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Causal Nexus between Stock Market Indices: Evidence from India's Nifty and Sensex

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Abstract **—Stock market indices play a crucial role in reflecting the overall performance and dynamics of financial markets. In India, NIFTY 50 and BSE SENSEX are the two major benchmark indices that represent the movement of the equity market and guide investors, policymakers and analysts in understanding market trends. Despite their close association and simultaneous movement, the direction and extent of the causal relationship between these indices remain unclear. Addressing this gap, the present study attempts to analyse the volatility perspective of stock market indices and to examine the causal nexus between NIFTY 50 and SENSEX 30 using daily data for the period 2023–2024. The analysis employs descriptive statistics, correlation analysis, Augmented Dickey–Fuller for unit root test, Johansen co-integration test and Granger causality test. The results reveal a strong positive correlation and confirm the existence of a long-run co-integration relationship between the indices. The causality analysis indicates a unidirectional causal relationship from NIFTY 50 to SENSEX 30, suggesting that past movements in NIFTY 50 can significantly predict movements in SENSEX 30, whereas the reverse relationship is not supported. These findings provide important insights for investors, portfolio managers and policymakers in understanding market dynamics and forecasting stock market movements.**

Keywords—Augmented Dickey–Fuller Test, Cointegration, Granger Causality, NIFTY 50, SENSEX 30

I. INTRODUCTION

The stock exchange serves as the foundation for the functioning of the stock market. The Indian stock market has a rich history, tracing its origins back to the British colonial era. Today, five stock exchanges operate actively in India. A stock market index is a vital tool that provides insights and data on price fluctuations of financial instruments within the market. The stock market serves as a barometer of economic activity, reflecting investor sentiment and economic conditions. In India, the NIFTY 50 and SENSEX 30 indices are the two leading benchmarks that represent the performance of the broader equity market. While the NIFTY 50 comprises the 50 largest companies listed on the National Stock Exchange (NSE), the SENSEX 30 consists of the 30 largest companies listed on the Bombay Stock Exchange (BSE). Both indices are closely watched by investors, policymakers, and analysts for insights into market trends and economic health. Despite their shared purpose, the dynamics between NIFTY and SENSEX have drawn significant attention. Understanding the causal relationship between these indices is crucial, as it can help investors design strategies, policymakers anticipate market movements, and researchers explore the efficiency and integration of financial markets. Volatility can be defined as change or randomness of prices. Theoretically, an adjustment of the unpredictability of either future returns or discount rates causes an adjustment of the unpredictability of share price (Schwert, 1989). Volatility is the magnitude at which the price of a stock up or down over a period of time. High magnitude of volatility shows higher risk and gives an investor to make a perception on the fluctuation that may incur in the upcoming period.

II. STATEMENT OF THE PROBLEM

The NIFTY 50 and SENSEX 30 indices are pivotal benchmarks of the Indian stock market, influencing investment decisions, portfolio management, and economic policy formulation. While these indices represent overlapping segments of the equity market and often move in tandem, the extent and direction of their causal relationship remain unclear. The lack of clarity on this causal nexus poses challenges for market participants and policymakers. For investors, it creates uncertainties in forecasting and hedging strategies. For policymakers, it complicates efforts to gauge systemic risk and market sentiment accurately. Despite the importance of this relationship, existing literature provides limited empirical evidence using robust econometric techniques like the Granger causality test. This study systematically investigates the causal relationship between NIFTY 50 and SENSEX
30. It aims to determine whether past movements in one index can predict the other, providing insights into their interdependencies and contributing to more informed decision- making in financial markets.

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III. OBJECTIVES OF THE STUDY

- To examine the perspective of Volatility in Stock Market Indices.
- To analyze the causal relationship between NIFTY 50 and SENSEX 30 indices.

IV. METHODOLOGY

The study is descriptive and analytical in nature and carried out with the help of reports published by NSE and BSE. The data for the year 2023-24 was obtained from the reports. The frequency of the data is on daily basis rather than monthly, Quarterly, Semi- annually or yearly. This project proposes to examine the relationship of Sensex 30 with the Nifty 50, the market indices. In order to carry out the study, 2 indices including the Nifty 50 index and Sensex 30 were selected. To identify the structure of the data, descriptive analyses have been performed. In order to check the presence of stationarity, issues Augmented Dickey Fuller test was used. To find the co integration of the indices Johanson Co-integration test was performed. Finally in order to examine the causality Granger causality test was performed.

V. ANALYSIS AND INTERPRETATION

A. *Descriptive Statistics*

Descriptive statistics explores the characteristics of variables used for the study.

Table 1 shows the descriptive elements under consideration.

The Skewness and Kurtosis value confirmed the normality. Hence, the variables under consideration were normally distributed.

TABLE I
SUMMARY STATISTICS

Variable	Mean	Median	S.D.	Min	Max	Skewness	Kurtosis
Nifty50	1996.	19662	1384.3	17398	22494	0.25317	-1.0554
Sensex 30	20936	20616	1435.1	18298	23604	0.27927	-1.0428

B. *Time series Plot*

The plotting of time series is another tool used to detect the characteristics of the variables during the study period. Figure shows the relationship and movement of Nifty 50 Index and Sensex 30 for the study period. It is observed that all the variables had a trend with mild fluctuation.

