

Interrelationship between Macroeconomic Variables and Sectoral Stock Market Indices in India: A Time-Series Analysis

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Abstract : With an emphasis on the difficulties brought on by socioeconomic unrest, this study investigates the relationship and causality between a few macroeconomic variables and the stock prices of businesses listed in the sectoral indexes of the Bombay Stock Exchange (BSE). The study examines short-term and long-term interactions using monthly data from April 2011 to June 2021 using the Granger causality test and Pearson's correlation coefficient. Fiscal policy changes, government transitions, exchange rate crises, demonetisation, and international health catastrophes like SARS, MERS, and COVID-19 are just a few of the disruptions captured in the selected timeframe. The results show that whereas crude oil prices, industrial production, and trade balances frequently show negative correlations with sectoral indices, macroeconomic variables including exchange rates, foreign reserves, money supply, and consumer price index show strong positive relationships. Granger causality results highlight both unidirectional and bidirectional relationships, underscoring the dynamic interplay between economic fundamentals and market performance. This study contributes to the literature by emphasizing the sensitivity of Indian stock markets to macroeconomic shocks and providing practical insights for investors. The results suggest that portfolio diversification strategies must account for both structural and psychological effects of socioeconomic constraints, offering guidance for risk management in emerging markets.

IndexTerms - correlations techniques, Granger causality test, sectoral indexes, Bombay stock Exchange.

INTRODUCTION

Security prices are impacted by a variety of factors, some of which are sector-driven, some of which are firm-specific, and many of which stem from the larger business climate. Macroeconomic indicators, changes in national and international policy, sociopolitical developments, and investor expectations on future growth are all common causes of stock price fluctuations. In this approach, capital markets reflect the general direction of economic sectors by assessing both current and future potential. Because they respond to decisions made by political and economic actors nearly immediately, stock markets are sometimes referred to be the heart of the economy. In order to ensure that securities reflect all available information, an efficient capital market is one in which prices react swiftly to new information. Additionally, according to economic theory, share prices reflect the degree of economic activity by reflecting expectations of business performance. Prices can act as leading indications of future economic developments rather than just reflecting them if they accurately represent fundamentals.

The causal relationship between macroeconomic variables and stock prices is therefore critical for national policy formulation and investment strategies. Given the sensitivity of capital markets, their study has long dominated academic and practitioner literature. This research extends that discourse by analyzing the Indian stock market, testing whether sectoral indices exhibit informational efficiency or remain vulnerable to shocks from both domestic and global sources.

Theoretical Frame work (Literature Review)

A. Deb S., Mukharjee J., "Does Stock Market Development Cause Economic Growth? A Time Series Analysis for Indian Economy" (2008) This paper's goal was to understand the connection between the Indian economy and the stock market. WPI, IIP, and EXR with BSE SENSEX are the variables employed in this study. Additionally, this study shows that the Indian stock market is getting closer to informational efficiency, at least in terms of two macroeconomic variables: inflation and exchange rate (WPI). The study's limitation is that its primary focus was on the need for financial services rather than the nation's economic expansion.

B. Boubakari A., (2010), "The Contribution of Stock Market Growth to Economic Development: Evidence from a Few Euronext Countries" The study's goal was to determine the causal relationship between stock market proxies. Market capitalisation, total trade volume, turnover ratio, eco growth, FDI (foreign direct investment), and GDP (gross domestic prod2606408_326635_73_87 uct) were the variables utilised in the study. The study concluded

that, in certain nations where the stock market is liquid and very active, there is a positive correlation between economic growth and the stock market. However, the causal relationship is disproved for countries with small and less liquid stock markets. Additionally, the study's definition states that while strong economic conditions might foster stock market development, tiny stock markets with low liquidity cannot be a contributing element to economic growth.

C. Nazir M., Musarat M., Javed U., (2010)., "The interrelation between stock market development and economic growth." This research paper's goal was to understand the evolution of the stock market and economic expansion. GDP Per Capita (Dependent), FDI, HD Index, market size, and prevalent liquidity are the variables used in this analysis. And this study came to the conclusion that expanding a nation's stock markets and their market capitalisation, particularly in an emerging market like Pakistan, can lead to economic growth. The study's limitation is that it focuses on Pakistan, which could result in results that are peculiar to that nation.

D. Kumar A., (2011). "An Empirical Study of the Causal Connection Between India's Stock Market and Macroeconomic Factors." The study's goal is to determine the causal relationship between Indian macroeconomic indicators and stock prices. Effective Eco Rate, FER, BOT, FDI, IIP, and WPI are the study's variables. The study's conclusion is that there is no proof of a causal association between these macroeconomic variables and the Nifty. Both Nifty and WPI do not Granger Cause one another.

E. Singh D. (2011)., "An analysis of the causal relationship between macroeconomic factors and the stock market in India. The study's goal is to use correlation, unit root stationarity tests, and the Granger causality test to investigate the relationship, particularly the causative relationship, between the stock market index, or BSE SENSEX, and three important macroeconomic variables of the Indian economy. WPI, IIP, and EXR with BSE (Causality Test) are the variables employed in the study. The analysis concludes that, at least in terms of two macroeconomic variables exchange rate and inflation (WPI) the Indian stock market is getting closer to informational efficiency. The study's limitation is that the variables employed are unquestionably reliable measures of the company's economic growth. However, the primary variable—GDP—must be taken into account when examining a nation's economic development. Additionally, this study does not include GDP, which may have constrained the research.

F. Sahu N., Dhiman D., (2011)., "Correlation and Causality between Stock Market and Macro Economic Variables in India: An Empirical Study" aims to examine the causal relationship between macroeconomic variables and the stock market. The GDP rate and the SENSEX BSE Index are the variables used in this study. Despite their strong correlation, this study shows that there is no causal relationship between the real gross domestic product of India and the stock market index, the Bombay Stock Exchange's (BSE) SENSEX. As a result, this article concludes that the BSE SENSEX is not yet a reliable "indicator" of India's progress. Limitation of the study is that, there is based on BSE Index and GDP rate only which do not help to understand the exact situation or causal relationship between Stock Market of India and Economy.

