Analysing the Causal Relationship Between Nifty 50 and Sectoral Indices

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*Abstract***:** *The present study is an attempt to analyse the causal relationship between Nifty 50 and sectoral indices of National Stock Exchange (NSE) for the period 2013–2023. The adjusted closing prices was collected for a period of 11-years, starting from January 1, 2013 to December 31, 2023. The analysis is solely based on secondary data obtained from NSE. To critically examine this relation, the study uses various statistical techniques such as descriptive statistics, correlation analysis, and econometric tests such as Granger causality test and Augmented Dickey–Fuller test. The results of the unit root test indicate that the return series of all the selected indices are stationary. The study noticed a strong positive relationship between Nifty 50 and Sectoral indices returns for Nifty Auto index, Nifty Bank Index, and Nifty Financial Services Index, and weak positive relationship for Nifty Energy index, Nifty FMCG index, Nifty IT index, Nifty Media Index, Nifty Metal Index, Nifty Realty index and Nifty PSU Index. The granger casualty test demonstrates that Nifty Bank Indices and Nifty Financial services indices have a causal association with the Nifty, but Nify Auto index, Nifty Media index, Nifty Realty index, and Nifty IT do not demonstrate any causal association with Nifty.*

Key words: Nifty, National Stock Exchange, Sectoral indices, Causality

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1. INTRODUCTION

Globalization and shifts in the finance sector in developing countries have resulted in a significant change in the country's financial structure. In current circumstances, financial market operations and their connections to the actual market are expected to be critical. Stock market decisions regarding investments are always made after a careful examination of the risk-reward equation. Investors choose securities in sectors that provide the greatest return with minimal risk.

Benchmarking has become increasingly important in today's ever-changing marketplace. NIFTY is an important benchmark that represents principal stock exchange of India, the National Stock Exchange (NSE). Numerous research has been done to determine the impact of various financial and economic variables on the NIFTY. Understanding the NIFTY determinants is crucial since it explains the index's behavior over both short and long periods.

Numerous scholars have examined the Indian Stock Market's co-movement with global market features, but no one has studied the Indian Stock Market's overall co-movement, taking into account all variables. This study provides context for analysts and policymakers seeking to restructure the market by examining the causes and effects of various sectors indices on the NIFTY. It will help determine whether sectoral indices will shake hands with the overall index, and if so, which index does so first. The subsequent information is structured as a review of literature, data, and methodology, a discussion of the findings, and the study's conclusion.

2. LITREATURE REVIEW

Vardhan (2015) investigated the long-term, short-term, and causal links between 8 sector indices and the Sensex in the Indian market following the subprime crisis. Using the Vector Error Correction Model (VECM) for analysis, the data indicated tiny lead-lag correlations between sector indices, with the banking index emerging as a significant integrator that influences other indices.

Singhal and Ghosh (2016) investigated the relationship of the price of crude oil and Indian market returns between January 2006 and February 2008, at both the aggregate and sector levels. According to the study's findings, there was no significant direct volatility spillover from the oil market into the Indian stock market.

Aravind (2017) examined the daily co-movements of 12 NSE sectoral indices and Nifty using the Granger causality test from January 2012 to December 2016, The data found a substantial bidirectional relationship between private sector banks and Nifty, whereas IT and FMCG exhibited a notable unidirectional relationship.

Pandey, Samanta, and Kumar (2017) conducted a comparable study by from 2011 to 2015, using correlation and multiple regression analysis, discovered a significant causal connection between the Nifty 50 and specific sectoral indices, with a notable exception of the Nifty Realty and Nifty Bank sectors.

Anjana Raju and Velip (2019) analyzed the correlation patterns across 11 Nifty indices in Asia's nine emerging markets from 2009 to 2018. Their findings showed a significant correlation between the Nifty sectoral indices in these markets, indicating interconnectedness and possible consequences for regional investment strategies.

Florence, Dibin, and Victor (2020) used a Granger causality test inside a VAR framework to explore the relationships and correlations among 8 National Stock Exchange (NSE) sectors indices between 2009 and 2018. Their research emphasized the creation of an efficient portfolio, recommending a balanced allocation strategy that includes 50% defensive stocks such as pharmaceuticals and media and 50% cyclical firms in the remaining sectors.

Raval and Mehta (2020) examined the link between the Nifty 50 and the financial services and pharmaceutical sectors from 2008 to 2018. Their study, which used basic correlation and independent t-tests, found a strong positive link between the Nifty 50 and both the financial services and pharmaceutical sectors.

Singh and Kumar (2020) investigated the performance patterns of the Nifty 50 and sectoral indices, indicating that the financial services sector outperformed the other main indexes in India.

