

# Effects of Macroeconomic Variables on Stock Market Performance in India: Study of Bombay Stock Exchange (BSE)

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**Abstract:** *The study examines the effects of selected macroeconomic variables on the stock market performance in India. Monthly data collected for last 20 years (1<sup>st</sup> January 2001 to 31<sup>st</sup> December 2020) of respective variables and indices as Interest rate, exchange rate, inflation and BSE (Sensex). Analysis part was achieved using the VAR model approach by computing the impulse response functions and Variance Decomposition Analysis. Overall study revealed that the exchange rate, inflation and interest rate is affecting the BSE indices as per the multiple regression models co integration model there was no strong integration noticed between variable and the BSE. As per the impulse response function result shows that BSE responds negatively to the shocks of exchange rate and positively to its own shocks of Inflation and interest rate shown by the side in which blue line lies with reference to the origin black line.*

**Keywords:** Macroeconomic variables, stock market, BSE, VAR analysis, Co integration

## INTRODUCTION

The stock market plays a critical function in a market economy. The stock market's proper operation is critical in today's economy in order to achieve an effective transfer of monetary resources from people who save money to those who need capital and can put it to better use; the stock market can have a substantial impact on the quality of investment decisions. The capital market's role in the economy of many countries is defined by the collection of temporary capitals that are available in the economy, the reallocation of those that are insufficiently or inefficiently utilised at a given time, and even the favouring of some sectorial rearrangement. The ensemble's quality is determined by how well the capital market operates. The efficient allocation of resources attained through the capital market, for example, is based on the knowledge gained regarding market pricing. The inadequate functioning of the stock market mechanism as a component part of the capital market and eventually the lack of relevance of the stock market prices can generate errors inside the system which can alter its finality.

A healthy stock market may help an economy flourish in two ways: by increasing savings and allowing for more effective resource allocation. Savings are expected to rise as the stock market offers households with assets that meet their risk and liquidity requirements. A well-functioning stock market also values profitable firms' shares more than failing companies' shares, based on the concept of the pricing mechanism. That is, in a well-functioning stock market, relative share prices may fundamentally represent a company's status in relation to other firms listed in the stock market, such as predicted dividend growth and discount rates. As a result, the price mechanism maintains the economy's efficiency in utilising existing and future economic resources by ensuring that the prosperous company's cost of capital is lower than the failed company's cost of capital.

A multifactor model can be constructed using either arbitrage pricing theory (APT) or a multi-beta CAPM approach. These multi factor models are based on the idea that stock performance is influenced by a number of economic factors, including market performance and other factors, which can be classified into sectoral and macroeconomic forces. Many countries around the world now compare their economies based on the stock market's functioning and performance. The stock market is critical to the country's investment promotion and economic growth. Macroeconomic factors will always have an impact on the stock market. Macroeconomic factors that impact one country may not effect another because different macroeconomic indicators capture diverse information; some macroeconomic indicators are worldwide in scope, while others are special to a particular country, and still others are unique to specific industries. If a country is not economically connected to the rest of the world, then the influence of macroeconomic indicators with the global scope is either minimal or nonexistent.

## LITERATURE REVIEW

**PRAKASH K. AITHAL (2019)** identified the impact of macroeconomic indicators on India's National Stock Exchange (NSE) and Bombay Stock Exchange (BSE). The survey considered a total of 44 macroeconomic indicators over the eight years from 2011 to 2018. Use the Principal Component Analysis (PCA) method to reduce the dimension to seven factors, then apply PCA using the Varimax rotation method to find the factor with the greatest variability. In addition, the impact of these seven factors on the NSE

nifty and BSE SENSEX indexes is analyzed using regression. Finally, we use artificial neural networks to predict stock market movements with the help of macroeconomic indicators. With NSENIFTY and BSE SENSEX, 92% and 87% accuracy is achieved.

**R. Gopiinathan and S. Raja Sethu Durai (2019)** investigated the long-term relationship between stock markets and macroeconomic variables. Empirical results suggest that standard cointegration tests cannot identify the relationships between these variables. However, a transformation that uses the alternating conditional expected value algorithm to extract the actual functional relationships between these variables identifies strong evidence of cointegration and suggests long-term relationship nonlinearity. In addition, the continuous partial wavelet coherence model identifies strong coherence of transformed variables at low frequencies, due to the fact that the long-term relationship between Indian stock prices

**Raghutla Chandrashekar, P. Sakthivel, T. Sampath, and Krishna Reddy Chittedi (2018)** investigated the role of macroeconomic variables and stock prices from the perspective of emerging economies. The study also looks at the relationship between macroeconomic variables and stock prices across a panel of India and Brazil. The research uses monthly data from 2000M1 through 2016M08. Various panel econometric approaches are used in the study. The results show that there is a long-term relationship between variables and that unidirectional causality exists. GDP, inflation, exchange rate, interest rate, and stock prices all play a significant effect in economic development, according to the findings.