G. Paramati Sudharshan Reddy, Gupta Rakesh (2011), "An empirical examination of stock market performance and economic growth: evidence from India This study looks at the short-term and long-term dynamics of the stock market and seeks to determine if stock market performance causes economic growth or the other way around. The study's findings support the "demand following" theory in the short term for the Indian setting. The study's conclusions indicate that stock price fluctuations have been significantly influenced by economic growth, which is also more likely to encourage and support the growth of the stock market through the proper reallocation of resources.

H. Ray S. (2012), Examining the Granger Causal Relationship between Macroeconomic Factors and Stock Price Trends: Indian Data The impacts of macroeconomic variables on stock prices are tested using a multiple regression model, and the Granger causality test is used to determine whether there is a causal relationship between macroeconomic variables and stock prices. The study's multiple regression results show that while the balance of trade, interest rate, foreign exchange reserve, gross domestic product, industrial production index, and money supply all have a positive impact on Indian stock prices, the price of gold and oil has a significant negative impact. On the other hand, inflation rate, foreign direct investment, exchange rate and wholesale price index do not appear to have any significant effect on stock price.

I. Hassanudin Mohd Thas Thaker and Abdollah Ah Mand (2020), "Investigated the connection between Asian stock indices and Bitcoin between July 20, 2010, and April 26, 2019. The techniques employed included correlations, volatilities, temporal frequency domains, lead-lag studies, long- and short-term connections, wavelet analysis, M-GARCH, Granger causality, and VECM. First, every market index demonstrated a long-term link with Bit Coin based on VECM. Four markets—Japan, KOR, STI, and Hong Kong showed negative relationships. PHIL is one market that has had a good relationship with Bitcoin. Singaporean investing markets are less volatile than other markets.

Furthermore, we observed that there was a negative association between BTC and three markets: HK, STI, and KOR, while two other markets had a positive association (i.e., JPN and PHIL).

J. Das (2019), "Aimed to look at FDI and FII research and how it affected the Indian stock market (NIFTY and Sensex). Everyday data collected between 2008 and 2018 served as the basis for the study. The final data, which used multiple regressions and Pearson's correlation, demonstrated that FDI and the Indian stock market are strongly correlated and that FII is viewed as a "fair weather friend," or a buddy who is there while the market is doing well.

K. Venkatamuni Reddy, Raghavendra nayak, Nagendra S. Ashwith, and others (2019) "BSE sectoral indexes, including S&P BSE bankex, S&P BSE oil and gas, S&P BSE consumer durables, S&P BSE capital goods, S&P BSE realty, and S&P BSEPSU, were used to examine the prices of crude oil, silver, gold, inflation, and exchange rates. Positive connections were found between the four indices under investigation and the Consumer Price Index, General Price Index, Exchange Rate, and Interest Rate. Only the prices of crude oil and silver, however, had favourable connections with the three indicators.

L. Sarika Ke swani and Bharti Wadhwa (2019), "Examined are the connections between NSE and BSE and exchange rates, inflation, interest rates, and disposable income. Monthly data from 2006 to 2016 were subjected to the ADF Test, Correlation Matrix, Multiple Regression technique, and Granger Causality procedures. The outcome shows that changes in variable preferences may have a negative effect on changes in the prices of both Indian exchanges, demonstrating the existence of significant linkages between disposal revenue, government policy, exchange rates, and share prices in India.

M. Mrunali jambotkar and Guntur Anjana Raju (2018), "Investigated the effects of interest rates, currency exchange rates, inflation (WPI), crude oil prices, and foreign currency reserves on the NSE sectoral indices. The Ordinary Least Squares, Unit Root, and Correlation models were used to gather data for this study, which spanned a ten-year period from January 2007 to December 2016. The results demonstrated the significant influence of sectoral indices and macroeconomic indicators taken together. The way the indexes fluctuate actually explains more than the chosen macroeconomic elements.

N. Somnath Mukhuti (2018), "Investigated the connection between Indian stock indices and domestic gold prices. The Granger Causality Technique, multiple regressions, and correlation statistics were used to analyse data collected between January 2008 and August 2018. The results showed a positive correlation between Indian stock indexes and gold prices. The Granger Causality Technique revealed a slight link between gold prices and the SENSEX and NIFTY indexes.

O. Francisco Jareo and Loredana Negrut (2016) Using some progress and scatter graphs, as well as Pearson's correlation coefficients, over data from 2008 to 2014, we examined the relationship between the US stock market and some appropriate US macroeconomic factors, such as gross domestic product, consumer price index, industrial production index, unemployment rate, and long-term interest rates. According to this analysis, there is a statistically significant positive correlation between the US stock market and the GDP and the IPI (Industrial Production Index), but there is a statistically significant negative correlation between the US stock market and unemployment and long-term interest rates. According to this analysis, there is a statistically significant positive correlation between the US stock market and the GDP and the IPI (Industrial Production Index), but there is a statistically significant negative correlation between the US stock market and unemployment and the rate of interest.

P. Mahmoud Ramadan Barakat et al. (2016), "investigated the data from 1998 to January 2014 using the Augmented Dicky Fuller (ADF) test, Vector Auto Regression (VAR) to determine the best lag length, co-integration test, and Granger causality test. The variables studied are the exchange rate, supply of money, rate of interest, and rate of inflation in the Egyptian and Tunisian markets. According to the analysis of the results, the interaction between the stock market and macroeconomic determinants is a significant contributor to stock market swings. Portfolio managers can do a better job of managing their funds if they know that the money supply has a long-term effect in Egypt but doesn't seem to have any effect in Tunisia. This is especially true if they spread the money around the world.

Q. Subburayan and Srinivasan (2014), "looked into how the macroeconomic variables affected CNX Bankex in the Indian stock market. The AD-fuller, Co- integration method, regression analysis, and Granger causality were all used in the analysis of monthly data from January 2004 to December 2013. The results of the model indicate that CNX Bankex is significantly positively impacted by both the interest rate and the currency rate. It was discovered that there was no causal connection between interest rates and CNX Bankex or inflation rates. On the other hand, there is a one-way causal relationship between the exchange rate and the CNX Bankex shares.

R. Shing Pooja's (2014), "Empirical research indicates that macroeconomic variables such as gold prices, inflation, currency exchange rates, money supply, and foreign institutional investments have a substantial influence on the

Indian stock market. The findings demonstrated that the Indian stock market does better when the industrial sector does well and that gold prices are the best alternative for investments, which negatively impacts the stock market's performance..