Objectives of the study:

- To analyse the performance of the Nifty Sectoral Indices against NIFTY 50
- To examine the causal relationship between Nifty sectoral indices and NIFTY 50

Hypothesis of the study:

- The return series of select sectoral indices are normally distributed
- The return series of select sectoral indices are non-stationary
- The return series of Nifty sectoral indices does not Granger cause with Nifty 50.

3. DATA METHODOLOGY

The primary aim of the study is to determine how sectoral indices and the whole market index relate to one another. Since the outbreak of COVID-19 in the first quarter of 2020, the Indian stock market, as reflected by the NIFTY 50 index, has been extremely volatile. The index reached the lowest point of the year in late March 2020 as a consequence of the pandemic's effects, but has since recovered. The NIFTY 50 has been affected with a wide

range of pandemic-related factors, including lock downs and economic downturns. While some industries, such as IT, have grown all through the global epidemic, others, such as tourism and hospitality, have suffered significantly. Overall, the NIFTY 50 index has been robust. To keep the study as relevant and up-to-date as feasible, data up to 2023 is considered. Sangeetha R and Krishna Makhariya explored the impact of sectoral indexes on the Nifty, however their research limited itself to 2016.

Duration of the study:

The data is collected is for a period of 11 years starting from 1st Jan 2013 to 31st Dec 2023

A. Data Collection:

The analysis was carried on using secondary data collected from the NSE website. Data is collected for a period of 11 years (going from January 1st, 2013 up to December 31st, 2023). The data is collected on a daily basis instead of monthly, annually, semiannually, or quarterly. The daily data for the 11 indices were sourced from the NSE's official website, www.nseindia.com.

Following are the Indices are chosen for this study:

- Nifty Auto Index
- Nifty Bank Index
- Nifty Energy Index
- Nifty Financial Services Index
- Nifty FMCG Index
- Nifty IT Index
- Nifty Media Index
- Nifty Metal Index
- Nifty PSU Index
- Nifty Realty Index

The Nifty 50 index has been selected to represent the whole market. The indices were chosen to make the study more dynamic, robust, and comprehensive.

Tools for analysis:

> **Descriptive statistics:**

The average return is calculated by taking arithmetic mean of the stock's returns every day. The research uses descriptive statistics such as average, standard deviation, skewness, and kurtosis to better understand the distributional characteristics of the Nifty Indices.

➢ **Unit root test:**

The financial time series data employed in any study must be stationary. As a result, in this study, tests were used to determine if the chosen financial time series were stationary.

• Augmented Dickey Fuller test

• Phillips-Perron test.

➢ **Correlation:**

In finance, a statistical indicator of the relationship between two stocks or indices. Correlations are used in advanced asset management. Correlation is calculated to obtain the correlation coefficient, which ranges from -1 to +1. A perfect positive correlation (a correlation value of +1) indicates that whether an index rises upward or downward, the other index moves in lockstep, in the same direction. Alternatively, perfect negative correlation means that if one index moves in one direction, the other index moves in the opposite direction. If the correlation is 0, the index changes are said to be completely random.

➢ **Granger causality test:**

The Granger Causality Test is a tool that is used to investigate the causal link between variables empirically. It helps determine if one series is useful for estimating and forecasting the other.

Limitations of the study:

➢ Analysis is based on secondary/historical data collected from NSE website, published literature etc.

4. RESULTS AND INFERENCES

Descriptive Statistics

Table 1 shows the results of the descriptive statistic. The table clearly shows that the mean return for all sectoral indices is positive during the study period. While among the indices chosen for the purpose of the research, Nifty IT has the highest mean return for the specified time period, while Nifty Media has the lowest mean return. The standard deviation is largest for the Nifty PSU and lowest for the Nifty 50. Except for the NIFTY 50, all indices have a skewness of less than one. Hence the return series are not normally distributed. Except for PSU, all of the indices are negatively skewed, which means they have a longer tail to the left of the peak and are asymmetric.

Kurtosis values more than 3 indicate fat-tailed distributions for all sectoral indices, indicating non-normality. As the coefficient is greater than the 3, the data is Leptokurtic, with larger peaks and fat tails. The exceptionally high Jarque-Bera statistic values, combined with the related probability less than 0.05 for each distribution, significantly reject the null hypothesis of normality, indicating that the return series of all the indices is not normal.