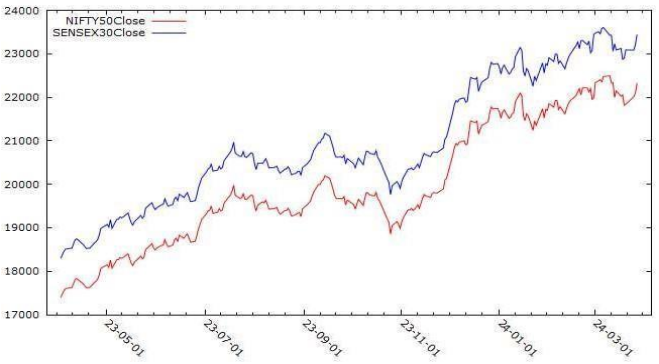

Fig. 1 Time Series Plot of Nifty 50 and Sensex 30

C. *Correlation Analysis*

Table 2 shows that all the variables demonstrate significant positive relationship with each other, which is indicated by the positive values. In terms of strength of relationship between variables, Nifty 50 has shown good relationship with Sensex

TABLE 2
CORRELATION ANALYSIS

		Nifty	Sensex
	Pearson Correlation	1	.999**
Nifty	Sig. (2-tailed)		.000
	N	244	244
	Pearson Correlation	.999**	1
Sensex	Sig. (2-tailed)	.000	
	N	244	244

**. Correlation is significant at the 0.01 level (2-tailed).

D. *Unit Root Test*

In Time series data unit root test is performed to find whether there any stationarity issue is present in the data structure. The aim of co-integration test is to find out if a linear combination of non-stationary variables is stationary. If co- integration exists between the variables that share

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similar non-stationary properties, then regression can proceed without generating spurious results. The results of the analysis based on p value, it can be interpreted that the data are non- stationary.

TABLE 3
RESULT OF ADF TEST OF UNIT ROOT

Variables	t – Statistics	p value
Nifty 50	-0.894607	0.7889
Sensex 30	-0. 841625	0.805

E. Co- Integration Test

Johanson Co integration test is used to determine the long-term stationary relationship between the variables. The null hypothesis of no integration between the variables is rejected at five per cent level of significance and supported the existence of co-integration.

TABLE 4
UNRESTRICTED CO-INTEGRATION RANK TEST (TRACE)

Hypothesized No of CE(s)	Eigen Value	Trace Statistics	Probability
None	0. 07880	19.959	0.0091
At most 1	0. 00212	0.50483	0.4801

F. Causality Test

In order to determine which variable causes the other, Granger Causality Test was used. The data for Nifty index with Sensex were analyzed using pair wise granger causality test. Table 5 depicts the results.

TABLE 5
PAIRWISE GRANGER CAUSAL TESTS

Null Hypothesis	F Statistic	Probability
Nifty 50 does not Cause Sensex 30	2.7213	0.0210
Sensex 30 does not Cause Nifty 50	1.3811	0.2328

The null hypothesis is rejected at a significance level of 5% as the p-value (0.0210) is less than 0.05. This suggest that past values of NIFTY 50 contain significant information that can help predict SENSEX 30. In other words, there is evidence that NIFTY 50 Granger- causes SENSEX 30. The null hypothesis cannot be rejected at any common significance level as the p-value (0.2328) is greater than 0.05. This indicates that past values of SENSEX 30 do not provide significant predictive power for NIFTY 50. There is a unidirectional Granger causality from NIFTY 50 to SENSEX 30 at lag 2, meaning NIFTY 50 influences SENSEX 30 but not the other way around.

Major Findings of the Study

1. *Normal Distribution of Data*
Descriptive statistics indicate that both NIFTY 50 and SENSEX 30 show normal distribution, as confirmed by skewness and kurtosis values.

2. *Strong Positive Correlation*
Correlation analysis shows a very high positive correlation (0.999) between NIFTY 50 and SENSEX 30, indicating that both indices move closely together
.

3. *Presence of Non-stationarity*
The Augmented Dickey–Fuller (ADF) unit root test indicates that both indices are non-stationary at their levels.

4. *Existence of Long-Run Relationship*
The Johansen co-integration test confirms that there exists a long-term equilibrium relationship between NIFTY 50 and SENSEX 30.

5. *Unidirectional Causality*
The Granger causality test reveals a unidirectional causal relationship from NIFTY 50 to SENSEX 30.

6. *Predictive Power of NIFTY 50*
Past values of NIFTY 50 provide significant information for predicting the movements of SENSEX 30.

7. *No Reverse Causality*
The analysis shows that SENSEX 30 does not significantly influence or predict the movements of NIFTY 50.

8. *Implications for Investors*
Investors and portfolio managers can use movements in NIFTY 50 as an indicator for forecasting trends in SENSEX 30.

9. *Market Integration Evidence*
The strong correlation and co-integration results indicate a high level of integration within the Indian stock market.

10. Policy Relevance

The findings help policymakers understand systemic risk and market sentiment within the Indian financial system

VI. CONCLUSION

This study provides a detailed exploration of the causal relationship between India's two major stock market indices, NIFTY 50 and SENSEX 30. Using econometric techniques, including the Granger Causality Test, it was identified that NIFTY 50 Granger-causes SENSEX 30, indicating that past movements in NIFTY 50 can predict SENSEX 30. However, the reverse relationship was not supported, signifying a unidirectional causality. The findings highlight the importance of the NIFTY 50 index in shaping market trends and its predictive power concerning the SENSEX 30. This has implications for investors, portfolio managers, and policymakers in understanding market dynamics, formulating strategies, and managing systemic risks.

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