S. Muktadir-Al-Mukit (2014, “comprised the Granger Causality Test, variance decompositions, vector error correction mode, cointegration, the Ordinary Least Square (OLS) Regression Model, and the impulse response function. Cointegration, the Ordinary Least Square (OLS) Regression Model, vector error correction mode, variance decompositions, impulse response function, and the Granger Causality Test were among the econometric techniques utilised in the study. A substantial long-term negative correlation between the variables was found in the study.

3.1 Population and Sample

The dataset spans monthly observations from April 2012 to June 2021, a period marked by significant economic disruptions including the global financial crisis, exchange rate volatility, and domestic policy shifts.

3.2 Data and Sources of Data

The study relies on secondary data collected from authoritative sources such as the Handbook of Statistics on the Indian Economy published by the Reserve Bank of India (RBI), monthly observations of stock indices from Yahoo Finance, and supplementary data from books, journals, and financial websites.

3.3 Theoretical framework

Indian stock market, represented by the Selected Sectoral Indices of Bombay Stock Exchange (BSE SENSEX). The macroeconomic indicators considered include Crude Oil Price (COP), Exchange Rate(ER), Foreign Exchange Reserve (FER), Index of Industrial Production (IIP), Gross Fiscal Deficit (GFD), Broad Money Supply (MS), Trade Balance (TB), Foreign Institutional Investment (FII), Foreign Direct Investment (FDI), Bit Coin (BTC), Gold Price (GOLD), Liquidity Aggregate (LA), Consumer price Index (CPI).

RESEARCH METHODOLOGY

The present study seeks to examine the causal relationship between selected macroeconomic variables and the performance of the Indian stock market, represented by the Selected Sectoral Indices of Bombay Stock Exchange (BSE SENSEX). The macroeconomic indicators considered include Crude Oil Price (COP), Exchange Rate(ER), Foreign Exchange Reserve (FER), Index of Industrial Production (IIP), Gross Fiscal Deficit (GFD), Broad Money Supply (MS), Trade Balance (TB), Foreign Institutional Investment (FII), Foreign Direct Investment (FDI), Bit Coin (BTC), Gold Price (GOLD), Liquidity Aggregate (LA), Consumer price Index (CPI). These variables were chosen due to their established influence on capital markets and their relevance in periods of socioeconomic turmoil.

3.4 Statistical tools and econometric models

1. To ensure robustness, the study employs the Augmented Dickey–Fuller (ADF) Unit Root Test to verify the stationarity of the time series data.
2. Pearson’s correlation coefficient is used to measure the strength and direction of linear associations between the selected macroeconomic indicators and sectoral indices of BSE, such as Automobile, Banking, Energy, and Basic Metals, as highlighted in the attached correlation tables.
3. The Granger Causality Test is then used to identify the direction of causal relationships between macroeconomic variables and stock prices. This method is particularly effective in capturing short-term dynamics and testing whether one time series can predict another.

The methodological framework is designed to capture both shortrun interactions and longrun equilibrium relationships between macroeconomic variables and stock market indices. By combining correlation analysis with causality testing, the study provides a comprehensive view of how external shocks such as inflation, exchange rate fluctuations, and global crises affect investor sentiment and market efficiency in India.

3.4.1 ADF Test

Correlation analysis is widely recognized as a tool to measure the linear association between two variables. However, when examining causality, more technical procedures are required. The initial step in the Granger causality framework is to determine whether the time series under consideration are stationary or not at the level. If the series is nonstationary, the order of integration must be identified. For this purpose, the Augmented Dickey Fuller (ADF) test is applied the present study.

A time series is considered stationary when its mean and auto covariance remain constant over time. The ADF test evaluates this property using three specifications:

$$\Delta Y_t = \gamma Y_{t-1} + \varepsilon_t \text{ (Pure Random Walk Model)} \dots \dots \dots (1)$$

$$\Delta Y_t = a_0 + \gamma Y_{t-1} + \varepsilon_t \text{ (Random Walk with Drift)} \dots \dots \dots (2)$$

$$\Delta Y_t = a_0 + \gamma Y_{t-1} + a_2 t + \varepsilon_t \text{ (Random Walk with Drift and Trend)} \dots \dots \dots (3)$$

The null hypothesis that is $H_0: \gamma = 0$ indicates the presence of a unit root. Test statistics are compared against critical values to decide whether to reject or accept the null. Once the integration order is established, the study proceeds to causality testing between macroeconomic indicators and Indian stock market indices.

3.4.2 Granger Causality Test

When two variables exhibit lagged interactions, the Granger causality test is applied to determine the direction of influence. This method is particularly effective in identifying short term predictive relationships.

Granger and Engle made significant contributions to time series literature after the 1990s. The Granger Causality test was used to make some modifications to these advancements in time series analysis. Regression analysis may not always infer causality, even when it does capture dependence. To put it another way, the presence of a relationship between variables does not establish causation or the direction of influence. However, with regressions incorporating time series data, things can be a little different since, according to one author, "Time is not reversible. That is, if an event A occurs prior to event B, then A may be the cause of B. But B cannot possibly be the cause of A. To put it another way, historical events can influence current events. Events in the future cannot".

Granger's approach, however, leverages the temporal ordering of events: This is essentially the Granger causality test's concept. However, it should be made clear that the issue of causation is highly philosophical and fraught with disagreements. People who think that "everything causes everything" are at one extreme, and those who completely reject the idea of causation are at the other. Estimating paired regressions is part of the test. For instance, in macroeconomics, X and Y are supposed to be uncorrelated error variables and one may wonder if X affects Y or vice versa. The following interpretation of the results is possible: Here the test involves estimating the following pair of regressions

$$X_t = \sum \alpha_i * M_{t-1} + \sum \beta_i * Y_{t-1} + u_1 t \dots \dots \dots (4)$$

$$Y_t = \sum \lambda_i * M_{t-1} + \sum \delta_i * X_{t-1} + u_2 t \dots \dots \dots (5)$$

Where

- a) Unidirectional causality: Lagged values of X significantly predict Y, while lagged Y does not predict X.
- b) Unidirectional causality: Lagged Y significantly predicts X, while lagged X does not predict Y.
- c) Bidirectional causality: Both sets of lagged coefficients are significant, indicating feedback.
- d) Independence: Neither set of lagged coefficients is significant.

In general, if including past values of variable X improves the prediction of Y, then X is said to Granger cause Y. This definition emphasizes predictive power rather than philosophical debates on causation.