Table 1 – Descriptive Statistics

	Nifty 50	Auto	Bank	Energy	Fin. Services	FMCG	IT	Media	Metal	PSU	Realty
Mean	0.000478	0.0005	0.000494	0.000531	0.000525	0.000486	0.00065	0.00011	0.00037	0.000155	0.00037
Median	0.000728	0.00095	0.000732	0.000883	0.000597	0.000678	0.0007	0.00063	0.00082	1.58E-05	0.00127
Maximum	0.084003	0.099	0.099952	0.082818	0.089107	0.079906	0.08922	0.13451	0.09388	0.259487	0.08303
Minimum	-0.139038	-0.1491	-0.18313	-0.102167	-0.173623	-0.111998	-0.1249	-0.1788	-0.1233	-0.141109	-0.1233
Std. Dev.	0.010551	0.01364	0.014858	0.013133	0.014111	0.010753	0.01318	0.01671	0.01788	0.021312	0.02002
Skewness	-1.23497	-0.515	-0.759737	-0.609094	-0.893808	-0.453175	-0.5751	-0.4834	-0.3725	0.5342	-0.5013
Kurtosis	21.24119	13.2022	16.65398	8.897266	16.61965	13.14998	11.7549	13.0599	6.00324	13.47008	6.27942
Jarque-Bera	38260.87	11872.7	21311.9	4094.554	21306.31	11725.68	8804.29	11532.9	1081.13	12507.12	1327.89
Probability	0	0	0	0	0	0	0	0	0	0	0
Observations	2710	2710	2710	2710	2710	2710	2710	2710	2710	2710	2710

Source: Author's calculation

Correlation Analysis

Table 2 shows that all indices have a positive correlation with the National Stock Index Nifty 50. This suggests that all of these sectors' returns are positively correlated with the benchmark index. The correlation is particularly strong in the auto, bank, financial services, metal, and energy sectors.

In the case of Public Sector Undertaking (PSU), FMCG, IT, Media, and Realty, the relationship is moderately positive. The significant magnitude of the connection with banks, financial services, and the automobile sector can be attributed to the sectors' high weightage in the Nifty index.

Table 2 – Correlation analysis

	Nifty	Auto	Bank	Energy	Fin. Services	FMCG	IT	Media	Metal	PSU	Realty
Nifty	1	0.80082	0.88546	0.77214	0.910999	0.66137	0.57119	0.58712	0.70066	0.64923	0.67662
Auto	0.80082	1	0.68847	0.61965	0.698458	0.52924	0.37645	0.57563	0.62946	0.55606	0.6141
Bank	0.88546	0.68847	1	0.62069	0.968693	0.48501	0.3237	0.50985	0.59544	0.73837	0.63714
Energy	0.77214	0.61965	0.62069	1	0.627212	0.47163	0.33071	0.49273	0.64455	0.55416	0.57604
Fin. Services	0.911	0.69846	0.96869	0.62721	1	0.51297	0.34906	0.5062	0.59224	0.67829	0.63783
FMCG	0.66137	0.52924	0.48501	0.47163	0.512971	1	0.33155	0.39025	0.41236	0.35925	0.43171
IT	0.57119	0.37645	0.3237	0.33071	0.34906	0.33155	1	0.32736	0.32883	0.20761	0.29143
Media	0.58712	0.57563	0.50985	0.49273	0.5062	0.39025	0.32736	1	0.52485	0.48829	0.54462
Metal	0.70066	0.62946	0.59544	0.64455	0.592237	0.41236	0.32883	0.52485	1	0.56874	0.59966
PSU	0.64923	0.55606	0.73837	0.55416	0.678293	0.35925	0.20761	0.48829	0.56874	1	0.57709
Realty	0.67662	0.6141	0.63714	0.57604	0.637834	0.43171	0.29143	0.54462	0.59966	0.57709	1

Source: Author's calculation

Unit Root Test

In econometrics, the unit root test determines whether the data is stationary or non-stationary. In this test, the null hypothesis is stated that the return series of all the selected indices are non-stationary, whereas the alternative hypothesis is that the return series of all the selected indices is stationary. The results can be examined in two ways: using t-statistics and P value.

The outcomes of the t-statistic and probability tests for both ADF and PP indicate that the return series of the selected sectoral indices are stationary. All of the indices' t-statistic coefficients are greater than the crucial value of the t-statistic at 5% significance. Furthermore, the probability method results indicate the same outcome, as the probability coefficient in all situations is less than the 0.05. Therefore, we reject the null hypothesis and conclude that the dataset is stationary.

