relations among all sectoral indices and with Nifty-50. Nifty-Bank exhibited the strongest correlation with Nifty-Auto among the inter-sectoral correlations, and even with the benchmark index, reflecting substantial co-movement with broader market conditions. Overall, the varying strength of correlations observed across sectors indicates potential opportunities for portfolio diversification, particularly among sectors which exhibit comparatively weaker co-movement.

Keywords: Sectoral Indices, Nifty-50, risk-return analysis, correlation analysis, portfolio diversification

Introduction

Stock market indices capture the pulse of a stock market and track its movements of the market over time. Such indices are widely used as a benchmark for market behaviour and portfolio performance, as an underlying in derivative instruments, and in passive fund management by index funds (Saha, 2021) ^[8]. Broad market indices provide an overview of the market, while sectoral indices offer insights about the performance of companies operating within a specific sector. In India, the sectoral indices of the National Stock Exchange (NSE), such as the Nifty Bank, Nifty IT, Nifty Auto, Nifty Pharma, Nifty Metal, Nifty Media, etc monitor the performance of leading companies in their respective sectors (NSE Indices Limited, 2025) ^[6]. Since different sectors respond differently to macroeconomic conditions and business cycles (Bodie *et al.*, 2021), these sectoral indices provide useful insights into sector-specific market dynamics and industry performance. The Indian economy has witnessed significant events in recent years, such as demonetisation and the COVID-19 pandemic, which have affected different sectors in different ways (Sinchan, 2025). Therefore, understanding sectoral indices has become important for assessing sectoral performance and resilience, identifying investment opportunities, and

formulating diversification strategies. In this context, the current study aims to examine the performance of selected NSE sectoral indices, namely Nifty Bank, Nifty IT, Nifty Auto, Nifty Pharma, Nifty Metal, and Nifty Media, in comparison with the Nifty 50 benchmark index. More specifically, the study aims to address the following research questions (RQs):

1. **RQ1:** What is the risk and return characteristics of the select sectoral indices in India, and how do they compare with each other and with the benchmark index (Nifty 50)?
2. **RQ2:** What is the degree of association between the returns of the select sectoral indices in India and the benchmark index (Nifty 50)?

Past Studies

Several studies have been conducted focusing on the performance of sectoral indices of Indian stock exchanges. Kaul *et al.* (2026) ^[5] conducted a market efficiency study on 12 BSE sectoral indices using the Runs Test and Autocorrelation Test and identified that the majority of the sectoral indices displayed inefficient market behaviour with predictable patterns and serial dependence. Chauhan *et al.*

(2025)^[3] investigated the relationship between macroeconomic indicators and selected NSE sectoral indices. They found that macroeconomic variables had differential long-run and short-run effects on sectoral returns, with Foreign Institutional Investment (FII) emerging as the most significant determinant. Spencer and Charithra (2025)^[12] compared NSE sectoral indices with the Nifty 50 benchmark using multiple indicators such as Sharpe ratio, Sortino ratio, beta, alpha, tracking error, etc. The study concluded that sectoral allocation played an important role in portfolio diversification and investment performance due to differences in risk-return profile and volatility of different sectors. Pranchana *et al.* (2025)^[7] examined the market efficiency of selected NSE sectoral indices and found that Nifty Bankex and Nifty PSU Index exhibited no significant autocorrelation at different lags, while the Nifty Financial Services Index showed predictable return patterns due to positive autocorrelation. Sengupta (2025)^[10] analysed the volatility and risk of NIFTY sectoral indices using Geometric Brownian Motion (GBM) and Monte Carlo Simulation. She found volatility persisted across the majority of selected sectoral indices. However, Pharma, PSU Bank, and Metal sectors had relatively lower downside risk during the study period. Bhuvaneshwari (2021)^[1] studied the relation between Nifty 50 and selected financial sector indices using OLS regression, Granger causality, and the Impulse Response Function (IRF). The study found significant causal relationships between Nifty 50 and selected financial sector indices; further, the IRF results showed significant responses of Nifty 50 to changes in the financial sector indices. Sankararaman *et al.* (2019)^[9] examined the volatility and relationship between the Nifty index and selected NSE sectoral indices during Union Budget periods using multiple regression, correlation analysis, and ANOVA. They found significant associations and relationships between the benchmark index (Nifty index) and several selected sectoral indices during budget periods.