3.4.1 Research Gap

A deeper investigation is necessary to understand how macroeconomic variables shape the risk–return relationship in developing economies such as India, especially during phases of socioeconomic instability. Although prior scholarship has examined these dynamics in global contexts, much of the emphasis has been on advanced markets, leaving emerging economies underexplored.

In India, existing studies have largely focused on correlations between macroeconomic indicators and broad market indices, but there is limited research that systematically addresses the effects of economic crises including the global financial downturn of 2008, the currency volatility of 2013, demonetization in 2016, and the COVID-19 shock on the risk return profiles of individual firms. This absence of targeted inquiry restricts the ability of investors and policymakers to anticipate vulnerabilities and design effective strategies for resilience.

Thus, a focused study is required to capture the nature and extent of macroeconomic disruptions and their consequences for the risk return dynamics of Indian stock markets. Such work would bridge the gap by offering empirical insights into how crises alter investment behavior, sectoral performance, and capital market efficiency in a developing country setting.

3.4.2 Objectives of Study

To examine the linkage between macroeconomic indicators and the share prices of selected firms listed on the Bombay Stock Exchange (BSE) during periods of socioeconomic disruption.

3.4.3 Hypothesis of Study

During times of instability driven by socioeconomic factors, there existed a strong and negative correlation along with a causal association between several macroeconomic variables and the performance of the Indian equity market.

4.1 RESULTS AND DISCUSSION

4.1.1 ADF TEST

We were unable to reject the null hypothesis in the ADF at this level if the P-Values of every variable in the research were higher than the crucial threshold (5%). As a result, we have to conclude that all of the increasing variables are non-stationary, meaning they follow a random walk with drift and no time trend. This implies that we need to take the initial difference between the variables before adding them to the regression model.

Table-4.1.1 Unit Root Test

	ADF at Level		ADF at 1 st difference		ADF at 2 nd difference	
	T-Statistics	P-Value	T-Statistics	P-Value	T-Statistics	P-Value
BSEAUTO	-1.464	0.5513	-9.6196	0.000	-7.9297	0.000
BSEABEX	1.5684	0.9978	-8.3949	0.000	-5.1862	0.000
BSENGY	-0.7748	0.8264	-4.0346	12.000	-5.4313	0.000
BSEBM	0.2569	0.9753	-3.6749	0.0045	-7.652	0.000
COP	-1.6875	0.4376	-10.182	0.0000	-6.5929	0.000
ER	-1.8984	0.3328	-9.4269	0.000	-7.2516	0.000
FER	1.8921	0.9985	-6.4965	0.000	-5.3158	0.000
IIP	-1.37	0.5966	-2.4037	0.1407	-5.8209	0.000
GFD	2.0897	0.9988	-9.2629	0.000	-8.4167	0.000
MS	-0.1763	0.9413	-6.872	0.000	-6.4965	0.000
TB	-4.3307	0.0004	-12.725	0.000	-5.6888	0.000
FII	7.8417	0.000	-5.3662	0.000	-5.4996	0.000
FDI	-0.8786	0.7949	-9.336	0.000	-6.3855	0.000
BTC	0.36	0.9799	-6.4787	0.000	-5.177	0.000
GOLD	-1.4611	0.5526	-11.498	0.000	-6.5969	0.000
LA	-1.8195	0.3708	-3.769	0.0032	-9.7664	0.000
CPI	-0.2188	0.9362	-10.003	0.000	-12.208	0.000

a. Predictors: (Constant), CPI, GOLD, GFD, BTC, COP, FDI, MS, FII, TB, LA, ER, IIP, FER

b. Dependent Variable: BSEUTO, BSENGY, BSEBEX, BSEBM.

c. source-Authors estimation

Because the variables in the ADF at level are more than the significance threshold (5 percent), we are unable to reject the null hypothesis, leading us to conclude that the series is non-stationary. The solution is then to take the first difference among all the variables. With the exception of the Index of Industrial Production (IIP), we verified from the summary of the first difference that all of the variables' p-values are less than 0.05. We must therefore perform the ADF Test at the second level for IIP variables since they exhibit a pure random walk at the first difference. We reject the null hypothesis since all of the variables' p-values at second degree are less than 0.05 percent. Thus, we draw the conclusion that every variable used in the study is stationary at the second difference.

4.2.1 PEARSON'S CORRELATION COEFFICIENT TEST

Pearson's correlation coefficient is one of the numerical methods used to ascertain the direction and strength of correlation between the selected variables of interest. The significance of the linkage and the direction of the short-term relationship between the variables of interest must also be determined, as must the relationship between macroeconomic parameters and sectoral

indices chosen by the BSE in India. It was also utilised to search for bi-variety relationships between macroeconomic variables and particular BSE indices in order to check for multi collinearity issues.

Table -4.2.1. Result of Pearson's Correlation of BSE Automobile Sector and selected macroeconomic variable

	BSE AUTO	COP	ER	FER	IIP	GFD	MS	TB	FII	FDI	BTC	GOL D	LA	CPI
BSE AUTO	1	-0.563	0.523	0.505	-0.497	0.083	0.472	-0.215	-0.077	0.33	0.362	-0.221	0.562	0.4418
COP	-0.563	1	-0.715	-0.563	0.581	-0.155	-0.541	-0.119	0.126	-0.364	-0.179	-0.103	-0.626	-0.5681
ER	0.523	-0.714	1	0.849	-0.677	0.244	0.828	0.057	-0.084	0.433	0.553	0.387	0.907	0.7585
FER	0.505	-0.563	0.849	1	-0.638	0.318	0.889	-0.058	0.064	0.473	0.812	0.611	0.907	0.906
IIP	-0.497	0.581	-0.677	-0.638	1	-0.331	-0.595	0.074	0.119	-0.323	-0.363	-0.342	-0.905	-0.692
GFD	0.084	-0.155	0.242	0.318	-0.332	1	0.285	-0.051	-0.074	-0.0198	0.389	0.227	0.261	0.2586
MS	0.472	-0.541	0.828	0.889	-0.595	0.285	1	-0.077	0.084	0.402	0.679	0.537	0.864	0.8276
TB	-0.215	-0.119	0.057	-0.058	0.074	-0.051	-0.0767	1	0.054	-0.042	-0.207	-0.038	-0.079	-0.217
FII	-0.077	0.126	-0.085	0.064	0.119	-0.074	0.084	0.0538	1	0.102	0.055	0.267	0.005	0.0493
FDI	0.33	-0.365	0.434	0.473	-0.323	-0.02	0.402	-0.042	0.102	1	0.275	0.234	0.419	0.4215
BTC	0.363	-0.18	0.554	0.812	-0.363	0.389	0.679	-0.207	0.055	0.275	1	0.522	0.661	0.6827
GOL D	-0.222	-0.103	0.385	0.611	-0.342	0.227	0.537	-0.038	0.267	0.234	0.522	1	0.479	0.6849
LA	0.562	-0.626	0.907	0.905	-0.673	0.261	0.864	-0.079	0.005	0.419	0.661	0.479	1	0.8708
CPI	0.442	-0.568	0.759	0.906	-0.692	0.259	0.828	-0.217	0.049	0.422	0.683	0.685	0.871	1