**Mr. Boldwin Ndlovu and Dr. Faisal Faisal (2018)** examined the relationship between macroeconomic variables such as inflation (INF), money supply growth (M3), interest rates (IR), and the USD ZAR exchange rate (EX) using quarterly data on stock prices for the Johannesburg Stock Exchange in South Africa from 1981Q1 to 2016Q4. To explore the link between the variables, the researchers used co-integration tests, a vector error correction model, a variance decomposition, and an impulse response function. Interest rates, money supply, and inflation all have a positive association with stock prices in the long run, however the exchange rate has a negative relationship with stock prices. The variance decompositions established that share price shocks account for the bulk of changes in themselves for all periods in the short and long run, while also consolidating the results of causality shocks in the stock price and exchange rate shocks, also the impulse response function further confirmed causal relationships between the variables and the stock price.

**M.F. SHUBITA and Adel A. AL-SHARKAS (2010)** used a large sample of New York Stock Exchange prices to investigate the 'size-effect' question. The amount of stock returns is also considered, as is the viability of hypotheses that explain the observed negative correlations between asset returns and inflation. It is decided to use generalised impulse response functions. To determine the impact of specified macroeconomic variables on the NYSE, the vector error correction model (VECM) (Johansen (1991)) is used. The findings show that stock returns are influenced by size. Furthermore, it appears that stock prices and inflation have a consistent negative association. Stock prices are positively affected by the level of real economic activity. Finally, interest rates and stock prices have a negative association.

## STATEMENT OF THE PROBLEM

The stock market's growth, in general, determines a country's economic performance. An increasing Share index over time suggests economic stability, whereas a falling Share index shows economic instability. Investors are finding simple access to stock markets all around the world as a result of the advent of free and open economic policies and innovative technologies all over the world. The growing prominence of the stock market has prompted the development of a slew of hypotheses to explain how it operates. Several research on stock market performance have been conducted in both developed and emerging economies. These researches, on the other hand, have differing perspectives on the factors that influence stock market performance.

## OBJECTIVES OF THE STUDY

1. To establish the effects of interest rates on stock market performance in India.
2. To analyze the effects of exchange rate on stock market performance in India.
3. To determine the effects of inflation on stock market performance in India.

## RESEARCH HYPOTHESES

The following hypotheses will guide this research based on the specific objectives.

1. **Ho1:** Interest rate has significant effect on stock market performance in India.
2. **Ho2:** Exchange rate has significant effect on stock market performance in India.
3. **Ho3:** Inflation has significant effect on stock market performance in India.

**RESEARCH METHODOLOGY**

The major objective of this study was to examine the effects of selected macroeconomic variables on the stock market performance in India. Monthly data collected for last 20 years (1<sup>st</sup> January 2001 to 31<sup>st</sup> December 2020) of respective variables and indices as Interest rate, exchange rate, inflation and BSE (Sensex). Analysis part was achieved using the VAR model approach by computing the impulse response functions and Variance Decomposition Analysis.

**Unit Root Test**

This is the initial stage in analysing time series data. This entails checking for time series data stationarity in order to avoid receiving erroneous results, such as type I or type II errors, which can be deceptive in decision-making. The mean, variance, and auto covariance of a stationary time series data set are constant for each lag. Chris Brooks (Chris Brooks, 2008). All of the variables will be tested for unit root using the Augmented Dickey Fuller Test. The presence of a unit root will be the null hypothesis, whereas the absence of a unit root will be the alternative.

**Cointegration Test**

There are two models for testing cointegration, the Engel and Granger (1987) model and the Johansen and Joselius (1990) model. While the Engle and Granger model represents a two-step error correction process, Johansen's method allows one-step testing of cointegrations in the system, eliminating the need for errors from the first step to the second step. Therefore, the estimation of the cointegration vector becomes more efficient. Another important implication is that the Johansen method avoids the necessary assumptions of endogenous / exogenous variables in the model.

**Vector Autoregressive (VAR) Model**

Vector autoregressive (VAR) models have a long tradition as tools for multiple time series analysis. Vector autoregressive models became popular for economic analysis when Sims (1980) advocated them as alternatives to simultaneous equations. One of the critics of the model is that it has no theory foundation. VAR is a theoretical model that uses observed time series properties of the data to forecast economic variables.