Most previous studies, as seen above, have focused on either market efficiency, macroeconomic determinants, or volatility behaviour of sectoral indices in isolation. However, limited attention has been given to a comprehensive study focusing on risk-return characteristics of selected sectoral indices along with correlation analysis among them and with the benchmark index over a longer study period. Based on the gap, the current study aims to make a comparative assessment of select sectoral indices and the Nifty 50 on the National Stock Exchange by analysing their risk-return performance and measuring the degree of association among them.

Research Methodology

1. Sampling Design and Study Period

The study examines the return and risk characteristics, along with the degree and direction of interconnectedness among the following selected sectoral indices and Nifty-50 for the period of April 1, 2016 to March 31, 2026 using Judgement Sampling method. Nifty-Bank, Nifty-IT, and Nifty-Media were selected to represent the service sector, which constitutes the largest share of India's sector-wise Gross

Domestic Product (GDP) at 54.93% in 2024-2025. Subsequently, Nifty-Auto, Nifty-Metal, and Nifty-Pharma were selected to represent industrial sectors, which account for the second-largest share of India's sector-wise GDP at 27.13% as of 2024-2025. These indices were selected based on their sectoral representation and availability of continuous data for the study period. The selection of three indices from each sector provides a diversified and balanced perspective of the Indian capital market across the two largest segments of the economy over the previous decade.

2. Data Collection

Data on daily adjusted closing prices for the selected sectoral indices and NIFTY-50 benchmark index listed on the National Stock Exchange (NSE) were collected from www.investing.com for the period from April 1, 2016 to March 31, 2026. Appropriate data mining and cleaning procedures were performed to eliminate inconsistencies and ensure uniform trading dates across all indices for which complete observations were available. The data hence obtained were transformed into daily logarithmic returns

using the formula $R_t = \ln\left(\frac{P_t}{P_{t-1}}\right)$. Eventually, the study comprised 2472 daily return observations for all selected sectoral indices and the benchmark index Nifty-50.

3. Statistical Tools

The study employed descriptive statistical tools such as mean, standard deviation, skewness, and kurtosis in order to examine the return and risk characteristics of selected sectoral indices and benchmark index Nifty-50. Additionally, graphical analysis was used to compare the risk and return behaviour of the sectoral indices in comparison to the benchmark index (Nifty-50) over the study period. Further, Spearman rank order correlation as non-parametric test was employed based on the results of non-normality in return series as per the Jarque-Bera statistic in order to examine the degree and direction of association among the selected sectoral indices and to assess their co-movement of returns with the Nifty-50 benchmark index.

Results and Discussions

1. Risk-Return Characteristics of Selected Sectoral Indices and Nifty-50

Descriptive statistics in Table 1 provide a comprehensive overview of the return and risk characteristics of the chosen sectoral indices and the NIFTY-50 using metrics like mean, standard deviation, skewness, kurtosis, minimum, and maximum values. The mean daily return in the past decade is highest for Nifty-Metal (0.000715), followed by Nifty-Bank (0.000459) and Nifty-Auto (0.000439). All three indices have outperformed the benchmark index Nifty-50 (0.000430), demonstrating their strong sectoral performances in comparison to market. Nifty-IT (0.000386) and Nifty-Pharma (0.000287), although they underperformed when compared with benchmark index, have generated a positive mean daily return. Only Nifty-Media (-0.000247) has generated a negative average daily return, indicating its weak sectoral performance.