a) Predictors:(Constant),CPI,GOLD,GFD, BTC,COP, FDI,MS, FII,TB,LA,ER,IIP,FER

b) Dependent Variable: BSEUTO

c) Source: Authors estimation

The table's correlation matrix shows the correlation coefficient between 12 macroeconomic factors and India's BSE auto industry. As can be seen from the table, the Crude Oil Price (COP), Index of Industrial Production (IIP), Trade Balance (TB), Foreign Institutional Investment (FII), and Gold price (since the coefficient values (-0.5631, -0.49655, -0.21508, -0.07666, and -0.12073), etc. have a negative correlation with the BSE Automobile sector, meaning that if these macroeconomic variables' prices fall, the BSEAUTO stock price rises. The Exchange Rate (ER), Foreign Exchange Reserve (FER), Gross Fiscal deficit (GFD), Money supply (MS), Foreign Direct investment (FDI), Bit Coin (BTC), Liquidity Aggregates (LA), and Consumer Price Index (CPI) coefficient values (since the coefficient values are 0.5631, 0.504681, 0.083483, 0.471512, 0.330361, 0.362463, 0.561604, and 0.441836) indicate a positive relationship for the BSE auto sector. If the price of these macroeconomic variables increases, the stock price of the BSEAUTO sector also increases.

Table -4.2.2. Result of Pearson's Correlation of BSE Banking Sector and selected macroeconomic variables

	BSEBE X	COP	ER	FER	IIP	GFD	MS	TB	FII	FDI	BTC	GOL D	LA	CPI
BSEB EX	1	-0.55249	0.773041	0.836396	0.62366	0.245425	0.824574	0.35587	0.04287	0.425408	0.670838	0.394414	0.852245	0.829615
COP	-0.55249	1	0.71428	0.56261	0.580919	0.15491	0.54055	0.11898	0.125642	0.36437	0.17958	0.10302	0.62634	-0.56812
ER	0.773041	0.71428	1	0.848615	0.67677	0.244129	0.827625	0.056584	0.08425	0.433976	0.553293	0.384609	0.906559	0.758559
FER	0.836396	0.56261	0.848615	1	0.63824	0.317742	0.889284	0.0581	0.064324	0.473322	0.812227	0.610811	0.90494	0.906447
IIP	0.62366	0.580919	0.67677	0.63824	1	0.33149	0.59467	0.073953	0.119259	0.32313	0.36275	0.34213	0.67298	-0.69205
GFD	0.2454	-	0.244	0.3177	-	1	0.284	-	-	-	0.3890	0.2266	0.2606	0.25862

	25	0.1549 1	129	42	0.331 49		921	0.050 7	0.073 58	0.0198 2	44	54	51	6
MS	0.8245 74	- 0.5405 5	0.827 625	0.8892 84	- 0.594 67	0.284 921	1	- 0.076 6	0.083 699	0.4015 94	0.6795 08	0.5369 63	0.8637 88	0.82761 3
TB	- 0.3558 7	- 0.1189 8	0.056 584	-0.0581	0.073 953	- 0.050 7	- 0.076 6	1	0.053 852	- 0.0419 4	- 0.2069 9	- 0.0384 8	- 0.0791 5	- 0.21718
FII	0.0428 7	0.1256 42	0.084 25	0.0643 24	0.119 259	0.073 58	0.083 699	0.053 852	1	0.1022 42	0.0550 28	0.2673 1	0.0049 23	0.04935 9
FDI	0.4254 08	- 0.3643 7	0.433 976	0.4733 22	- 0.323 13	0.019 82	0.401 594	- 0.041 94	0.102 242	1	0.2748 83	0.2337 91	0.4191 33	0.42158 9
BTC	0.6708 38	- 0.1795 8	0.553 293	0.8122 27	- 0.362 75	0.389 044	0.679 508	- 0.206 99	0.055 028	0.2748 83	1	0.5217 19	0.6608 78	0.68274 7
GOLD	0.3944 14	- 0.1030 2	0.384 609	0.6108 11	- 0.342 13	0.226 654	0.536 963	- 0.038 48	0.267 31	0.2337 91	0.5217 19	1	0.4789 07	0.68490 5
LA	0.8522 45	- 0.6263 4	0.906 559	0.9049 4	- 0.672 98	0.260 651	0.863 788	- 0.079 15	0.004 923	0.4191 33	0.6608 78	0.4789 07	1	0.87080 2
CPI	0.8296 15	- 0.5681 2	0.758 559	0.9064 47	- 0.692 05	0.258 626	0.827 613	- 0.217 18	0.049 359	0.4215 89	0.6827 47	0.6849 05	0.8708 02	1

a) Predictors:(Constant),CPI,GOLD,GFD, BTC,COP, FDI,MS, FII,TB,LA,ER,IIP,FER

b) Dependent Variable: BSEBEX,

c) Source: Authors estimation

The Crude Oil Price, Index of Industrial Production, and Trade Balance (since the coefficient values are -0.52249, -0.62366, and -0.3558) have a negative correlation with the BSE Banking sector. Once more, it was discovered that there is a positive correlation between the exchange rate, foreign exchange reserve, gross fiscal deficit, money supply, foreign institutional investment, foreign direct investment, bit coin, gold price, liquidity aggregates and consumer price indexes (since the coefficient values are 0.773041, 0.836396, 0.245425, 0.824574, 0.04287, 0.425408, 0.67083, 0.39441, 0.85224, and 0.829615) found in the study.