**RESEARCH FINDINGS****Unit root test**

In order to avoid the risk of getting spurious results, the researcher tested for stationarity of the data using the ADF test method with intercept.

**Table 1 ADF Stationarity Test**

Intermediate ADF test results at in level and 1 <sup>st</sup> Difference				
Series	Prob. (1 <sup>st</sup> Difference)	Prob. (Level)	Max Lag	Obs
(BSE)	0.0000	0.9899	14	238
(EXCHANGE_RATE)	0.0000	0.9430	14	238
(INFLATION)	0.0000	0.5250	14	227
(INTEREST_RATE)	0.0000	0.5117	14	238

(Self constructed table from Eviews result)

The following hypothesis for stationarity of data set.

- **H<sub>0</sub>**: Presence of unit root in the data set
- **H<sub>1</sub>**: No unit root in the data set

The decision criterion is that the null hypothesis is rejected when the probability is less than 5% otherwise accepted. From the results in the table above, the probabilities for all variables at level are greater than 5% hence we accept null hypothesis of presence of unit

root hence no stationarity at level. In the first difference, the probabilities for all variables are less than 5% hence we reject null hypothesis of presence of unit root meaning that there is no unit root in the data set hence stationary. Therefore, the data set becomes stationary at first difference.

### Co Integration Test

**Table 2 CoIntegration Test**

Series: BSE EXCHANGE_RATE INFLATION INTEREST_RATE				
Sample: 2001M01 2020M12				
Included observations: 240				
Null hypothesis: Series are not cointegrated				
Cointegrating equation deterministics: C @TREND				
Automatic lags specification based on Schwarz criterion (maxlag=14)				
Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
BSE	-3.796361	0.2172	-29.41476	0.1497
EXCHANGE_RATE	-2.976909	0.6172	-17.35268	0.6031
INFLATION	-3.708019	0.2520	-27.77784	0.1883
INTEREST_RATE	-2.750954	0.7276	-13.81402	0.7729

From the table above, the null hypothesis is that series are not cointegrated. This hypothesis is rejected if the probability of the variables is less than 5% otherwise accepted. The probability values for all the variables both at t-statistic and z-statistic are more than 5% hence the null hypothesis is accepted meaning the series are not cointegrated, so, there is a no long run relationship between the variables.

### Multiple Regression Analysis

Regression analysis describes the magnitude of change of dependent variable per unit change of independent variable.

**Table 3 Multiple Regression test**

Dependent Variable: BSE				
Method: Least Squares				
Sample: 2001M01 2020M12				
Included observations: 240				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXCHANGE_RATE	962.4740	33.89722	28.39390	0.0000
INFLATION	861.8768	123.1864	6.996523	0.0000
INTEREST_RATE	-1457.077	297.4231	-4.899004	0.0000
C	-29336.29	2548.881	-11.50948	0.0000
R-squared	0.775196	Mean dependent var		18753.11
Adjusted R-squared	0.772338	S.D. dependent var		11329.80
S.E. of regression	5405.894	Akaike info criterion		20.04489
Sum squared resid	6.90E+09	Schwarz criterion		20.10290
Log likelihood	-2401.387	Hannan-Quinn criter.		20.06827
F-statistic	271.2673	Durbin-Watson stat		0.135018
Prob(F-statistic)	0.000000			

From the results in the table above, it is evident that Exchange rate, inflation and interest rate have significant effects on BSE since the probabilities of 0.0000, 0.0000 and 0.0000 respectively are less than 5%. It indicates that null hypothesis will be rejected and alternative will be accepted means the exchange rate, inflation and interest rate are affecting the BSE indices. And the value of Adjusted R squared and F statistic is showing the fitness of model with respective figures of 0.77 and 0.00.