Table 1: Descriptive Statistics

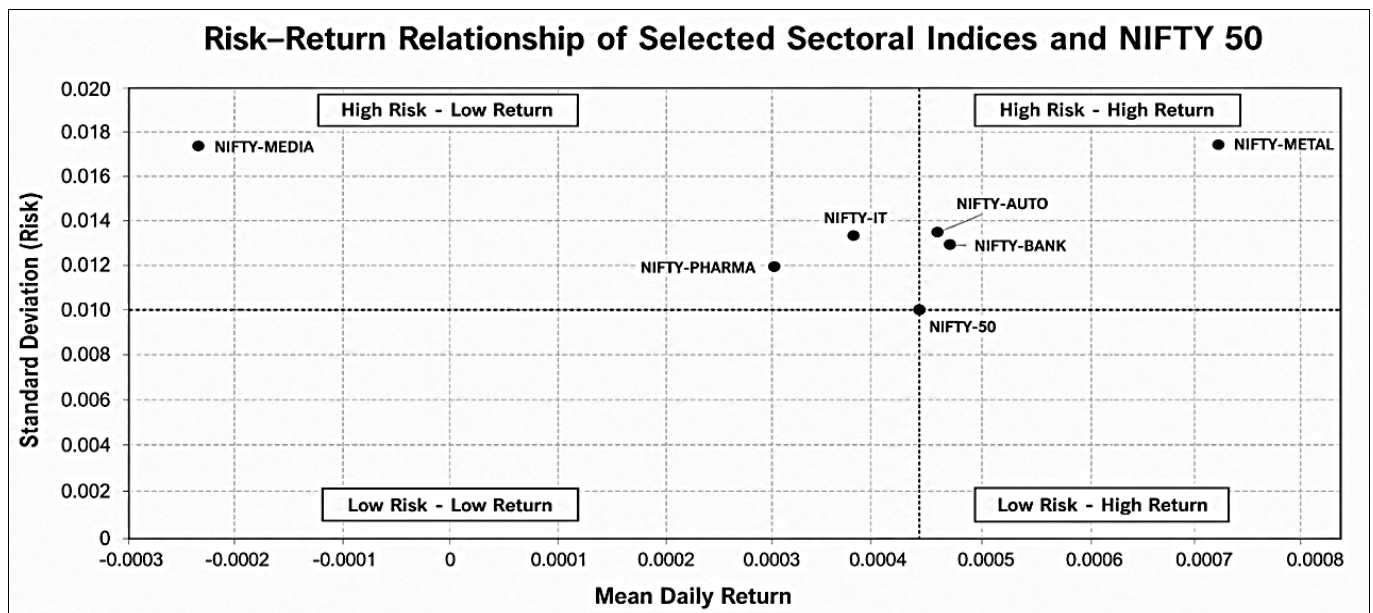
Descriptive Statistical Tools	NIFTY-50	Nifty-Auto	NIFTY-Metal	NIFTY-Pharma	NIFTY-Bank	NIFTY-IT	NIFTY-Media
Mean	0.000430	0.000439	0.000715	0.000287	0.000459	0.000386	-0.000247
Median	0.000705	0.000743	0.001352	0.000166	0.000855	0.000431	0.000321
Maximum	0.084003	0.098997	0.075992	0.098650	0.099951	0.086408	0.134510
Minimum	-0.139038	-0.149055	-0.123318	-0.093507	-0.183130	-0.100654	-0.178817
Std. Dev.	0.010262	0.013837	0.017655	0.011989	0.013635	0.013314	0.017488
Skewness	-1.423027	-0.539657	-0.648377	-0.034244	-1.219620	-0.366785	-0.640707
Kurtosis	25.29401	13.32224	6.901509	8.307423	23.34049	8.731943	13.46325
Jarque-Bera	52027.68	11094.51	1741.045	2901.863	43227.59	3439.510	11445.53
Probability	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Sum	1.063080	1.085217	1.768019	0.710188	1.134054	0.954016	-0.610948
Sum Sq. Dev.	0.260199	0.473105	0.770174	0.355148	0.459376	0.438023	0.755702
Observations	2472	2472	2472	2472	2472	2472	2472

Source: Compilation of secondary data using EViews 10

Standard deviation is considered a standard metric to measure the volatility and risk in an investment (Corporate Finance Institute, 2022) ^[4]. Nifty-Metal (0.017655) was the riskiest with the highest standard deviation in daily returns, inferring that a higher investment return is often accompanied by higher risk. Nifty-Media (0.017488) also displayed significant volatility, followed by Nifty-Auto (0.013837), Nifty-Bank (0.013635), and Nifty-IT (0.013314), demonstrating moderate levels of risk. Nifty-50 (0.010262) recorded the lowest total risk when compared with the selected sectoral indices, signifying stable market behaviour during the period.

The risk-return scatter plot in Figure-1, highlights the relation between average daily return and the total risk

(standard deviation) associated with it. Daily mean return and risk of Nifty-50 have been used as a benchmark in the figure. Nifty-Metal, Nifty-Auto, and Nifty-Bank fall in the high-risk, high-return quadrant, whereas Nifty-IT and Nifty-Pharma fall in the high-risk, low-return quadrant. Nifty-Media exhibited high risk and negative return during the period, reflecting the weakest risk-return trade-off among the selected indices. The maximum and minimum values represent the extreme market movements. Nifty-Media (0.134510) has experienced the highest daily spike in return, while Nifty-Bank (-0.183130) recorded the lowest minimum daily return. Significant minimum daily return values across all indices reflect substantial downside risk exposure during crisis periods.



Note: This figure, created using MS Excel, visualises the risk-return characteristics of select sectoral indices.