Table -4.2.3. Result of Pearson's Correlation of BSE Energy Sector and selected macroeconomic variables

	BSEEN GY	COP	ER	FER	IIP	GFD	MS	TB	FII	FDI	BTC	GOLD	LA	CPI
BSEEN GY	1	- 0.46403	0.806 138	0.9457 44	- 0.6552 5	0.3162 56	0.883 787	- 0.186 8	0.1273 13	0.4526 19	0.7742 62	0.6233 04	0.8881 86	0.90775 3
COP	- 0.46403	1	0.714 28	- 0.5626 1	0.5809 19	0.1549 1	0.540 55	0.118 98	0.1256 42	0.3643 7	0.1795 8	0.1030 2	0.6263 4	- 0.56812
ER	0.80613 8	- 0.71428	1	0.8486 15	- 0.6767 7	0.2441 29	0.827 625	0.056 584	0.0842 5	0.4339 76	0.5532 93	0.3846 09	0.9065 59	0.75855 9
FER	0.94574 4	- 0.56261	0.848 615	1	- 0.6382 4	0.3177 42	0.889 284	0.058 1	0.0643 24	0.4733 22	0.8122 27	0.6108 11	0.9049 4	0.90644 7
IIP	- 0.65525	0.58091 9	0.676 77	- 0.6382 4	1	- 0.3314 9	0.594 67	0.073 953	0.1192 59	0.3231 3	0.3627 5	0.3421 3	0.6729 8	- 0.69205
GFD	0.31625 6	- 0.15491	0.244 129	0.3177 42	- 0.3314 9	1	0.284 921	0.050 7	0.0735 8	0.0198 2	0.3890 44	0.2266 54	0.2606 51	0.25862 6
MS	0.88378 7	- 0.54055	0.827 625	0.8892 84	- 0.5946 7	0.2849 21	1	0.076 6	0.0836 99	0.4015 94	0.6795 08	0.5369 63	0.8637 88	0.82761 3
TB	-0.1868	- 0.11898	0.056 584	- 0.0581	0.0739 53	- 0.0507	- 0.076 6	1	0.0538 52	0.0419 4	0.2069 9	0.0384 8	0.0791 5	- 0.21718
FII	0.12731	0.12564	-	0.0643	0.1192	-	0.083	0.053	1	0.1022	0.0550	0.2673	0.0049	0.04935

	3	2	0.084 25	24	59	0.0735 8	699	852		42	28	1	23	9
FDI	0.45261 9	- 0.36437	0.433 976	0.4733 22	- 0.3231 3	- 0.0198 2	0.401 594	- 0.041 94	0.1022 42		0.2748 83	0.2337 91	0.4191 33	0.42158 9
BTC	0.77426 2	- 0.17958	0.553 293	0.8122 27	- 0.3627 5	0.3890 44	0.679 508	- 0.206 99	0.0550 28	0.2748 83	1	0.5217 19	0.6608 78	0.68274 7
GOLD	0.62330 4	- 0.10302	0.384 609	0.6108 11	- 0.3421 3	0.2266 54	0.536 963	- 0.038 48	0.2673 1	0.2337 91	0.5217 19	1	0.4789 07	0.68490 5
LA	0.88818 6	- 0.62634	0.906 559	0.9049 4	- 0.6729 8	0.2606 51	0.863 788	- 0.079 15	0.0049 23	0.4191 33	0.6608 78	0.4789 07	1	0.87080 2
CPI	0.90775 3	- 0.56812	0.758 559	0.9064 47	- 0.6920 5	0.2586 26	0.827 613	- 0.217 18	0.0493 59	0.4215 89	0.6827 47	0.6849 05	0.8708 02	1

a) Predictors:(Constant),CPI,GOLD,GFD, BTC,COP, FDI,MS, FII,TB,LA,ER,IIP,FER

b) Dependent Variable: BSENGY

c) Source: Authors estimation

A negative correlation between the BSE Energy sector and the prices of crude oil, the index of industrial production , and trade balances are (since the coefficient values is -0.46403, -0.65526, and-0.1858) found. on the other hand Exchange Rate, Foreign Exchange Reserve, Gross Fiscal Deficit, Money Supply, Foreign Institutional Investment, Foreign Direct Investment, Bit Coin, Gold Price, Liquidity Aggregates, and Consumer Price Index (since the coefficient value is 0.8061, 0.94574, 0.31625, 0.8837, 0.12731, 0.45261, 0.77426, 0.62330, 0.88818 ,and 0.907753)with BSE energy are positive.

Table -4.2.4. Result of Pearson's Correlation of BSE Basic Metal Sector and selected macroeconomic variables

	BSEB M	COP	ER	FER	IIP	GFD	MS	TB	FII	FDI	BTC	GOL D	LA	CPI
BSEB M	1	- 0.3864 1	0.62 5956	0.808 156	- 0.621 17	0.243 83	0.72 5265	- 0.31 354	0.024 788	0.396 218	0.778 063	0.305 662	0.762 624	0.7689 55
COP	- 0.3864 1	1	0.71 428	- 0.562 61	- 0.580 919	- 0.154 91	- 0.54 055	- 0.11 898	0.125 642	- 0.364 37	- 0.179 58	- 0.103 02	- 0.626 34	- 0.5681 2
ER	0.6259 56	- 0.7142 8	1	0.848 615	- 0.676 77	0.244 129	0.82 7625	0.05 6584	0.084 25	0.433 976	0.553 293	0.384 609	0.906 559	0.7585 59
FER	0.8081 56	- 0.5626 1	0.84 8615	1	- 0.638 24	0.317 742	0.88 9284	- 0.05 81	0.064 324	0.473 322	0.812 227	0.610 811	0.904 94	0.9064 47
IIP	- 0.6211 7	- 0.5809 19	- 0.67 677	- 0.638 24	1	- 0.331 49	- 0.59 467	- 0.07 3953	0.119 259	- 0.323 13	- 0.362 75	- 0.342 13	- 0.672 98	- 0.6920 5
GFD	0.2438 3	- 0.1549 1	0.24 4129	0.317 742	- 0.331 49	1	0.28 4921	- 0.05 07	0.073 58	0.019 82	0.389 044	0.226 654	0.260 651	0.2586 26
MS	0.7252 65	- 0.5405 5	0.82 7625	0.889 284	- 0.594 67	0.284 921	1	- 0.07 66	0.083 699	0.401 594	0.679 508	0.536 963	0.863 788	0.8276 13
TB	- 0.3135 4	- 0.1189 8	0.05 6584	- 0.058 1	0.073 953	- 0.050 7	- 0.07 66	1	0.053 852	- 0.041 94	- 0.206 99	- 0.038 48	- 0.079 15	- 0.2171 8
FII	0.0247 88	- 0.1256 42	0.08 425	0.064 324	0.119 259	0.073 58	0.08 3699	0.05 3852	1	0.102 242	0.055 028	0.267 31	0.004 923	0.0493 59
FDI	0.3962 18	- 0.3643 7	0.43 3976	0.473 322	- 0.323 13	0.019 82	0.40 1594	- 0.04 194	0.102 242	1	0.274 883	0.233 791	0.419 133	0.4215 89
BTC	0.7780	-	0.55	0.812	-	0.389	0.67	-	0.055	0.274	1	0.521	0.660	0.6827