Table 3 – Unit Root Test

Index/Tests	ADF			PP		
	t-statistic	Critical Value @ 5%	Probability	t-statistic	Critical Value @ 5%	Probability
NIFTY 50	-18.52427	-2.8624	0	-51.69427	-2.862407	0.0001
Auto	-50.18105	-2.8624	0.0001	-50.24891	-2.862407	0.0001
Bank	-49.28292	-2.8624	0.0001	-49.28712	-2.862407	0.0001
Energy	-51.11035	-2.8624	0.0001	-51.11776	-2.862407	0.0001
Fin. Services	-18.92457	-2.8624	0	-49.95516	-2.862407	0.0001
FMCG	-52.3282	-2.8624	0.0001	-52.32781	-2.862407	0.0001
IT	-51.90236	-2.8624	0.0001	-51.9125	-2.862407	0.0001
Media	-51.4615	-2.8624	0.0001	-51.48056	-2.862407	0.0001
Metal	-52.27984	-2.8624	0.0001	-52.43485	-2.862407	0.0001
PSU	-50.56352	-2.8624	0.0001	-50.58503	-2.862407	0.0001
Realty	-47.95735	-2.8624	0.0001	-47.97449	-2.862407	0.0001

Source: Author's calculation

Granger Casualty Test

Granger (1969) introduced a time-series data-driven approach for determining causality. The Granger causality test demonstrates the link of precedence among variables. This test will help us determine whether sector-specific indices cause the Nifty. Nifty is said to be granger caused by sector-specific indices if it helps in the forecasting of Nifty. It applies to the stationary series. We take the null hypothesis as that the return series of selected sectoral indices does not granger cause with Nifty 50 and vice versa.

The results of the Granger Casualty test reveal the distinct relationships between Nifty and various sectoral indices. Notably, Nifty, Bank and Financial services exhibit mutual influence on each other. Conversely, it shows that there is no significant effect of Nifty and Auto, IT, Media, Realty on each other. However, there is a unidirectional influence from Nifty to Energy, FMCG, Metal, and PSU indices. And there is unidirectional relationship between Nifty with Energy and Metal. In some cases Nifty is causing the sector to move and in some

cases sectors are causing Nifty to move. These findings emphasize the market's complicated interplay, showing areas of influence and independence between the Nifty and various sectoral indices.

Table 4 – Results of Granger Casualty Test

	Null Hypothesis	F-Statistic	Probability	Result
1	AUTO does not Granger Cause NIFTY	0.59929	0.5493	Reject
	NIFTY does not Granger Cause AUTO	0.65989	0.517	Reject
2	BANK does not Granger Cause NIFTY	6.22495	0.002	Accept
	NIFTY does not Granger Cause BANK	6.92036	0.001	Accept
3	ENERGY does not Granger Cause NIFTY	5.22372	0.0054	Accept
	NIFTY does not Granger Cause ENERGY	0.12221	0.885	Reject
4	FIN. SERVICES does not Granger Cause NIFTY	7.03474	0.0009	Accept
	NIFTY does not Granger Cause FIN. SERVICES	4.50347	0.0112	Accept
5	FMCG does not Granger Cause NIFTY	0.33442	0.7158	Reject
	NIFTY does not Granger Cause FMCG	5.56815	0.0039	Accept
6	IT does not Granger Cause NIFTY	1.15139	0.3164	Reject
	NIFTY does not Granger Cause IT	1.90084	0.1496	Reject
7	MEDIA does not Granger Cause NIFTY	2.59302	0.075	Reject
	NIFTY does not Granger Cause MEDIA	1.97258	0.1393	Reject
8	METAL does not Granger Cause NIFTY	3.94444	0.0195	Accept
	NIFTY does not Granger Cause METAL	0.35166	0.7036	Reject
9	PSU does not Granger Cause NIFTY	0.03266	0.9679	Reject
	NIFTY does not Granger Cause PSU	0.86713	0.4203	Reject
10	REALTY does not Granger Cause NIFTY	1.24762	0.2874	Reject
	NIFTY does not Granger Cause REALTY	0.9191	0.399	Reject

Source: Author's calculation

5. FINDINGS AND THE CONCLUDING REMARKS

The main objective of this paper was to investigate the relationship between multiple sectoral indices and the Nifty, as well as the contrary relationship. All of the tests performed resulted in a connected picture, which when examined as a whole, offers a larger picture. The descriptive statistics showed that the data did not follow a normal distribution. The unit root test validated the data's stationarity. The casualty test eliminates the myth that all the sectoral indices directly contribute to movement in the overall market condition. It clearly outlines the sectors that drive market movement, as well as how market conditions influence indices.

The results indicates that Energy, FMCG, and Metal have a unidirectional relationship with Nifty, meaning that the markets depend heavily on the performance of these sectors. On the other hand, Nifty has a bidirectional

interaction with banks and financial services. This shows that either of the variables can cause changes. And we can see that Nifty has no connection with Auto, IT, Media, PSU and Realty.

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