Source: Compiled by authors

Fig 1: Scatter plot showing Risk-Return characteristics of select sectoral indices

Skewness measures the asymmetry in the distribution of data. All indices are negatively skewed; that is, they have longer left tails and values are concentrated on the right side of the distribution. The results of kurtosis analysis for all indices have a value far greater than 3, implying that the return distribution for all indices is leptokurtic with fat tails and extreme observations. Further, the Jarque-Bera statistic

confirmed the non-normality in the distribution of returns for all indices at the 1% level of significance.

2. Correlation among Sectoral Indices and Benchmark Nifty-50

The correlation matrix in Table-2 measures the degree and direction of association among the sectoral index returns

individually and their relation with the benchmark Nifty-50 index returns. In the study, Spearman rank-order correlation was employed to examine the degree of association, since the return series of all selected sectoral indices and the

Nifty-50 are not normally distributed as per the Jarque-Bera statistic. The values of the correlation coefficient range between -1 and +1 based on the degree and direction of association.

Table 2: Spearman Rank-Order Correlation Matrix

Probability	NIFTY-50	NIFTY-Auto	NIFTY-Metal	NIFTY-Pharma	NIFTY-Bank	NIFTY-IT	NIFTY-Media
NIFTY-50	1 -----						
NIFTY-Auto	0.729154 (0.00)	1 -----					
NIFTY-Metal	0.658242 (0.00)	0.582991 (0.00)	1 -----				
NIFTY-Pharma	0.502155 (0.00)	0.452698 (0.00)	0.434225 (0.00)	1 -----			
NIFTY-Bank	0.846406 (0.00)	0.589145 (0.00)	0.541225 (0.00)	0.355335 (0.00)	1 -----		
NIFTY-IT	0.544723 (0.00)	0.318069 (0.00)	0.285863 (0.00)	0.303816 (0.00)	0.290629 (0.00)	1 -----	
NIFTY-Media	0.519753 (0.00)	0.520276 (0.00)	0.496037 (0.00)	0.392100 (0.00)	0.442857 (0.00)	0.263924 (0.00)	1 -----

Note: (i) The probability values associated with all correlation coefficients are significant at the 1% level of significance ($p < 0.01$).

(ii) Probability values are presented in parentheses.

Source: Compilation of secondary data using EViews 10.

All sectoral indices displayed positive and statistically significant relations among themselves during the study period. Strongest positive correlations were observed between Nifty-Bank and Nifty-Auto indices (0.589145), as well as between the Nifty-Auto and Nifty-Metal indices (0.582991). Substantial interdependence in movement among Metal and Banking sectors (0.541225), and Auto and Media sectors (0.520276) has been identified. Pharma sector observed relatively lower correlation with all other selected sectoral indices, particularly with Banking (0.355335) and IT (0.303816), showing its return behaviour is influenced by separate factors. The weakest correlation is observed between Nifty-IT and Nifty-Media (0.263924), displaying independent movement and lower co-movement of returns in these sectors in the Indian capital market.

The correlation analysis further demonstrates a positive and statistically significant relation of all sectoral indices with the benchmark index, Nifty-50. Among the sectoral indices, Nifty-Bank had the highest correlation with the benchmark index (0.846406) during the study period. The auto sector (0.729154) and metal sector (0.658242) displayed strong positive correlation with the benchmark index, indicating their strong responsiveness to broader market conditions. However, sectors like IT (0.544723), Media (0.519753), and Pharma (0.502155) exhibited a moderate correlation with the benchmark index, showing relatively lower sensitivity to market dynamics when compared to other selected sectors.

Conclusion

The study analysed the risk-return characteristics and correlation patterns of selected NSE sectoral indices in comparison with the benchmark Nifty-50. The findings revealed that all selected sectoral indices, as well as the Nifty-50, generated positive average daily returns, with the exception of Nifty-Media, which recorded a negative mean daily return. In terms of risk, Nifty-Metal emerged as the

most volatile sector, exhibiting the highest standard deviation of daily returns, whereas Nifty-50 recorded the lowest standard deviation, indicating comparatively greater stability during the study period. The correlation analysis further revealed positive and statistically significant relationships among the selected sectoral indices and between the sectoral indices and Nifty-50, although the magnitude of these relationships varied across sectors. Overall, the findings suggest that sectoral indices exhibit distinct risk-return profiles but generally move in tandem with the broader market. The varying strength of correlations across sectors also indicates potential opportunities for portfolio diversification, particularly when sectors with relatively lower correlations are combined with the broader market index.

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