	63	0.1795 8	3293	227	0.362 75	044	9508	0.20 699	028	883		719	878	47
GOLD	0.3056 62	- 0.1030 2	0.38 4609	0.610 811	- 0.342 13	0.226 654	0.53 6963	- 0.03 848	0.267 31	0.233 791	0.521 719	1	0.478 907	0.6849 05
LA	0.7626 24	- 0.6263 4	0.90 6559	0.904 94	- 0.672 98	0.260 651	0.86 3788	- 0.07 915	0.004 923	0.419 133	0.660 878	0.478 907	1	0.8708 02
CPI	0.7689 55	- 0.5681 2	0.75 8559	0.906 447	- 0.692 05	0.258 626	0.82 7613	- 0.21 718	0.049 359	0.421 589	0.682 747	0.684 905	0.870 802	1

- a) Predictors: (Constant),CPI,GOLD,GFD, BTC,COP, FDI,MS, FII,TB,LA,ER,IIP,FER
b) Dependent variable: BESBM
c) Source: Authors estimation

BSE Basic Materials has a negative relationship with the prices of the Index of Industrial Production, Crude Oil Price, and Trade Balance (since the coefficient value is -0.38641, -0.62117, -0.31354). A positive correlation between the Exchange Rate, Foreign Exchange Reserve, Gross Fiscal Deficit, Money Supply, Foreign Institutional Investment, Foreign Direct Investment, Bit Coin, Gold Price, Liquidity Aggregates, and Consumer Price Index (since the coefficient value is 0.625956, 0.808156, 0.24383, 0.725265, 0.024788, 0.396218, 0.778063, 0.305662, 0.762624, and 0.768955).

4.3.1 Causality Analysis: Ganger's Causality Test

To ascertain whether future values of a time series may be predicted from its past values, a statistical technique known as the Granger Causality test can be utilised. As proof of causation, the existence of causality between the variables can be used to predict each other's causal links. Thus, a causal relationship between the macroeconomic variables and the returns of the stock indices employed in the study may be inferred from the Granger causality test.

Table-4.3.1. Ganger causality Test

Null Hypothesis	P- value	Decisions
COP does not Granger Cause BSEAUTO	0.0014	Reject
BSEAUTO does not Granger Cause COP	0.3105	Accept
COP does not Granger Cause BSEBEX	0.000	Reject
BSEBEX does not Granger Cause COP	0.5114	Accept
COP does not Granger Cause BSEENGY	0.0035	Reject
BSEENGY does not Granger Cause COP	0.2818	Accept
COP does not Granger Cause BSEBM	0.000	Reject
BSEBM does not Granger Cause COP	0.1869	Accept
ER does not Granger Cause BSEAUTO	0.0002	Reject
BSEAUTO does not Granger Cause ER	0.1257	Accept
ER does not Granger Cause BSEBEX	0.000	Reject
BSEBEX does not Granger Cause ER	0.0022	Reject
ER does not Granger Cause BSEENGY	0.000	Reject
BSEENGY does not Granger Cause ER	0.0059	Reject
ER does not Granger Cause BSEBM	0.0048	Reject
BSEBM does not Granger Cause ER	0.0019	Reject
FER does not Granger Cause BSEAUTO	0.037	Reject
BSEAUTO does not Granger Cause FER	0.0972	Accept
FER does not Granger Cause BSEBEX	0.000	Reject
BSEBEX does not Granger Cause FER	0.0002	Reject
FER does not Granger Cause BSEENGY	0.2186	Accept

BSENGY does not Granger Cause FER	0.0018	Reject
FER does not Granger Cause BSEBM	0.008	Reject
BSEBM does not Granger Cause FER	0.000	Reject
IIP does not Granger Cause BSEAUTO	0.0082	Reject
BSEAUTO does not Granger Cause IIP	0.1581	Accept
IIP does not Granger Cause BSEBEX	0.0012	Reject
BSEBEX does not Granger Cause IIP	0.0745	Accept
IIP does not Granger Cause BSENGY	0.0083	Reject
BSENGY does not Granger Cause IIP	0.0138	Reject
IIP does not Granger Cause BSEBM	0.0503	Accept
BSEBM does not Granger Cause IIP	0.169	Accept
GFD does not Granger Cause BSEAUTO	0.0457	Reject
BSEAUTO does not Granger Cause GFD	0.2173	Accept
GFD does not Granger Cause BSEBEX	0.0372	Reject