### Impulse Response Functions

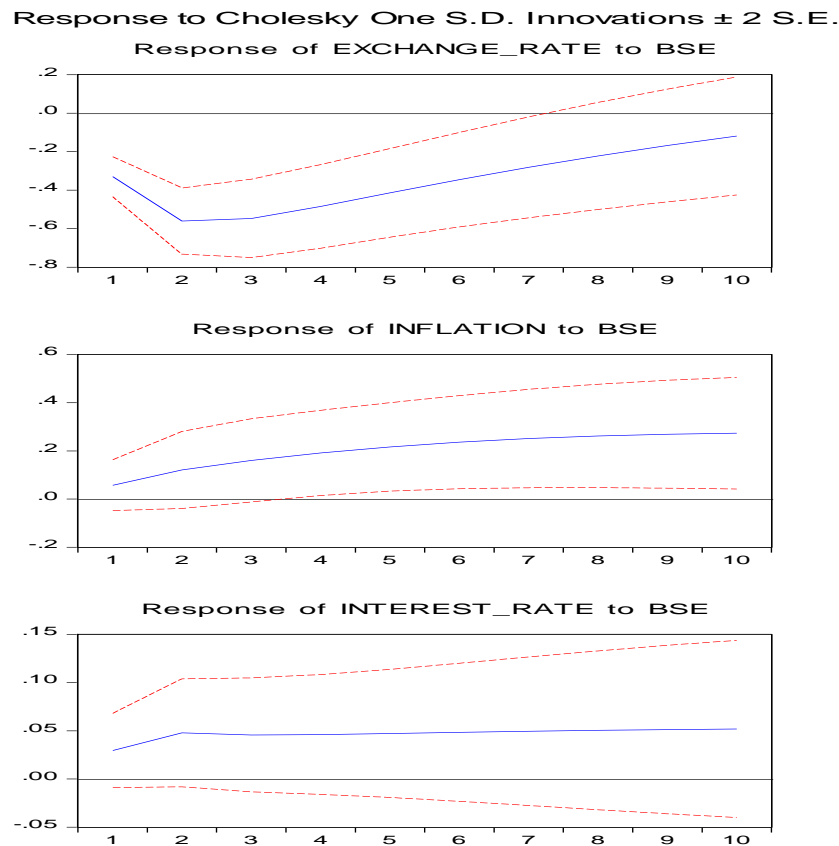


Figure 1 Impulse Response function chart

The figure above shows the impulse response functions. The last row shows the response of BSE which is a measure of stock market performance to its own shocks and those of other variables under study. The results show that BSE responds negatively to the shocks of exchange rate and positively to its own shocks of Inflation and interest rate shown by the side in which blue line lies with reference to the origin black line.

### Variance Decomposition Model

Table 4 Variance Decomposition Model

Variance Decomposition of BSE:					
Period	S.E.	BSE	EXCHANGE_RATE	INFLATION	INTEREST_RATE
1	1244.428	100.0000	0.000000	0.000000	0.000000
2	1749.103	99.65685	6.62E-05	0.007002	0.336083
3	2108.073	99.30964	0.023809	0.028528	0.638026
4	2387.482	98.91674	0.107359	0.057604	0.918300
5	2615.524	98.45388	0.264839	0.091230	1.190049
6	2807.849	97.91560	0.499034	0.127484	1.457880
7	2974.105	97.30446	0.808083	0.164816	1.722641
8	3120.668	96.62638	1.188182	0.201977	1.983466
9	3251.971	95.88858	1.634659	0.237988	2.238776
10	3371.217	95.09864	2.142451	0.272120	2.486791
11	3480.793	94.26402	2.706341	0.303855	2.725785
12	3582.515	93.39182	3.321109	0.332856	2.954213

13	3677.794	92.48867	3.981625	0.358935	3.170767
14	3767.743	91.56066	4.682924	0.382019	3.374393
15	3853.250	90.61332	5.420248	0.402132	3.564296
16	3935.034	89.65164	6.189081	0.419364	3.739918
17	4013.679	88.68005	6.985172	0.433854	3.900920
18	4089.669	87.70252	7.804540	0.445778	4.047161
19	4163.401	86.72252	8.643480	0.455330	4.178671
20	4235.212	85.74310	9.498561	0.462716	4.295626

From the result of variance decomposition model of BSE indicates that on the short run periods there is very nominal impact is notice from the variables. But after the period number 8<sup>th</sup> exchange rate and interest rate shown the effect on BSE and there is no effect of inflation is noticed for the short as well as long run. So, it can say that there is long run effect exist for the exchange rate and interest rate for the BSE but not for short run.

## CONCLUSION

The result of overall study reveals that the exchange rate, inflation and interest rate is affecting the BSE indices as per the multiple regression models. And the value of Adjusted R squared and F statistic is showing the fitness of model with respective figure of 0.77 and 0.00. But as per the result of cointegration model there was no strong integration noticed between variable and the BSE. As per the impulse response function result shows that BSE responds negatively to the shocks of exchange rate and positively to its own shocks of Inflation and interest rate shown by the side in which blue line lies with reference to the origin black line. Variance decomposition model found that there is long run effect exist for the exchange rate and interest rate for the BSE but not for short run.

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