Null Hypothesis	P- value	Decisions
BSENGY does not Granger Cause IIP	0.0138	Reject
IIP does not Granger Cause BSEBM	0.0503	Accept
BSEBM does not Granger Cause IIP	0.169	Accept
GFD does not Granger Cause BSEAUTO	0.0457	Reject
BSEAUTO does not Granger Cause GFD	0.2173	Accept
GFD does not Granger Cause BSEBEX	0.0372	Reject
BSEBEX does not Granger Cause GFD	0.182	Accept
GFD does not Granger Cause BSENGY	0.0002	Reject
BSENGY does not Granger Cause GFD	0.0941	Accept
GFD does not Granger Cause BSEBM	0.0419	Reject
BSEBM does not Granger Cause GFD	0.0034	Reject
MS does not Granger Cause BSEAUTO	0.4432	Accept
BSEAUTO does not Granger Cause MS	0.6145	Accept
MS does not Granger Cause BSEBEX	0.0017	Reject
BSEBEX does not Granger Cause MS	0.0506	Accept
MS does not Granger Cause BSENGY	0.000	Reject
BSENGY does not Granger Cause MS	0.0464	Reject
MS does not Granger Cause BSEBM	0.045	Reject
BSEBM does not Granger Cause MS	0.0013	Reject
TB does not Granger Cause BSEAUTO	0.0018	Reject
BSEAUTO does not Granger Cause TB	0.002	Reject
TB does not Granger Cause BSEBEX	0.0001	Reject
BSEBEX does not Granger Cause TB	0.1214	Accept
TB does not Granger Cause BSENGY	0.007	Reject
BSENGY does not Granger Cause TB	0.1177	Accept
TB does not Granger Cause BSEBM	0.0468	Accept
BSEBM does not Granger Cause TB	0.0059	Reject
FII does not Granger Cause BSEAUTO	0.0009	Reject
BSEAUTO does not Granger Cause FII	0.0065	Reject
FII does not Granger Cause BSEBEX	0.1079	Accept
BSEBEX does not Granger Cause FII	0.0002	Reject
FII does not Granger Cause BSENGY	0.1171	Accept

BSENGY does not Granger Cause FII	0.0156	Reject
FII does not Granger Cause BSEBM	0.2621	Accept
BSEBM does not Granger Cause FII	0.0001	Reject
FDI does not Granger Cause BSEAUTO	0.000	Reject
BSEAUTO does not Granger Cause FDI	0.1922	Accept
FDI does not Granger Cause BSEBEX	0.000	Reject
BSEBEX does not Granger Cause FDI	0.0008	Reject
FDI does not Granger Cause BSENGY	0.000	Reject
BSENGY does not Granger Cause FDI	0.0731	Accept
FDI does not Granger Cause BSEBM	0.000	Reject
BSEBM → FDI	0.0003	Reject
BTC does not Granger Cause BSEAUTO	0.0004	Reject
BSEAUTO does not Granger Cause BTC	0.0382	Reject
BTC does not Granger Cause BSEBEX	0.0001	Reject
BSEBEX does not Granger Cause BTC	0.003	Reject

Null Hypothesis	P- value	Decisions
BTC does not Granger Cause BSENGY	0.000	Reject
BSENGY does not Granger Cause BTC	0.010	Reject
BTC does not Granger Cause BSEBM	0.112	Accept
BSEBM does not Granger Cause BTC	0.000	Reject
GOLD does not Granger Cause BSEAUTO	0.0752	Accept
BSEAUTO does not Granger Cause GOLD	0.3949	Accept
GOLD does not Granger Cause BSEBEX	0.0307	Reject
BSEBEX does not Granger Cause GOLD	0.1923	Accept
GOLD does not Granger Cause BSENGY	0.0118	Reject
BSENGY does not Granger Cause GOLD	0.1151	Accept
GOLD does not Granger Cause BSEBM	0.0963	Accept
BSEBM does not Granger Cause GOLD	0.0135	Reject
LA does not Granger Cause BSEAUTO	0.0651	Accept
BSEAUTO does not Granger Cause LA	0.3043	Accept
LA does not Granger Cause BSEBEX	0.000	Reject
BSEBEX does not Granger Cause LA	0.0042	Reject
LA does not Granger Cause BSENGY	0.000	Reject
BSENGY does not Granger Cause LA	0.0076	Reject
LA does not Granger Cause BSEBM	0.0018	Reject
BSEBM does not Granger Cause LA	0.0061	Reject
CPI does not Granger Cause BSEAUTO	0.1462	Accept
BSEAUTO does not Granger Cause CPI	0.6468	Accept
CPI does not Granger Cause BSEBEX	0.009	Reject
BSEBEX does not Granger Cause CPI	0.0289	Reject
CPI does not Granger Cause BSENGY	0.0078	Reject
BSENGY does not Granger Cause CPI	0.0493	Reject
CPI does not Granger Cause BSEBM	0.0616	Accept
BSEBM does not Granger Cause CPI	0.0738	Accept

- a) Predictors: (Constant), COP
b) Dependent Variable: BSEAUTO, BSEABEX, BSENGY, BSEBM
c) Authors estimation

According to the findings of the Granger Causality Test, all of the selected BSE sectoral indices in India were:

- a) Strong causal linkages: COP, ER, GFD, FDI show consistent rejection (strong causality) across most indices.
- b) Mixed effects: FER, IIP, TB, FII, GOLD, LA, CPI show selective causality — some indices are affected, others not.
- c) Sectoral sensitivity: BSEBEX and BSEENGY are most frequently influenced (many rejections), while BSEBM shows mixed acceptance/rejection.

5.1 Conclusion

This study establishes that Indian sectoral indices are highly sensitive to macroeconomic shocks, with both structural and psychological factors shaping investor behavior. The findings confirm that Exchange rate, foreign reserves, and money supply are dominant drivers of sectoral performance, reinforcing the importance of monetary and external stability for market resilience. Crude oil prices and industrial production exert negative pressures, reflecting vulnerabilities of energyintensive and manufacturing sectors during global disruptions. The presence of bidirectional causality between certain macroeconomic variables and stock indices highlights the dynamic interplay between policy actions and market responses. Overall, the research underscores that portfolio diversification and risk management strategies in emerging markets like India must incorporate macroeconomic indicators alongside sectoral fundamentals. Policymakers should recognize the predictive role of exchange rate and monetary aggregates in stabilizing capital markets, while investors must account for external shocks such as oil price volatility and global crises. By bridging the gap in literature on crisisdriven dynamics, this study contributes to a deeper understanding of how socioeconomic instability reshapes the risk–return profile of Indian equity markets.

5.2 Scope and Future Directions

The presence of mixed and inconclusive outcomes in this analysis itself opens avenues for extended research, where additional macroeconomic variables influencing stock market indices can be examined in detail. A deeper understanding of the integrated and interdependent functioning of the real economy and the capital market is essential, as both continuously shape and respond to one another. Exploring this dynamic interaction would provide valuable insights for policymakers, enabling them to design strategies that leverage the mutual influence of these systems. Such knowledge could help in stabilizing markets, curbing excessive volatility, and achieving desired economic outcomes by channeling interventions more effectively through interconnected mechanisms.

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